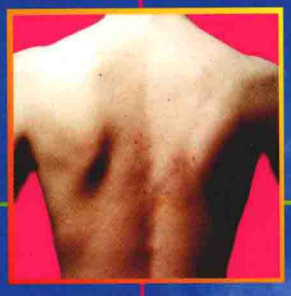
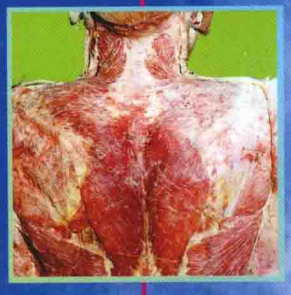
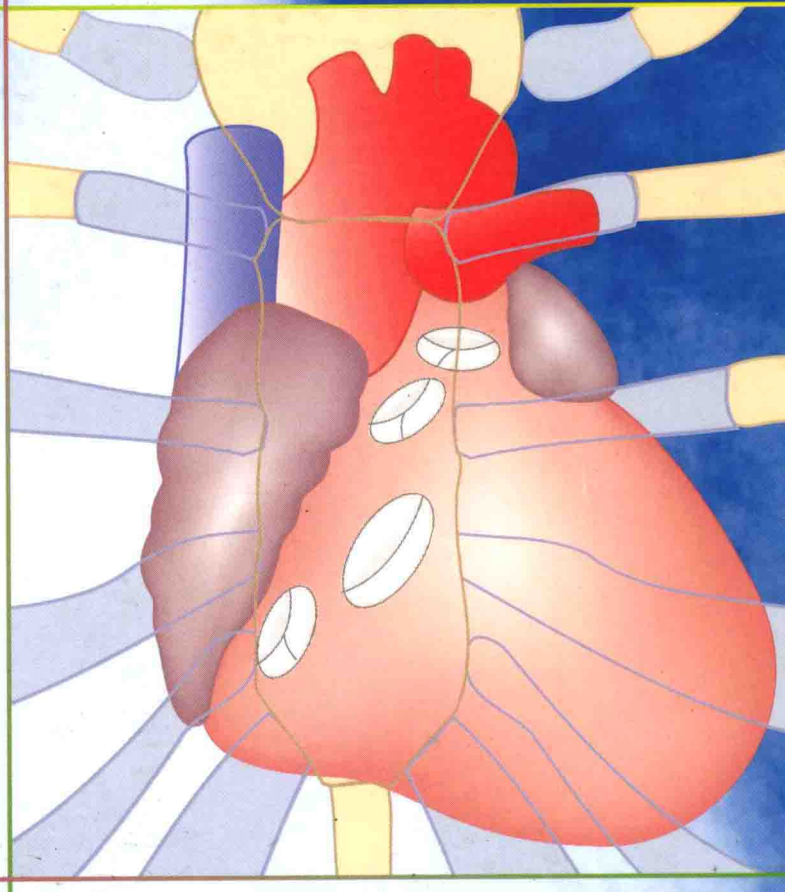
ATLAS OF Human Anatomy

S. Jacob







CHURCHILL LIVINGSTONE

ATLAS OF HUMAN ANATOMY

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Note
Medical knowledge is constantly changing. As new information becomes available, changes in treatment, procedures, equipment and the use of drugs become necessary. The author and publishers have taken care to ensure that the information given in this text is accurate and up to date. However, readers are strongly advised to confirm that the information, especially with regard to drug usage, complies with the latest legislation and standards of practice.

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ATLAS OF HUMAN ANATOMY

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PREFACE

Human gross anatomy is one of the most important subjects in the study of Medicine and Allied Health Sciences. Dissection of the cadavers is the best means of studying gross anatomy. However, this is often difficult because of limitations of facilities, the short time available in the curriculum and the growing shortage of cadavers for dissection. By using a combination of fully labelled photographs of dissections, radiological anatomy, and drawings, along with a comprehensive descriptive text, this book aims to provide the student with a real understanding of the anatomy of the human body. The *Atlas of Human Anatomy* contains illustrations of surface anatomy, osteology, dissections, radiological, CT and MRI images and line artwork. The background text, concise but comprehensive, describes the most important features of each area with special emphasis on clinical relevance and application. Organised on a regional basis the *Atlas* contains illustrations and descriptions on upper limb, thorax, abdomen and pelvis, vertebral column and spinal cord, lower limb, and head and neck. Each chapter starts with a relevant account of surface anatomy and osteology. Features of anatomy that are of clinical importance are indicated with an  icon in the margin.

In planning this book I took into account the time constraint affecting most modern anatomy courses as well as the wide variety of teaching methodology used. It is hoped that the book will act as a useful companion for those who learn anatomy by dissection or by using prosections and plastinated specimens. The level of detail contained in it is more than adequate for most undergraduate medical and dental courses. The book is also useful for students of Biological, Biomedical and Allied Health Sciences where human anatomy is part of the curriculum. Surgeons in training can use this for a rapid review of anatomy while preparing for post-graduate examinations.

I would like to express my gratitude to many co-workers and friends who gave me invaluable help and encouragement towards the production of this book. I am greatly indebted to David Hinchcliffe for producing the excellent dissections and to Mick Turton for his exceptional expertise in photography. The *Atlas* would not have been possible without their dedicated efforts and unswerving enthusiasm. Jill Revill, Caroline Couldwell, Andy Fitzgerald and Malcolm Hinchcliffe also deserve credit for facilitating this work. Professor Rachel Koshi and the late Dr Thomas Koshi (Christian Medical College, Vellore) provided many of the radiographs. The MRI and CT scans were obtained from Dr Matthew Bull, Consultant, Northern General Hospital, Sheffield. Emily Evans carried out the dissection of the female pelvis under the supervision of my colleague Geoff Cope. I am grateful to them all. Thanks are also due to Professor Peter Andrews, Chairman of the Department, and Mr Ivan Dart, Laboratory Manager, for the facilities in the department of Biomedical Science, University of Sheffield. Finally my sincere thanks to Janice Urquhart and her production team for the expertise and care with which they made possible the preparation of this *Atlas* and to Timothy Horne and Richard Furn at Harcourt Health Sciences for entrusting me with this project.

Sheffield 2001 S. Jacob

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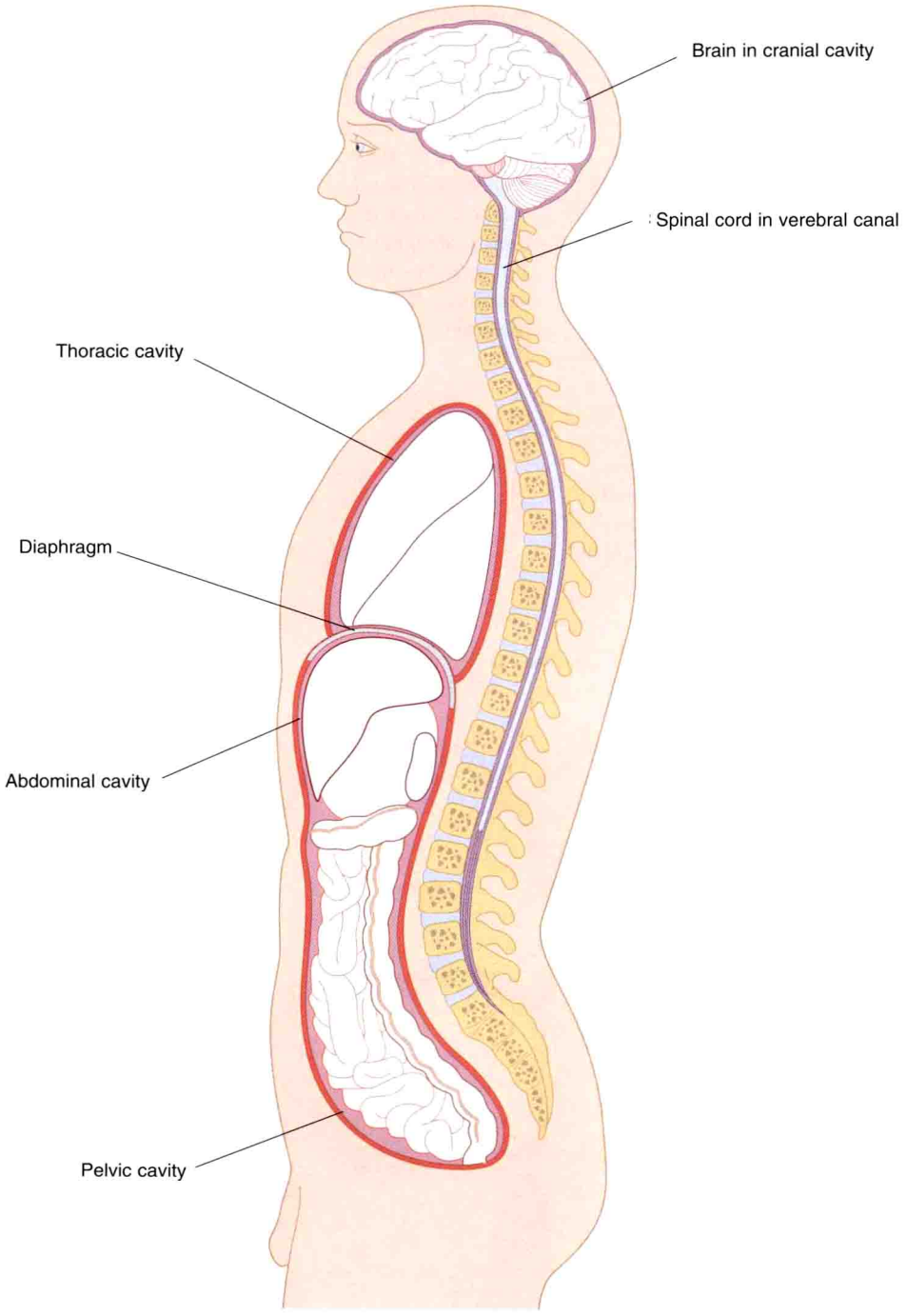

Fig. 1.1 *Internal organs within the various cavities of the body — lateral view*

column contains the spinal cord. The right and left lungs and the heart are in the thoracic cavity. Each lung is surrounded by the pleural cavity and the heart by the pericardial cavity. The thoracic cavity is separated from the abdominal cavity by the dome-shaped diaphragm, which is a sheet of muscle. The abdominal cavity is further divided into the abdominal cavity proper, which contains the liver, stomach, small intestine, parts of the large intestine, pancreas, spleen and kidneys, and the pelvic cavity which has the sigmoid colon, rectum, urinary bladder and parts of the reproductive system.

Anatomy has a highly specialised vocabulary, most of them derived from Greek or Latin. It is the language of medicine. Communications between health professionals can be severely hampered without the accurate use of anatomical nomenclature.

The anatomical position, about which the anatomical relations of structures are described, is that in which the person stands erect, arms by the sides, palms of the hands facing forwards (Fig. 1.3). Structures in front are termed anterior and those behind, posterior. Structures above are superior and those below, inferior. Structures nearer the midline of

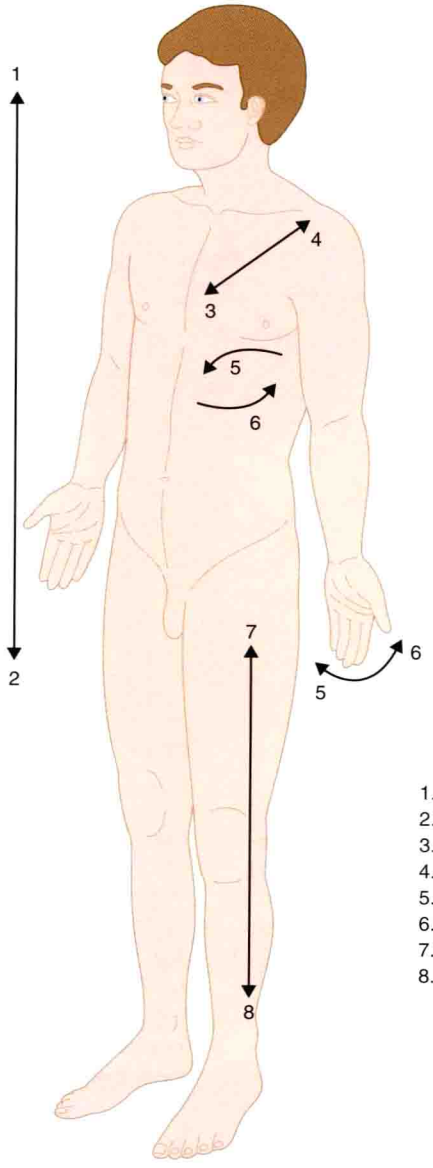

Fig. 1.3 *Commonly used positional and directional terms when the body is in standard anatomical position.*

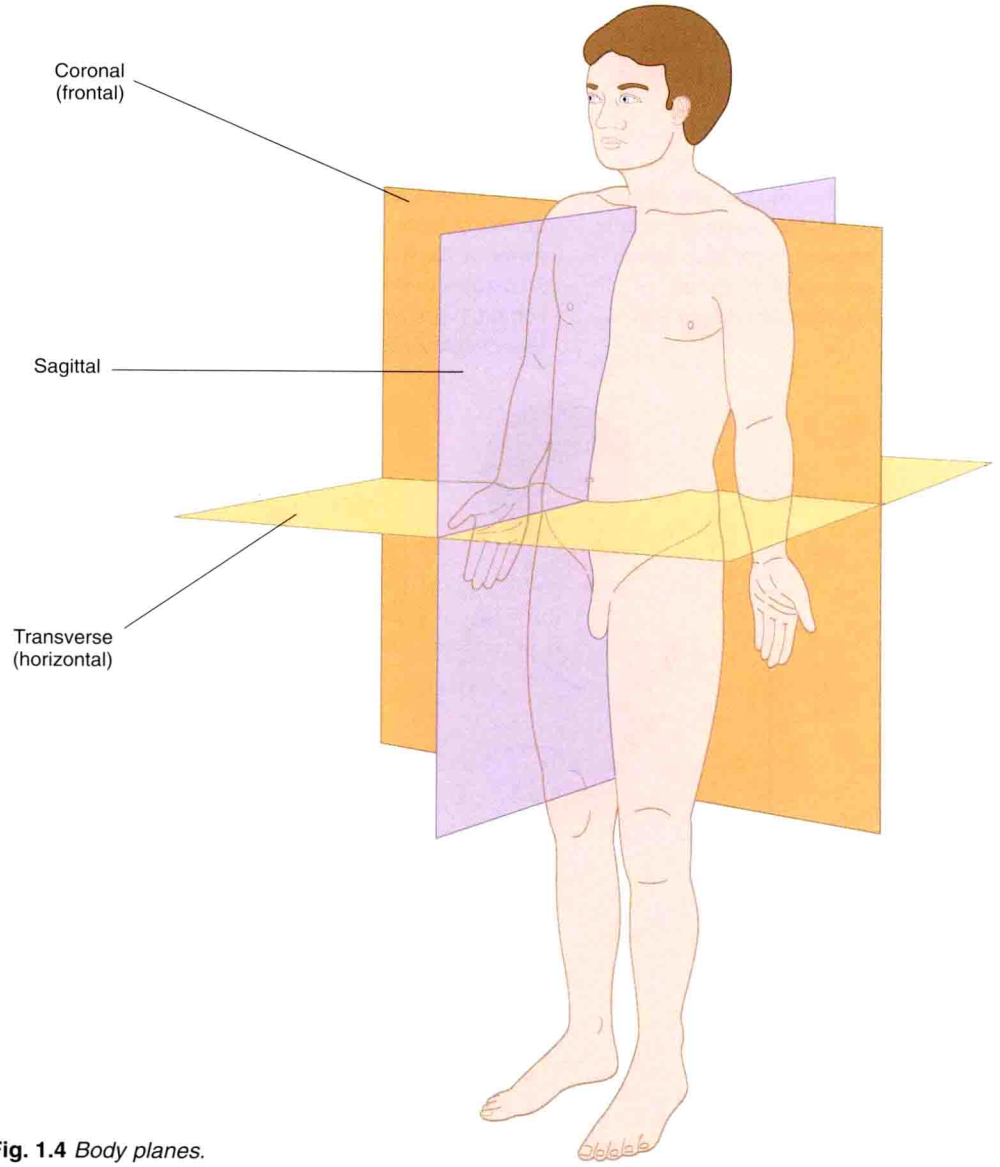

Fig. 1.4 *Body planes.*

the body are medial and those away from the midline, lateral. Structures nearer to the surface are superficial and those further from the surface are deep. In the limbs, the term proximal is used to describe structures nearer to the trunk and distal for those away from the trunk. A sagittal plane passes vertically anteroposteriorly through the body and the coronal plane is at right angles to the sagittal plane. A plane that passes at right angles to both the coronal and sagittal plane dividing the body into cross sections is the transverse or horizontal plane (Fig. 1.4).

Movement in the coronal plane away from the midsagittal plane is called abduction, return towards the midsagittal plane is adduction. Bending of any part in the sagittal plane is flexion and straightening is extension. Rotation occurs around a vertical axis. It may be medial rotation, towards the midline, or lateral, away from it.

UPPER LIMB

INTRODUCTION

The human upper limb, which is primarily used for grasping and manipulating objects, consists of the following five regions (Fig. 2.1):

- shoulder
- axilla
- arm
- forearm
- hand.

The shoulder has a wide range of mobility by virtue of the movements of the humerus, the clavicle and the scapula. The axilla or the armpit is the space between the chest wall and the upper part of the arm and contains the principal nerves and vessels. The bone of the arm, the region between the shoulder and the elbow, is the humerus (Fig. 2.2). In the arm the muscles are arranged in two compartments, flexors anteriorly and extensors posteriorly. A similar arrangement is seen in the forearm as well. The forearm is the region between the elbow and the wrist. The radius and the ulna of the forearm articulate with the humerus at the elbow joint and with each other at the superior and inferior radioulnar joints. Pronation and supination to rotate the forearm and hand for grasping and manipulating objects occur at the radioulnar joints; flexion and extension of the forearm take place at the elbow joint.

The wrist containing the carpal bones connects the forearm and hand. The skeleton of the hand is formed by the five metacarpal bones and that of the fingers by the phalanges. The anterior aspect of the hand is the palm of the hand. The hand can act as a tactile organ as the skin of the palm has a rich sensory innervation. The hand is for grasping objects. In the precision grip, as in holding a pen, the thumb is in the opposed position where the pulp of the thumb faces the pulp of the index finger. The thumb is of great functional value in all grips especially in the precision grip. In a power

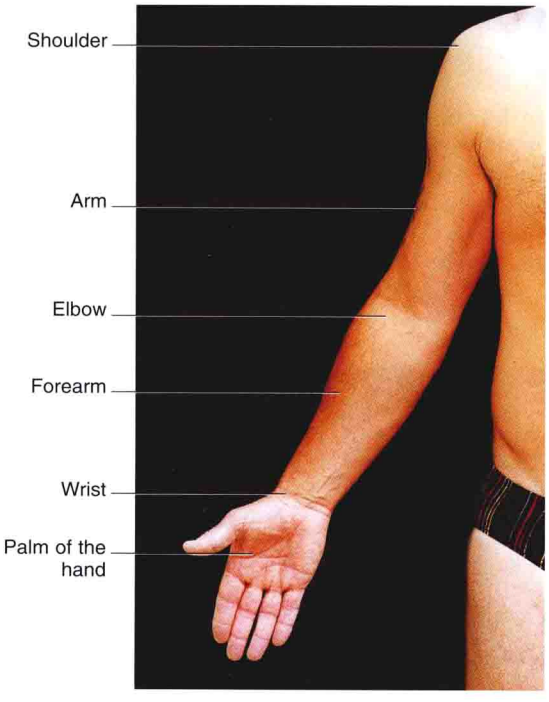

Fig. 2.1 *Regions of the upper limb.*

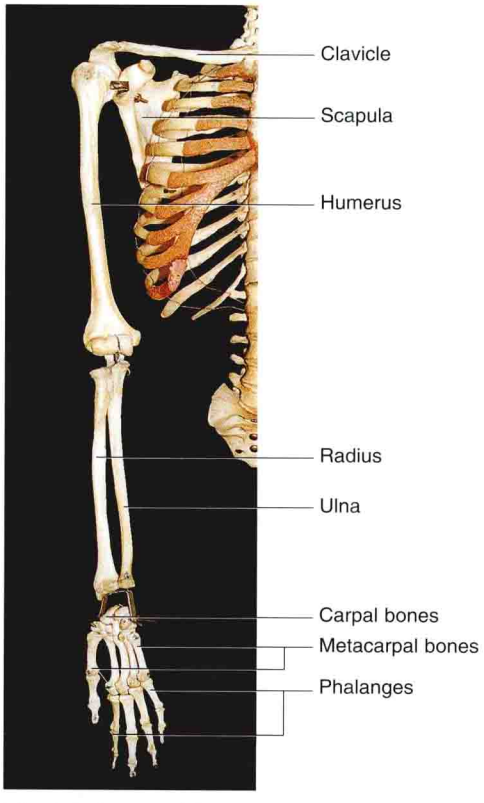

Fig. 2.2 *Bones of the upper limb.*

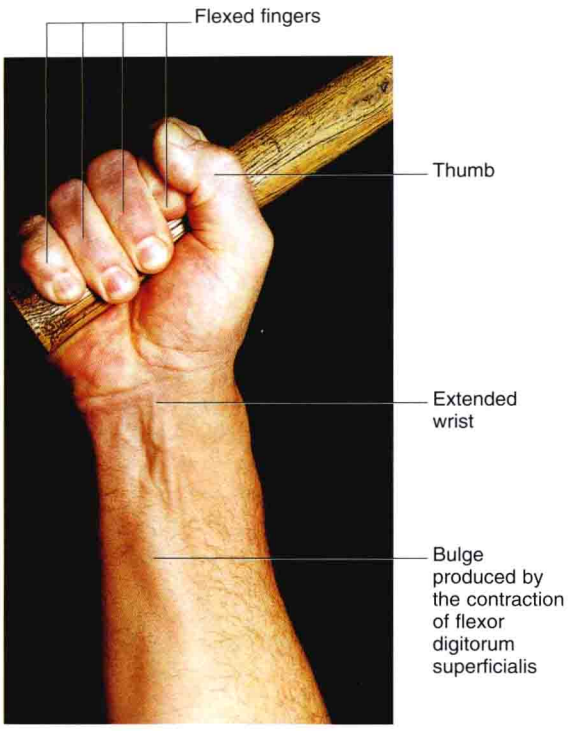

Fig. 2.3 *Power grip.*

grip as in holding a hammer, the wrist is kept extended and the powerful long flexors of the digits contract to make the fingers flex to hold the handle (Fig. 2.3). The thumb reinforces the grip. All grips and manipulations rely on normal mobility of all the fingers. A single immobile finger can make the whole hand clumsy.

SURFACE ANATOMY AND BONES OF THE SHOULDER AND PECTORAL REGIONS

The clavicle which is subcutaneous is palpable throughout and its movements during the movements of the upper limb can be felt by holding it between finger and thumb. The jugular notch (suprasternal notch) is felt between the prominent medial end of the clavicle. The clavicular and sternal heads of the sternocleidomastoid are visible (Fig. 2.4). The pulsation of the subclavian artery is felt on deep palpation against the first rib in the supraclavicular region just lateral to the clavicular head of the muscle. More posteriorly in the root of the neck the upper lateral border of the trapezius is visible. The muscle can be felt contracting by elevating the shoulder against resistance. The pectoralis major, as it bridges across the chest wall and arm, forms the anterior wall of the axilla. Its lower border is the anterior axillary fold. The muscle can be felt contracting when the arm is adducted against resistance. The clavicular and the sternocostal heads of the muscle may be visible in a muscular person. Below and lateral to the pectoralis major the digitations of the serratus anterior may be seen (Fig. 2.4).

The acromion of the scapula (Fig. 2.5) forms the highest bony point of the shoulder region. This point is used to measure the length of the upper limb. The coracoid process of the scapula is felt on deep palpation below the clavicle at its junction between the lateral third and the medial two-thirds. The muscle covering the whole of the shoulder region and giving it its

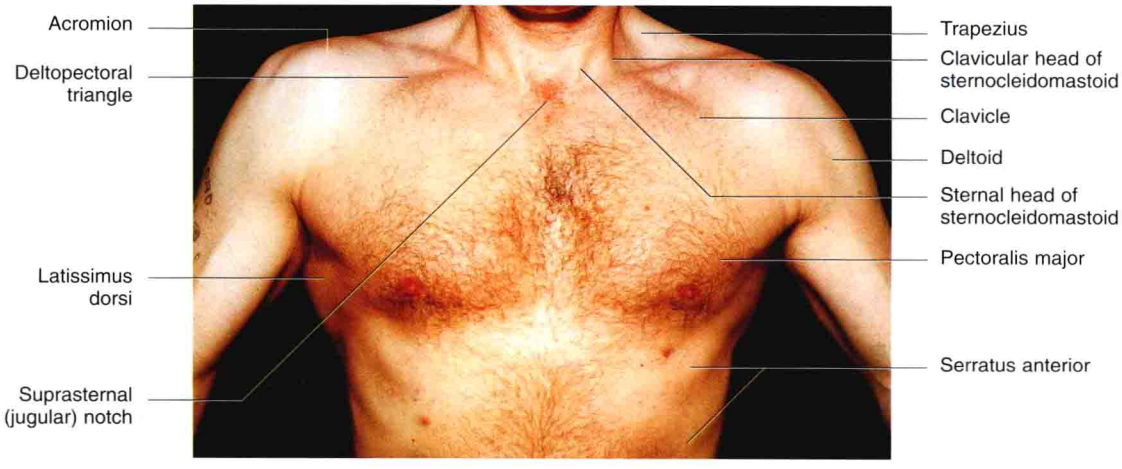

Fig. 2.4 *Surface anatomy of the shoulder and pectoral region.*

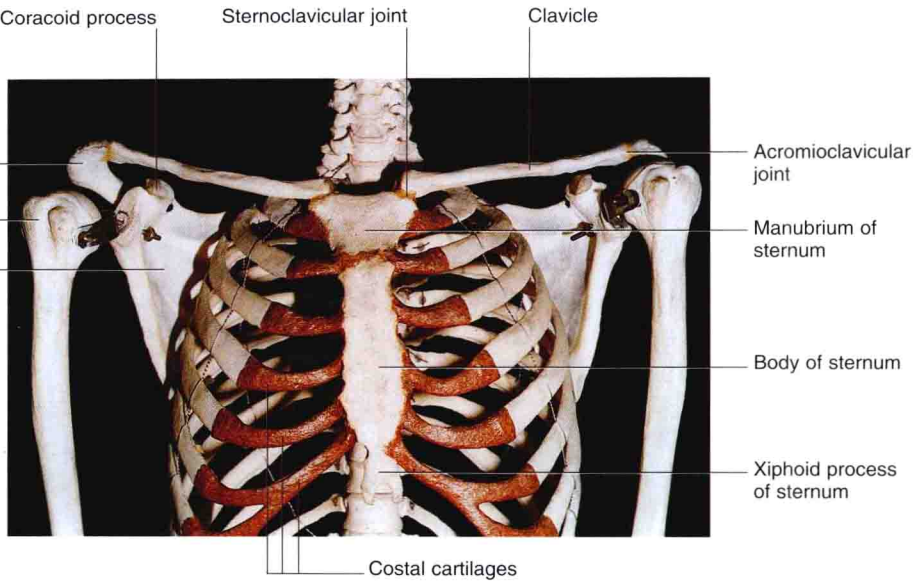

Fig. 2.5 *Bones of the pectoral and shoulder regions.*

rounded contour is the deltoid. The cephalic vein, a superficial vein of the upper limb, lies subcutaneously in the deltopectoral triangle which is the gap between the deltoid and the pectoralis major.

Pectoralis major (Fig. 2.6)

Origin
Medial third of the clavicle (clavicular head) and the sternum and costal cartilages (sternocostal head).
Insertion
Lateral lip of the bicipital groove on the shaft of the humerus.
Nerve supply
Lateral and medial pectoral nerves.
Action
The sternocostal fibres adduct and medially rotate the humerus at the shoulder joint. The clavicular fibres flex the humerus. If the upper limb is abducted and fixed the muscle can move the ribs and act as an accessory muscle of respiration.
Test
For clavicular head — abduct the arm to 90° and ask the patient to push the arm forward against resistance. For sternocostal head — abduct the arm to 60° and adduct it against resistance. The contracting heads can be seen and felt.

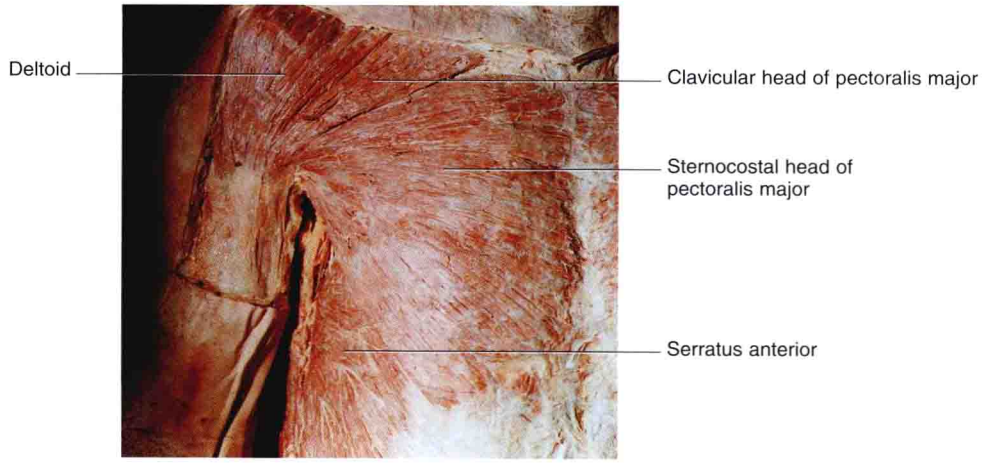

Fig. 2.6 *Pectoralis major, deltoid and serratus anterior.*

Pectoralis minor (Fig. 2.7)

Origin
Third to fifth (often second to fourth) ribs.
Insertion
The coracoid process of the scapula.
Nerve supply
Medial pectoral nerve.
Action
Draws the scapula (hence the arm) forwards — protraction of shoulder. It can also depress the shoulder.

Serratus anterior

Origin
By a series of digitations from the upper eight ribs.
Insertion
The costal surface of the scapula along its medial border. The muscle forming the medial wall of the axilla lies between the scapula and the chest wall before reaching its insertion.
Nerve supply
Long thoracic nerve from the roots of the brachial plexus (see Fig. 2.32). The nerve lies on the surface of the muscle on the medial wall of the axilla and is vulnerable in surgical procedures such as 'axillary clearance' of lymph nodes for the treatment of carcinoma of the breast. Nerve damage causes winging of the scapula where its medial border is seen more raised and prominent.
Action
Protraction (forward movement) of the scapula as in pushing, punching and fencing.

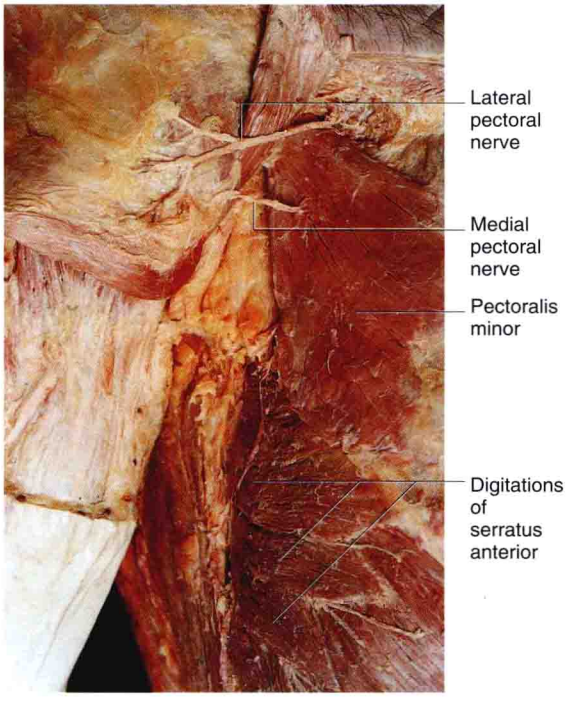

Fig. 2.7 *Pectoralis minor.*

THE SKELETON VIEWED FROM THE BACK (Fig. 2.8)

The most prominent point in the midline on the occipital bone is the external occipital protuberance from which the superior nuchal line, a transverse ridge, extends laterally. The vertebral column consists of seven cervical, twelve thoracic and five lumbar vertebrae, and the sacrum. The upper border of the hip bone, the iliac crest, forms the border between the back of the trunk and the gluteal region of the lower limb. The spinous processes of the vertebrae to which the latissimus dorsi and the trapezius muscles are attached project backwards in the midline. The scapula whose concave costal surface lies against the convex rib cage has a projection backwards, the spine of the scapula. When the arm is by the side of the trunk the medial end of the spine known as the root of the spine of the scapula lies at the level of the third rib.

SURFACE ANATOMY OF THE BACK (Fig. 2.9)

Surface features of the trapezius and the latissimus dorsi can be examined at the back. The superolateral border of the trapezius is seen and felt in the lower part of the neck. This can be made more prominent by raising the point of the shoulder against resistance. The spinous processes of the vertebrae are palpable in the midline. They can be made more prominent by bending the trunk forward. The lateral border of the latissimus dorsi is visible as the posterior axillary fold. The muscle can be palpated here by adducting the abducted arm against resistance. The medial border, the inferior angle and the spine of the scapula and the acromion are also seen. As the scapula contributes to the movement of the shoulder, the mobility of the shoulder joint (glenohumeral joint) is assessed by immobilising the scapula by holding on to it at the back.

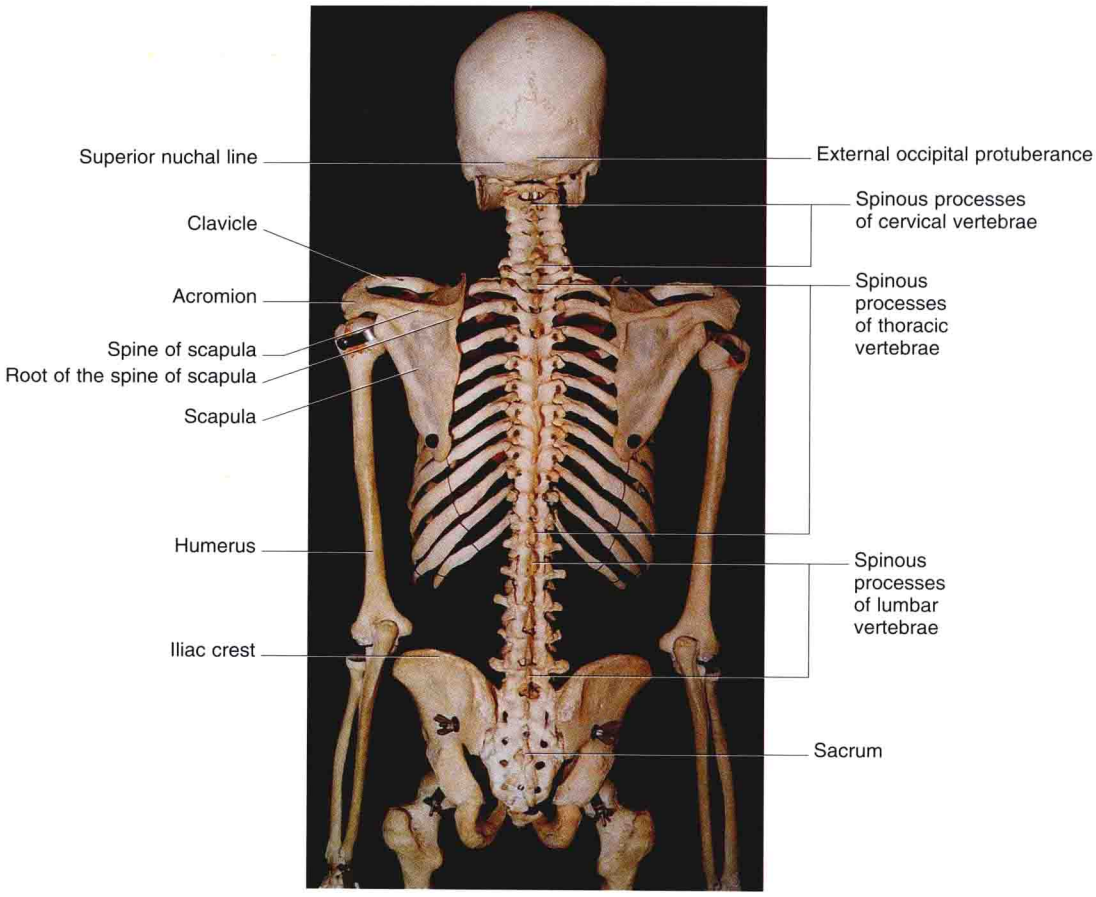

Fig. 2.8 *The skeleton viewed from the back.*

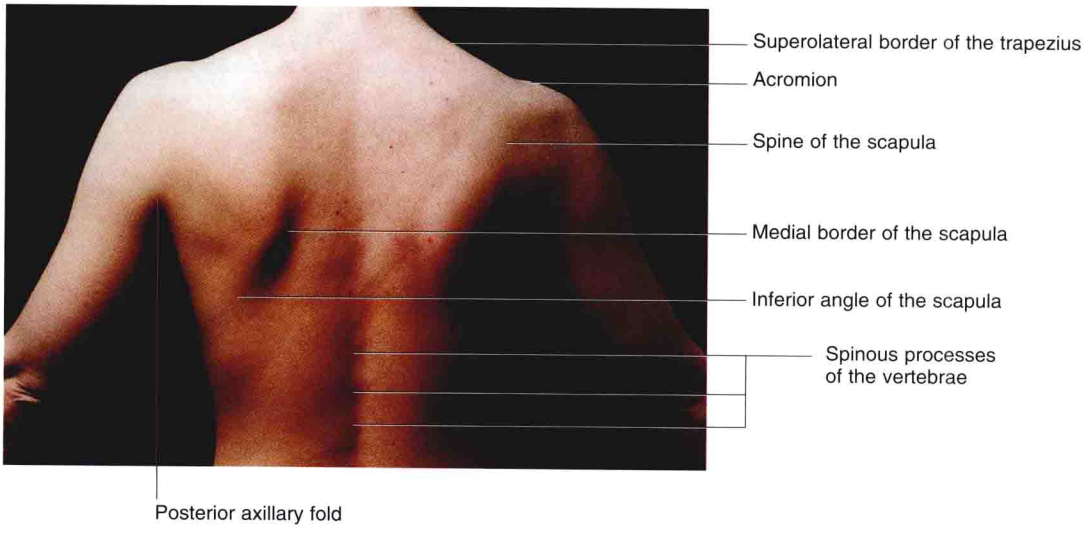

Fig. 2.9 *Surface anatomy of the back.*

SUPERFICIAL MUSCLES OF THE BACK

(Fig. 2.10)

Trapezius

Origin

- External occipital protuberance and the superior nuchal line.
- Ligamentum nuchae — fibroelastic tissue connecting the muscle to the spines of the cervical vertebrae.
- Spinous processes of seventh cervical to twelfth thoracic vertebrae.

Insertion

- Upper fibres to the lateral third of the clavicle.
- Middle fibres to the acromion.
- Lower fibres to the spine of the scapula.

Nerve supply

Spinal part of the accessory nerve.

Actions

Assisted by the lower fibres of the serratus anterior the trapezius rotates the scapula so that the glenoid fossa faces upwards. This action is important for raising the arm above the level of the shoulder. The shoulder is elevated by the upper fibres (as in shrugging the shoulder). All fibres of the muscle help to retract the scapula.

Test

Shrug the shoulder against resistance. The upper part of the muscle can be seen and felt as contracting.

Latissimus dorsi

This large superficial muscle is seen in the lower half of the back. It wraps around the chest wall and as it comes to be inserted in the bicipital groove of the humerus, contributes to the posterior axillary fold.

Nerve supply

The thoracodorsal nerve (C6,7,8) from the posterior cord of the brachial plexus. It is vulnerable in operations on the axilla.

Actions

Extension, medial rotation and adduction of the shoulder (as in scratching the opposite scapular region). The muscle is used as a myocutaneous flap in reconstructive breast surgery.

Test

Abduct the arm and adduct it against resistance. The muscle can be felt contracting in the posterior fold of the axilla.

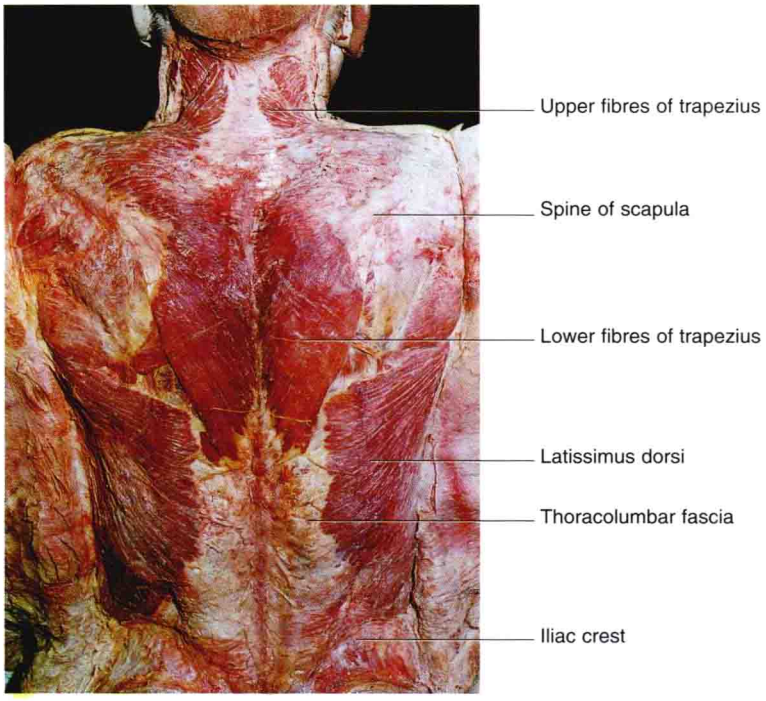

Fig. 2.10 *Superficial muscles of the back.*

STRUCTURES DEEP TO THE TRAPEZIUS (Fig. 2.11)

The levator scapulae and the two rhomboids lying deep to the trapezius are inserted on the medial border of the scapula.

BONES OF THE SHOULDER GIRDLE

Clavicle (Figs 2.12, 2.13)

The clavicle holds the upper limb away from the trunk and allows it to have a wide range of movements in the shoulder region. It is subcutaneous throughout and is easily palpable. It has two curves, the lateral third being concave forward and the medial two-thirds convex forward. The junction between the two curves is the weakest point and is the commonest site of clavicular fractures. After a fracture the lateral fragment of the clavicle may get displaced downwards due to the weight of the upper limb. The classic injury for fracture is a fall on the outstretched hand when the body weight is transmitted through the clavicle to the sternum. Medially the clavicle articulates with the sternum at the sternoclavicular joint and laterally with the acromion of the scapula at the acromioclavicular joint. The lateral end of the clavicle is held firmly on to the coracoid process by the strong coracoclavicular ligament attached to the conoid tubercle and the trapezoid ridge. Through this ligament the scapula, and hence the upper limb, is held suspended from the clavicle. Four major muscles of the shoulder region are attached to the clavicle, medially the pectoralis major and the clavicular head of the sternocleidomastoid and laterally the deltoid and the trapezius. The small subclavius muscle arising from the first rib is attached to the groove on the under surface.

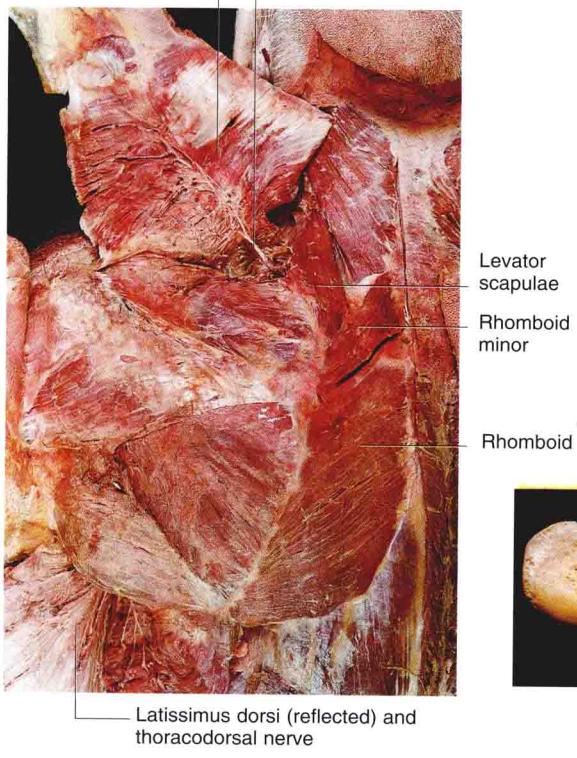

Fig. 2.11 *Structures deep to the trapezius.*

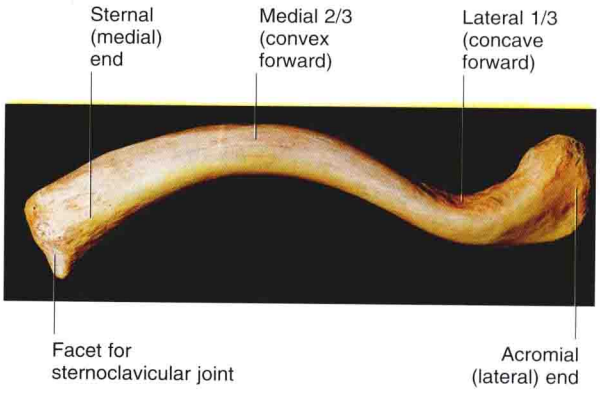

Fig. 2.12 *Right clavicle viewed from above.*

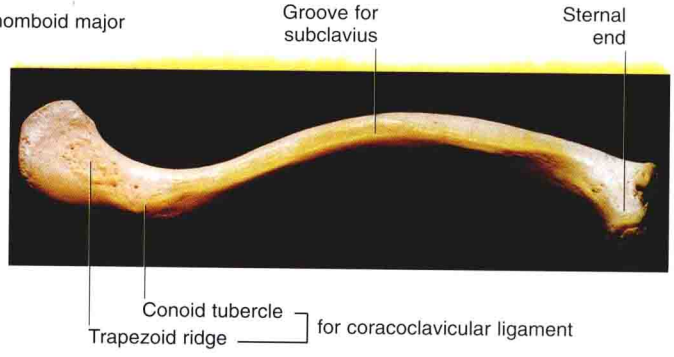

Fig. 2.13 *Right clavicle viewed from below.*