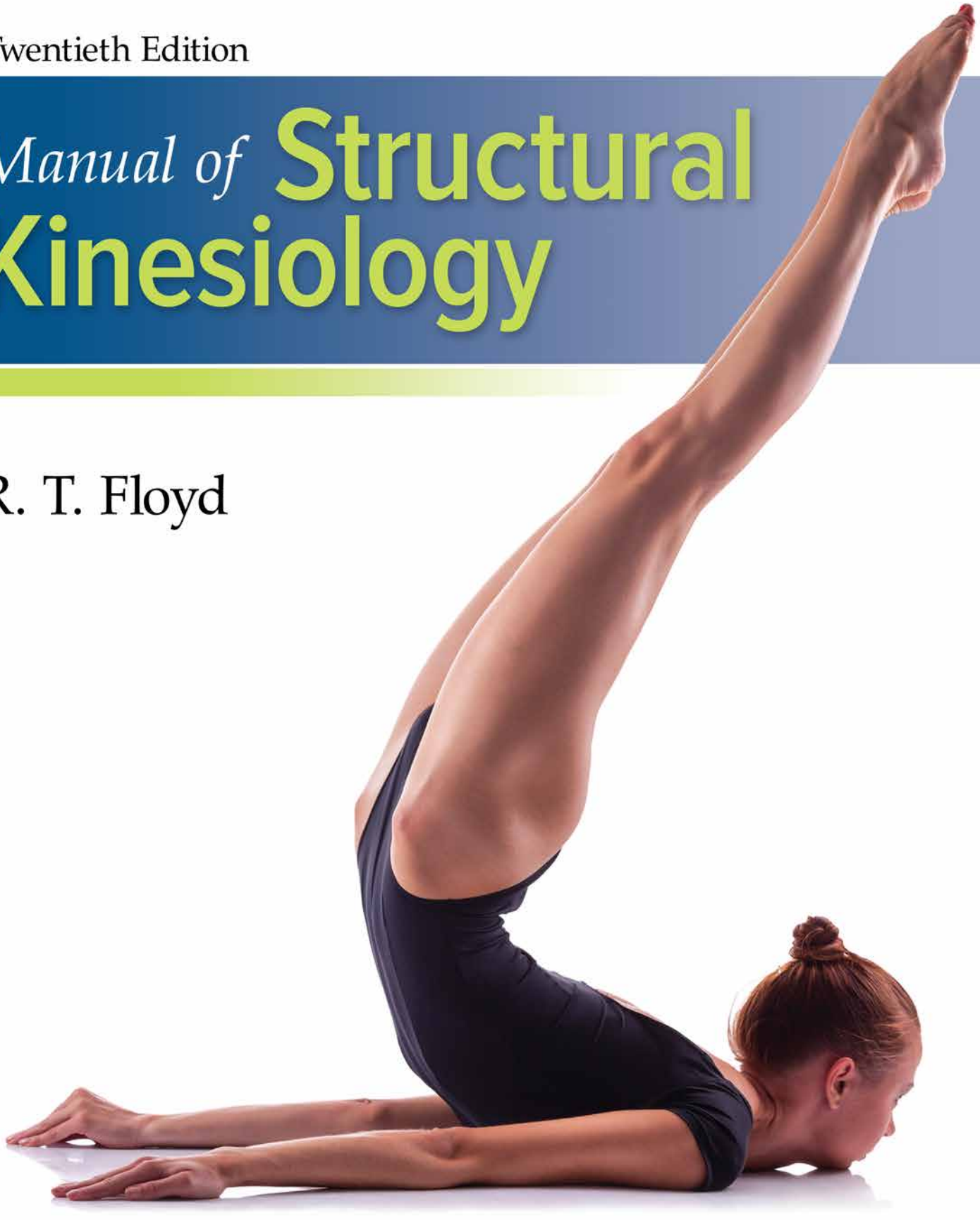
Twentieth Edition

Manual of Structural Kinesiology

R. T. Floyd



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Manual of Structural Kinesiology

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TWENTIETH EDITION

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MANUAL OF STRUCTURAL KINESIOLOGY, TWENTIETH EDITION

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Preface

I greatly appreciate the loyalty that the numerous faculty members, students, and other professionals have shown this work over the years. Conversations with some of you have generated ideas to improve and advance the presentation of the content which I continue to incorporate while attempting to maintain the successful presentation approach the late Dr. Clem Thompson established from 1961 through 1989. I first used this book as an undergraduate and later in my teachings over the years. Having developed great respect for this text and Dr. Thompson's style, it is my intention to continue to preserve the effectiveness of this time-honored text, while adding material pertinent to the professions working with today's ever-growing physically active population. I have attempted to maintain and improve clarity while continuing with a concise, simple, and straightforward presentation method. I have drawn upon my career experiences, both as a clinician and an educator, to assist in this process and sincerely hope that this approach is beneficial to those who use this text.

This text, now in its 70th year, has undergone many revisions over the years. My goal continues to be making the material as applicable as possible to physical activity and to make it more understandable and easier to use for the student and professional. While reading this text, I challenge kinesiology students and professionals to immediately apply the content to physical activities with which they are individually familiar. I hope that the reader will simultaneously palpate his or her own moving joints and contracting muscles to gain application. Concurrently, I encourage readers to palpate the joints and muscles of colleagues to gain a better appreciation of the wide range of normal anatomy and, when possible, appreciate the variation from normal found in injured and pathological musculoskeletal anatomy. Additionally, with the tremendous growth of information and media available via the Internet and other technological means, I encourage careful and continuous exploration of these resources. These resources should be helpful, but must be reviewed with a critical eye, as all information should be.

Audience

This text is designed for students in an undergraduate structural kinesiology course after completing courses in human anatomy and physiology. While primarily utilized in physical education, human performance, movement science, exercise science, athletic training, physical therapy, and massage therapy curriculums, it is often used as a continuing reference by other clinicians and educators in addressing musculoskeletal concerns of the physically active. Applied kinesiologists, athletic trainers, athletic coaches, physical educators, physical therapists, occupational therapists, health club instructors, strength and conditioning specialists, personal trainers, massage therapists, physicians, and others who are responsible for evaluating, improving, and maintaining the muscular strength, endurance, flexibility, and overall health of individuals will benefit from this text.

With the ever-continuing growth in the number of participants of all ages in a spectrum of physical activity, it is imperative that medical, health, fitness, and education professionals involved in providing instruction and information to the physically active be correct and accountable for the teachings that they advance. The variety of exercise machines, techniques, strengthening and flexibility programs, and training programs is continuously expanding and changing, but the musculoskeletal system is constant in its design and architecture. Regardless of the goals sought or the approaches used in exercise activity, the human body is the basic factor and must be thoroughly understood and considered to maximize performance capabilities and minimize undesirable results. Most advances in kinesiology and exercise science continue to result from a better understanding of the

body and how it functions. I believe that an individual in this field can never learn enough about the structure and function of the human body and that this is typically best learned through practical application.

Those who are charged with the responsibility of providing examination, instruction and consultation to the physically active will find this text a helpful and valuable resource in their never-ending quest for knowledge and understanding of human movement.

New to this edition

The most obvious change in this edition is the combination of what was previously Chapter 8 and 13 into a new Chapter 12, Muscular Analysis of Selected Exercises and Related Concepts. This change was designed to assemble the content primarily relevant to movement analysis in one location for improved focus. Chapters 4 through 11 now have a reasonably extensive table in each chapter that provides details regarding the names, origin, insertion, and function of most ligaments that provide static stability to each joint. Another addition to each of these chapters is an illustration detailing the innervation of the muscles and their related movements. A number of figures have been tweaked for more detail. Some tables have been refined, along with an extensive review and editing of the content throughout. Additional references have been added along with some revisions and additions to the review and laboratory exercises, and end-of-chapter worksheets. Additional questions and exercises will continue to be added to the Online Learning Center. Finally, a few new terms have been added to the Glossary.

The 20th edition of *Manual of Structural Kinesiology* is now available online with Connect, McGraw-Hill Education's integrated assignment and assessment platform. Connect also offers SmartBook for the new edition, which is the first adaptive reading experience proven to improve grades and help students study more effectively. All of the title's website and ancillary content are also available through Connect, including:

- Downloadable PowerPoint presentations
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- Student Success Strategies

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I am very appreciative of the numerous comments, ideas, and suggestions provided by the eight reviewers. These reviews have been a most helpful guide in this revision and the suggestions have been incorporated to the extent possible when appropriate. These reviewers are:

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I would like to especially thank the kinesiology, exercise science and athletic training students and faculty of the University of West Alabama for their suggestions, advice, and input throughout this revision. Their assistance and suggestions have been very helpful. I am particularly grateful to Britt Jones of Livingston, Alabama, for his outstanding photography. I also acknowledge John Hood and Lisa Floyd of Birmingham and Livingston, Alabama, respectively, for the fine photographs. Special thanks to Linda Kimbrough of Birmingham, Alabama, for her superb illustrations and insight. I appreciate the models for the photographs, Audrey Crawford, Fred Knighten, Darrell Locket, Amy Menzies, Matthew Phillips, Emma Powell, Jay Sears, Marcus Shapiro, and David Whitaker. My thanks also go to Poornima H and Erin Guendelsberger, Jamie Laferrera, Jasmine Staton, and the McGraw-Hill staff who have been most helpful in their assistance and suggestions in preparing the manuscript for publication.

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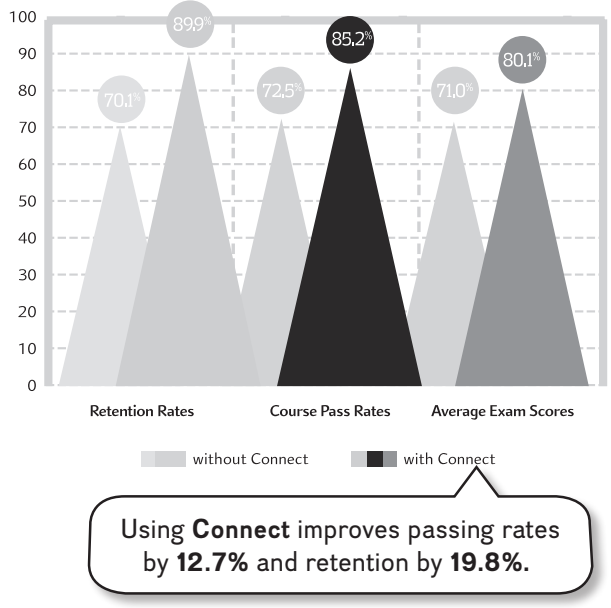

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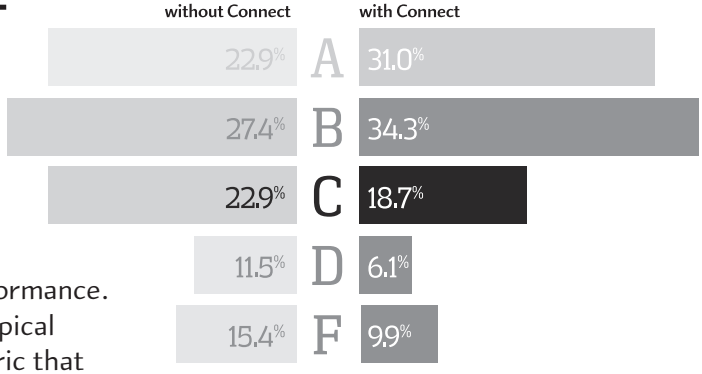

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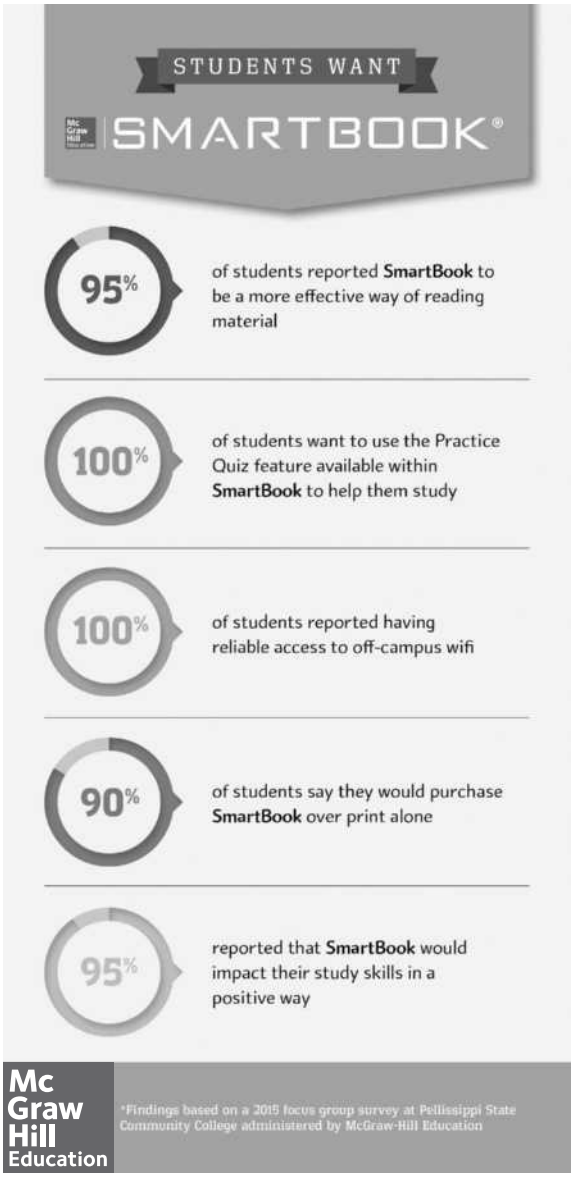

About the Author

R. T. Floyd is in his forty-third year of providing athletic training services for the University of West Alabama. Currently, he serves as the Director of Athletic Training and Sports Medicine for the UWA Athletic Training and Sports Medicine Center, Program Director for UWA's CAATE accredited curriculum, and as a distinguished professor in the Department of Physical Education and Athletic Training, which he chairs. He has taught numerous courses in physical education, exercise science and athletic training, including kinesiology, at both the undergraduate and graduate levels since 1980.

Floyd has maintained an active professional life throughout his career. He is currently serving as President of the National Athletic Trainers' Association (NATA) Research & Education Foundation after serving in multiple roles on the Board of Directors since 2002. He previously finished eight years of service on the NATA Board of Directors representing District IX, the Southeast Athletic Trainers' Association (SEATA). Previously, he served as the District IX representative to the NATA Educational Multimedia Committee from 1988 to 2002. He has served as the Convention Site Selection Chair for District IX from 1986 to 2004 and has directed the annual SEATA Competencies in Athletic Training Student Workshop since 1997. He has also served as a NATA BOC examiner for well over a decade and has served as a Joint Review Committee on Educational Programs in Athletic Training site visitor several times. He has provided over a hundred professional presentations at the local, state, regional, and national levels and has published several articles and videos related to the practical aspects of athletic training. He began authoring the *Manual of Structural Kinesiology* in 1992 with the twelfth edition after the passing of Dr. Clem W. Thompson, who authored the fourth through the eleventh editions. In 2010, much of the content of this text was incorporated into *Kinesiology for Manual Therapies,* which he co-authored with Nancy Dail and Tim Agnew.

Floyd is a certified member of the National Athletic Trainers' Association, a Certified Strength & Conditioning Specialist, and a Certified Personal Trainer in the National Strength and Conditioning Association. He is also a Certified Athletic Equipment Manager in the Athletic Equipment Managers' Association, a member of the American College of Sports Medicine, the American Orthopaedic Society for Sports Medicine, the American Osteopathic Academy of Sports Medicine, the American Sports Medicine Fellowship Society, and SHAPE America. Additionally, he is licensed in Alabama as an Athletic Trainer and an Emergency Medical Technician.

Floyd was presented the NATA Athletic Trainer Service Award in 1996, the Most Distinguished Athletic Trainer Award by the NATA in 2003, and received the NATA Sayers "Bud" Miller Distinguished Educator Award in 2007. In 2013 he was inducted into the NATA Hall of Fame. He received the District IX Award for Outstanding Contribution to the field of Athletic Training by SEATA in 1990 and the Award of Merit in 2001 before being inducted into the organization's Hall of Fame in 2008. In 1997, the UWA Faculty and Board of Trustees recognized Floyd for outstanding achievement in scholarship, teaching, and leadership by presenting him with a Loraine McIlwain Bell Trustee Professorship. In 2001, he was inducted into the Honor Society of Phi Kappa Phi and the University of West Alabama Athletic Hall of Fame. He was inducted into the Alabama Athletic Trainers' Association Hall of Fame in May 2004. In 2012, he was presented the Great Minds Award by the UWA Phi Kappa Phi Honor Society and the Nellie Rose McCrory Service Excellence Award by UWA. In 2014, he was inducted into the Society of the Golden Key at UWA and was selected as the first recipient of the UWA Distinguished Professorship. Upon completion of its expansion in 2014, the athletic training facility was named the R.T. Floyd Athletic Training and Sports Medicine Center by the UWA Board of Trustees.

To

my family,
Lisa, Robert Thomas, Jeanna, Rebecca, and Kate
who understand, support, and allow me to
pursue my profession

and to my parents,
Ruby and George Franklin,
who taught me the importance of a strong work ethic
with quality results

R.T.F.

Chapter 1

Foundations of Structural Kinesiology

Objectives

- To review the anatomy of the skeletal system
- To review and understand the terminology used to describe body part locations, reference positions, and anatomical directions
- To review the planes of motion and their respective axes of rotation in relation to human movement
- To describe and understand the various types of bones and joints in the human body and their functions, features, and characteristics
- To describe and demonstrate the joint movements

Kinesiology may be defined as the study of the principles of anatomy (active and passive structures), physiology, and mechanics in relation to human movement. The emphasis of this text is **structural kinesiology**—the study of muscles, bones, and joints as they are involved in the science of movement. To a much lesser degree, certain physiological and mechanical principles are addressed to enhance the understanding of the structures discussed.

Bones vary in size and shape, which factors into the amount and type of movement that occurs between them at the joints. The types of joint vary in both structure and function. Muscles also vary greatly in size, shape, and structure from one part of the body to another.

Anatomists, athletic trainers, physical therapists, occupational therapists, physicians, nurses, massage therapists, coaches, strength and conditioning specialists, performance enhancement specialists, personal trainers, physical educators, and others in health-related fields should have an adequate knowledge and understanding of all the large muscle groups so they can teach others how to strengthen, improve, and maintain optimal function of the human body. This knowledge forms the basis of exercise programs followed to strengthen and maintain all the muscles. In most cases, exercises that involve the larger primary movers also involve the smaller muscles, however, in certain instances more detailed programs are needed to address certain muscles.

More than 600 muscles are found in the human body. In this book, an emphasis is placed on the larger muscles that are primarily involved in movement of the joints. Details related to many of the small muscles located in the hands, feet, and spinal column are provided to a lesser degree.

Fewer than 100 of the largest and most important muscles, primary movers, are considered in this text. Some small muscles in the human body, such as the multifidus, plantaris, scalenus, and serratus posterior, are omitted because they are exercised with other larger primary movers. In addition, most small muscles of the hands and feet are not given the full attention provided to the larger muscles. Many small muscles of the spinal column, and the facial muscles, are beyond the scope of this text, and are not considered in full detail.

Kinesiology students frequently become so engrossed in learning individual muscles that they lose sight of the total muscular system. They miss

the "big picture"—that muscle groups move joints in given movements necessary for bodily action and skilled performance. Although it is vital to learn the small details of muscle attachments, it is even more critical to be able to apply the information to real-life situations. Once the information can be applied in a useful manner, the specific details are usually much easier to understand and appreciate.

Reference positions

It is crucial for kinesiology students to begin with a reference point in order to better understand the musculoskeletal system, its planes of motion, joint classification, and joint movement terminology. Two reference positions can be used as a basis from which to describe joint movements. The **anatomical position** is the most widely used and is accurate for all aspects of the body. Fig. 1.1 demonstrates this reference position, with the subject standing in an upright posture, facing straight ahead, with feet parallel and close and palms facing forward. The **fundamental position** is essentially the same as the anatomical position, except that the arms are at the sides with the palms facing the body.

Reference lines

To further assist in understanding the location of one body part in relation to another, certain imaginary reference lines may be used. Some examples follow in Fig 1.2.

Mid-axillary line: A line running vertically down the surface of the body passing through the apex of the axilla (armpit)

Mid-sternal line: A line running vertically down the surface of the body passing through the middle of the sternum

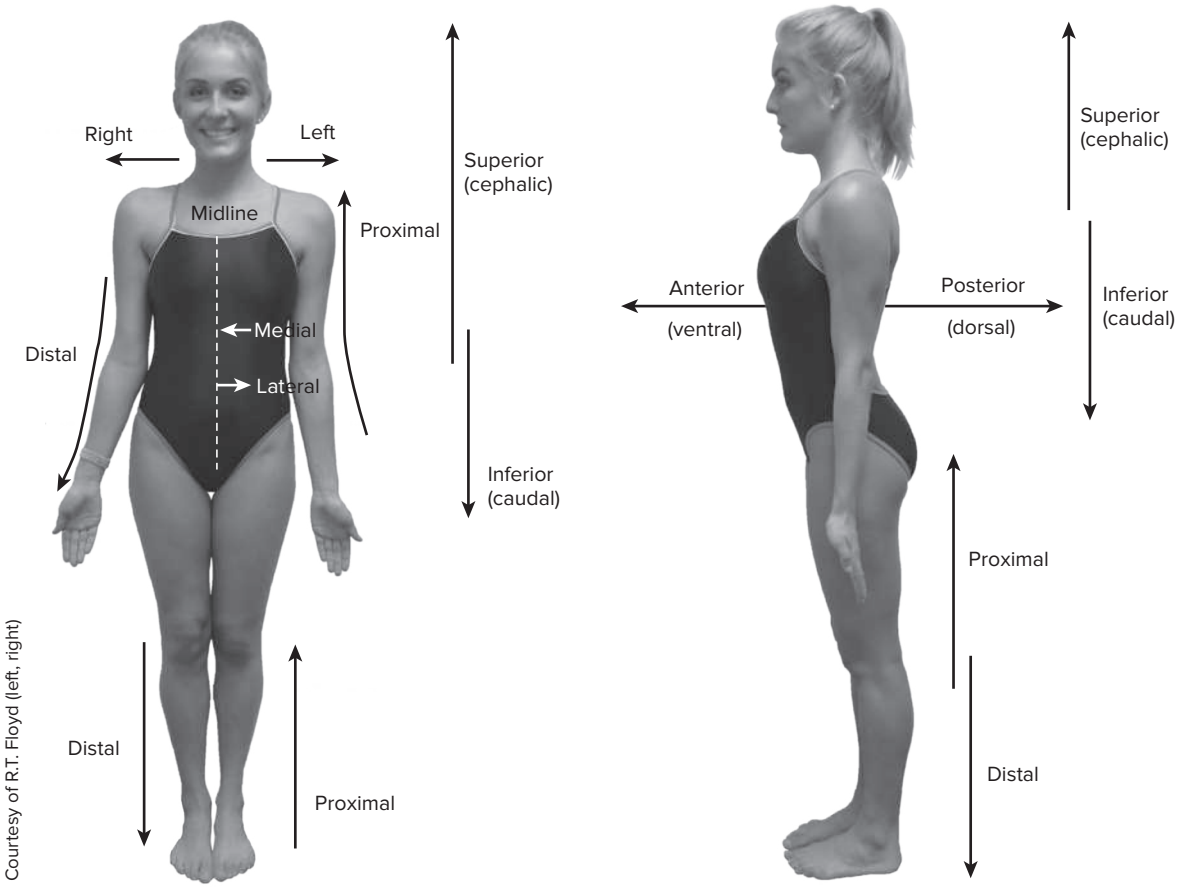

FIG. 1.1 • Anatomical position and anatomical directions. Anatomical directions refer to the position of one body part in relation to another.

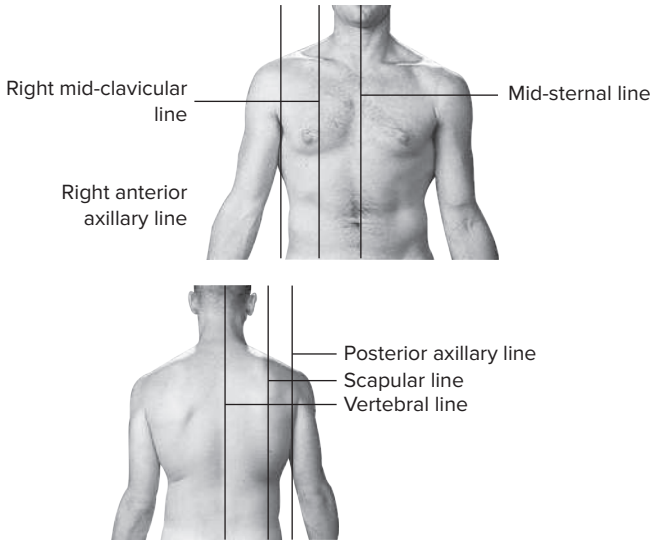

FIG. 1.2 • Reference lines.

Anterior axillary line: A line that is parallel to the mid-axillary line and passes through the anterior axillary skinfold

Posterior axillary line: A line that is parallel to the mid-axillary line and passes through the posterior axillary skinfold

Mid-clavicular line: A line running vertically down the surface of the body passing through the midpoint of the clavicle

Mid-inguinal point: A point midway between the anterior superior iliac spine and the pubic symphysis

Scapula line: A line running vertically down the posterior surface of the body passing through the inferior angle of the scapula

Vertebral line: A line running vertically down through the spinous processes of the spine

Anatomical directional terminology FIGS. 1.1, 1.3, 1.4

It is important that we all be able to find our way around the human body. To an extent, we can think of this as similar to giving or receiving directions about how to get from one geographic location to another. Just as we use the terms *left, right, south, west, northeast,* etc. to describe geographic directions, we have terms such as *lateral, medial, inferior, anterior, inferomedial,* etc. to use for anatomical directions. With geographic directions we may use *west* to indicate the west end of a street or the western United States. The same is true when we use anatomical directions. We may use *superior* to indicate the end of a bone in our lower leg closest to the knee, or we may be speaking about the top of the skull. It all depends on the context at the time. Just as we combine *south* and *east* to get *southeast* for the purpose of indicating somewhere

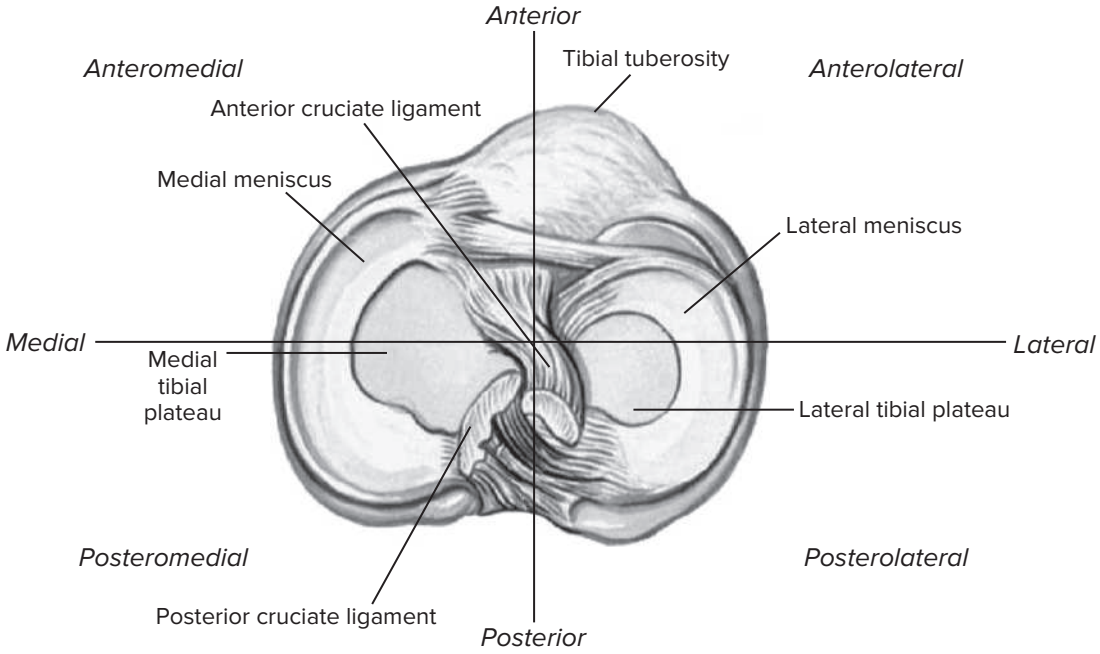

FIG. 1.3 • Anatomical directional terminology.

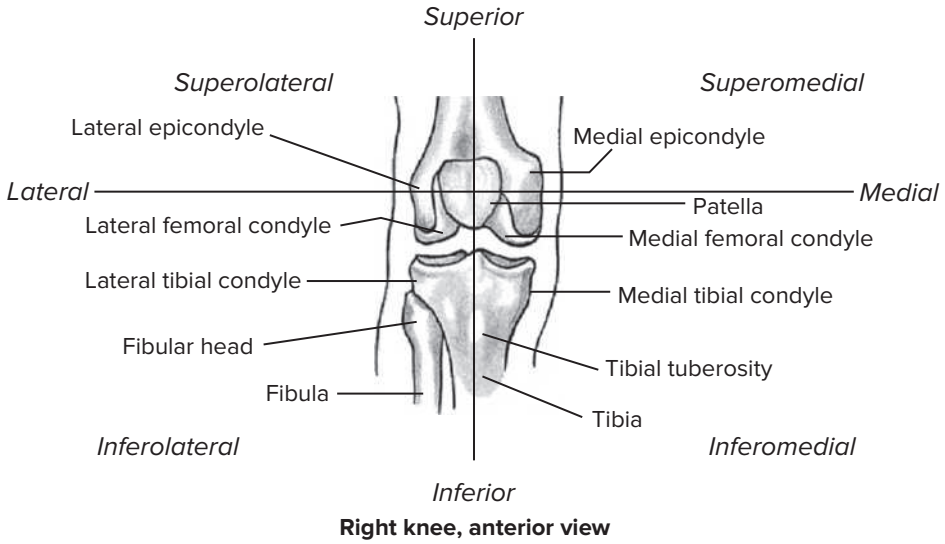

FIG. 1.4 • Anatomical directional terminology.

in between these directions, we may combine *anterior* and *lateral* to get *anterolateral* for the purpose of describing the general direction or location "in the front and to the outside." Figs. 1.3 and 1.4 provide further examples.

Anterior: In front or in the front part

Anteroinferior: In front and below

Anterolateral: In front and to the outside

Anteromedial: In front and toward the inner side or midline

Anteroposterior: Relating to both front and rear

Anterosuperior: In front and above

Bilateral: Relating to the right and left sides of the body or of a body structure such as the right and left extremities

Caudal: Below in relation to another structure; inferior

Caudocephalad: Directionally from tail to head in the long axis of the body

Cephalic: Above in relation to another structure; higher, superior

Cephalocaudal: Directionally from head to tail in the long axis of the body

Contralateral: Pertaining or relating to the opposite side

Deep: Beneath or below the surface; used to describe relative depth or location of muscles or tissue

Dexter: Relating to, or situated to the right or on the right side of, something

Distal: Situated away from the center or midline of the body, or away from the point of origin

Dorsal (dorsum): Relating to the back, being or located near, on, or toward the back, posterior part, or upper surface of; also relating to the top of the foot

Fibular: Relating to the fibular (lateral) side of the knee, leg, ankle, or foot

Inferior (infra): Below in relation to another structure; caudal

Inferolateral: Below and to the outside

Inferomedial: Below and toward the midline or inside

Ipsilateral: On the same side

Lateral: On or to the side; outside, farther from the median or midsagittal plane

Medial: Relating to the middle or center; nearer to the median or midsagittal plane

Median: Relating to, located in, or extending toward the middle; situated in the middle, medial

Palmar: Relating to the palm or volar aspect of the hand

Plantar: Relating to the sole or undersurface of the foot

Posterior: Behind, in back, or in the rear

Posteroinferior: Behind or in back and below

Posterolateral: Behind and to one side, specifically to the outside

Posteromedial: Behind and to the inner side

Posterosuperior: Behind or in back and above

Prone: Face-downward position of the body; lying on the stomach

Proximal: Nearest the trunk or the point of origin

Proximodistal: From the center of the body out toward the distal ends of appendages

Radial: Relating to the radial (lateral) side of the forearm or hand

Scapular plane: In line with the normal resting position of the scapula as it lies on the posterior rib cage; movements in the scapular plane are in line with the scapular, which is at an angle of 30 to 45 degrees from the frontal plane

Sinister: Relating to, or situated to the left or on the left side of, something

Superficial: Near the surface; used to describe relative depth or location of muscles or tissue

Superior (supra): Above in relation to another structure; higher, cephalic

Superolateral: Above and to the outside

Superomedial: Above and toward the midline or inside

Supine: Face-upward position of the body; lying on the back

Tibial: Relating to the tibial (medial) side of the knee, leg, ankle, or foot

Ulnar: Relating to the ulnar (medial) side of the forearm or hand

Ventral: Relating to the belly or abdomen, on or toward the front, anterior part of

Volar: Relating to palm of the hand or sole of the foot

Alignment variation terminology

Anteversion: Abnormal or excessive rotation forward of a structure, such as femoral anteversion

Kyphosis: Increased curving of the spine outward or backward in the sagittal plane

Lordosis: Increased curving of the spine inward or forward in the sagittal plane

Recurvatum: Bending backward, as in knee hyperextension

Retroversion: Abnormal or excessive rotation backward of a structure, such as femoral retroversion

Scoliosis: Lateral curving of the spine

Valgus: Outward angulation of the distal segment of a bone or joint, as in knock-knees

Varus: Inward angulation of the distal segment of a bone or joint, as in bowlegs

Planes of motion

When we study the various joints of the body and analyze their movements, it is helpful to characterize them according to specific planes of motion (Fig. 1.5). A plane of motion may be defined as an imaginary two-dimensional surface through which a limb or body segment is moved.

There are three specific, or **cardinal**, planes of motion in which the various joint movements can be classified. The specific planes that divide the body exactly into two halves are often referred to as cardinal planes. The cardinal planes are the sagittal, frontal, and transverse planes. There are an infinite number of planes within each half that are parallel to the cardinal planes. This is best understood in the following examples of movements in the sagittal plane. Sit-ups involve the spine and, as a result, are performed in the cardinal sagittal plane, which is also known as the **midsagittal** or **median** plane. Biceps curls and knee extensions are performed in **parasagittal** planes, which are parallel to the midsagittal plane. Even though these latter examples are not in the cardinal plane, they are thought of as movements in the sagittal plane.

Although each specific joint movement can be classified as being in one of the three planes of motion, our movements are usually not totally in one specific plane but occur as a combination of motions in more than one plane. These movements in the combined planes may be described as occurring in diagonal, or oblique, planes of motion and involve joints that are capable of movement in two or more planes.

Sagittal, anteroposterior, or AP plane

The sagittal, anteroposterior, or AP plane bisects the body from front to back, dividing it into right and left symmetrical halves. Generally, flexion and extension movements such as biceps curls, knee extensions, and sit-ups occur in this plane.

Frontal, coronal, or lateral plane

The frontal plane, also known as the coronal or lateral plane, bisects the body laterally from side to side, dividing it into front (ventral) and back (dorsal) halves. Abduction and adduction movements such as jumping jacks (shoulder and hip) and spinal lateral flexion occur in this plane.

Transverse, axial, or horizontal plane

The transverse plane, also known as the axial or horizontal plane, divides the body into superior (cephalic) and inferior (caudal) halves. Generally, rotational movements such as forearm pronation and supination and spinal rotation occur in this plane.

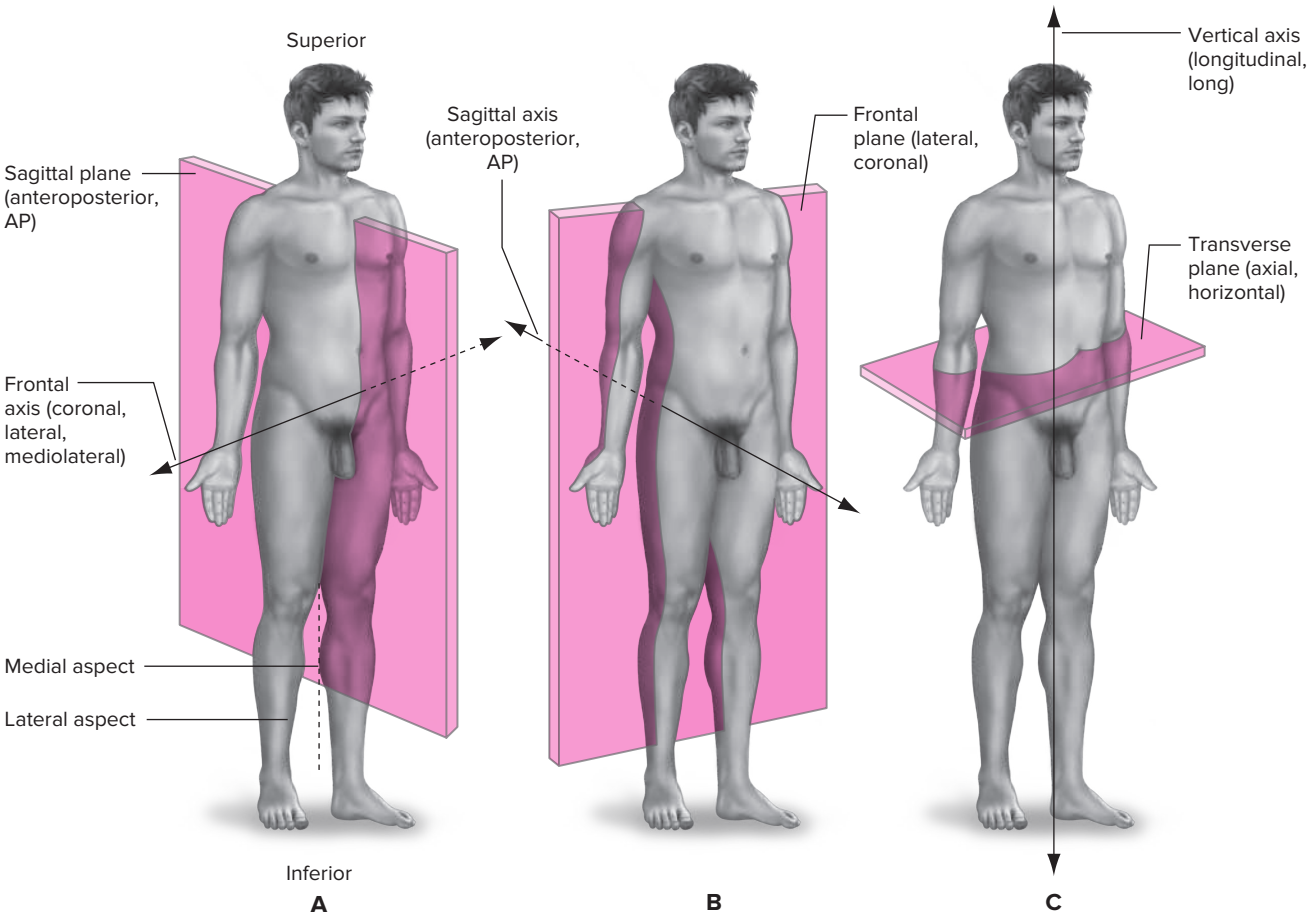

FIG. 1.5 • Planes of motion and axes of rotation. **A**, Sagittal plane with frontal axis; **B**, Frontal plane with sagittal axis; **C**, Transverse plane with vertical axis.

Diagonal or oblique plane FIG. 1.6

The diagonal or oblique plane is a combination of more than one plane of motion. In reality, most of our movements in sporting activities fall somewhere between parallel and perpendicular to the previously described planes and occur in a diagonal plane. To further delineate, all movements in diagonal planes occur in a high diagonal plane or one of two low diagonal planes. The high diagonal plane is utilized for overhand movements in the upper extremity, whereas the two low diagonal planes are used to differentiate upper-extremity underhand movements from lower-extremity diagonal movements.

It should be noted that for a joint to move in a diagonal plane, the joint must be capable of movements in at least two planes. In other words, diagonal plane movements involve combining motions in one plane with motions of one or more other planes. Less commonly mentioned are diagonal movements that involve biaxial joints. For example, combining wrist flexion and ulnar deviation or metacarpophalangeal extension with radial deviation when pointing with the index finger.

Axes of rotation

As movement occurs in a given plane, the joint moves or turns about an axis that has a 90-degree relationship to that plane. The axes are named in relation to their orientation (Fig. 1.5). Table 1.1 lists the planes of motion with their axes of rotation.

Frontal, coronal, lateral, or mediolateral axis

If the sagittal plane runs from anterior to posterior, then its axis must run from side to side. Since this axis has the same directional orientation as the frontal plane of motion, it is named similarly. As the elbow flexes and extends in the sagittal plane during a biceps curl, the forearm is actually rotating about a frontal axis that runs laterally through the elbow joint. The frontal axis may also be referred to as the bilateral axis.

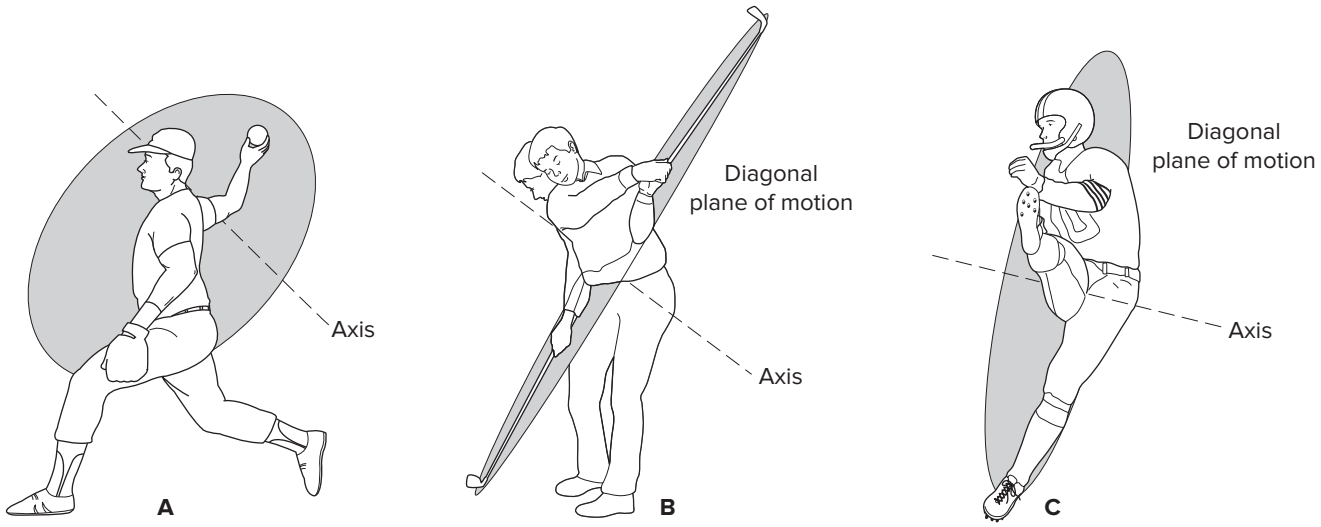

FIG. 1.6 • Diagonal planes and axes of rotation. **A**, Upper-extremity high diagonal plane movement and axis; **B**, Upper-extremity low diagonal plane movement and axis; **C**, Lower-extremity low diagonal plane movement and axis.

TABLE 1.1 • **Planes of motion and their axes of rotation**

Plane	Description of plane	Axis of rotation	Description of axis	Common movements
Sagittal (anteroposterior or AP)	Divides the body into right and left halves	Frontal (coronal, lateral, or mediolateral)	Runs medial/lateral	Flexion, extension
Frontal (coronal or lateral)	Divides the body into anterior and posterior halves	Sagittal (anteroposterior or AP)	Runs anterior/posterior	Abduction, adduction
Transverse (axial, horizontal)	Divides the body into superior and inferior halves	Vertical (longitudinal or long)	Runs superior/inferior	Internal rotation, external rotation

Sagittal or anteroposterior axis

Movement occurring in the frontal plane rotates about a sagittal axis. This sagittal axis has the same directional orientation as the sagittal plane of motion and runs from front to back at a right angle to the frontal plane of motion. As the hip abducts and adducts during jumping jacks, the femur rotates about an axis that runs front to back through the hip joint.

Vertical or longitudinal axis

The vertical axis, also known as the longitudinal or long axis, runs straight down through the top of the head and is at a right angle to the transverse plane of motion. As the head rotates or turns from left to right when indicating disapproval, the skull and cervical vertebrae are rotating around an axis that runs down through the spinal column.

Diagonal or oblique axis FIG. 1.6

The diagonal axis, also known as the oblique axis, runs at a right angle to the diagonal plane. As the glenohumeral joint moves from diagonal abduction to diagonal adduction in overhand throwing, its axis runs perpendicular to the plane through the humeral head.

Body regions

As mentioned later under the skeletal system, the body can be divided into axial and appendicular regions. Each of these regions may be further divided into different subregions, such as the cephalic, cervical, trunk, upper limbs, and lower limbs. Within each of these regions are many more subregions and specific regions. Table 1.2 details a breakdown of these regions and their common names, illustrated in Fig. 1.7.

TABLE 1.2 • **Body parts and regions**

	Region name	Common name	Subregion	Specific region name	Common name for specific region
Axial	Cephalic	Head	Cranial (skull)	Frontal	Forehead
				Occipital	Base of skull
			Facial (face)	Orbital	Eye
				Otic	Ear
				Nasal	Nose
				Buccal	Cheek
				Oral	Mouth
				Mental	Chin
	Cervical	Neck		Nuchal	Posterior neck
				Throat	Anterior neck
	Trunk	Thoracic	Thorax	Clavicular	Collar bone
				Pectoral	Chest
				Sternal	Breastbone
				Costal	Ribs
				Mammary	Breast
		Dorsal	Back	Scapula	Shoulder blade
				Vertebral	Spinal column
				Lumbar	Lower back or loin
		Abdominal	Abdomen	Celiac	Abdomen
				Umbilical	Navel
		Pelvic	Pelvis	Inguinal	Groin
				Pubic	Genital
				Coxal	Hip
				Sacral	Between hips
				Gluteal	Buttock
				Perineal	Perineum
Appendicular	Upper limbs	Shoulder		Acromial	Point of shoulder
				Omus	Deltoid
				Axillary	Armpit
				Brachial	Arm
				Olecranon	Point of elbow
				Cubital	Elbow
				Antecubital	Front of elbow
				Antebrachial	Forearm
				Carpal	Wrist
		Manual		Palmar	Palm
				Dorsal	Back of hand
				Digital	Finger
	Lower limbs			Femoral	Thigh
				Patella	Kneecap
				Popliteal	Back of knee
				Sural	Calf
				Crural	Leg
		Pedal	Foot	Talus	Ankle
				Calcaneal	Heel
				Dorsum	Top of foot
				Tarsal	Instep
				Plantar	Sole
				Digital	Toe

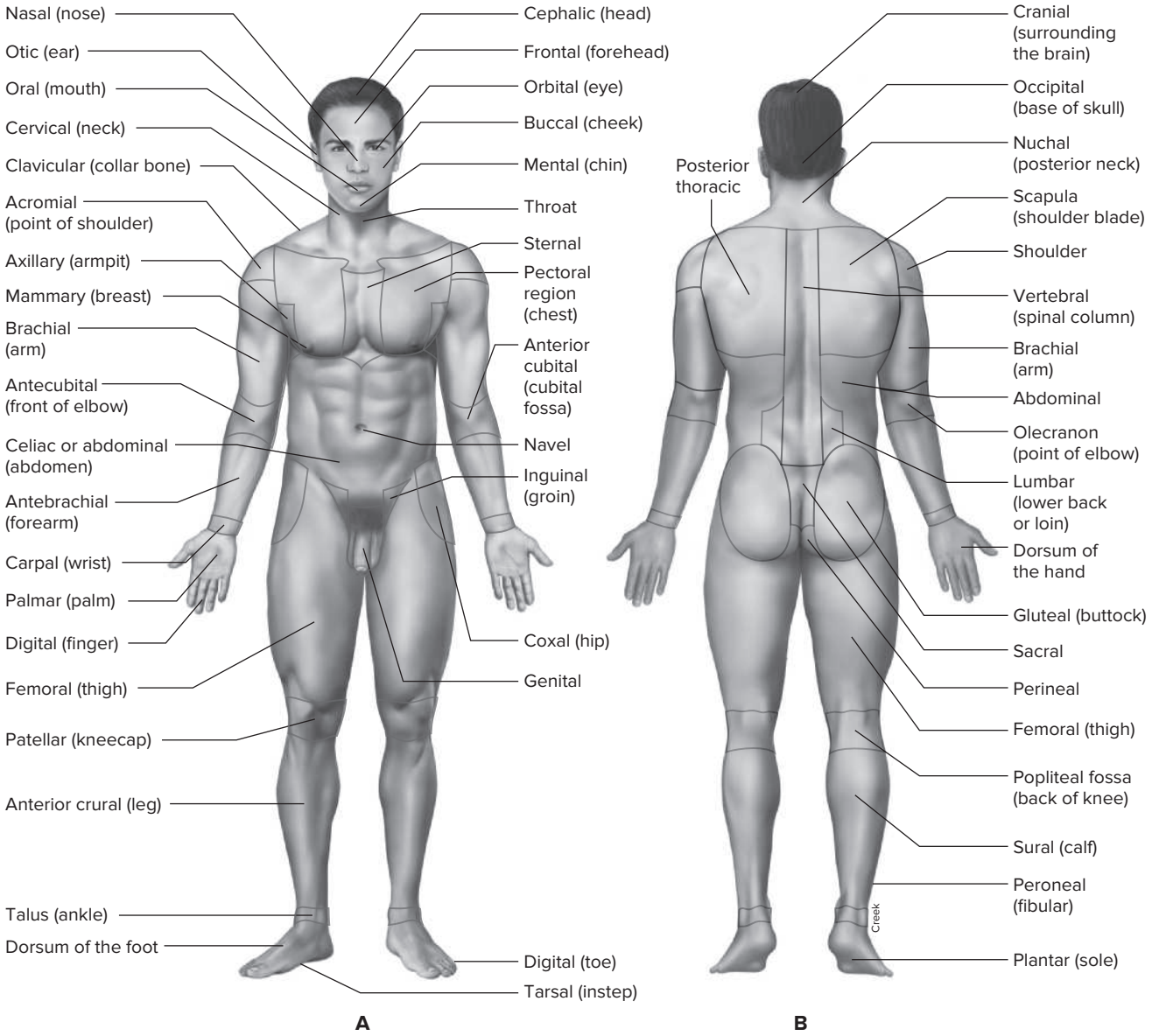

FIG. 1.7 • Body regions. **A**, Anterior view; **B**, Posterior view.

Skeletal systems

Fig. 1.8 shows anterior and posterior views of the skeletal system. Some 206 bones make up the skeletal system, which provides support and protection for other systems of the body and provides for attachments of the muscles to the bones, by which movement is produced. Additional skeletal functions are mineral storage and hemopoiesis, which involves blood cell formation in the red bone marrow. The skeleton may be divided into the appendicular and the axial skeletons. The appendicular skeleton is composed of the appendages, or the upper and lower extremities, and the shoulder and pelvic girdles. The axial skeleton consists of the skull, vertebral column, ribs, and sternum. Most students who take this course will have had a course in human anatomy, but a brief review is desirable before beginning the study of kinesiology. Later chapters provide additional information and more detailed illustrations of specific bones.

Osteology

The adult skeleton, consisting of approximately 206 bones, may be divided into the axial skeleton and the appendicular skeleton. The axial skeleton contains 80 bones, which include the skull, spinal column, sternum, and ribs. The appendicular skeleton contains