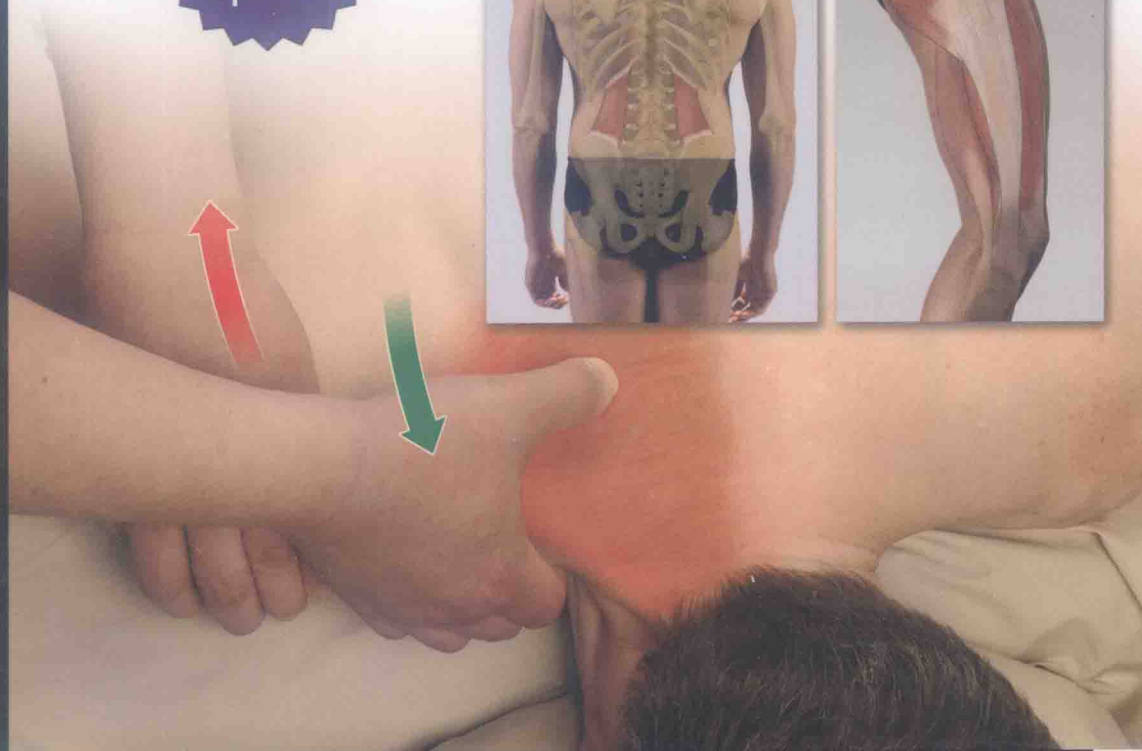


FUNCTIONAL ANATOMY

Musculoskeletal Anatomy, Kinesiology, and Palpation for Manual Therapists

Revised and Updated



LWW Massage Therapy & Bodywork Educational Series

Christy Cael



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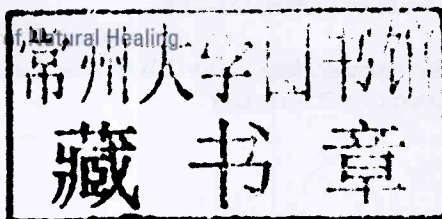
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FUNCTIONAL ANATOMY

*Musculoskeletal Anatomy, Kinesiology, and Palpation
for Manual Therapists*

For Alla.

None of this would have been possible without your love, support, skill, knowledge,
participation, insight, unwavering faith, and magical powers.

I am forever grateful.

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Preface

Today's massage, bodywork, and fitness professionals are increasingly becoming members of the healthcare team. These professionals collaborate with physicians, physical therapists, occupational therapists, chiropractors, nurse care managers, attorneys, insurance companies, and other healthcare providers. Professionals must have a clear understanding of muscle and joint function beyond simple actions. This allows them to communicate clearly, maintain credibility, and obtain reimbursement for therapeutic work. The emerging requirement for "outcome-based" justification of treatments further supports the need for a thorough understanding of the body in motion.

Functional Anatomy was written to help students of human movement and bodywork understand how anatomical structures work together to create motion. Developing an understanding of the body in all of its complex synchronicity is critical for students of massage and bodywork. These careers require the therapist to create concise and effective treatment plans. Fitness and sports professionals are routinely called upon to analyze complex movement patterns in order to maximize the athlete's performance and prevent injury.

Beyond these pragmatic benefits, an understanding of functional anatomy develops heightened intellectual and artistic appreciation of the human body in motion. With a deep understanding of structure–function relationships, we begin to see the client's body as a living, breathing, *moving* marvel. *Functional Anatomy: Musculoskeletal Anatomy, Kinesiology, and Palpation for Manual Therapists* can assist you in exploring the structures and anatomical relationships responsible for movements such as walking, running, lifting, and throwing. You will be guided through activities that involve inspecting, touching, and moving these structures, enabling you to create a solid, three-dimensional image of the human body and its movement potential.

ORGANIZATION AND CONTENT

The chapters in *Functional Anatomy* are organized to build anatomical regions "from the ground up." This means deeper structures are identified first, and then structural layers are added. This organization helps readers understand the relationship between static structures such as bones, ligaments, and joint capsules and dynamic functions of muscles. Muscles are presented from superficial to deep to develop systematic palpation skills. *Functional Anatomy* also groups muscles together functionally. For example, the latissimus dorsi and teres major are located next to each other in the body, have a common insertion, and perform the same actions. Because of this, they are considered sequentially in Chapter 4.

The first three chapters in the book describe how the body is put together and how it achieves movement. In Chapter 1, the basic structures and systems of the body, the text's organization of the layers of the human body, and the language of anatomy and movement are discussed and explored. Chapter 2 provides an in-depth investigation of bones and joints, including their basic structure, various shapes and functions, classification, and location of the different types in the body. Chapter 3 delves into skeletal muscles, including their functions, properties, fiber directions and types, the different types of contractions they create, and how they are regulated. After studying these introductory chapters, you should understand the basic structures of the body and methods for creating movement. You will also have developed a language for discussing these concepts.

Each of the remaining six chapters explores a specific region of the body. These chapters follow a consistent template, with the same type of information occurring at the same place in each chapter. This predictability will help you locate any topic within a given chapter quickly and easily.

The recurring elements in the first half of each chapter include, in order:

- competency-based objectives
- overview of the region
- surface anatomy
- skeletal structures
- bony landmark palpation
- muscle attachment sites
- joints and ligaments
- superficial muscles of the region
- deep muscles of the region
- special structures located in the region (other than bones, ligaments, and muscles)
- movements allowed by the region's joints
- passive and resisted range of motion techniques

This opening section is followed by a set of one- or two-page profiles of each muscle pertinent to that region. Profiles include an illustration of the muscle showing its origin, insertion, and fiber arrangement and direction. Text descriptions of the muscle attachments, actions, and innervations are located next to this image. The profile also includes a description of the muscle's functional anatomy; that is, the relationships it has with other muscles, how it works in the body beyond its actions, and common imbalances or dysfunctions associated with it. Finally, the profile explains in simple, easy-to-follow steps how to palpate and fire the muscle against resistance. A photograph shows proper positioning of the practitioner and client, as well as the pertinent bony landmarks and muscle features. The simple, consistent design of each muscle profile

ensures ease of use in the classroom or lab, as well as for studying and quick reference.

A section discussing the functional aspects of the body region follows the muscle profiles. This section includes information on synergist and antagonist relationships and a photo essay called *Putting It in Motion*, which explores the structure–function relationships involved during activities of daily living and sport.

Every chapter of the book closes with a concise summary, review questions, and study activities. The latter includes specific exercises aimed at kinesthetically engaging the covered material.

FEATURES

Functional Anatomy will guide you to a deeper understanding of the structure and function of the human body by engaging not only your mind, but also your other senses. Features include dynamic, colorful visuals, kinesthetic exercises to enhance your palpatory skills, and individual and group activities. Each region of the body is explored from the inside out to enhance understanding of structural relationships and movement possibilities. Simple, easy-to-follow instructions for palpation of bony landmarks and each muscle profiled are provided.

Functional Anatomy recognizes that you may be experiencing the challenges of learning a new language. To help you in acquiring this new language, we include within each muscle profile a guide to correct pronunciation of the muscle name. The companion Web site (thePoint.lww.com/cael) also includes an auditory guide to pronunciation, so you can hear proper pronunciation of each muscle profiled.

A *Synergist/Antagonist* table is included in each regional chapter. A photograph of a specific body motion, such as flexion or extension, is accompanied by a list of all muscles that contribute to that motion. Each motion is paired with its opposite in order to help you appreciate balanced muscle relationships.

Each regional chapter also discusses and illustrates passive and resisted range of motion procedures for assessing normal joint function. This is included to help you physically access the specific structures identified in this text.

As mentioned earlier, each regional chapter contains a section called *Putting It in Motion*, which identifies and explains specific actions that contribute to motions we use in daily activity or in sports. The photographs of these movements are enhanced to show the pertinent muscle groups driving the action. This feature is linked to the animations on the student resource site, which further explore some of these movements.

The *Try This* activity located at the end of each chapter includes a simple, kinesthetic activity that engages one or more key concepts identified in the chapter. Easy-to-follow

steps are listed, as well as any special equipment that may be needed. For example, the *Try This* in Chapter 1 instructs readers to verbally position or move a partner in ways described on cards they create. This activity engages multiple senses and encourages correct use of anatomical terms and concepts.

The student resource site for this text has been developed alongside this manuscript in order to ensure strong connections between the special features of the book, student study materials, and teacher resources. Although the text is a stand-alone product, it can be greatly enhanced when used in conjunction with the companion student resource site at thePoint.lww.com/cael. Features of the resource site include animations that correspond with the *Putting It in Motion* segment in each regional chapter. These animations sequentially reveal muscle functions during common activities such as walking, jogging, standing, and throwing. Other features include video footage of palpation, study questions for self-assessment, a Stedman's audio glossary of the muscles profiled, and searchable full text online. The inside front cover of the text contains more details including the passcode you will need to gain access to the site. In addition to the student resources, instructors will also have access to lesson plans, PowerPoint presentations, and Brownstone Test Generator.

DESIGN

The design of *Functional Anatomy* creates a user-friendly, predictable, and interactive experience for readers. The text and art are arranged to allow quick-reference for study as well as maximum usability during classroom activities such as guided palpation exercises. Specific icons identify where these activities are located and when they are linked to the ancillary materials. All of these features will help you develop competency in the key skills identified in each of the chapter objectives.

FINAL NOTE

I hope that *Functional Anatomy* helps you discover new and exciting things about the human body. It is intended to enhance your personal and classroom experience and engage you in exploring how the body works. I encourage you to try as many of the activities as possible, utilize the learning tools provided, and embark upon your educational journey with wonder and curiosity.

Please contact me at functionalbook@hotmail.com with any comments or suggestions about this book. My students have always been both an inspiration and my toughest critics, and I wish for that to continue. Your perceptions, responses, and experiences with this text are valuable and I am interested in what you have to share. In the meantime, thank you and enjoy.

– Christy Cael

Acknowledgments

Producing *Functional Anatomy* has been a journey requiring the effort, enthusiasm, and patience of many. I would like to thank those who have believed in me and this project, contributed their vast knowledge and expertise, and tolerated my distraction, as well as my single-minded immersion.

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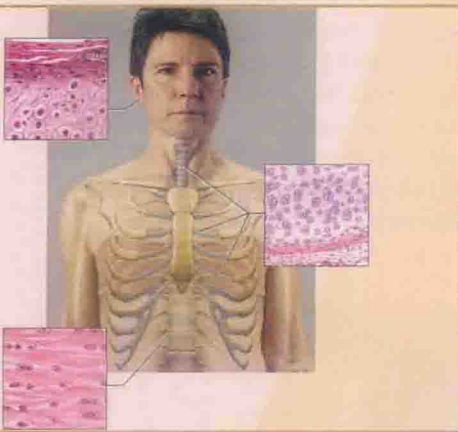
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Introduction to the Human Body



Learning Objectives

After working through the material in this chapter, you should be able to:

- Label the regions of the human body on a diagram.
- Draw the anatomical position and explain its importance in understanding human movement.
- Use appropriate directional terms when describing locations of anatomical features of the human body.
- Identify the three planes of movement and their corresponding axes, and demonstrate movements possible for each.
- Identify the main structures of the body involved in human movement, and strategies for locating and palpating each.
- Describe the functions of various special structures in the body, including skin, blood vessels, lymphatics, nerves, cartilage, and bursae.

Chapter Outline

COMMUNICATING ABOUT THE BODY

- Regional Terms
- Anatomical Position
- Directional Terms
- Planes of Movement
- Axes
- Joint Movements

STRUCTURES OF THE HUMAN BODY

- Tissue Types in the Body
 - Epithelial Tissue*
 - Connective Tissue*
 - Components of Connective Tissue
 - Types of Connective Tissue
 - Muscle Tissue*
 - Nervous Tissue*

BODY STRUCTURES INVOLVED IN HUMAN MOVEMENT

- Bone
 - Shapes of Bones*
 - Palpating Bone*
- Ligament
 - Structure of Ligaments*
 - Palpating Ligaments*
- Muscle
 - Types of Muscle*
 - Palpating Muscle*
- Tendon
 - Shapes of Tendons*
 - Palpating Tendons*
- Fascia
 - Structure of Fascia*

- Fascia Layers*
- Palpating Fascia*

SPECIAL STRUCTURES

- Skin
 - Structure of the Skin*
 - Palpating Skin*
- Blood Vessels
- Lymphatic Vessels and Nodes
- Nerves
- Cartilage
- Bursae

Imagine that a client is referred to you because he “can’t use his arm.” You might wonder what this means. Which joint is involved? What movements are affected? Or perhaps you’ve been further instructed to “look at his golf swing.” How would you describe what you are seeing? Fortunately, a universal system of communication has been established to precisely describe the regions of the human body and their movements. This shared language, called *anatomical terminology*, allows for a common understanding and point of reference for professionals, scholars, and students. We begin by introducing you to this specialized language.

Human movement requires the coordinated efforts of several body structures. The bones and muscles provide a system of levers, which are held together by ligaments, tendons, joint capsules, and fascia. These are supported by special structures that provide nutrients, stimulation, or protection. We complete Chapter 1 by exploring these locomotive and special structures.

COMMUNICATING ABOUT THE BODY

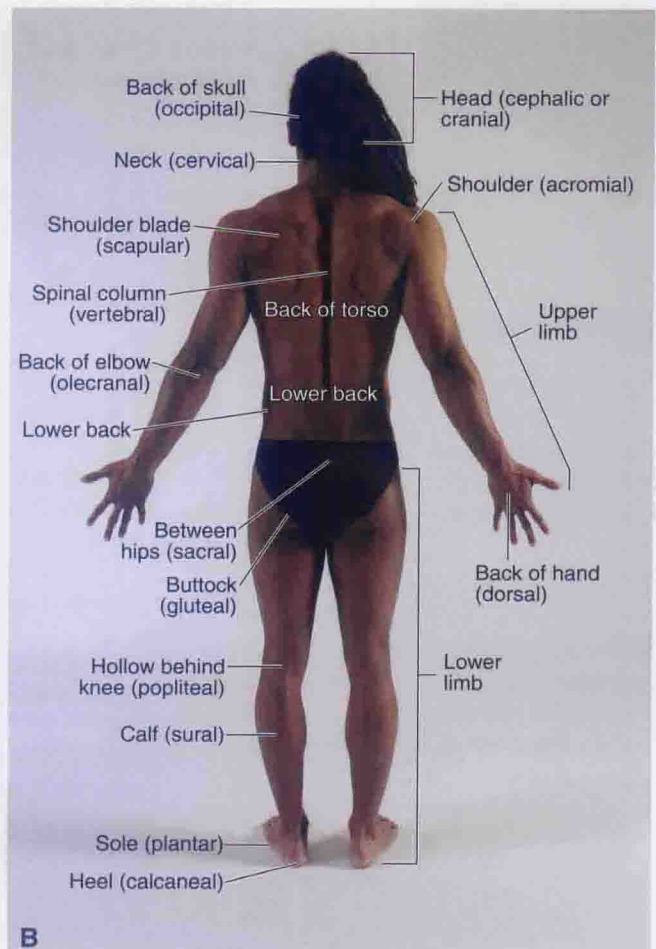
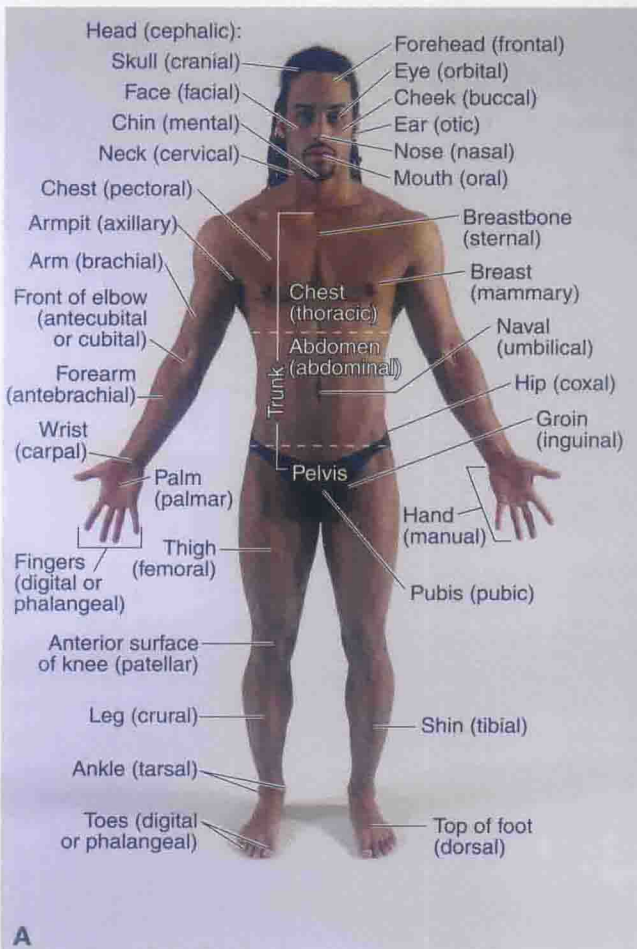
When communicating about the human body, it is important to use the language that has been agreed upon by scientists, scholars, and health care providers.

Regional Terms

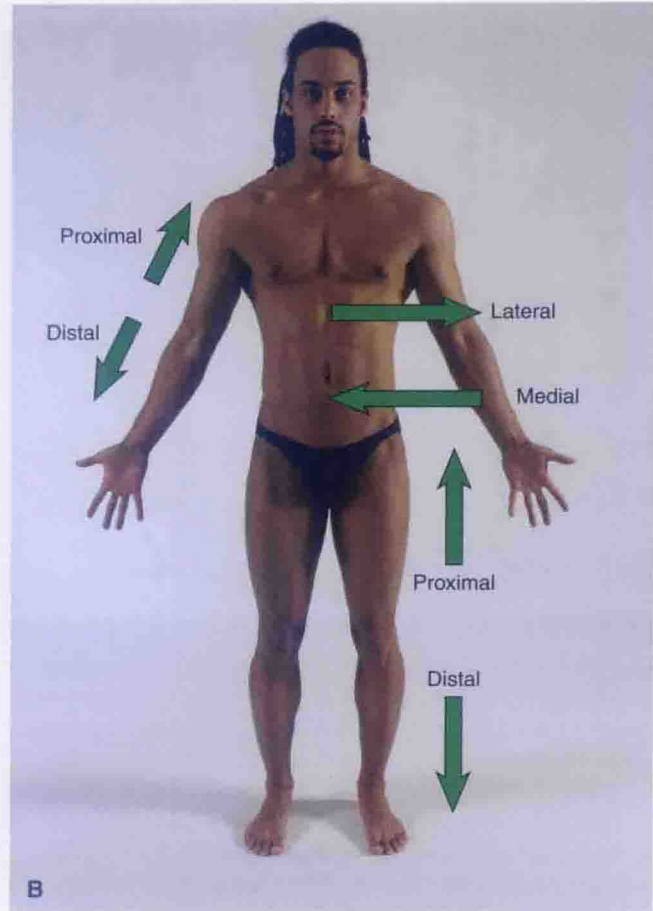
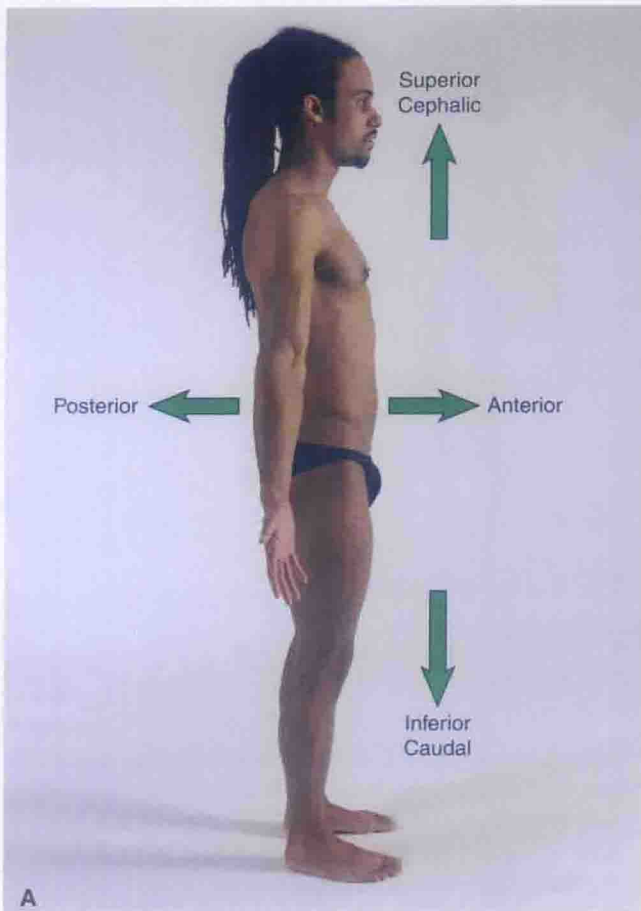
If a classmate were describing to you a tissue injury in a client’s leg, you might assume that the injury was located in the thigh when your classmate actually meant the lower leg. To avoid such mix-ups, precise names are assigned to different regions of the body (FIG. 1-1). This is the first point of reference and the beginning of anatomical communication.

Anatomical Position

Even when using regional terminology, miscommunication can occur if both parties don’t share the same point of reference. That’s where the **anatomical position** comes in. In western medicine, anatomical position is described as body erect and facing forward, feet parallel, arms at sides with forearms extended, and palms facing forward (FIG. 1-1A,B). This position of the body is used to describe the relative location of anatomical features as well as to describe movements of the various parts of the body. Most anatomical textbooks and charts utilize this position when depicting and describing the body’s structures.



1-1. Regions of the body in the anatomical position. A. Anterior. B. Posterior.



1-2. Directional terms. A. Lateral view. B. Anterior view.

Directional Terms

Starting from anatomical position, you can describe relative positions of different body structures (FIG. 1-2). For example:

- The chest is anterior to the spine.
- The hand is distal to the elbow; that is, the hand is further from the point of attachment of the upper limb than is the elbow, which is more proximal.
- The head is superior to the shoulders.
- The nose is medial to the ears; that is, the nose is closer to the midline of the body than are the ears, which are more lateral.

Directional terms are useful for describing the location of injuries, as in, “The client is experiencing soreness about two inches proximal to the left patella.” They are also useful when describing positions of the body, such as, “The athlete should finish the movement with the hands just lateral to the hips.”

Relative terms not shown in Figure 1-2 describe how close to the surface of the body a structure lies. These include the terms **superficial** (closer to the surface) and **deep** (farther from the surface of the body). For example, the scalp is superficial to the skull, whereas the brain is deep to the skull.

Planes of Movement

Now that anatomical position and appropriate directional terminology have been established, we’re ready to explore the language of human movement. The human body moves in complex ways, which can make description difficult. Scientists have categorized and simplified the terminology of human movement in an effort to heighten understanding and communication. This strategy encourages consistent description and analysis of complex human movements by breaking them down into simpler parts.

Motions occur at the joints of the body in one of three general directions: front to back, side to side, or rotationally. To describe these movements precisely, it helps to visualize the body transected by one of three large imaginary planes.

The first plane, which divides the body vertically into right and left halves, is called the **sagittal plane** (FIG. 1-3A). Front-to-back movements occur parallel to this imaginary plane. Swinging your arms and legs back and forth with walking are examples of sagittal movements.

The second plane divides the body into front and back halves. It is called the **frontal** (or **coronal**) **plane** (FIG. 1-3B). Side-to-side movements occur parallel to this imaginary plane. The upper and lower limb movements that occur when you do jumping jacks are examples of frontal movements.