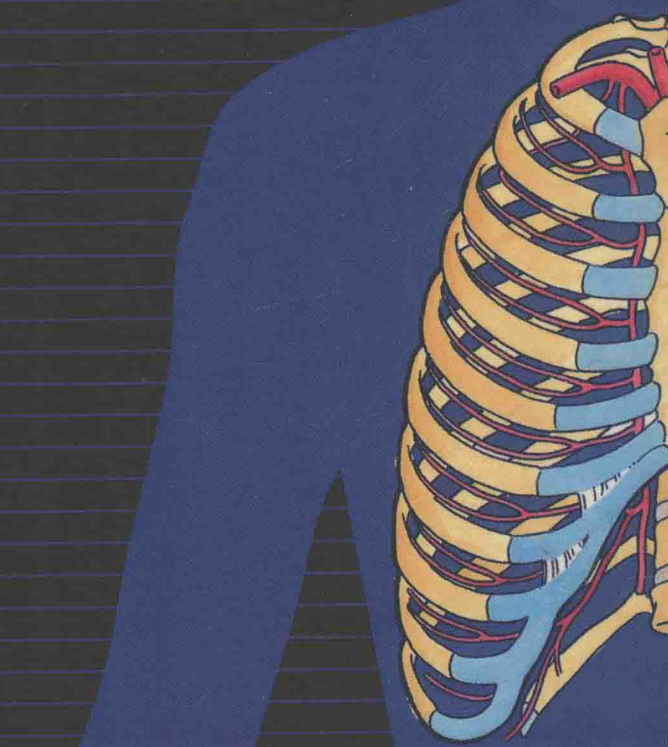
ESSENTIAL ANATOMY DISSECTOR

Following Grant's Method



JOHN T. HANSEN

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John T. Hansen, Ph.D.

Professor and Associate Dean for Admissions
Department of Neurobiology and Anatomy
University of Rochester
School of Medicine and Dentistry
Rochester, New York

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Preface

Grant's Dissector initially appeared over half a century ago in 1940, and has been one of the premier dissectors available for human anatomy courses in the health professions schools. While the approach used in *Grant's Dissector* is well known and time-honored, medical and dental school curricula have changed significantly since 1940, not only in their emphasis but also in the time allotted for anatomical dissection. In response to the need for a more concise dissector which maximizes the students' actual laboratory dissection time, this first edition of *Essential Anatomy Dissector* was conceived in an effort to facilitate the actual physical work of dissection yet highlight the essential structures that all generalist physicians should know.

Health professionals, in the limited time available for their undergraduate professional training, cannot learn all the anatomy there is to learn. Therefore, this dissector focuses on the essential anatomy and key concepts that most practitioners would agree is important to learn. Emphasis in the laboratory is placed upon appreciating surface anatomy, relationships of important structures, cross sectional anatomy, and clinical relevance of the anatomical structures. To this end, the use of an appropriate atlas of human anatomy in conjunction with this dissector is critical. Likewise, it is important that the students realize that **this dissector is not meant to replace or substitute for an atlas and a good clinically-oriented textbook of human anatomy.** The purpose of the dissector is to complete the dissection in a timely fashion and to highlight important structures that each student should find. Then, the student is directed to the atlas and textbook to enhance their knowledge of these structures and read about their relevance to clinical medicine. Most of this reading needs to occur outside of the dissection laboratory and is an important aspect of developing life-long learning skills in our students.

The dissector is organized so that students can easily follow the dissection protocols, which are highlighted in color to separate these instructions

from the remaining text. The format is in an outline style so students can easily group concepts or regional anatomy into blocks of information that are systematically presented. Important structures to be identified are highlighted in color and the approach is regional and follows the general procedures that have made Grant's method the benchmark of anatomical dissection. Figures and tables are used as regional guides to the dissection; however, it is expected that students will also access an atlas during their dissection. Moreover, *Essential Anatomy Dissector* is the only dissector keyed to five of the more popularly used atlases of anatomy, making it widely applicable to individual course needs. Finally, Learning Objectives and Key Concepts at the beginning of major regional dissections help guide the students to their atlas, textbook and the cadaver, emphasizing the important anatomical material that each student should learn regarding that region. Naturally, individual course directors may wish to supplement these objectives or concepts with expanded material of their own.

Because of the unique nature of individual anatomy courses, the dissector is written so that students can begin their dissection in virtually any region of the body, although in my experience most courses begin either on the back or thorax where the guiding principles of segmentation and bilateral symmetry are clearly evident. This dissector also should meet the needs of those courses which use some prossected material. Because the actual descriptive material is kept at a minimum, the students can use the dissector as a guide to identifying the relevant structures and then return to their textbooks for a more complete description of the anatomy. Every effort has been made to make *Essential Anatomy Dissector* a focused, directive and concise manual of dissection that will optimize limited laboratory time, encourage student reading in their textbook, yet include the "essential" anatomy that all generalist physicians should encounter and learn, regardless of future specialization.

John T. Hansen

Acknowledgments

I am indebted to all my former and current students, and faculty colleagues who have taught me far more than I have ever taught them. Their honest and constructive feedback is always helpful and enlightening, and their inspiration keeps me going. Medicine is in good hands.

At Williams & Wilkins, the dedicated staff is professional at every level and it has been a joy and a learning experience just to know them. Any mistakes are mine, just as any successes are ours. I sincerely appreciate and gratefully acknowledge the efforts of Tim Satterfield, Vice President and Publisher, and Paul Kelly, Acquisitions Editor, for believing that a concise, directive, and focused dissector was an idea whose time had come. Also, the combined efforts of Crystal Taylor, Nancy Evans, Becky Himmelheber, Laura O'Leary, Mario Fernández, and Mike Standen have been extraordinary. It is a distinct pleasure to be associated with Williams & Wilkins, the premier publishing house in the field of human anatomy.

Because this manual follows *Grant's Dissector,* albeit in a more concise and focused format, I also am indebted to Eberhardt K. Saurland, M.D., who has enriched all of us by his masterful editing of *Grant's Dissector* since its seventh edition.

Most of all, I want to thank my wife, Paula, and my children for their unconditional love and support over the years. Because we've shared so much, this effort, like all the others, was multiauthored.

Credits

Illustrations listed below are reproduced from the following Williams & Wilkins publications.

Agur AMR. Grant's Atlas of Anatomy, 9th ed., 1991.
Figures 1.2, 1.5, 2.6–2.8, 2.12, 2.16, 2.17, 3.6, 3.9, 4.2, 4.4, 6.7C, 6.8B, 6.10 bottom, 7.12, 7.13A, 7.15, 7.17, 7.20, 7.23, and the illustrations that appear in Tables 7.2 (bottom illustration only) and 7.6 (left illustration only).

Basmajian JV, Slonecker CE. Grant's Method of Anatomy, 11th ed., 1989.
Figures 2.2 and 5.2.

Moore KL, Agur AMR. Essential Clinical Anatomy, 1995.
Figures 1.1, 1.3, 1.4, 1.6–1.9, 2.1, 2.3–2.5, 2.9–2.11, 2.13–2.15, 2.18, 3.1–3.5, 3.7, 3.8, 4.1, 4.3, 4.5, 5.1, 5.2–5.10, 6.1–6.6, 6.9, 7.1–7.11, 7.14, 7.16, 7.18, 7.19, 7.21, 7.22, and the illustrations that appear in Tables 7.1, 7.2 (top two illustrations only), 7.4, 7.5, 7.6 (right illustration only), and 7.8.

Olson TR. A.D.A.M. Student Atlas of Anatomy, 1996. Illustrations that appear in the chapter openers on pages 1, 19, 47, 63, 73, 97, and 123. © A.D.A.M. Software, Inc.

Figure 7.1 is redrawn from Wilson JL. Dissection Manual, 2nd ed. New York: Igaku-Shoin Medical Publishers, Inc., 1988:187.

Figures 2.13, 3.2, and 7.8 are redrawn from Glasgow EF, Dolph J, Chase RA, Gosling JA, Mathers LH, Jr. Clinical Anatomy Dissections. St. Louis: Mosby, 1996.

All tables that appear in this book are reproduced from Moore KL, Agur AMR. Essential Clinical Anatomy, 1995.

Introduction

Purpose. Dissection is vital to a full appreciation of human anatomy. In no other format can students better learn the three-dimensional features of the human body, the inherent variability in structure, the importance of careful observation, the feel and texture of the dissection experience, or the exposure to the normal and abnormal that is part of every dissection exercise. To make the most of this experience, follow carefully the guidelines and expectations of your instructors, and always approach dissection with the utmost reverence and respect for the living persons who have donated their bodies for medical study and research.

Technique. Your instructors will provide guidelines regarding the proper care of the cadaver or specimens you work with, what instruments they wish for you to use, and the appropriate rules of conduct in the dissection laboratory. Additionally, they may alter the sequence of dissections listed in this manual, and supplement or modify the Learning Objectives and Key Concepts to meet the needs of their individual courses.

The scalpel is used mostly for skin incisions, reflecting the skin, and in cutting large structures where indicated in the dissector. Blunt or fine dissection should be done with your scissors, probe and forceps. Blunt dissection is best performed by using your fingers or the scalpel handle to gently separate structures. The "scissor technique" also may be used to spread structures apart or to dissect along vessels or nerves in parallel with their course. Your staff will demonstrate these techniques to you.

In most instances, when the dissector directs you to reflect the skin, you will reflect both the skin and the underlying subcutaneous tissue (tela subcutanea), unless your instructor prefers to leave the tela in place to identify cutaneous nerves and vessels. However, for the most part, the manual will point out important cutaneous nerves and vessels as you encounter them and encourage you to read about their distribution in your textbook and atlas. Time in most laboratories will not be devoted to the tedious dissection of these superficial structures.

Terminology. From your textbook and atlas, become familiar with the universally approved position of the body known as the "anatomical position." Also, become familiar with essential terms such as **superior (cranial), inferior (caudal), anterior (ventral), posterior (dorsal), coronal, sagittal, and transverse.** Also understand what is meant by structures lying "superficial" or "deep" to one another.

About This Manual. Use the Learning Objectives and Key Concepts to guide your study of important "general" points that you should understand regarding the regional anatomy being learned. For the most part, reading your clinically-oriented textbook will be invaluable in achieving the intent of these objectives. This reading occurs outside of the laboratory and is an important part of developing life-long learning skills.

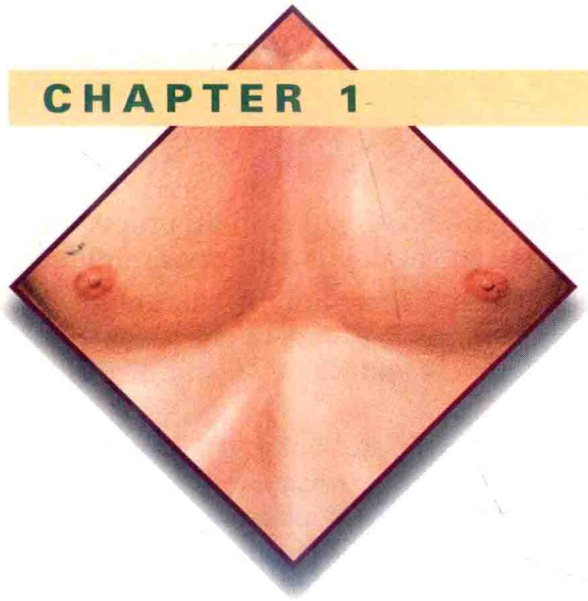
The organization of the dissector is in outline format to facilitate an appreciation for regional organization and for ease of use. The dissection exercises for the most part follow the time-honored method of *Grant's Dissector,* but are abbreviated or modified in some regions to highlight only the "essential" material or to render the dissection less destructive. Key structures are highlighted in color and may be required "identifications" by your instructor. Likewise, the actual dissection instructions ("cut, incise, reflect, etc.") are highlighted in color for easy identification.

The figures are intentionally kept to a minimum and are guides only to the "actual performing" of the dissection. All students should become accustomed to using a good atlas to visualize the highlighted structures and study their important relationships. Consequently, this manual is keyed in to five different atlases of human anatomy, with key illustrations indicated by an abbreviation and the figure (**G**rant's and **A.**D.A.M.), plate (**C**lemente and **N**etter) or page (**R**ohen) number. In the text of the dissector, emphasis is placed on the action of muscles on the joints they cross. For those courses that place an emphasis on learning the origins and insertions of major muscle groups, tables are provided to summarize this information.

Finally, each major regional dissection begins by directing students to examine the surface anatomy on either their cadaver, each other, from an illustration, or on yourself. This is a good practice to cultivate as surface anatomy is vitally important in medicine; again, a good clinically-oriented textbook or atlas can be an invaluable resource. Bony features also are important to learn and one should have access to skeletons and normal radiographs. Each regional section ends by encouraging students to study cross sections and CT or MRI films. This is vitally important as radiographic anatomy will be how many of you will "visualize" your patient's anatomy during your medical practice.

Contents

CHAPTER 1



Thorax

I THORACIC WALL

LEARNING OBJECTIVES

- Identify the features of the ribs and sternum and important surface landmarks on the anterior thoracic wall.
- Diagram the lymphatic drainage of the breast and understand its importance in the spread of cancer.
- Describe the function of the pectoral muscles and the role of the intercostal muscles in respiration.
- Describe how intercostal neurovascular bundles radiate around the thoracic wall.
- Know why the sternal angle of Louis is an important surface landmark.

KEY CONCEPTS

- Sternal angle of Louis as an important surface landmark
- Muscles involved in respiration
- Distribution of intercostal neurovascular bundles

A. Introduction. The thorax contains and protects the heart and lungs. The thoracic wall is comprised of the vertebrae, ribs, sternum, and muscles. Examine the thoracic vertebrae and note whether your cadaver has any abnormal curvatures of the thoracic spine such as kyphosis (hunchback) or scoliosis (lateral curvature).

B. Bony Landmarks. G1.8B; C94-97; R183; A2.3; N170-171

1. **Sternum.** Identify the **manubrium, body,** and **xiphoid process.** The xiphoid process is cartilagenous in youth but ossifies by midlife.

   Each rib is connected anteriorly to the sternum by a bar of hyaline cartilage. The costal cartilages of ribs 8, 9, and 10 reach only as far as the cartilage superior to it. Ribs 11 and 12 are "floating" ribs.

2. **Ribs.** Identify the **head, neck, tubercle,** and **body.** The lower border of each rib shelters the intercostal neurovascular bundle (nerve, artery, and vein). Observe that each rib articulates with two vertebral bodies and the intervening disc. The tubercle articulates with the transverse process of the vertebra with the same segmental number while the head articulates both with the vertebra above and at the same segmental level (e.g., the head of rib 5 articulates with vertebrae T4 and T5, and the tubercle with the transverse process of T5).

3. **Thoracic vertebra.** Identify the **body** and protective vertebral arch made up of the **pedicles, laminae,** and the **spinous process. Articular processes** project superiorly and inferiorly.

4. Note important surface landmarks, the **jugular notch** and **sternal angle (of Louis).** The sternal angle marks the junction of the manubrium with the body of the sternum and the point where the second rib articulates with the sternum. This important surface landmark is used to count ribs and intercostal spaces. Also note the outline of the **clavicle, acromion** of the scapula forming the point of the shoulder, the **xiphoid process,** and the location of the **nipple,** which is associated with the T4 dermatome in males (somewhat more variable in females).

   Make the skin incisions shown in Figure 1.1. Remove the skin and tela subcutanea (subcutaneous tissue or superficial fascia) until the underlying muscles are encountered, but leave the subcutaneous tissue of the female breast in place. Deep to the tela lies the deep fascia, which envelops the underlying muscles.

C. The Female Breast.

If you have already dissected the breast and pectoralis muscles as part of the Upper Limb dissection, skip to the section on the intercostal muscles.

The two mammary glands lie within the tela (superficial fascia) and really are modified sweat glands. Between the gland and deep fascia investing the pectoralis major muscle lies the **retromammary space,** which allows the breast to move freely over the muscle. The gland is attached to the skin by fibrous septa, the **suspensory ligaments** (Cooper's ligaments) G1.4/ C3-5/ R245/ A1.41-1.42/ N167-169

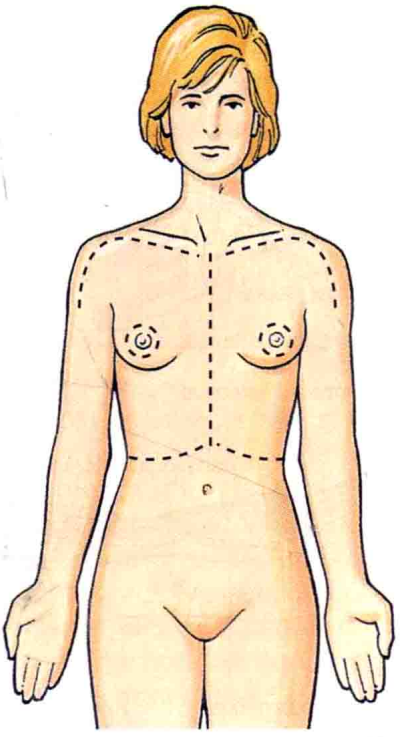


FIGURE 1.1 Anterior view.

1. Identify the **nipple** and **areola.** Observe that the **suspensory ligaments** form septa that divide the breast tissue into compartments that contain fat.

2. Cut through the nipple and find several of the 15 to 20 **lactiferous ducts** that converge on the nipple (often too small to adequately identify grossly).

3. Review on your own the important lymphatic drainage of the breast in your textbook and atlas, noting especially the drainage to the axillary lymph nodes. **G1.5/ C6/ R245/ A6.26/ N169**

D. Muscles, Nerves, and Vessels. Although we will not dissect the cutaneous nerves of the thoracic wall, please note their distribution in your atlas and appreciate that they are divided into lateral and anterior branches (Fig. 1.2). **G1.20/ C7/ R202-203/ A1.35/ N175, 179**

To better study the thoracic wall, we will first dissect two muscles of the upper limb, the pectoral muscles, and then proceed with the intercostal muscles.

1. **Pectoralis major.** Clean the pectoralis major muscle. Identify the **deltopectoral triangle** and the **cephalic vein,** which drains blood into the axillary vein. The pectoralis major muscle forms

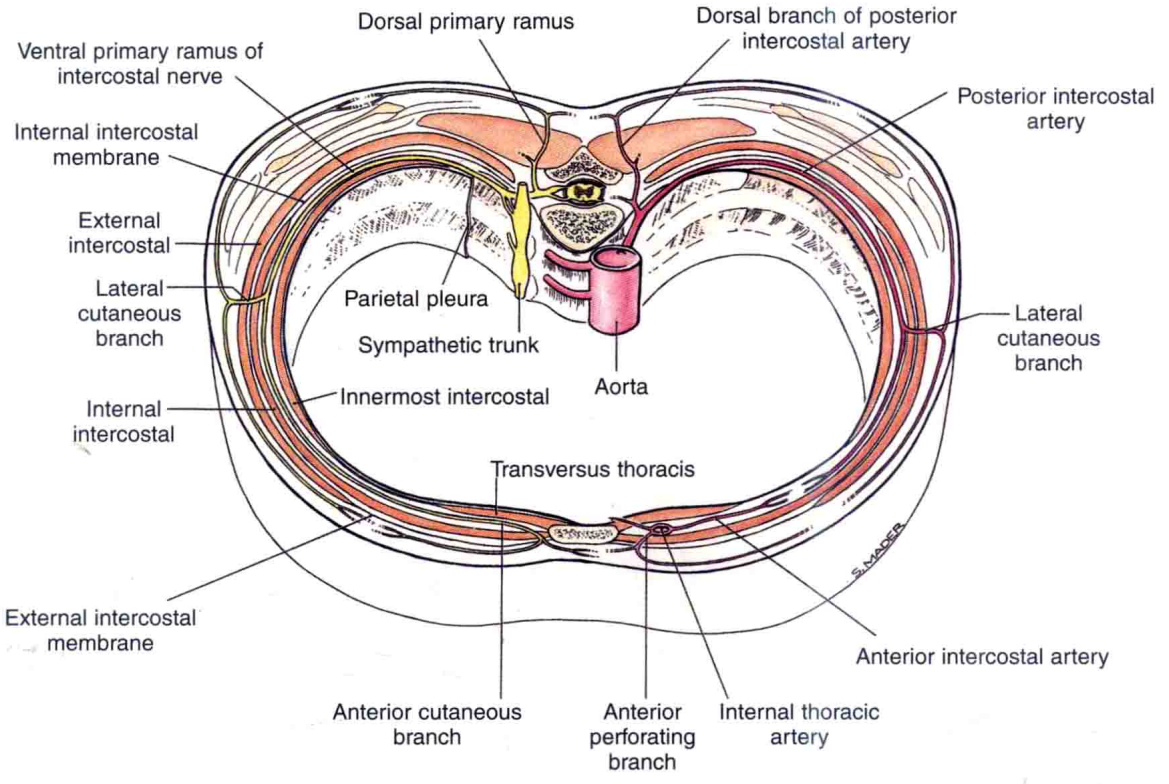


FIGURE 1.2 Transverse section of thorax showing contents of an intercostal space.

the anterior axillary fold (grip this muscle anterior to your own arm pit). **G1.2/ C11/ R195/ A6.28/ N174**

Cut and partially reflect the pectoralis major muscle close to its attachment to the clavicle. Look for the **lateral pectoral nerve** on its underside. **G6.22/ C15/ R196/ A6.29/ N174, 400**

Next, relax the muscle by adducting the cadaver's arm. Separate the pectoralis muscle from the underlying clavipectoral fascia, which envelops the pectoralis minor muscle, cut the sternal head of the muscle, and begin reflecting the muscle laterally. Find the **medial pectoral nerve,** which pierces the pectoralis minor muscle before entering the pectoralis major. Cut the nerves and reflect the pectoralis major laterally toward the arm to expose the pectoralis minor. **G6.22/ C15/ R196/ A6.29/ N399-400**

2. **Pectoralis minor.** Identify and clean the **thoracoacromial artery** (a branch of the axillary artery) medial to the **pectoralis minor** muscle (it lies next to the lateral pectoral nerve). Next, detach the pectoralis minor from the costal cartilages of ribs 3, 4, and 5, and reflect it toward the shoulder. **G6.22/ C13-14/ R196, 387/ A6.28/ N400**

3. **Intercostal muscles.** Study the **external intercostal, internal intercostal,** and **innermost intercostals.** These muscles are supplied by the corresponding intercostal vessels and nerve, and fill the inter-

costal spaces. Study the distribution of these structures in your atlas and understand the function of the intercostal muscles in respiration (Table 1.1). G1.16-1.18/ C92-93/ R193-196/ A1.45-1.46/ N175, 177, 183

In the fourth intercostal space (between ribs 4 and 5) at the anterior axillary line, identify each of the intercostal muscles by cutting through their layers and demonstrate an **intercostal nerve and vessels** (artery and vein).

E. Removal of Thoracic Wall. To visualize the thoracic contents, we will first remove the breastplate.

Cut ribs 2 through 6 just *anterior* to the **serratus anterior muscle** on both sides (Fig. 1.3). Cut only the ribs and not the underlying pleura, if possible. The parietal pleura often is adherent to the rib cage (occurs postmortem). Then cut horizontally through the sternal manubrium just inferior to the first rib and cut the sternum at the sixth intercostal space. Cut the internal thoracic vessels on both sides just superior and inferior to the breastplate. Gently elevate the inferior part of the sternum together with the attached portions of the severed ribs and cut any remaining soft tissue connections.

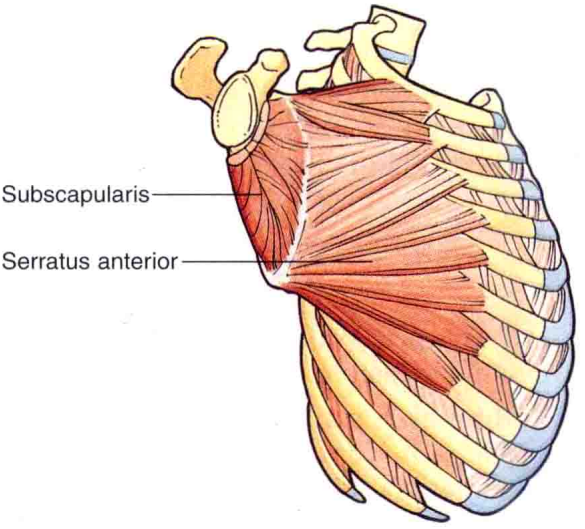
TABLE 1.1

MUSCLES OF THORACIC WALL

Muscles	Superior Attachment	Inferior Attachment	Innervation	Action[a]
External intercostal	Inferior border of ribs	Superior border of ribs below	Intercostal n.	Elevate ribs
Internal intercostal	Inferior border of ribs	Superior border of ribs below	Intercostal n.	Depress ribs
Innermost intercostal	Inferior border of ribs	Superior border of ribs below	Intercostal n.	Probably elevate ribs
Transversus thoracis	Posterior surface of lower sternum	Internal surface of costal cartilages 2-6	Intercostal n.	Depress ribs
Subcostal	Internal surface of lower ribs near their angles	Superior borders of 2nd or 3rd ribs below	Intercostal n.	Elevate ribs
Levator costarum	Transverse processes of T7-T11	Subjacent ribs between tubercle and angle	Dorsal primary rami of C8-T11 nn.	Elevate ribs
Serratus posterior superior	Ligamentum nuchae, spinous processes of C7 to T3 vertebrae	Superior borders of 2nd to 4th ribs	Second to fifth intercostal nn.	Elevate ribs
Serratus posterior inferior	Spinous processes of T11 to L2 vertebrae	Inferior borders of 8th to 12th ribs near their angles	Ventral rami of ninth to twelfth thoracic spinal nn.	Depress ribs

[a]All intercostal muscles keep intercostal spaces rigid, thereby preventing them from bulging out during expiration and from being drawn in during inspiration. Role of individual intercostal muscles and accessory muscles of respiration in moving the ribs is difficult to interpret despite many electromyographic studies.

FIGURE 1.3



1. Identify the following structures: G1.16/ C100/ R194/ A1.43-1.44/ N176
   a. **Internal thoracic (mammary) artery** and **vein**(s). These vessels anastomose with the intercostal vessels laterally.
   b. **Transversus thoracis muscle.**
   c. **Sternocostal joints** that allow gliding movements during respiration.

II PLEURAL CAVITIES AND THE LUNGS

LEARNING OBJECTIVES

- Understand the concept of pleural sac and potential space.
- Identify the features of each lung.
- Draw and describe the topographical surface projections of the lungs and parietal pleural reflections on the thoracic wall.
- Define the term "bronchopulmonary segment"and know its importance.

KEY CONCEPTS

- Potential space and pleural cavity
- Pleural reflections on the thoracic wall
- Bronchopulmonary segment

A. Introduction. The thoracic cavity contains two **pleural sacs** (containing the lungs) and the **mediastinum.** Each lung is covered with a smooth glistening membrane, the **visceral pleura.** At the root of the lung (where structures enter or leave the lung), the visceral pleura reflects