

# BASIC HUMAN ANATOMY

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ALEXANDER P. SPENCE



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# Preface

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*Basic Human Anatomy* provides a definitive introduction to human anatomy for students majoring in health science programs, the allied-health professions, physical education, or the liberal arts. The text is written in such a way that it should be accessible to students with only a limited background in biology.

Though this text is designed for one-term courses in human anatomy, I have chosen not to ignore physiology. I have found that a strictly anatomical approach leaves too many unanswered questions in the minds of students. Therefore, I have included brief discussions of the physiology of selected organs to enable students to appreciate the relationship between structure and function. For the same reason, I briefly discuss aging, as well as common dysfunctions or diseases associated with the structures described.

## Sequence of Chapters

Based on detailed instructor surveys, the chapters follow the most common sequence used in the classroom. For those instructors who wish to follow an alternate sequence, I have made each chapter as independent as possible. In addition, cross-references are included to aid the presentation for instructors who teach the material in another sequence.

The first three chapters provide basic information concerning anatomical terminology, the cell, and tissues, and should be studied first. Following these introductory chapters, each of the ten systems of the body is covered in successive chapters and can be studied in any sequence. A chapter on pregnancy and early development of the embryo (Chapter 22) follows naturally after the study of the reproductive systems. Since some instructors prefer to cover embryonic development at the beginning of their courses, I have organized the chapter in such a way that selected pages can be assigned at the outset.

## The Integration of Art and Text

Perhaps the most distinctive feature of this text compared to the other anatomy textbooks currently available is the superb artwork, which we have carefully integrated with the text. I am indebted to the artist, Fran Milner, who developed insets to help orient students to particular aspects of many of the figures, and who made certain I included only essential labels on the figures. Fran and the designer, John Edeen, along with the Benjamin/Cummings staff, labored over every page of the book making certain that each figure is as close as possible to the corresponding text. The integration of artwork and text is further enhanced by a marginal figure referencing system that enables students to correlate figures efficiently with the relevant text discussion. The careful integration of art and text should make this book a significantly better teaching tool than was previously available.

## Special Features

To enhance the text's usefulness as a teaching tool and to increase student interest, the following special features are included:

- *Integration of Embryology.* I have found that structural relationships within the body are best understood when students have some knowledge of the embryonic development of the structures involved. For this reason, the discussion of each system begins with a brief consideration of the development of the system in the embryo. These discussions are self-contained and, if the instructor chooses, may be omitted without detracting from the remainder of the chapter.
- *Surface Anatomy.* When students can visualize



structures, this improves their retention and their understanding of anatomical relationships. One of the best ways to visualize anatomical relationships is to have students locate structures on their own bodies. The chapter on surface anatomy (Chapter 8), placed after the skeletal and muscular system chapters, will facilitate this understanding. The surface anatomy chapter is an excellent review of many of the structures identified in previous chapters.

- *Special Topics Boxes.* These brief essays, accompanied by photographs, focus on subjects that students find particularly interesting. They include such areas as burn treatment and skin grafting, and the effects of cigarette smoking on the lungs.
- *Pathology and Aging.* My emphasis throughout the text is on normal human anatomy. Brief discussions of common dysfunctions are included where they serve to enhance and reinforce an understanding of normal human anatomy. Discussions of the effects of aging also add depth to the material.
- *Light Micrographs and Scanning Electron Micrographs.* I have included light micrographs to aid the histological descriptions. These micrographs are often accompanied by labeled line illustrations, drawn from the same specimen. Scanning electron micrographs are used to illustrate the three-dimensional relationships of many important microscopic structures.

## In-Text Learning Aids

Students learn in different ways. I have, therefore, provided various pedagogical aids to assist the diverse group of students who take courses in human anatomy. Each chapter includes:

- learning objectives
- detailed chapter contents
- end-chapter study outlines with specific references to the text
- self-quizzes, with an answer key at the end of the text

In addition to the chapter-level pedagogical aids, the book also includes:

- *Guide to Word Roots, Prefixes, Suffixes, and Combining Forms.* This guide, found just after the detailed table of contents, should be a valuable aid to students throughout the course.

- *Glossary.* Located at the end of the book, the glossary includes over 1,000 definitions and provides a phonetic pronunciation of each term.
- *Metric Appendix.* Also located at the end of the book, this appendix provides metric/English conversion figures.

## Supplements

- *Instructor's Guide.* Robin Lenn of Sacramento City College has prepared a comprehensive and valuable instructor's guide to accompany the text. It includes 44 chapter quizzes set up for easy photocopying, plus two final exams. Numerous references and resource bibliographies are included.
- *Overhead Transparencies.* The publisher is generously offering, gratis to all adopters of this text, a set of 68 two-color acetate transparencies. Transparencies are available on written request to the publisher.

## Acknowledgments

In the preparation of this textbook, I have relied heavily on the constructive comments and advice of a number of instructors who have reviewed various portions and drafts of the manuscript (see list that follows). I gratefully acknowledge their help and encouragement.

Jackie Walker and Sadao Hamada, the coaches of the Stanford University Women's and Men's Gymnastics Teams, allowed us to conduct photo sessions for the surface anatomy chapter using some of their team members as subjects. Doctors Lawrence Mathers and John Dolph of the Stanford University Medical School served as consultants to the publisher for the surface anatomy photo sessions. I am very much indebted to these people.

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Finally, I would like to thank the many instructors and students who have used my previous text, *Human Anatomy and Physiology*, which I co-authored with Dr. Elliott Mason. I have learned much from the comments and suggestions that have been sent to me through the publisher. Many of these suggestions have been incorporated into *Basic Human Anatomy*.

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# Word Roots, Prefixes, Suffixes, and Combining Forms

Dear Student:

Your success in the course you are about to begin will depend, to a great degree, on your ability to master a new vocabulary. This appendix should be a valuable resource for you throughout the course. Good luck!

A. P. Spence

## PREFIXES AND COMBINING FORMS

- a-, an-** *absence or lack* acardia, lack of a heart; anaerobic, in the absence of oxygen
- ab-** *departing from; away from* abnormal, departing from normal
- acou-** *hearing* acoustics, the science of sound
- acr-, acro-** *extreme or extremity; peak* acrodermatitis, inflammation of the skin of the extremities
- ad-** *to or toward* adorbital, toward the orbit
- aden-, adeno-** *gland* adeniform, resembling a gland in shape
- amphi-** *on both sides; of both kinds* amphibian, an organism capable of living in water and on land
- angi-** *vessel* angiitis, inflammation of a lymph vessel or blood vessel
- ant-, anti-** *opposed to; preventing or inhibiting* anticoagulant, a substance that prevents blood coagulation
- ante-** *preceding; before* antecubital, in front of the elbow
- arthr-, arthro-** *joint* arthropathy, any joint disease
- aut-, auto-** *self* autogenous, self-generated
- bi-** *two* bicuspid, having two cusps *cuspid 牙尖*
- bio-** *life* biology, the study of life and living organisms
- blast-** *bud or germ* blastocyte, undifferentiated embryonic cell
- broncho-** *bronchus* bronchospasm, spasmodic contraction of bronchial muscle
- bucco-** *cheek* buccolabial, pertaining to the cheek and lip
- caput-** *head* decapitate, remove the head
- carcin-** *cancer* carcinogen, a cancer-causing agent
- cardi-, cardio-** *heart* cardiotoxic, harmful to the heart
- cephal-** *head* cephalometer, an instrument for measuring the head
- cerebro-** *brain, especially the cerebrum* cerebrospinal, pertaining to the brain and spinal cord
- chondr-** *cartilage* chondrogenic, giving rise to cartilage
- circum-** *around* circumnuclear, surrounding the nucleus
- co-, con-** *together* concentric, common center, together in the center
- contra-** *against* contraceptive, agent preventing conception
- cost-** *rib* intercostal, between the ribs
- crani-** *skull* craniotomy, a skull operation
- crypt-** *hidden* cryptomenorrhea, a condition in which menstrual symptoms are experienced but no external loss of blood occurs
- cyt-** *cell* cytology, the study of cells
- de-** *undoing, reversal, loss, removal* deactivation, becoming inactive
- di-** *twice, double* dimorphism, having two forms
- dia-** *through, between* diaphragm, the wall through or between two areas
- dys-** *difficult, faulty, painful* dyspepsia, disturbed digestion
- ec-, ex-, ecto-** *out, outside, away from* excrete, to remove materials from the body
- en-, em-** *in, inside* encysted, enclosed in a cyst or capsule
- entero-** *intestine* enterologist, one who specializes in the study of intestinal disorders
- epi-** *over, above* epidermis, outer layer of skin
- eu-** *well* eesthesia, a normal state of the senses
- exo-** *outside, outer layer* exophthalmos, an abnormal protrusion of the eye from the orbit
- extra-** *outside, beyond* extracellular, outside the body cells of an organism
- gastr-** *stomach* gastrin, a hormone that influences gastric acid secretion
- glosso-** *tongue* glossopathy, any disease of the tongue
- hema-, hemato-, hemo-** *blood* hematocyst, a cyst containing blood
- hemi-** *half* hemiglossal, pertaining to one half of the tongue
- hepat-** *liver* hepatitis, inflammation of the liver
- hetero-** *different or other* heterosexuality, sexual desire for a person of the opposite sex
- hist-** *tissue* histology, the study of tissues

**hom-, homo-** *same* homeoplasia, formation of tissue similar to normal tissue; homocentric, having the same center

**hydr-, hydro-** *water* dehydration, loss of body water

**hyper-** *excess* hypertension, excessive tension

**hypno-** *sleep* hypnosis, a sleeplike state

**hypo-** *below, deficient* hypodermic, beneath the skin; hypokalemia, deficiency of potassium

**hyster-, hystero-** *uterus or womb* hysterectomy, removal of the uterus; hysterdynia, pain in the womb

**im-** *not* impermeable, not permitting passage, not permeable

**inter-** *between* intercellular, between the cells

**intra-** *within, inside* intracellular, inside the cell

**iso-** *equal, same* isothermal, equal, or same, temperature

**leuko-** *white* leukocyte, white blood cell

**lip-, lipo-** *fat, lipid* lipophage, a cell that has taken up fat in its cytoplasm

**macro-** *large* macromolecule, large molecule

**mal-** *bad, abnormal* malfunction, abnormal functioning of an organ

**mamm-** *breast* mammary gland, breast

**mast-** *breast* mastectomy, removal of a mammary gland

**meningo-** *membrane* meningitis, inflammation of the membranes of the brain

**meso-** *middle* mesoderm, middle germ layer

**meta-** *beyond, between, transition* metatarsus, the part of the foot between the tarsus and the phalanges

**metro-** *uterus* metroscope, instrument for examining the uterus

**micro-** *small* microscope, an instrument used to make small objects appear larger

**mito-** *thread, filament* mitochondria, small, filamentlike structures located in cells

**mono-** *single* monospasm, spasm of a single limb

**morpho-** *form* morphology, the study of form and structure of organisms

**multi-** *many* multinuclear, having several nuclei

**myelo-** *spinal cord, marrow* myeloblasts, cells of the bone marrow

**myo-** *muscle* myocardium, heart muscle

**narco-** *numbness* narcotic, a drug producing stupor or numbed sensations

**nephro-** *kidney* nephritis, inflammation of the kidney

**neuro-** *nerve* neurophysiology, the physiology of the nervous system

**ob-** *before, against* obstruction, impeding or blocking up

**oculo-** *eye* monocular, pertaining to one eye

**odonto-** *teeth* orthodontist, one who specializes in proper positioning of the teeth in relation to each other

**ophthalgo-** *eye* ophthalmology, the study of the eyes and related disease

**ortho-** *straight, direct* orthopedic, correction of deformities of the musculoskeletal system

**osteo-** *bone* osteoderma, bony formations in the skin

**oto-** *ear* otoscope, a device for examining the ear

**oxy-** *oxygen* oxygenation, the saturation of a substance with oxygen

**pan-** *all, universal* panacea, a cure-all

**para-** *beside, near* paraphrenitis, inflammation of tissues adjacent to the diaphragm

**peri-** *around* perianal, situated around the anus

**phago-** *eat* phagocyte, a cell that engulfs and digests particles or cells

**phleb-** *vein* phlebitis, inflammation of the veins

**pod-** *foot* podiatry, the treatment of foot disorders

**poly-** *multiple* polymorphism, multiple forms

**post-** *after, behind* posterior, places behind (a specific) part

**pre-, pro-** *before, ahead of* prenatal, before birth

**procto-** *rectum, anus* proctoscope, an instrument for examining the rectum

**pseudo-** *false* pseudotumor, a false tumor

**psycho-** *mind, psyche* psychogram, a chart of personality traits

**pyo-** *pus* pyocyst, a cyst that contains pus

**retro-** *backward, behind* retrogression, to move backward in development

**sclero-** *hard* sclerodermitis, inflammatory thickening and hardening of the skin

**semi-** *half* semicircular, having the form of half a circle

**steno-** *narrow* stenocoria, narrowing of the pupil

**sub-** *beneath, under* sublingual, beneath the tongue

**super-** *above, upon* superior, quality or state of being above others or a part

**supra-** *above, upon* supracondylar, above a condyle

**sym-, syn-** *together, with* synapse, the region of communication between two neurons

**tachy-** *rapid* tachycardia, abnormally rapid heartbeat

**therm-** *heat* thermometer, an instrument used to measure heat

**tox-** *poison* antitoxic, effective against poison

**trans-** *across, through* transpleural, through the pleura

**tri-** *three* trifurcation, division into three branches

**viscero-** *organ, viscera* visceroinhibitory, inhibiting the movements of the viscera

## SUFFIXES

**-able** *able to, capable of* viable, ability to live or exist

**-ac** *referring to* cardiac, referring to the heart

**-algia** *pain in a certain part* neuralgia, pain along the course of a nerve

**-ary** *associated with, relating to* coronary, associated with the heart

**-atresia** *imperforate* proctatresia, an imperforate condition of the rectum or anus

**-cide** *destroy or kill* germicide, an agent that kills germs

**-ectomy** *cutting out, surgical removal* appendectomy, cutting out of the appendix

**-emia** *condition of the blood* anemia, deficiency of red blood cells

**-ferent** *carry* efferent nerves, nerves carrying impulses away from the CNS

**-fuge** *driving out* vermifuge, a substance that expels worms of the intestine

**-gen** *an agent that initiates* pathogen, any agent that produces disease

**-gram** *data that are systematically recorded, a record* electrocardiogram, a recording showing action of the heart

**-graph** *an instrument used for recording data or writing* electrocardiograph, an instrument used to make an electrocardiogram

**-ia** *condition* insomnia, condition of not being able to sleep

**-iatrics** *medical specialty* geriatrics, the branch of medicine dealing with disease associated with old age

**-itis** *inflammation* gastritis, inflammation of the stomach



- logy** *the study of* pathology, the study of changes in structure and function brought on by disease
- lysis** *loosening or breaking down* hydrolysis, chemical decomposition of a compound into other compounds as a result of taking up water
- malacia** *soft* osteomalacia, a process leading to bone softening
- mania** *obsession, compulsion* erotomania, exaggeration of the sexual passions
- odyn** *pain* coccygodynia, pain in the region of the coccyx
- oid** *like, resembling* cuboid, shaped as a cube
- oma** *tumor* lymphoma, a tumor of the lymphatic tissues
- opia** *defect of the eye* myopia, nearsightedness
- ory** *referring to, of* auditory, referring to hearing
- pathy** *disease* psychopathy, any disease of the mind
- phobia** *fear* acrophobia, fear of heights
- plasty** *reconstruction of a part, plastic surgery* rhinoplasty, reconstruction of the nose through surgery
- plegia** *paralysis* paraplegia, paralysis of the lower half of the body or limbs
- rrhagia** *abnormal or excessive discharge* metrorrhagia, uterine hemorrhage
- rrhea** *flow or discharge* diarrhea, abnormal emptying of the bowels
- scope** *instrument used for examination* stethoscope, instrument used to listen to sounds of various parts of the body
- stasis** *arrest, fixation* hemostasis, arrest of bleeding
- stomy** *establishment of an artificial opening* enterostomy, the formation of an artificial opening into the intestine through the abdominal wall
- tomy** *to cut* appendectomy, surgical removal of the appendix
- ty** *condition of, state* immunity, condition of being resistant to infection or disease
- uria** *urine* polyuria, passage of an excessive amount of urine

## LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Describe several subdivisions of the study of anatomy.
- Name four types of tissues produced by the three embryonic cell layers.
- Name the ten major organ systems in the human body.
- Be familiar with common directional and regional terms.
- Describe the anatomical position.
- Name the planes and cavities of the body.
- Distinguish between the parietal and the visceral membranes of the ventral body cavities.
- Describe the mesenteries of the abdominopelvic cavity.

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*Nervous Tissues*

*Connective Tissues*

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BODY POSITIONS

DIRECTIONAL TERMS

REGIONAL TERMS

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