

**A COMPEND OF HUMAN  
PHYSIOLOGY, ESPECIALLY  
ADAPTED FOR THE USE OF  
MEDICAL STUDENTS**

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A compend of human physiology, especially adapted for the use of medical students by Albert Philson Brubaker

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**ALBERT PHILSON BRUBAKER**

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HUMAN PHYSIOLOGY

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OF MEDICAL STUDENTS

BY

ALBERT P. BRUBAKER, A. M., M. D.

AUTHOR OF "A TEXT-BOOK OF PHYSIOLOGY"; PROFESSOR OF PHYSIOLOGY AND  
MEDICAL JURISPRUDENCE IN THE JEFFERSON MEDICAL COLLEGE; FORMERLY  
PROFESSOR OF PHYSIOLOGY IN THE PENNSYLVANIA COLLEGE OF DENTAL  
SURGERY; LECTURER ON ANATOMY AND PHYSIOLOGY IN THE DREXEL  
INSTITUTE OF ART, SCIENCE, AND INDUSTRY; FELLOW OF THE  
COLLEGE OF PHYSICIANS OF PHILADELPHIA

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## PREFACE TO THE THIRTEENTH EDITION.

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In the preparation of a thirteenth edition of the Compend an opportunity has been furnished for the revision of many paragraphs for the addition of such new material as seemed necessary for the needs of students during their attendance on lectures and for reviewing the subject prior to their examinations. That it may continue to meet the needs of the student class in the future as it has in the past is the sincere wish of the author.

ALBERT P. BRUBAKER.

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# A COMPEND OF HUMAN PHYSIOLOGY.

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**Introduction.**—An animal organism in the living condition exhibits a series of phenomena which relate to growth, movement, mentality, and reproduction. During the period preceding birth, as well as during the period included between birth and adult life, the individual grows in size and complexity from the introduction and assimilation of material from without. Throughout its life the animal exhibits a series of movements, in virtue of which it not only changes the relation of one part of its body to another, but also changes its position in space. If, in the execution of these movements, the parts are directed to the overcoming of opposing forces, such as gravity, friction, cohesion, elasticity, etc., the animal may be said to be doing work. The result of normal growth is the attainment of a physical development that will enable the animal, and, more especially, man, to perform the work necessitated by the nature of its environment and the character of its organization. In man, and probably in lower animals as well, mentality manifests itself as intellect, feeling, and volition. At a definite period in the life of the animal it reproduces itself, in consequence of which the species to which it belongs is perpetuated.

The study of the phenomena of growth, movement, mentality, and reproduction constitutes the science of **ANIMAL PHYSIOLOGY**. But as these general activities are the resultant of and dependent on the special activities of the individual structures of which an animal body is composed, Physiology in its more restricted and generally accepted sense is the science which investigates the actions or functions of the individual organs and tissues of the body and the physical and chemic conditions which underlie and determine them.

This may naturally be divided into:

1. *Special physiology*, the object of which is a study of the vital phenomena or functions exhibited by the organs of any individual animal.
2. *Comparative physiology*, the object of which is a comparison of the vital phenomena or functions exhibited by the organs of two or more animals, with a view to unfolding their points of resemblance or dissimilarity.

**Human physiology** is that department of physiologic science which has for its object the study of the functions of the organs of the human body in a state of health.

Inasmuch as the study of function, or physiology, is associated with and dependent on a knowledge of structure, or anatomy, it is essential that the student should have a general acquaintance not only with the structure of man, but with that of typical forms of lower animal life as well.

If the body of any animal be dissected, it will be found to be composed of a number of well-defined structures, such as heart, lungs, stomach, brain, eye, etc., to which the term organ was originally applied, for the reason that they were supposed to be instruments capable of performing some important act or function in the general activities of the body. Though the term organ is usually employed to designate the larger and more familiar structures just mentioned, it is equally applicable to a large number of other structures which, though possibly less obvious, are equally important in maintaining the life of the individual—*e. g.*, bones, muscles, nerves, skin, teeth, glands, blood-vessels, etc. Indeed, any complexly organized structure capable of performing some function may be described as an organ. A description of the various organs which make up the body of an animal, their external form, their internal arrangement, their relations to one another, constitutes the science of ANIMAL ANATOMY.

This may naturally be divided into:

1. *Special anatomy*, the object of which is the investigation of the construction, form, and arrangement of the organs of any individual animal.
2. *Comparative anatomy*, the object of which is a comparison of the organs of two or more animals, with a view to determining their points of resemblance or dissimilarity.

If the organs, however, are subjected to a further analysis, they can be resolved into simple structures, apparently homogeneous, to which the name tissue has been given—*e. g.*, epithelial, connective, muscle, and nerve tissue. When the tissues are subjected to microscopic analysis, it is found that they are not homogeneous in structure, but composed of still simpler elements, termed cells and fibers. The investigation of the internal structure of the

organs, the physical properties and structure of the tissues, as well as the structure of their component elements, the cells and fibers, constitutes a department of anatomic science known as HISTOLOGY, or as it is prosecuted largely with the microscope, MICROSCOPIC ANATOMY.

**Human anatomy** is that department of anatomic science which has for its object the investigation of the construction of the human body.

### GENERAL STRUCTURE OF THE ANIMAL BODY.

The body of every animal, from fish to man, may be divided into—

1. An axial and
2. An appendicular portion. The axial portion consists of the head, neck, and trunk; the appendicular portion consists of the anterior and posterior limbs or extremities.

The **axial portion** of all mammals, to which class man zoologically belongs, as well as of all birds, reptiles, amphibians, and osseous fish, is characterized by the presence of a bony, segmented axis, which extends in a longitudinal direction from before backward, and which is known as the vertebral column or backbone. In virtue of the existence of this column all the class of animals just mentioned form one great division of the animal kingdom, the *Vertebrata*.

Each segment, or vertebra, of this axis consists of—

1. A solid portion, known as the body or centrum, and
2. A bony arch arising from the dorsal aspect and surmounted by a spine-like process.

At the anterior extremity of the body of the animal the vertebrae are variously modified and expanded, and, with the addition of new elements, form the skull; at the posterior extremity they rapidly diminish in size, and terminate in man in a short, tail-like process. In many animals, however, the vertebral column extends for a considerable distance beyond the trunk into the tail. The vertebral column may be regarded as the foundation element in the plan of organization of all the higher animals and the center around which the rest of the body is developed and arranged with a certain degree of conformity. In all vertebrate animals the bodies of the segments of the vertebral column form a partition which serves to divide the trunk of the body into two cavities—viz., the dorsal and the ventral.

The **dorsal cavity** is found in the head. Its walls are not only in the trunk, but also formed partly by the arches which arise from the posterior or dorsal surface of the vertebrae and partly by the bones of the skull. If a longitudinal section be made through the center of the vertebral column, and including the head, the dorsal cavity will be observed running through its entire extent. (See Fig. 1.) Though for the most part it is quite narrow,