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ABSTRACT

The syllabus package was developed for two health-related science courses: a two-semester course designed to fulfill the basic human-biology requirements of students enrolled in two-year allied health careers programs and a condensed one-semester course for students enrolled in one-year programs. Each course requires four hours per week. Contents for each course are organized as follows: introduction, general course objectives, general student behavioral objectives, methodology, references, teacher preparation, student activities (lecture and laboratory), and student evaluation (including testing, counseling, and grading policies). A topic outline and instructional objectives for each semester are also included. The topic outline is organized into units, with each unit terminating in a laboratory experience called the activity. An approximate hour allocation for each unit and activity are given, based upon 50 minutes as one contact hour. Specific instructional objectives are stated for each unit and activity of the topic outline. Suggested guidelines for preparing handout sheets to accompany the laboratory investigations and a sample handout sheet are included. (Author/RG)

State of New Jersey
Department of Education
Division of Vocational Education

# HUMAN ANATOMY & PHYSIOLOGY - SYLLABI FOR ALLIED-HEALTH-CAREER COURSES

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# TABLE OF CONTENTS

# INTRODUCTION

This syllabus package was developed primarily to set forth the instructional objectives of two health-related science courses that would meet the needs of several health-core areas in technical education, including the newer health technologies. That is to say, it presents the fundamentals of the human body, yet it is innovative enough to include discussions on current trends in the various paraprofessional realms, as the study of the human body dictates.

Two packages are included in this manual. The first is for a two-semester course, 4 hours per week, which in the Union County Technical Institute is taught to the so-called Track I students. These students are enrolled in a two-year Allied Health Career program, in one of these core curriculums:

Medical Technology
Respiratory Therapy
Physical Therapy
Occupational Therapy
Medical Records Technician

The second package details a one-semester course, also 4 hours per week, for the Track II students. They are enrolled in a one-year Allied Health Career program, in one of these core curriculums

Medical Assisting
Dental Assisting
Dental Technology
Medical Secretarial

Each package begins with general course objectives. These form a patchwork quilt, within which the instructor will apply the general student objectives that follow. In this regard, the student is made aware of not only the course requirements but also the anticipated professional skills to be achieved.

The sections on methodology describe the format that is desired to achieve an organized presentation to the student. Visual aids should be employed as often as appropriate to achieve the intended learning end. Included in the methodology section are suggestions for teacher preparation, student activities and evaluation, counseling, and grading policies. The instructor will no doubt find areas to modify. Certainly, this is only one format of approach. The instructor may wish to delete or add on to sections as time, emphases, and student interest prescribe.

The topic outline for each course is organized in units. Each unit terminates with a laboratory experience, called the Activity. An approximate hour allocation for each unit and activity are given at the right margin, based upon 50 minutes as one contact-hour. The topic outline for each course is then broken down into specific instructional objectives for each topic.

## HANDOUT-SHEET GUIDELINES

Throughout this course outline, reference is made to handout sheets. Although the adopted lab manual or workbook outlines procedures, each instructor will no doubt wish to modify its suggested procedures to meet the priorities of the course and the students.

Below appear a series of general guidelines which might be used in the preparation of handout sheets to accompany the laboratory investigations.

I Statement of the instructional objective is given to reaffirm the purpose(s) of the lab exercise and establish the student's level of expectation for the material to be covered.

II Statement of potential hazards and anticipated problems to be made aware of. For example, the exercise may involve use of chemicals, special lab equipment, glassware, etc.

III Date for submission and grading, this might be stated on a unit basis for each lab submitted, or on a quarterly or semester basis, if preferred.

IV Outline of the lab manual's or workbook's stated directions, with the instructor's modifications, such as omission of certain areas that are not appropriate for the level of learning, or lack of available equipment. Should drawings be required, then the instructions might also include the magnification necessary, type of pencil to use, labels, etc.

V Additional resources and demonstration materials available to help the student understand the investigation(s).

A sample (hypothetical) handout sheet is shown on the next page.

SAMPLE HANDOUT SHEET

# DISSECTION OF THE SHEEP HEART: UNIT 5

I. Upon completion of the lab exercise, the student should be able to:

A. Identify all major landmarks, both external and internal, to the heart.

B. Recognize the major blood vessels, pericardium, heart valves, and associated structures.

C. Trace the flow of blood from the vena cavae to the aorta.

II. Working in groups of two to three, obtain a dissection tray and line it with layers of toweling. Obtain two glass probes and other required dissecting instruments. When working with the glass probes, use gentle pressure to trace openings and blood-flow. In your initial dissection, attempt to remove as much fat and associated connective tissues as possible to better expose the great vessels and their foundations. Use mainly scissors and forceps and NOT scalpel to accomplish this part of the dissection.

III. Submit this lab investigation in your looseleaf binder on Friday of this week for grading. Late lab submissions will be penalized.

IV. PART I Surface anatomy. Complete all sections. A through D; omit section E.

PART II Major vessels. Complete all sections. A through C. Answer the questions in section B.

PART III Internal structures in the heart. Complete sections A through G. Omit section F. Answer all questions.

PART IV Complete all answers to the practical investigations at the end of the lab investigation.

V. Observe the kymograph demonstration of the beating frog heart on the front bench.

On the rear benches are heart models and charts depicting blood-flow.

# HUMAN ANATOMY AND PHYSIOLOGY I AND II

## Introduction to the Two-Semester Course

The total course syllabus of human anatomy and physiology as viewed in this revised modular approach sets forth those instructional objectives which best supplement the core program, presenting physiological concepts and associated laboratory experiences that extend the student's understanding of the typical developmental, structural, and physiological bases of human biology.

This course has been developed to parallel the major study of the systems as undertaken in the core programs. Each unit commences with a presentation on normal functionings, moves on to a brief discussion of abnormalities, and terminates with a lab or two to explain and reinforce the theory discussed in the lectures. Each unit is designed as a complete self-contained module.

Human Anatomy and Physiology is a two-semester course designed to fulfill the basic human-biology requirements of students enrolled in the *two-year Allied Health Careers programs.* It is the intent to have the student progress from fundamental concepts toward in-depth studies of the various systems of the body. Lecture presentations are integrated as closely as is feasible with laboratory investigations. Although most of the course is theoretical in presentation, the student will be introduced to related instrumentation and laboratory procedures that can be successfully transferred to the job situation. The pertinent modules are presented at approximately the same time that coverage is given in the core curriculum at the Union County Technical Institute, thereby reinforcing and strengthening the learning process.

## General Course Objectives

The objectives of the course are to

1. Teach the discipline of anatomy and physiology so that the knowledge gained by the allied health student can be transferred to the student's core curriculum.

2. Relate the structure of the bodily parts to their functions (e.g. being able to associate the shape of a bony protuberance to its role in allowing for muscular attachment and movement of a limb.)

3. Develop confidence in the student to succeed as a paraprofessional in the field, through the knowledge and skills gained in the course.

4. Demonstrate the proper uses, handling, and principles of operation of the scientific equipment and supplies (e.g. binocular light microscope, refractometer, etc.)

## General Student Behavioral Objectives

At the termination of the course the student should be able to:

1. List the major organ systems of the body and identify the major organs in terms of size, location, shape, and normal function. In addition, he/she will be able to relate the structure to selected types of dysfunctions which he or she will later experience as a paraprofessional.

2. Define the concept of homeostasis and present selected examples of the concept as it relates to the functional systems of the body (e.g. cardiac dynamics, pulmonary parameters, etc.), stressing the normal sequence of physiological events for these systems.

3. Demonstrate an understanding of the meaning of medical and anatomical terms through performance in oral and written exercises, and an appreciation of pathological conditions through an understanding of the meaning of medical terms – prefixes, roots, and suffixes.

4. Demonstrate an ability to organize and prepare a laboratory notebook covering the investigations studied, which will include all data or observations, and from these results be able to achieve scientifically based conclusions.

5. Recognize and demonstrate the importance of performing all biochemical and physiological laboratory investigations with appropriate efficiency and accuracy.

6. For the second semester, an additional objective is to develop an appreciation of the need for cooperation between workers in the professional laboratory setting. This is brought about through sharing the labor of performing surgical procedures on animals and then synthesizing the data for the laboratory notebook.

Methodology

Human Anatomy and Physiology is taught by an Allied Health science instructor. The approach utilizes self-contained lecture units on the organ systems with close synchrony to the unit related laboratory studies. Each module utilizes predominantly oral lectures and discussions, which are supplemented with several audiovisual devices, these include use of color transparencies, Kodachrome slides, demonstration setups, Technamation projectuals, anatomical models, films, and colored diagrams and drawings. The audiovisual aids are intended to complement the principles and skills developed in the laboratory during the presentation of that module. Handout sheets are used throughout the course in both lecture and laboratory. These spell out objectives and course concepts.

The course commences with descriptions of the procedures necessary to complete the investigations. In addition, continuous close supervision at the lab stations affords checks on skills and understanding of the procedures. The student is instructed in the preparation and presentation of a laboratory notebook. (See Student Activities - Laboratory Area, section 2C, Structuring the Notebook.) The notebook serves to assist the student in organizing his/her knowledge and will reinforce the laboratory experiments when he/she is studying in preparation for the semester laboratory examination. Related abnormalities (pathology) are discussed at the end of each unit insofar as they pertain to the core program of the student.

Text. Chaffee, Ellen E. and Greisheimer, Esther M., *Basic Physiology and Anatomy*. Philadelphia: J.B. Lippincott Co., 1969 (or latest edition)

Laboratory Manual:

Chaffee, E.E., *Laboratory Manual in Physiology and Anatomy*. Philadelphia: J.B. Lippincott Co., 1969 (or latest edition)

Other References:

Anthony, C. P., *Textbook of Anatomy and Physiology* St. Louis: C.V. Mosby Co., 1972

Crouch, J.E., *Functional Human Anatomy*. Philadelphia: Lea and Febiger, 1972.

Jacob, S.W., and Francone, C., *Structure and Function in Man*. Philadelphia: W.B. Saunders Company, 1974.

Learning Aids:

Where applicable in laboratory, the following aids are used: Preserved anatomical specimens, prepared histology slides, anatomical models, and living and preserved animals (e.g., frogs, rats, cats), and related instrumentation.

Periodicals:

Scientific American (Reprint Series)
Ciba Symposia
Medical World News (McGraw-Hill)

Films:

"Exploring the Human Nervous System," Churchill Films, 23 Minutes, Color, 1963

"Fundamentals of the Nervous System," Encyclopedia Brittanica Ed. Corp., 16 Minutes, Color, 1960.

"Heart, Cardiovascular Pressure Pulses and Electro-Cardiography," distributed by G.D. Searle and Co., 35 Minutes.

Teacher Preparation

The instructor will prepare lectures in advance which focus upon the overall performance requirements set forth in the course instructional objectives. He/she will adhere as closely as possible to the lecture and laboratory assignment schedules, which are given to the students at the earliest convenient class meeting. Lesson plans setting forth the behavioral objectives of each section are to be maintained, with revisions as current as is feasible, so that the student is made aware of the dynamic innovations in the allied health fields. The student is encouraged to use the library, and on occasion, related information will be placed on library reserve.

Student Activities

1. Lecture Area

A. The student is informed at the initial class meeting about various study techniques and the objectives of the course.

B. The student is strongly encouraged to read the lecture assignments before the topics are covered in class.

C. Since proper note-taking is vitally important, the student is taught the proper way to take notes in class.

D. Attendance rosters will be prepared and, although the number of absences will have no direct bearing upon grade computations, it is an accepted educational tenet that attendance is directly related to achievement levels, and any work missed is within the responsibility of the student to complete. The student who is absent for good cause will usually be able to obtain the lecture input through a conference with the instructor.

E. There is an open student participation in question answer situations, and students are encouraged to raise questions of relevant nature in class.

F. During lecture or laboratory sessions, announced quizzes of 10-15 minute duration may be given to evaluate the knowledge learned in the module studies (e.g. Nervous System, Unit 8, divisions 8.1 through 8.13). All quizzes and exams will be objectively structured and will relate to the behavioral objectives for each module studied.

G. Additional reading matter on course-related topics is placed on library reserve for student use.

2. Laboratory Area

The mechanics of the laboratory serve not only to reinforce and expand upon the theory discussed in the lecture, but also to develop the skills required to manipulate basic laboratory instruments and related materials.

A. Attendance will be taken, and its importance in developing skills and obtaining data will be stressed.

B. Students must present a professional appearance in the laboratory setting; a lab apron or coat is required; and safety glasses are optional during investigations that utilize biochemicals, burners, etc.

C. A laboratory notebook will be developed and maintained for periodic submission to the instructor; it will contain five sections for each investigation and preferably should be typewritten. The sections will include, in sequence:

1. *Statement of Objective* - A succinct explanation of the purpose of the performance or investigation to be undertaken.

2. *Statement of Materials* - A listing of all needed equipment, supplies, reagents (concentrations, etc. to perform the experiment.

3. *Statement of Methods* - This is an outline approach of the procedures to follow in performing the experiment. Any addenda or handout sheets which modify directives are to be included here.

4. *Data* - This section will contain all the results of the investigation, if analytical or observational; any required drawings, tables, or charts are also to appear in this section.

5. *Statement of Discussion and Conclusions 'D & C'* - This section will contain criticisms of the experimental findings (E.g., "The data obtained verify the hypothesis or anticipated outcome of the exercise.") It should also include introductory remarks by the instructor in developing the rationale for the experiment. Any related information may be included, such as a write-up of personal views, etc. (E.g., "The preparatory group viewing of the demonstration was poor in my view, since not all students could fully see the demonstration.")

Sections 4 and 5 will carry the most weight in evaluating the notebook.

D. At the completion of each semester, a comprehensive practical laboratory examination will be given. The practical exam is to be given during the final 3-hour examination period. This means that the final written exam would take two hours and the lab practical would fill the remaining time.

The practical exam will contain at least two station- demonstrations on each lab investigation, and all questions will be based upon the information in the student's notebook. The examination will be semi-objectively structured, consisting of multiple-choice and completion questions; the methodology for laboratory investigations would also be tested for, on the practical exam.

The station-demonstrations should be numbered consecutively - possibly 20 or so in all. For each station there might be a prepared dissection or microscope slide with label covered over or other appropriate material which the student had studied. A 3" x 5" card will accompany each demonstration and briefly describe the procedural task for the student. The test question or questions would follow. The students are timed and limited to one or two minutes per station. After time has elapsed, the students move on to the next higher numbered question. When all stations have been viewed, the instructor might allow 3 to 5 minutes for students to recheck any demonstration, providing not more than one student views one station at any one time.

E. The student is instructed in the proper use and handling of all equipment, and he/she is expected to maintain their proper use at all times. Under no circumstances will students be allowed to remove equipment or supplies from the designated instructional area without permission of the related allied health instructor and/or coordinator.

Evaluation of Students

1 Tests and Quizzes

All vehicles for grading are to be based upon the given instructional objectives for each unit and activity.

Announced tests and quizzes will be administered to check the ability of the student to understand the lecture concepts and the laboratory investigations. Testing will include written examinations; however, the instructor will discuss lab methodology with the student at times to determine his level of comprehension of the lab exercise.

One quiz will be given after each module is completed; written tests will be administered as follows.

| | Course I | |
|---|---|---|
| Hour exam I | After Unit 3 | One contact hour |
| Hour exam II | After Unit 6 | One contact hour |
| Post semester examination | After Unit 8 | Two to three hours |
| | **Course II** | |
| Hour exam I | After Unit 2 | One contact hour |
| Hour exam II | After Unit 4 | One contact hour |
| Post semester examination | After Unit 6 | Two to three hours |

Grades on objective examinations and quizzes will be entered as raw scores based upon 100% as total score. Students having missed scheduled testings will have the opportunity of making up the tests at a time convenient to both student and instructor.

2 Student Counseling and Advisement

The instructor will inform the students at the initial class meeting of his office hours and room number. Wherever possible, the schedule of the students will be considered in setting open office hours. Should this not be feasible, hours by appointment will be maintained.

Conferences will be provided to all students having a failing grade in the first hour exam on a one-to-one basis. The student is told to bring the exam, with lecture and lab notebooks, to the conference for analysis by the instructor. Together the instructor and student will devise a study technique. Reaffirmation of the goals of student and instructor will be made at this time.

Any continued deterioration in grades by any student below the level of D will result in referral to the coordinator in the respective allied health program. A suggested course of action will be given, understood by the instructor, the student, and the coordinator.

At midsemester (during the 8th to 9th week), the instructor will prepare referrals on all students achieving at or below D-, to be submitted to both the Dean of Allied Health and the coordinator of the respective core program for exploratory consultation with the student and instructor, if necessary.

3. Final Grades

The final grade in the course reflects directly the degree of achievement in meeting the course' objectives and student behavioral objectives presented at the beginning of the syllabus. The student will have the opportunity to study his exam in conference with the instructor after grades are entered for the semester. Early in the semester the students will be informed of the weight distribution of all tests, quizzes, and notebooks.

# HUMAN ANATOMY AND PHYSIOLOGY I

First Semester (16 weeks)
Hours per week - 4
Credit hours - 3

Contact hours 64
Semester examination hours 2-3

## Topic Outline

Note: The module sections within the topic outline include laboratory investigation(s) as the last division(s) of each unit, indicated by the term "Activity."

| | | Approximate Hours |
|---|---|---|
| Unit 1. | Introduction and application to allied health fields | 5 |
| 1.1 | Concept of universality of life and physiological processes | 1 |
| 1.2 | Survey of basic organ systems | 1 |
| 1.3 | Descriptive terminology and body orientation | 1 |
| Activity 1.4 | Mechanics of the microscope and orientation terminology | 2 |
| Unit 2. | Organizational scheme of body | 6 |
| 2.1 | Cellular ultrastructure and function | 1 |
| 2.2 | Transport mechanisms – passive and active | 1 |
| 2.3 | Formation of tissue and lymphatic fluids | 1 |
| 2.4 | Development of homestatic control in fluid environment | 1 |
| Activity 2.5 | Transport mechanisms and changes in tonicity | 2 |
| Unit 3. | Primary tissue types | 4 |
| 3.1 | Types (Epithelium, muscular, connective, nervous); structure and functions | 1 |
| Activity 3.2 | Histological study of epithelium | 2 |
| Hour examination I on sections 1 through 3 | | 1 |
| Unit 4. | Blood system | 6 |
| 4.1 | Blood characteristics and functions | 1 |

| | | | Approximate Hours |
|---|---|---|---|
| | 4.2 | Characteristics, counts and genesis of erythrocytes, leukocytes, platelets | 1 |
| | 4.3 | Hemostasis and the clotting reaction; anti-coagulant drugs and mechanisms of action | 1 |
| | 4.4 | Blood grouping systems | 1 |
| Activity | 4.5 | Examination of blood components HGB; hematological testings (e.g., blood typing, clotting time) | 2 |
| Unit | 5. | Heart and vasculature | 10 |
| | 5.1 | Fundamental structure, location, and function | 1 |
| | 5.2 | Factors regulating cardiac output | 1 |
| | 5.3 | EKG and cardiac cycle correlations | 1 |
| | 5.4 | Survey of cardiac dysfunctions, e.g. endocarditis, vascular disease, infarction, EKG abnormalities | 1 |
| | 5.5 | Parameters of blood pressure and flow | 2 |
| | 5.6 | Homeostatic control of B.P. and hypertension | 1 |
| Activity | 5.7 | Gross dissection of heart, examination of blood-vessel histology and blood pressure | 2 |
| Unit | 6. | Pulmonary system | 8 |
| | 6.1 | Structure and function of airways and lungs | ½ |
| | 6.2 | Pulmonary volumes and capacities and basis of pulmonary function testing | ½ |
| | 6.3 | Dynamics of gas exchange – physical and chemical relationships | 1 |
| | 6.4 | Blood gas transport mechanisms | 1 |
| | 6.5 | Homeostatic pulmonary factors in breathing | 1 |
| | 6.6 | Survey of respiratory diseases (e.g., edema, anoxia, T.B., acidosis, etc.) | 1 |

| | | | Approximate Hours |
|---|---|---|---|
| Activity | 6.7 | Gross and microscopic study of sheep lung, spirometer testing, ventilatory changes | 2 |
| Hour examination II on sections 4 through 6 | | | 1 |
| Unit | 7. | Muscular system | 8 |
| | 7.1 | Structure and function of muscle tissues, gross and anatomical | 1 |
| | 7.2 | Bioelectrical conductivity and neuromuscular transmission | 1 |
| | 7.3 | Biochemical properties of muscle contraction | 1 |
| | 7.4 | Muscle twitch and contraction variations | 1 |
| | 7.5 | Survey of musculature related to the field of study | 1 |
| | 7.6 | Survey of muscular dysfunctions (e.g., spasm, fibrillation, atrophic conditions, etc.) | 1 |
| Activity | 7.7 | Gross and microscopic examination of preserved muscle types, and kymographic study of muscular events | 2 |
| Unit | 8. | Nervous system | 17 |
| | 8.1 | Anatomy and function of typical nerve cells | 2 |
| | 8.2 | Anatomic and physiological divisions | ½ |
| | 8.3 | Nerve conduction | ½ |
| | 8.4 | Synthetic transmission | 1 |
| | 8.5 | Reflex arc patterns | 1 |
| | 8.6 | Spinal nerve pathways | 1 |
| | 8.7 | Brain structure and function and selected abnormalities | 2 |
| | 8.8 | Cranial nerves - form and function and selected abnormalities | 2 |

| | | Approximate Hours |
|---|---|---|
| | 8.9 Meninges and cerebro spinal fluid formation, function, and composition | 1 |
| | 8.10 Autonomic nervous system | 1 |
| | 8.11 Survey of neurological disorders related to core program | 1 |
| Activity | 8.12 Gross examination of sheep brain, histologic study of nerve tissues | 2 |
| Activity | 8.13 Use of kymograph in physiological parameters of nerve action – reflex activities in body | 2 |
| Semester examination – Units 1 – 8 | | 2–3 |

## INSTRUCTIONAL OBJECTIVES – COURSE I

The student should be able to:

Unit 1. Distinguish between the terms "anatomy" and "physiology" and note the broad application of the science to core program.

1.1 List and describe the six basic life processes, noting their significance.

1.2 List and discuss the ten organ systems of man, with emphasis upon one role for each system.

1.3 Upon assignment of an organ or section, indicate its anatomic position, distinguishing among the three major planes of body, with 100% accuracy.

Activity 1.4 Demonstrate in the laboratory the setting up of the binocular microscope; locate and assign roles for its parts and show proper cleaning and securement procedures; demonstrate skill in focusing clearly under all objettive magnifications, with 90% efficiency. The student will complete the appropriate sections in the laboratory manual as guided by handout sheets.

Unit 2. Organizational scheme of the body

2.1 Recognize the vital cellular organelles by their shapes, and ascribe roles.

2.2 Define the transport systems and differentiate among them in terms of energy requirements, method of function, and materials transported.

2.3 Describe the mechanism of tissue fluid formation, and ascribe the roles of osmotic and hydrostatic pressure in the process.

2.4 Describe the significance of fluid return via lymphatics and the causes of edematous conditions.

Activity 2.5 Demostrate the ability to perform diffusion, osmotic pressure, and filtration experiments. Complete related sections in laboratory manual, as directed on handout sheets.

Unit 3. Primary tissue types

3.1 Describe the gross appearance, location, and function of representative types of the four tissue categories.

Activity 3.2 Describe and differentiate among the four basic tissue types, using representative histiological slides, with 90% efficiency. Prepare drawings and complete relevant sections in the lab manual as indicated on handout sheets.

Unit 4. Blood system

4.1 List the components of vascular fluid and identify roles of each.

4.2 Differentiate among erythrocytes, leukocytes, and platelets according to the following:

A. Number of cells/$mm^3$ whole blood

B. Size, shape, and staining characteristics

C. Functions

D. Sites of production and destruction

4.3 A. Describe the last three phases of the clotting process

B. List and describe the factors that predispose to clot formation

C. Define the following terms:

1. anti-coagulant substances (e.g. oxalate, heparin, etc.)
2. thrombin
3. prothrombin
4. fibrinogen-fibrin
5. fibrinolysin
6. clot retraction
7. thrombus
8. clotting globulins
9. prothrombin time

4.4 A. Differentiate between blood types A, B, AB, and 0 with respect to antigen-antibody reactions.

B. Distinguish between compatibility and incompatibility as observed in slide testing.

C. List the frequencies of the blood groups in the U.S. population.

D. Define the terms and note examples or models of each:

1. cross-matching
2. agglutination
3. universal donor - universal recipient
4. clotting time
5. bleeding time
6. antibody titer

E Describe the Rh group system and differentiate between Rh (+) and Rh (−) types

F Define the following terms:

1. erythroblastosis fetalis
2. multiple alleles

G Describe etiology and symptoms of selected blood dyscrasias (e.g., anemia, mononucleosis, etc.)

Activity 4.5 Perform several blood-grouping and blood-clotting time tests, as directed by the instructor. Prepare and examine a Wright-stained blood smear; enumerate blood cells. Prepare drawings and complete the lab manual sections as directed from handout sheets.

Unit 5 Heart and vasculature

5.1 A Locate the heart and describe its composition and role.

B Describe the external and internal structure and direction of blood-flow.

5.2 A. Compare the mechanical events of the cardiac cycle with the electrical events.

B Define the following concepts:

1. pacemaker (S-A node)
2. cardiac output (C.O.) and its related factors
3. systole and diastole
4. EKG and interpretation of basic arrhythmias
5. conductive system (bundles of His, purkinje fibers, etc.)
6. electrical axis of heart

5.3 List the various factors that influence and/or maintain C.O.

5.4 Describe the etiology and symptoms of selected cardiac abnormalities (e.g. endocarditis, cardiac failure, infarction, etc.)

5.5 A. Show the blood pressure (B.P.) gradient from heart to veins, noting reasons for the drop in pressure.

B. List five factors which influence arterial B.P. and discuss them.

C. Explain the concept behind auscultation using a sphygmomanometer, and demonstrate its use.

D. Differentiate between palpation and ausculation, and note benefits of each determination for B.P.

5.6 A. Explain the term "hypertension" and distinguish between primary and secondary hypertension.

B. Discuss the basic input-output mechanism that sustains the B.P.

C. Define the terms: pressoreceptor, servomotor control, vasoconstriction, vasodilation, tachycardia, bradycardia

Activity 5.7 A. Working in pairs, students will dissect the sheep heart and identify all major structures important in the passage of blood and the creation of the B.P.

B. Individually examine slides on artery and vein histology; draw a section of each vessel, labeling the three basic layers.

C. Working with a partner, apply the sphygmomanometer reciprocally and determine B.P. under various physiological conditions (e.g., running, standing still, reclining, etc.). Record results, and complete the sections in the lab manual as directed by instructor.

Unit 6. Pulmonary system

6.1 A. Differentiate between external and internal respiration.

B. Identify all major passageways and structures involved in the movement of air between outside of body and blood system.

C. Associate the basic functions with all the structures of the system.

6.2 A. Describe the fundamentals of pulmonary-function testing and its diagnostic value.

B. Define the following terms:

1. mechanics
2. pressure
3. volume
4. pleura
5. intrathoracic
6. intrapulmonic
7. tidal volume
8. expiratory response
9. inspiratory response
10. residual volume
11. inspiration
12. expiration
13. vital capacity
14. dead space (anatomic and physiologic)

C. Describe the average ranges of air volumes and capacities mentioned in 6.2B.

6.3 Describe the pressure gradient involved in diffusion of gases between the lungs and blood and tissue cells and blood.

6.4 A. List and discuss the four categories of hypoxia.

B. Describe, in proper sequence, the biochemical events in the transport of oxygen gas within the blood, noting the percentage of oxygen carried in the red cells and in the plasma from lungs to tissue cells.

C. Describe the proper sequence of biochemical events in the carriage of carbon dioxide from cells to the lung and alveolus, noting the percentages of carbon dioxide transported by red cells, plasma, and as dissolved gas.

D. Differentiate among the terms: oxyhemoglobin, carbaminohemoglobin, methemoglobin, carboxyhemoglobin.

6.5 A. Describe the general mechanisms which regulate the breathing rate and depth.

B. Distinguish between the chemical factors that control respiration and the physical factors, noting an example for each.

C. Identify the terminology of respiratory regulation, as given on handout sheets.

6.6 Describe the symptoms and causes of a selected number of pulmonary diseases.

Activity 6.7 Working in groups of two, examine and draw a section of larynx and human lung tissue; label as directed on the handout sheet; recognize the different tissues that comprise lung and larynx and roles of each. Set up the respirometer and take vital capacity readings in ml; describe the changes that occur in pulmonary-function testing and describe the pattern of pressure-volume changes in the chest during normal activity and under stress (exercise). Complete all indicated sections of the laboratory manual and label all drawings.

Unit 7. Muscular system

7.1 A. Identify the distinguishing traits of the three types of muscle tissue.

B. Relate the structure of the three muscle types to their functionality, noting nervous influences.

7.2 A. Discuss the neuroelectrical and chemical factors implicated in muscular contraction; relate these events to the structure of the myofibril and sarcomere.

B. Identify the features of the neuromuscular junction and its role in stimulating muscle activity.

7.3 A. Trace the general metabolic pathway used by skeletal muscles to obtain energy from sugars.

B. Define or identify the following terms:

1. aerobic
2. anaerobic
3. glycolysis
4. A.T.P.
5. oxygen debt
6. Krebs cycle (citric acid cycle)
7. phosphocreatine
8. oxidative phosphorylation
9. glycogenolysis
0. glycogenesis

7.4 A. Identify, describe, and label the normal simple muscle-twitch tracing, and tracings on fatigue, tetanus (sustained and partial) and treppe.

B. Identify the factors that influence strength of contraction.

7.5 Discuss the systems by which skeletal muscles are distinguished into types and classified generally.

7.6 Classify selected types of muscle abnormalities, and give examples.

Activity 7.7 Locate selected muscles in the cat, identifying actions, origins, insertions, and innervations: identify the methods of muscle tracing and label tracing types: demonstrate and discuss the functionality of cardiac, skeletal, and smooth muscle, using the kymograph. Complete the related sections in the laboratory manual as indicated by the instructor.

Unit 8. Nervous system

8.1 A. Describe the broad functions of the nervous system and list the anatomical and physiological subdivisions of the system.

B. Construct and label a diagram of a nerve cell and associate a function with each part.

8.2 Describe the physiologic divisions of the nervous system, noting an example of each.

8.3 A. Describe the mechanism of nerve conduction

B. Define or identify the following terms:
   1. resting potential
   2. polarization
   3. depolarization
   4. repolarization
   5. Na–K pump
   6. refractory period
   7. threshold stimulus
   8. subthreshold stimulus

8.4 Outline the sequence of events in synaptic transmission, and describe the roles of the following substances:

mitochondrion, acetylcholine, cholinesterase, choline acetylase

8.5 Diagram, label, and explain the two- and three-neuron reflex-arc patterns, citing an example of each type.

8.6 Discuss at least two spinal pathways in terms of their direction, function, and location in the cord.

8.7 A. Identify and indicate roles for the major structural regions of the brain (e.g., thalamus, medulla, pons, etc.).

B. From a list of abnormalities, locate the brain region affected.

8.8 A. Describe the 12 pairs of cranial nerves by number, role, and location of innervation and action.

B. From a list of dysfunctions, name the cranial nerves responsible.

8.9 A. Identify, differentiate, and describe the three membranes of the cerebrospinal system.

B. Trace the circulation of cerebrospinal fluid and differentiate it from plasma.

8.10 A. Differentiate the autonomic nervous system (N.S.) from the somatic N.S., noting the circuitry of the visceral pathways of the two divisions.

B. Compare the physiology of the sympathetic N.S. to the parasympathetic N.S., noting their effects upon several effectors (e.g., heart, bronchi, ciliary muscles, etc.).

8.11 Characterize disorders of the nervous system related to the core programs (e.g., meningitis, Bell's palsy, etc.).

Activity 8.12 Working in teams of two students, dissect the sheep brain and locate pertinent neural regions. Examine and draw slides of nerve tissue as directed in handout sheets; complete the appropriate sections in the laboratory manual.

Activity 8.13 Examine a demonstration of reflex patterns in the frog and record results as directed by the instructor; perform the study of selected human reflex patterns with a partner and record all results; study a demonstration of autonomic plexuses of the cat and complete the laboratory manual as directed.

# HUMAN ANATOMY AND PHYSIOLOGY II

Second Semester (16 weeks)
Hours per week – 4
Credit hours – 3

Contact hours 64
Semester examinations hours 2–3

## Topic Outline

Note. The module sections within the topic outline include laboratory investigation(s) as the last division(s) of each unit, indicated by the term "Activity."

| | | | Suggested Hours |
|---|---|---|---|
| Unit 1 | | Urinary system | 9 |
| | 1.1 | Location, gross structure, and functions of kidney | 1 |
| | 1.2 | Microscopic anatomy-nephron unit: formation of urine | 1 |
| | 1.3 | Innervation of bladder and micturition reflex | 1 |
| | 1.4 | Characteristics of urine (urinalysis) | 1 |
| | 1.5 | Hormonal relationships in urine flow | 1 |
| | 1.6 | Electrolyte regulation and routes of water loss | 1 |
| | 1.7 | Abnormal urinalysis and terminology (e.g. ketosis, glycosuria, cystitis, etc.) | 1 |
| Activity | 1.8 | Gross and microscopic study of sheep kidney; urinalysis | 2 |
| Unit 2. | | Skeletal system | 9 |
| | 2.1 | Basic forms and functions of bone | 1 |
| | 2.2 | Bone classifications and markings | 1 |
| | 2.3 | Osteogenesis and osteolysis | 1 |
| | 2.4 | Survey of skeleton *in toto* | 1 |
| | 2.5 | Articulations, types, and maneuvers | 1 |
| | 2.6 | Bone dysfunctions (e.g. osteoporosis, osteomyelitis, osteitis fibrosis etc.) | 1 |
| Activity | 2.7 | Gross and microscopic anatomy of bone and biochemical tests on content. | 2 |
| Hour examination 1 on Sections 1 and 2 | | | 1 |

| | | |
|---|---|---|
| Unit 3. | Endocrine system | 16 |
| | 3.1 Location, names and basic functions of endocrine glands | 6 |
| | 3.2 Bioassay techniques and R.I.A. (Radio-immuno-assay methods) | 2 |
| | 3.3 Hormonal relationships, feedback mechanisms, etc. | 1 |
| | 3.4 Survey of related glandular dysfunctions | 1 |
| Activity | 3.5 Gross and microscopic study of selected endocrines | 4 |
| Activity | 3.6 Bilateral adrenalectomy in the rat | 2 |
| Unit 4. | Reproductive system | 12 |
| | 4.1 General overview and male system | 1 |
| | 4.2 Female system | 1 |
| | 4.3 Embryological changes | 1 |
| | 4.4 Menstrual cycle | 1 |
| | 4.5 Estrous cycle | 1 |
| | 4.6 Survey of birth control devices and hormone relationships | 1 |
| | 4.7 Terminology and common disorders | 1 |
| Activity | 4.8 Gross and microscopic study of reproductive organs of male and female cats | 2 |
| Activity | 4.9 Bilateral ovariectomy on rat. | 2 |
| Hour examination II – Sections 3 and 4 | | 1 |
| Unit 5. | Digestive system | 12 |
| | 5.1 General principles and nutritional requirements | 1 |
| | 5.2 Structure and role of gastrointestinal tract | 2 |
| | 5.3 Form and functions of pancreas and liver | 1 |
| | 5.4 Utilization and metabolism of nutrients – introduction | 1 |
| | 5.5 Metabolism of carbohydrates | 1 |

| | | | |
|---|---|---|---|
| Unit 5. | 6 | Metabolism of lipids | 1 |
| | 5.7 | Metabolism of proteins | 1 |
| Activity | 5.8 | Gross and microscopic dissection of digestive system of cat | 2 |
| Activity | 5.9 | Biochemical aspects of digestive physiology | 2 |
| Unit 6. | | Physiological responses to stress | 6 |
| | 6.1 | Conditions and categories of stress | 1 |
| | 6.2 | General adaptation syndrome (G.A.S.) | 2 |
| | 6.3 | Stress and correlation to disease | 1 |
| Activity | 6.4 | Bilateral-adrenalectomy in the rat and study of G.A.S. from Activity 3.6 | 2 |
| Post-semester examination | | | 2-3 |

## INSTRUCTIONAL OBJECTIVES – COURSE II

The student should be able to:

Unit 1. Urinary system

1.1 A. Locate exactly the anatomical region housing the kidneys and describe the five functions of the kidney.

B. Draw a sagittal section of a kidney and label all gross anatomical landmarks.

1.2 A. Construct a diagram of the nephron unit, label all parts, and indicate direction of urine flow.

B. Describe the functions of the nephron components and their contributions to urine formation (e.g. loop of Henle – creates a countercurrent multiplier).

C. Trace the flow of blood within the kidney and nephron unit.

1.3 A. Discuss the roles of the autonomic nervous system in bladder maintenance.

B. Describe the proper sequence of events leading to micturition and the role that the bladder musculature maintains.

1.4 A. List the major physical and chemical characteristics of urine.

B. List the major organic and inorganic urinary constituents.

1.5 Identify and describe regulatory roles of the following substances in urine production:

a. anti-diuretic hormone
b. aldosterone

1.6 A. List the various routes of water intake and loss in the body and state the relative importance of each pathway in water balance.

B. Differentiate among the fluid compartments and state their general electrolyte composition.

1.7 Understand the causes of various kidney and urine abnormalities and be able to describe the conditions caused.

Activity 1.8 With a partner, dissect a sheep kidney and locate all major gross structures. Examine a slide of human kidney, noting all histological structures in the nephron. Prepare drawings as indicated on handout sheets. Perform indicated urinalyses, testing fresh urine samples individually. Complete the related section in the laboratory manual.

Unit 2. Skeletal system

2.1. List and describe five functions of the skeletal system.

2.2 Identify the categories of bones based upon size and shape, and note functions of selected markings.

2.3 Describe the sequence of growth of cartilage into bone, and note the differences between endochondral and intra-cartilaginous ossification, together with sites of formation.

2.4. A. Construct and label diagrams of the axial skeleton; and from a listing of various bones identify those belonging within the axial skeleton.

B. Construct and label diagrams of the appendicular skeleton, and from a listing of various bones identify those belonging within the appendicular grouping.

2.5 Identify the three types of articulations (joints), e.g. synarthrosis, etc., and cite an example of each.

2.6 Understand the etiology of selected bone disorders and their symptomatic effects upon the body.

Activity 2.7 Examine the articulated human skeleton, study slides of osteogenesis and decalcified bone and prepare labeled drawings as indicated. Explain the effects that acid and heat have upon bone structure. From a cross section of fresh bone, differentiate between marrow, endosteum, bone, periosteum, epiphyseal plate, articular cartilage and diaphysis.

Unit 3 Endocrine system

3.1 A. List several methods of studying endocrine and hormonal activities.

B. Locate the following endocrine glands in the body and give the functions of their hormonal secretions.

a. pituitary
b. thyroid
c. adrenal
d. pancreas
e. gonads
f. parathyroid
g. placenta
h. others

Unit 3.2 Summarize the significance of bio-assay techniques and outline the methods employed in radio-immuno-assay procedures in thyroid studies.

3.3 A. Define the term "hormone" and list several examples of different types.

B Describe and trace the sequences involved in positive and negative feedback control, and present one example for each model.

3.4 Identify several glandular dysfunctions and demonstrate the changes each produces upon the body.

Activity 3.5 Working individually, locate the endocrine glands in the dissected cat. Examine slides of these glands, then draw and label representative glands as directed by the instructor

Activity 3.6 Four students are selected from the class to perform removal of both adrenal glands of one rat as the experimental animal, and perform a "sham" upon a control rat The job description of each student is as follows

1 *Surgeon* – performs assists instructor in surgical pre-operative preparation (e.g. shaving, etc., making the incisions in skin and muscle, removing the glands, applying wound clips and antiseptic.

2 *Anesthetist* – prepares etherizer and induces rat to the surgical grade of anesthesia, during the operation he will monitor respirations and reflex activity, and institute resuscitation if necessary.

3 *Recorder* - collects data on procedures: measurements of gland size, color, shape, problems encountered; weight determinations of rat on scheduled basis, and results of the investigation

4 *Post-operative assistant* - secures all operating equipment, autoclave dressings, solutions, etc., and monitors animal during the post-operative recovery phase All students will observe the operation and will receive data supplied by the recorder. Each student is expected to complete the sections in the lab manual as directed by the instructor.

Unit 4 Reproductive system

4.1 A. Describe the basic role that the male system plays in reproduction Identify the physical changes in the male at puberty

B List in proper sequence the structures through which spermatozoa migrate, and note a function of all associated glands.

C Distinguish between primary and secondary sexual characteristics and note the factors that cause them

Unit 4.2 A. Describe the basic role that the female system plays in reproduction. Identify the physical changes in the female at puberty (menarche).

B. List in proper sequence the structures through which an egg passes from ovary to the birth canal.

4.3 A. Describe the process of implantation and the sequence of development of various organ systems in the fetus, from fertilization to parturition.

B. Compare embryological development of gonad tissue in male and female fetuses (e.g., testis descent in males at eighth month).

4.4 A. Give the sequence of the physical and histologic changes that occur within the reproductive tract during menstruation, using a typical 30-day calendar.

B. Describe the pituitary-ovarian hormonal axis and the ovarian-uterine axis, noting functions of all related hormones.

4.5 A. Describe the physical events in the estrous cycle of the rat, stressing the hormonal influence upon the vaginal epithelium, as observed by a pap smear

B. Differentiate between the menstrual cycle and the estrous cycle, noting two dissimilarities.

4.6 List the various drug, implantation-type, and surgically prescribed birth control methods, noting in each case the degree of safety and percentage of control.

4.7 Discuss the etiology and symptoms of selected reproductive dysfunctions including amenorrhea, dysmenorrhea, ectopic pregnancy, etc.

Activity 4.8 Locate, identify, and assign roles to the male and female reproductive organs in dissected sexed cats and determine the sex.

Activity 4.9 A. Following the laboratory procedures of Activity 3.6, perform a bilateral ovariectomy on an experimental rat and a simulated operation on a control rat.

B. Demonstrate the technique for aspirating the vaginal canal, and prepare Pap smears of the epithelium of both rats for 7 days. Record all data.

C. Complete assigned sections in the lab manual as directed by handout sheets.

Unit 5. Digestive system

5.1 A. List and discuss the three basic organic nutrients and several good sources of each type.

B. List the water-soluble and fat-soluble vitamins, and note their sources and roles in metabolism.

5.2 A. Trace the sequence of digestive structures through which food travels from mouth to anus.

B. Identify digestive structures and state their enzymatic roles.

5.2 C. Describe, in outline form, the hormonal roles played by each of the following in the digestive process:

1. gastrin
2. secretin
3. pancreozymin
4. cholecystokinin
5. enterogastrone

D. List all final breakdown products of organic-food digestion and the enzymes mediating the process.

5.3 A. Differentiate the circulation of bile in the liver from the blood-flow based upon the histologic structure.

B. On a diagram of liver and pancreas tissues, label all digestive components.

5.4 A. Define metabolism, and differentiate anabolism from catabolism, citing an example of each process.

B. Describe the general structure and role of adenosine triphosphate.

C. Discuss the caloric requirements of man and explain obesity and malnutrition in this context.

5.5 A. List and describe the five fates of ingested sugar (glucose) as delineatdd in your text.

B. Distinguish between aerobic and anerobic metabolic pathways in the burning of carbohydrate.

C. Identify the significance of each of the following metabolic pathways, noting sites of occurrence in the cell. List important end products of each: glycolysis, Krebs cycle, electron transport system (oxidative phosphorylation).

D. List three roles of the Krebs cycle.

5.6 A. List three roles of fats in physiology.

B. Trace the general scheme of lipid utilization as depicted on the handout sheet.

C. Describe the structure of a typical fatty acid and compare it to a typical sugar molecule.

D. Discuss the mechanism of ketosis formation and relate it as a dysfunction of the lipid metabolic scheme.

E. Discuss the role of acetyl-CoA in lipid metabolism.

5.7 A. List the three sources of proteins in body metabolism.

B. Distinguish the typical protein structure from that of lipids and carbohydrates.

C. Contrast essential amino acids with nonessential amino acids.

D. Trace the pathways of protein metabolism involving the roles of intestines and liver, as outlined in the chart in your text p. 509.

E. Define "nitrogen balance" and identify the factors that can cause either a positive or negative nitrogen balance.

Activity 5.8 Locate and identify the major organs and glands in the gross dissection of the cat in group demonstrations.

Activity 5.9 Working in groups of two, perform selected biochemical tests on carbohydrates, lipids, and proteins; record all data and complete all assigned sections in the laboratory manual.

Unit 6. Physiological responses to stress

6.1 Define physiological stress and identify several types of stressful situations or conditions.

6.2 A. Describe the concept of the general adaptation syndrome (G.A.S.) as developed by Selye.

B. Outline the general relationships and sequence of activities of the pituitary gland upon target organs — adrenal glands, thymus, etc.

6.3 Discuss in general the experimental implications linking stress with various disease conditions, e.g., arthritis, ulcers, etc.

Activity 6.4 Using the adrenalectomized rats and controls from unit 3, activity 3.6, perform a classical experiment demonstrating the G.A.S. Follow directives from handout sheets, and after autopsy compare the experimental and control rats with respect to weight and the appearance of the thymus glands and gastrointestinal tracts. Also note the appearance of the adrenals of the control rat. Enter all data and complete all sections in the laboratory notebook as assigned by the instructor.

## HUMAN ANATOMY AND PHYSIOLOGY – CONDENSED COURSE

### Introduction to the Condensed Course

Human Anatomy and Physiology as outlined here has been developed to fulfill the basic human-biology requirements of students enrolled in *one-year Allied Health Career programs*. It is the intent to have the student progress from fundamental concepts toward in-depth studies of the various systems of the body. Lecture presentations are integrated as closely as is feasible with laboratory investigation. Although most of the course is theoretical in presentation, the student will be introduced to related instrumentation and laboratory procedures that can be successfully transferred to the job situation. The pertinent modules are presented at approximately the same time that coverage is given in the core curriculum at the Union County Technical Institute; thereby reinforcing and strengthening the learning process.

### General Course Objectives

The objectives of the course are to:

1. Teach the discipline of anatomy and physiology so that the knowledge gained by the allied health student can be transferred to the student's core curriculum.

2. Relate the structure of the bodily parts to their functions (e.g. being able to associate the shape of a bony protuberance to its role in allowing for muscular attachment and movement of a limb.)

3. Develop confidence in the student to succeed as a paraprofessional in the field, through the knowledge and skills gained in the course.

4. Demonstrate the proper use, handling, and principles of operation of the scientific equipment and supplies.(e.g. binocular light microscope, refractometer, etc.)

### General Student Behavioral Objectives

At the termination of the course the student should be able to:

1. List the major organ systems of the body and identify the major organs in terms of size, location, shape, and normal function. In addition, he/she will be able to relate the structure to selected types of dysfunctions which he or she will later experience as a paraprofessional.

2 Define the concept of homeostasis and present selected examples of the concept as it relates to the functional systems of the body (e.g. cardiac dynamics, pulmonary parameters, etc.), stressing the normal sequence of physiological events for these systems.

3. Demonstrate an understanding of the meaning of medical and anatomical terms through performance in oral and written exercises, and an appreciation of pathological conditions through an understanding of the meaning of medical terms – prefixes, roots, and suffixes.

4. Demonstrate an ability to organize and prepare a laboratory notebook covering the investigations studied, which will include all data or observations, and from these results be able to achieve scientifically based conclusions.

5. Recognize and demonstrate the importance of performing all biochemical and physiological laboratory investigations with appropriate efficiency and accuracy.

Methodology

Human Anatomy and Physiology is taught by an Allied Health science instructor. The approach utilizes self-contained lecture units on the organ systems with close synchrony to the unit-related laboratory studies. Each module utilizes predominantly oral lectures and discussions, which are supplemented with several audiovisual devices; these include use of color transparencies, Kodachrome slides, demonstration setups, Techniamation projectuals, anatomical models, films, and colored diagrams and drawings. The audiovisual aids are intended to complement the principles and skills developed in the laboratory during the presentation of that module. Handout sheets are used throughout the course in both lecture and laboratory. These spell out objectives and course concepts.

The course commences with descriptions of the procedures necessary to complete the investigations. In addition, continuous close supervision at the lab stations affords checks on skills and understanding of the procedures. The student is instructed in the preparation and presentation of a laboratory notebook. (See Student Activities – Laboratory Area, section 2C, Structuring the Notebook.) The notebook serves to assist the student in organizing his/her knowledge and will reinforce the laboratory experiments when he/she is studying in preparation for the semester laboratory examination. Related abnormalities (pathology) are discussed at the end of each unit insofar as they pertain to the core program of the student.

Text.

Jacob, S.W., and Françone, C., *Structure and Function in Man.* Philadelphia: W. B. Saunders Company, 1974.

Laboratory Manual

*Laboratory Manual to Structure and Function in Man*, as above.

Other References:

Anthony, C.P., *Textbook of Anatomy and Physiology* St. Louis, D.V. Mosby Co., 1972

Crouch, J.E., *Functional Human Anatomy*. Philadelphia. Lea and Febiger, 1972.

Learning Aids:

Where applicable in laboratory, the following aids are used: preserved anatomical specimens, prepared histology slides, anatomical models, and living and preserved animals (e.g. frogs, rats, and cats), and related instrumentation.

Periodicals:

Scientific American (Reprint Series)
Ciba Symposia
Medical World News (McGraw-Hill)

Films:

"Exploring the Human Nervous System," Churchill Films, 23 Minutes, Color, 1963.

"Fundamentals of the Nervous System," Encylopedia Brittanica Ed. Corp., 16 Minutes, Color, 1960.

"Heart, Cardiovascular Pressure Pulses and Electro-Cardiography," distributed by G.D. Searle and Co., 35 Minutes.

Teacher Preparation

The instructor will prepare lectures in advance which focus upon the overall performance requirements set forth in the course instructional objectives. He/she will adhere as closely as possible to the lecture and laboratory assignment schedules, which are given to the students at the earliest convenient class meeting. Lesson plans setting forth the behavioral objectives of each section are to be maintained, with revisions as current as is feasible, so that the student is made aware of the dynamic innovations in the allied health fields. The student is encouraged to use the library, and on occasion, related information will be placed on library reserve.

Student Activities

1. Lecture Area

   A. The student is informed at the initial class meeting about various study techniques and the objectives of the course.

   B. The student is strongly encouraged to read the lecture assignments before the topics are covered in class.

   C. Since proper note-taking is vitally important, the student is taught the proper way to take notes in class.

   D. Attendance rosters will be prepared and, although the number of absences will have no direct bearing upon grade computations, it is an accepted educational tenet that attendance is directly related to achievement levels, and any work missed is within the responsibility of the student to complete. The student who is absent for good cause will usually be able to obtain the lecture input through a conference with the instructor.

E. There is an open student participation in question-answer situations, and students are encouraged to raise questions of relevant nature in class.

F. During lecture or laboratory sessions, announced quizzes of 10-15 minute duration may be given to evaluate the knowledge learned in the module studies – e.g., Nervous system, Unit 8, divisions 8.1 through 8.13. All quizzes and exams will be objectively structured and will relate to the behavioral objectives for each module studied.

G. Additional reading matter in course-related topics is placed on library reserve for student use.

2. Laboratory Area

The mechanics of the laboratory serve not only to reinforce and expand upon the theory discussed in the lecture, but also to develop the skills required to manipulate basic laboratory instruments and related materials.

A. Attendance will be taken, and its importance in developing skills and obtaining data will be stressed.

B. Students must present a professional appearance in the laboratory setting: a lab apron or coat is required, and safety glasses are optional during investigations that utilize biochemicals, burners, etc.

C. The student will complete the laboratory manual as directed by handout sheets and the instructor. All drawings and auxiliary data are to be incorporated within the particular lab unit studied. Each unit will be submitted for evaluation immediately following the investigation. After grading, the unit will be returned to the student within one week. All situations relating to late submission, no submission, etc., will be outlined on handout grade-directive sheets early in the semester. It is advised that all drawings be in either 3-H or 4-H pencil (black), unless otherwise stated.

D. At the completion of each semester, a comprehensive practical laboratory examination will be given. The practical exam is to be given during the final 3-hour examination period. This means that the final written exam would take two hours and the lab practical would fill the remaining time.

The practical exam will contain at least two station- demonstrations on each lab investigation, and all questions will be based upon the information in the student's notebook. The examination will be semi-objectively structured, consisting of multiple-choice and completion questions; the methodology for laboratory investigations would also be tested for on the practical exam.

The station-demonstrations should be numbered consecutively — possibly 20 or so in all. For each station there might be a prepared dissection or microscope slide (with label covered over) or other appropriate material which the student had studied. A 3" x 5" card will accompany each demonstration and briefly describe the procedural task for the student. The test question or questions would follow. The students are timed and limited to one or two minutes per station. After time has elapsed, the students move on to the next higher numbered question. When all stations have been viewed, the instructor might allow 3 to 5 minutes for students to recheck any demonstration, providing not more than one student views one station at any one time.

E. The student is instructed in the proper use and handling of all equipment, and he/she is expected to maintain their proper use at all times. Under no circumstances will students be allowed to remove equipment or supplies from the designated instructional area without permission of the related allied health instructor and/or coordinator.

## Evaluation of Students

1. Tests and Quizzes

All vehicles for grading are to be based upon the given instructional objectives for each unit and activity.

Announced tests and quizzes will be administered to check the ability of the student to understand the lecture concepts and the laboratory investigations. Testing will include written examinations; however, the instructor will discuss lab methodology with the student at times to determine his level of comprehension of the lab exercise.

One quiz will be given after each module is completed: written tests will be administered as follows:

| | | |
|---|---|---|
| Hour exam I | After Unit 4 | One contact hour |
| Hour exam II | After Unit 7 | One contact hour |

Post-semester examination – After Unit 13 – Two to three hours

Grades on objective examinations and quizzes will be entered as raw scores based upon 100% as total score. Students having missed scheduled testings will have the opportunity of making up the tests at a time convenient to both student and instructor.

2. Student Counseling and Advisement

The instructor will inform the students at the initial class meeting of his office hours and room number. Wherever possible, the schedule of the students will be considered in setting open office hours. Should this not be feasible, hours by appointment will be maintained.

Conferences will be provided to all students having a failing grade in the first hour exam on a one-to-one basis. The student is told to bring the exam, with lecture and lab notebooks, to the conference for analysis by the instructor. Together the instructor and student will devise a study technique. Reaffirmation of the goals of student and instructor will be made at this time.

Any continued deterioration in grades by any student below the level of D will result in referral to the coordinator in the respective allied health program. A suggested course of action will be given, understood by the instructor, the student, and the coordinator.

At midsemester (during the 8th to 9th week), the instructor will prepare referrals on all students achieving at or below D-, to be submitted to both the Dean of Allied Health and the coordinator of the respective core program for exploratory consultation with the student and instructor, if necessary.

3. Final Grades

The final grade in the course reflects directly the degree of achievement in meeting the course objectives and student behavioral objectives presented at the beginning of the syllabus. The student will have the opportunity to study his exam in conference with the instructor after grades are entered for the semester. Early in the semester the students will be informed of the weight distribution of all tests, quizzes, and notebooks.

## HUMAN ANATOMY AND PHYSIOLOGY – CONDENSED COURSE

Course Duration – 16 weeks
Hours per week – 4
Credit hours – 3

Total contact hours 64
Semester examination hours 2-3

### Topic Outline

Note: The learning module sections within the topic outline include the laboratory investigation(s) as the last division(s) of each unit, indicated by the term "Activity."

| | | | Hours |
|---|---|---|---|
| Unit 1. | | Introduction to Anatomy and Physiology | 4 |
| | 1.1 | Terminology and relationships to Allied Health programs | 1 |
| | 1.2 | Criteria of life | 1 |
| Activity | 1.3 | Anatomical terminology<br>Microscope – principles and handling | 2 |
| Unit 2. | | Functional aspects of cell metabolism | 6 |
| | 2.1.1 | Transport mechanisms | 2 |
| | 2.1.2 | Diffusion | |
| | 2.1.3 | Osmosis | |
| | 2.1.4 | Filtration | |
| | 2.1.5 | Dialysis | |
| | 2.1.6 | Active transport | |
| | 2.2 | Homeostasis and transport | 1 |
| | 2.3. | Cellular energy and its utilization | 1 |
| Activity | 2.4 | Study of selected physiochemical processes (e.g. diffusion, osmosis, etc.) | 2 |
| Unit 3. | | Cellular structures and functions | 5 |
| | 3.1 | Universal physiological characteristics | 1 |
| | 3.2 | Functional organelles | 1 |

| | | | Hours |
|---|---|---|---|
| | 3.3 | Survey of protein synthesis | 1 |
| Activity | 3.4 | Examination of stained human cells | 2 |
| Unit 4. | | Epithelial and connective tissues | 5 |
| | 4.1 | Survey of epithelium and membranes and connective tissue types | 1 |
| | 4.2 | Skin and cartilage | 1 |
| Activity | 4.3 | Gross and microscopic examination of epithelial and connective tissues | 2 |
| Hour examination I on Units 1 through 4 | | | 1 |
| Unit 5. | | Skeletal system | 4 |
| | 5.1 | The osteogeneic process | 1 |
| | 5.2 | Bone classification, types, and functions | 1 |
| Activity | 5.3 | Gross and microscopic study of bone and skeleton with articulations | 2 |
| Unit 6. | | Muscular system | 5 |
| | 6.1 | Types and characteristics of muscles | 1 |
| | 6.2 | Biochemistry of contraction and oxygen debt | 1 |
| | 6.3 | Survey of muscular dysfunctions | 1 |
| Activity | 6.4 | Gross and microscopic study of representative musculature with terminology and selected physiological tracings | 2 |
| Unit 7. | | Nervous system | 8 |
| | 7.1 | Characteristics, development, and divisions of nerve tissue | 1 |
| | 7.2 | Nerve impulse and synaptic transmission | 1 |

| | | | Hours |
|---|---|---|---|
| Unit | 7.3 | Reflex arc patterns | 1 |
| | 7.4 | Brain and spinal cord | 1 |
| | 7.5 | Autonomic nervous system | 1 |
| Activity | 7.6 | Gross and microscopic study of nerve and physiology of reflex patterns | 2 |
| Hour examination II on Units 5 through 7 | | | 1 |
| Unit | 8. | Circulatory system | 7 |
| | 8.1 | Functions of blood | 1 |
| | 8.2 | Components and roles of cells and plasma | 2 |
| | 8.3 | Clotting reaction | 1 |
| | 8.4 | Blood groups | 1 |
| Activity | 8.5 | Preparation of blood smear, blood cell counts (e.g. differentials, C.B.C), type testings, and examination of blood disorders | 2 |
| Unit | 9 | Respiratory system | 4 |
| | 9.1 | Structure and function of respiratory tract | 1 |
| | 9.2 | Transport of gases | 1 |
| Activity | 9.3 | Gross and microscopic study of sheep lung and trachea; pneumographical determinations; respiratory dysfunctions | 2 |
| Unit | 10. | Urinary system | 6 |
| | 10.1 | Structure, location, and broad roles of kidneys | 1 |
| | 10.2 | Form of the nephron and urine formation | 2 |
| | 10.3 | Micturition reflex and water balance | 1 |
| | 10.4 | Gross and microscopic examination of the mammalian urinary system; urinalyses testing | 2 |

| | | Hours |
|---|---|---|
| Unit 11. | Digestive system and nutrition | 4 |
| | 11.1 Structure of gastrointestinal tract and role of glands | 1 |
| | 11.2 Nutritional requirements and deficiency diseases | 1 |
| Activity | 11.3 Gross and microscopic examination of digestive system in cat | 2 |
| Unit 12. | Endocrine system | 2 |
| | 12.1 Survey of major glands and functions | 1 |
| | 12.2 Survey of glandular hyper- and hyposecretion | 1 |
| Unit 13. | Reproductive system | 4 |
| | 13.1 Survey of male and female systems | 1 |
| | 13.2 Menstrual cycle and birth-control relationships | 1 |
| Activity | 13.3 Gross and microscopic study of reproductive system in cat and man | 2 |
| | Semester examination with emphasis upon the last 6 units. | 2–3 |

## INSTRUCTIONAL OBJECTIVES – CONDENSED COURSE

The student should be able to:

Unit 1. Introduction to Anatomy and Physiology

1.1 Define "Anatomy" and "Physiology" and relate the role of this discipline to core programs.

1.2 List and discuss six universal characteristics of life.

Activity 1.3 A. Demonstrate in the laboratory the following:

1. Setting up of the binocular microscope; locate parts
2. The functions of its parts
3. Proper cleaning and securement techniques

B. Identify parts of the body, using medical-anatomical terminology, based upon models and drawings of the human form.

Unit 2. Functional aspects of cell metabolism

2.1 List and describe the basic transport systems of the tissue cells as described in 2.1.1–2.1.6 of the topic outline.

2.2 Define "homeostasis" and relate this to the transport necessity of the cells.

2.3 A. Describe the role that energy has in sustaining cell activity.

B. Outline the functions of enzymes in energy relationships, such as catabolic and anabolic reactions.

C. Summarize the processes of utilization of glucose for adenosine triphosphate (A.T.P.) formation.

Activity 2.4 Demonstrate the physiochemical processes (e.g. osmosis, diffusion, dialysis, etc.)

Unit 3. Cellular structures and functions

3.1 Explain the importance of metabolism to the living cell.

3.2 Locate and describe the functions of all major organelles within the cell.

3.3 Summarize the mechanism of protein synthesis from D.N.A.

Activity 3.4 Individually, study prepared slides of human chromosomes and mitosis; draw and label according to directives on the handout sheet. Prepare and draw a stained smear of cheek cells for examination under the microscope. Complete all assigned sections in the laboratory manual.

Unit 4. Epithelial and connective tissues

4.1 A. Identify and describe the spectrum of epithelial tissues, their roles and locations.

B. Identify and describe selected connective-tissue types, their roles and locations.

4.2 A. From a diagram of typical human skin, label all major tissues and structures; identify their functions, noting homeostatic roles.

B. List three types of cartilage and indicate their locations, functions, and structural differences.

Activity 4.3 Working individually, examine prepared slides of epithelial and connective tissues (e.g. skin, lung, adipose, loose areolar, etc.); draw and label selected types as per directives on handout sheets; answer related questions in the lab manual.

Unit 5. Skeletal system

5.1 A. List five functions of bone.

B. Describe the process of bone formation within cartilage models, and distinguish membrane bone from cartilage bone.

C. Contrast cartilage tissue with bone tissue, noting two differences.

5.2 A. Describe the categories of bone shapes, citing an example of each.

B. Identify all bones in the human skeleton with the exception of carpal and tarsal elements.

C. List the three types of articulations and cite an example of each joint.

Activity 5.3 A. Observe the presentation of a long bone cut along length and in cross sections and identify the following parts:

shaft, epiphysis, compact bone, marrow cavity, periosteum, endosteum, articular cartilage.

B. View, draw, and label a section of ground bone on prepared slide.

C. Identify all bones in the articulated skeleton with exception of carpals and tarsals. Complete all sections in the lab manual.

Unit 6. Muscular system

6.1 A. List and compare the three basic muscle types, citing an example of each one.

B. Identify the features unique to muscle physiology.

6.2 A. Survey the mechanism of muscular contraction and the role of fermentation.

B. Define oxygen debt and then describe how the muscle cell regains its A.T.P. reserve.

6.3 List and discuss at least three abnormalities affecting muscle tissue (e.g. myasthenia gravis, infarction, etc.)

Activity 6.4 A. Describe selective muscle workings of the cat in terms of action, origin, insertion, and location. Examine, draw, and label slides of the muscle-tissue types.

B. Differentiate among the muscular tracings prepared on the kymograph and explain the physiological events observed.

Unit 7. Nervous system

7.1 A. List the functions of nerve tissue.

B. From a diagram provided, label and state a function of each structure of a neuron.

C. Outline the subdivisions of the central nervous system (C.N.S.) including both anatomy and physiology.

7.2 A. Characterize the bio-electrical changes involved in impulse conduction.

B. Summarize the events in synaptic transmission and identify two different neurotransmitter substances.

7.3 A. Diagram and summarize two basic neural circuits (e.g., convergence, divergence).

B. From a diagram, label the two basic reflex-arc patterns and describe their significance in maintaining homeostasis.

7.4 A. Chart the subdivisions of the brain and identify the membrane coverings of brain and cord.

B. List, locate, and describe the general roles of the major structural regions of the brain; trace an ascending and descending spinal pathway.

7.5 A. Differentiate between the sympathetic and parasympathetic divisions of the autonomic system in terms of:

1. circuitry
2. neurotransmitters
3. effectors stimulated or inhibited

B. Describe the homeostatic role of the autonomic N.S.

Activity 7.6 A. Individually examine slides of selected nerve tissue. Draw and label.

B. Observe a demonstration of reflex activity in a frog and record results.

C. Observe a presentation of a sectioned sheep brain with labels on major areas. Complete the assigned sections in the laboratory manual as indicated by handout sheets.

Unit 8. Circulatory system

8.1 List and describe eight functions of whole blood.

8.2 A. List the types of cellular elements in blood, and the basic constituents of plasma. For each element clearly describe sites of formation, function, and relative concentration.

B. Identify cell characteristics and differences.

8.3 Summarize the clotting reaction, with emphasis upon:

1. Factors initiating the clot formation
2. Three phases of clot formation
3. Sites of formation of clotting factors (proteins)
4. Observable sequence of clot formation
5. Roles of coagulants and anticoagulants, citing an example of each

8.4 A. Discuss the theory of antigen-antibody reaction.

B. Chart the A, B, O, AB types with recipient-donor reciprocal reactions.

C. Survey the Rh system and identify factors which cause hemolytic disease of the newborn.

8.5 Describe the causes of related blood abnormalities, their diagnoses and treatment (if applicable).

Activity 8.6 A. Working in pairs, perform finger punctures and prepare a stained blood smear. Draw and label each different white cell observed, and determine the differential count.

B. Obtain red- and white-cell counts using the hemocytometer.

C Perform blood typing by slide method.

D. Record all data and finish related sections in the lab manual, as directed by handout sheets.

Unit 9. Respiratory system

9.1 A. Define "respiration" and indicate the importance of the process to maintenance of metabolism.

B. List, in proper sequence, all structures through which air passes to reach the blood, and give the basic function of each structure.

C. Discuss the role of intercostals and diaphragm in breathing and fundamental nervous control in respiration.

D. Define and briefly describe the following respiratory conditions.

1. Dyspnea
2. Bronchiectasis
3. Pulmonary edema
4. Tuberculosis (of lungs)
5. Emphysema
6. Silicosis
7. Pneumonia
8. Pleurisy (pleuritis)

9.2 A. Compare the relative concentrations of inspired gases with expired gases (i.e. oxygen and carbon dioxide).

B. Trace the sequence of events in oxygen transport from lungs to tissue cells, noting the concentrations and forms of oxygen in the blood and the diffusion gradients involved.

C. Trace the sequence of events in the transport of carbon dioxide from tissue cells to lungs, noting the concentrations and forms of carbon dioxide in the blood and the directions of the diffusion gradients involved.

Activity 9.3 A. Observe, locate, and label all organs of the respiratory system of the cat or sheep as seen in demonstration.

B. Examine a slide of human lung tissue and larynx; draw and label according to handout sheets.

C. Working in teams of two, perform selected auscultations of chest and tracheal tube and record results.

D. Perform pneumographic-kymographic studies of respiratory movements and include labeled tracings in the manual.

E. Answer all related questions in the lab manual as directed by the instructor.

Unit 10. Urinary system

10.1 A. List and briefly describe four functions of the human kidney.

B. Describe the location and gross anatomical structures of the kidney and associated structures of urinary system (e.g. ureter, bladder, etc.)

10.2 A. On a diagram of the nephron, label all associated structures and identify basic functions.

B. Detail the physiology of urine formation and outline the sequence of one mechanism (e.g., A.D.H.) that regulates it.

10.3 A. Describe the micturition reflex generally and list two abnormal conditions.

B. Identify the four routes of water loss and note their respective importance.

Activity 10.4 A. Locate and label all structures in the urinary system of the cat or fetal pig, as observed on gross dissection.

B. Examine slides of human kidney sections and locate all major tubules and glomeruli of the nephron.

C. Individually, perform standard urinalysis testing and microscopic examination of specimen.

D. Record all results as directed by handout sheets.

Unit 11. Digestive system and nutrition

A. Outline all steps in the digestive process, from ingestion through egestion.

B. List and give the functions of all major structures of the alimentary system and associated glands.

11.2 A. Describe the basic types, functions, and sources in the diet of the four main nutritional substances.

1. proteins
2. carbohydrates
3. fats
4. vitamins
5. others

B. Identify and briefly explain the factors which cause selected abnormalities (e.g., ulceration, diarrhea, etc.)

Activity 11.3 A. Examine the entire digestive system of the cat or other selected mammal, through instructor-directed demonstration.

B. Examine prepared slides under 100x of stomach, small intestine, large intestine, epithelia, pancreas, and liver. Sketch and label several cells according to directions on handout sheets.

C. Perform indicated chemical tests on carbohydrates, fats, proteins (if applicable).

Unit 12. Endocrine system

12.1 A. Define "Endocrinology" and note the various methods of investigating gland and hormonal activities.

B. Locate and describe the functions of all the following major endocrine glands:

1. Pituitary
2. Pancreas
3. Gonads
4. Thyroid
5. Thymus
6. Adrenal
7. Parathyroid

C. Observing a dissected cat as shown to the class by the instructor, identify all glands noted in B above.

12.2 Identify selected glandular abnormalities and indicate etiology and methods of amelioration.

Unit 13. Reproductive system

13.1 A. Identify all major organs and tubes of the female system at maturity and describe the endocrine role in their development and maintenance.

B. Identify all major organs and tubes of the male system at maturity and describe the endocrine role in their development and maintenance.

C. Differentiate between two venereal diseases in terms of etiological agents, infective changes; symptoms, and prophylaxis.

13.2 A. Summarize on a 30-day calendar the activities of the pituitary, ovary, and uterus as affecting the menstrual cycle and dates of major bodily changes.

B. List four different birth-control techniques and note relative degrees of safety and effectiveness.

Activity 13.3 Locate and label all male and female reproductive structures as observed in gross dissections of sexed cats or fetal pigs. Complete all related sections in the laboratory manual as indicated by handout sheets.