study guide
and review manual of

HUMAN ANATOMY AND PHYSIOLOGY

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BASIC HUMAN ANATOMY AND PHYSIOLOGY

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PREFACE

This Study Guide and Review Manual has been written with the purpose of guiding the student through a first course of human anatomy and physiology.

Each chapter of this guide is begun by a set of learning objectives, which were developed to bring into sharp focus the key points to be learnt and to serve as the basis for developing the questions found within each chapter and the review examinations. The student's learning in each chapter is guided by a series of related questions in which the answer and explanations are provided. Finally, at the end of each part the student is provided with a number of questions compiled in an examination format to test his or her cumulative knowledge and to provide practise writing multiple choice examinations.

This guide is keyed to some of the current leading texts of basic human anatomy and physiology so that the student can quickly and easily read the appropriate chapters in the text being used in their course. The student may also want to consult one or more of the other keyed texts for their study. This guide is in no way intended to replace any given text, but rather to supplement a lecture course in anatomy and physiology. It is also intended to encourage the student to study beyond a given set of notes and to develop self-study habits.

I would like to thank Doctor Keith L. Moore, Professor and Chairman of the Department of Anatomy at The University of Toronto, for his initial encouragment to undertake the writing of this study guide and Doctor T.V.N. Persaud, Professor and Head of the Department of Anatomy at The University of Manitoba, for his interest and continued support during the writing of this study guide.

My special thanks go to Robert E. Wright, Helen L. Dietz, and Walter E. Bailey of the W. B. Saunders Company for their great assistance in the preparation of this book.

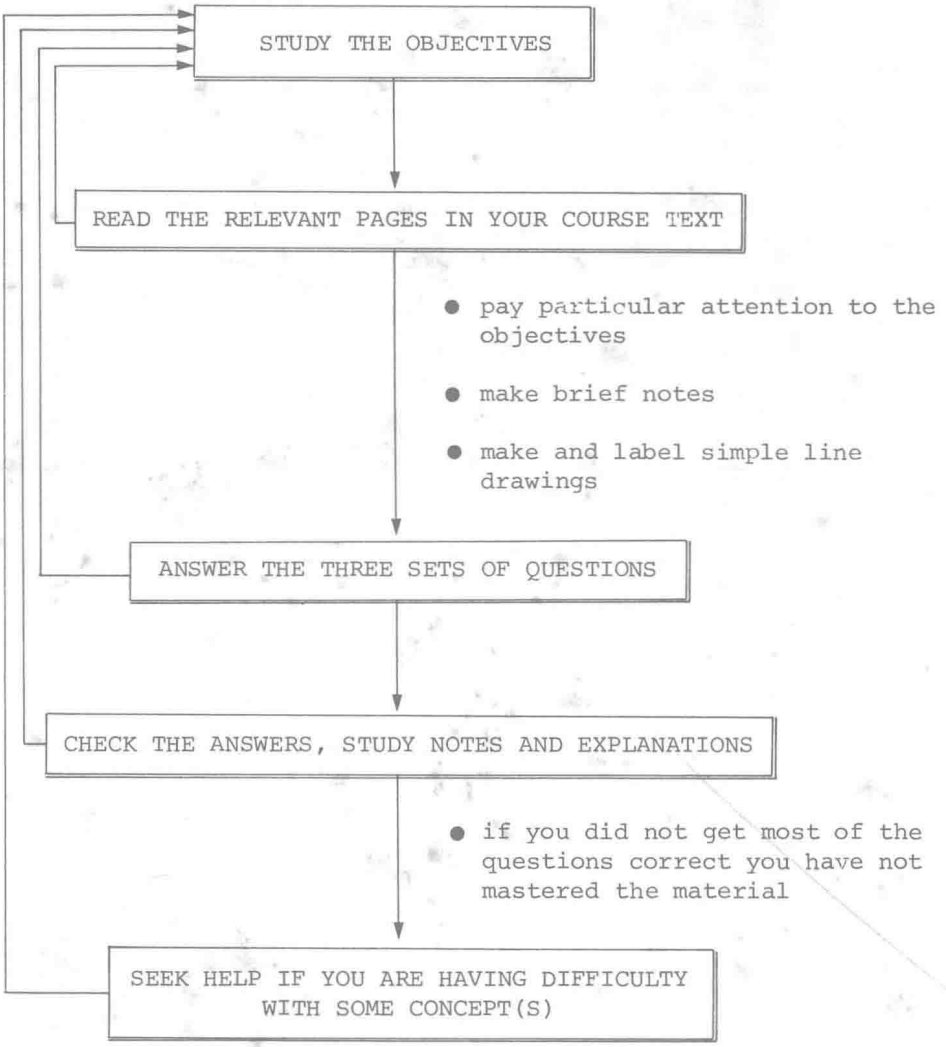
I am very grateful to my wife, Trish, for proofreading the manuscript and to Brenda Bell DiGaetino for her excellent photographic work and technical assistance. Finally, I would like to give a special thanks to Roslyn Hoad who so cheerfully typed the entire manuscript: without her patience and talents this study guide would never have been completed.

Winnipeg, Canada

M. H. Lindsay Gibson

HOW TO USE THIS GUIDE

FOR EACH CHAPTER:



After you have mastered the material in a chapter go on to the next chapter. At the end of each PART you will find a review examination which will test your knowledge of the material covered in a number of chapters. Answer sheets for your use are found in the back of the book on page 341.

CONTENTS

PART 4

REFERENCE BOOKS KEYED

Anthony, C.P., and Kolthoff, N.J.: Textbook of Anatomy and Physiology. 9th ed., Saint Louis, The C.V. Mosby Company, 1975.

Chaffee, E.E., and Greisheimer, E.M.: Basic Physiology and Anatomy. 3rd ed., Philadelphia, J.B. Lippincott Company, 1974.

Crouch, J.E., and McClintic, J.R.: Human Anatomy and Physiology. 2nd ed., New York, John Wiley and Sons, Inc., 1976.

Jacob, S.W., Francone, C.A., and Lossow, W.J.: Structure and Function in Man. 4th ed., Philadelphia, W.B. Saunders Company, 1978.

Landau, B.R.: Essential Human Anatomy and Physiology. 1st ed., Glenview, Illinois, Scott, Foresman and Company, 1976.

Tortora, G.J.: Principles of Human Anatomy. 1st ed., New York, Harper and Row, Publishers, Inc., 1977.

TO TRISH

AND OUR CHILDREN IAN AND JILL

PART ONE

INTRODUCTION TO THE BODY

THE CELL AND ITS PHYSIOLOGY

BODY TISSUES

1. INTRODUCTION TO THE BODY

LEARNING OBJECTIVES

Be Able To:

- Define the sciences of physiology and anatomy; giving the subspecialities of anatomy.
- Describe the body with reference to its anatomical position, relative directions, planes, abdominal regions, and cavities.
- Define and discuss the term homeostasis with reference to the organs involved in its maintenance, its regulating factors and its interaction.
- Discuss the cell, tissues, organs, and systems as structural units of the body.
- List the systems of the human body and give the general functions of each.

RELEVANT READINGS

Anthony & Kolthoff - Chapter 1.
Chaffee & Greisheimer - Chapters 1 and 2.
Crouch & McClintic - Chapter 1.
Jacob, Francone & Lossow - Chapter 1.
Landau - Chapters 1 and 3.
Tortora - Chapter 1.

FIVE-CHOICE COMPLETION QUESTIONS

DIRECTIONS: Each of the following questions or incomplete statements is followed by five suggested answers or completions. SELECT THE SINGLE BEST ANSWER in each case and then circle the appropriate letter at the lower right of each question.

1. THE _____ SYSTEM IS INVOLVED IN MAINTAINING POSTURE AND PRODUCING HEAT.
   A. Endocrine
   B. Muscular
   C. Respiratory
   D. Skeletal
   E. Urinary

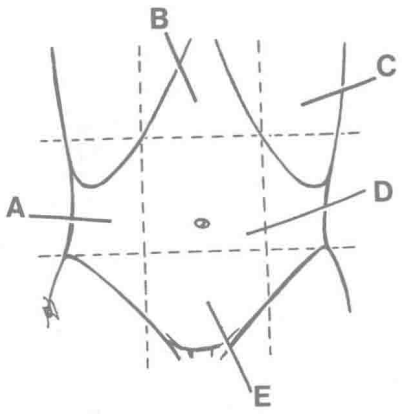
A B C D E

SELECT THE SINGLE BEST ANSWER

2. THE STUDY OF THE ACTIVITIES OF INDIVIDUAL CELLS IS CALLED:
   A. Cellular physiology
   B. Electron microscopy
   C. Microscopic Anatomy
   D. Neuroanatomy
   E. None of the above

   A B C D E

3. THE HYPOCHONDRIAC REGION IS INDICATED BY _____.



   A B C D E

4. THE SCAPULAE LIE _____ TO THE CHEST WALL.
   A. Anterior
   B. Inferior
   C. Medial
   D. Lateral
   E. Posterior

   A B C D E

5. THE STUDY OF A DEVELOPING ZYGOTE INTO A MATURE ORGANISM IS CALLED _____.
   A. Cytology
   B. Histology
   C. Pathology
   D. Embryology
   E. Physiology

   A B C D E

6. IN THE ANATOMICAL POSITION, THE LITTLE FINGER IS _____ TO THE THUMB.
   A. Medial
   B. Distal
   C. Lateral
   D. Inferior
   E. Proximal

   A B C D E

7. HISTOLOGY IS THE SCIENTIFIC STUDY OF:
   A. Cellular function
   B. Cellular structure
   C. Tissue structure
   D. Abnormal tissue
   E. Developmental structure

   A B C D E

8. THE ANKLE IS _____ IN POSITION TO THE KNEE.
   A. Medial
   B. Distal
   C. Lateral
   D. Superior
   E. Anterior

   A B C D E

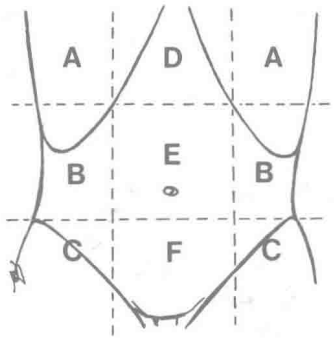
---------- ANSWERS, NOTES AND EXPLANATIONS ----------

1. B, The muscular system is not only responsible for the maintenance of body posture and the production of heat, but also provides for the movement of the whole body or its parts. The skeletal system protects and supports the body, allows for leverage, and provides sites for the production of blood cells and the storage of minerals. The endocrine system regulates many of the activitives

of the body through the action of hormones; the urinary system eliminates cellular wastes, maintains the acid-base balance, and helps regulate body fluids. The respiratory system is responsible for obtaining oxygen for the tissues of the body, eliminating carbon dioxide, and helps in regulating the acid-base balance of the body.

2. A, Cellular physiology is the study of the functions or activities of individual cells, along with the physical and chemical factors and processes involved.

3. C, For descriptive purposes the abdomen may be divided into nine regions by two vertical (sagittal) and two horizontal (transverse) planes. The superior horizontal plane passes midway between the jugular notch of the sternum and the symphysis pubis of the pelvis. The inferior horizontal plane passes through the tubercle of the iliac crests. The two vertical planes pass through the midpoint of the right and left inguinal ligaments. The nine regions demarcated by these four planes are illustrated: right and left hypochondriac (A), right and left lumbar (B), right and left iliac (C), epigastric (D), umbilical (E), and hypogastric (F) regions.



4. E, The scapulae not only lie posterior to the chest wall but may also be correctly described as lying superficial to it and deep to the skin of the back.

5. D, Embryology in its broadest concept is the study of the developing zygote through to its adult form. In the restricted sense, embryology is the study of the prenatal stages of development, especially those occurring during the embryonic period (from the beginning of the second week and continuing through to the end of the seventh week).

6. A, The anatomical position can be defined as the body in the erect position, with the arms at the sides and the head, eyes and palms facing forward. In this position the little finger would be medial to the thumb since the little finger would be closer to the midline of the body than the thumb. Conversely, the thumb would lie lateral to the little finger.

7. C, Histology, or microscopical anatomy, is the scientific study of tissue structure and function, and how the various tissues form the different organs and systems of the body. The studies of cellular function and structure are the sciences of physiology and cytology, respectively. The study of abnormal or diseased tissue is called pathology, whereas the study of developmental structure is called embryology.

8. B, The term distal means the farthest from any point of reference, whereas the term proximal means the opposite. Therefore the ankle is distal to the knee, but the ankle may also be described as being inferior to the knee. On the other hand, the knee may be described as lying proximal or superior to the ankle.

MULTI-COMPLETION QUESTIONS

DIRECTIONS: In each of the following questions or incomplete statements, ONE OR MORE of the completions given is correct. At the lower right of each question, circle A if 1, 2, and 3 are correct; B if 1 and 3 are correct; C if 2 and 4 are correct; D if only 4 is correct; and E if all are correct.

1. THE HOMEOSTATIC MECHANISMS OF THE BODY ARE SUBJECT TO CONTROL BY THE _____ SYSTEM(S).
   1. Circulatory
   2. Endocrine
   3. Muscular
   4. Nervous

   A B C D E

2. ORGAN(S) LOCATED IN THE ABDOMINAL CAVITY INCLUDE THE:
   1. Liver
   2. Kidney
   3. Spleen
   4. Pancreas

   A B C D E

3. WHICH OF THE FOLLOWING STATEMENTS IS(ARE) CORRECT FOR HOMEOSTASIS?
   1. Provides a constant cellular environment
   2. Regulated by the endocrine system
   3. Involved in controlling body temperatures
   4. Operates by a regulating feedback mechanism

   A B C D E

4. WHICH OF THE FOLLOWING STATEMENTS ABOUT TISSUES IS(ARE) CORRECT?
   1. Contains a varying amount of matrix
   2. Performs a particular function
   3. Form larger units called organs
   4. Smallest structural unit of the body

   A B C D E

5. WHICH OF THE FOLLOWING IS(ARE) CONSIDERED A VENTRAL CAVITY OF THE BODY?
   1. Pelvic
   2. Spinal
   3. Pericardial
   4. Cranial

   A B C D E

6. THE ORGAN(S) WHOSE PRIMARY FUNCTION IS THE MAINTENANCE OF HOMEOSTASIS IS(ARE) THE:
   1. Prostate
   2. Liver
   3. Spleen
   4. Kidneys

   A B C D E

7. WHICH OF THE FOLLOWING IS(ARE) A DISCIPLINE OF HUMAN ANATOMY?
   1. Gross
   2. Histology
   3. Embryology
   4. Pathology

   A B C D E

8. THE CIRCULATORY SYSTEM IS:
   1. Primarily responsible for body movements
   2. Directly involved with the digestion of food
   3. Responsible for the transmission of pain
   4. Involved in the regulation of body temperature

   A B C D E

---------- ANSWERS, NOTES AND EXPLANATIONS ----------

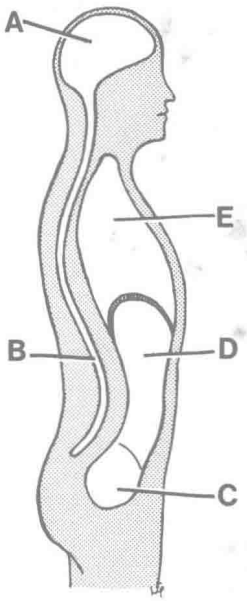
1. C, 2 and 4 are correct. The different systems of the body performing homeostatic mechanisms such as the digestive, circulatory and respiratory systems, are themselves controlled by the nervous and endocrine systems. In both these control systems specific cells react to chemical or hormonal changes in the blood and in turn elicit a cellular response to correct these changes. The speed at which nerve impulses correct a change in the internal environment of the body is very rapid; whereas the speed at which hormones correct such changes is usually much slower.

2. E, All are correct. The abdominal cavity is the largest of the ventral cavities of the body. It is separated superiorly from the thoracic cavity by the diaphragm and is continuous inferiorly with the pelvic cavity. The abdominal cavity contains the liver, gallbladder, spleen, pancreas, organs of the digestive tract and the kidneys with their ureters.

3. E, All are correct. Homeostasis is a condition which provides a relatively constant environment for the cells of the body so that they can function normally. Factors vital to the normal functioning of a cell are: exact concentrations of gases, nutrients, and ions; and optimal temperatures and osmotic pressures. Any stress producing a change in the cellular environment of the body is quickly corrected for by a feedback mechanism. This fine balance of homeostasis is regulated by the endocrine and nervous systems.

4. A, 1, 2, and 3 are correct. The term tissue can be defined as an aggregation of cells separated by a varying amount of matrix (intracellular substance) and performing a particular function. Combinations of the four basic tissues (i.e., epithelial, connective, muscular and nervous) form organs and in turn various organs performing a common function form a system. The smallest structural unit of the body is the cell.

5. B, 1 and 3 are correct. The dorsal cavities of the body consist of the cranial (A in the diagram) and spinal (B) cavities and contain the brain and spinal cord, respectively. The ventral cavities of the body include the thoracic (E), abdominal (D) and pelvic (C) cavities. The thoracic cavity can be further subdivided into a central pericardial cavity, containing the heart, and two lateral pleural cavities, each containing a lung.



6. C, 2 and 4 are correct. Several organs of the body can best be understood as homeostatic organs, since their primary function is directed towards the maintenance of homeostasis; these organs include the heart, lungs, kidneys, liver, gastrointestinal tract, and the skin. However, all body structures from the cellular to the systemic level, contribute in some way to the maintenance of the internal environment of the body within normal physiological limits.

7. A, 1, 2, and 3 are correct. The discipline of human anatomy deals with the structure of man and has four divisions: neuroanatomy, gross anatomy, histology, and embryology. Neuroanatomy deals with the structure of the nervous system; whereas gross and histology deal with normal macroscopic and microscopic structures of man, respectively. Embryology deals with the normal anatomical development of man, from the zygote through to the adult and on to senility.