Introduction

GENERAL

Gross anatomy is largely clinically oriented and in a sense can be termed *clinical anatomy*. A true understanding of gross anatomy depends upon the basic science of human structure; it depends upon knowing how apparently complex gross anatomy results from the very simple anatomy of the early embryo; how that apparently complex anatomy is related to function, e.g. biomechanical function; and how complex anatomy is related to evolution. Gross anatomy forms the foundation for procedures in diagnosis and treatment, in radiology, surgery, obstetrics and other medical fields.

Every practitioner who sees a patient makes a *physical examination* of the patient's anatomy. Since the examiner's sensory nervous system works by analogue methods, physical examination consists of comparing the possibly abnormal with a mental image of the normal.

Though gross anatomy is concerned with practical work in the dissecting laboratory, it also includes *imaging anatomy* and *living* or *surface anatomy*. It is a science of the living, not of the dead, and though our knowledge is, perforce, acquired from the cadaver it is in terms of the living that you must think. It also teaches something about human and constitutional variations — no two bodies are ever alike — and about the plasticity of the human form and biological variation of living populations.

The intent of this guide is not to teach clinical practice but to guide you in learning and appreciating the anatomy of the human body, the anatomical language and principles that will be needed in your medical career. The

A GUIDE TO DISSECTION OF THE HUMAN BODY (Second Edition)

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guide helps to make anatomy rational, interesting and directly applicable to the clinical problems encountered in the health professions. If anatomy is simply memorised and not understood, it will soon be forgotten. The practice of good medicine requires a significant knowledge of anatomy.

Dissecting material is both scarce and immensely valuable; therefore you must always scrupulously follow the instructions given by the department, tutor and dissecting manual concerning the care of the dissection and the procedure to be followed, otherwise much time and effort may be wasted.

At any time, only two to four members of a dissecting table group are able to dissect and two will be reading out aloud from the instruction manual. Those who are not dissecting should follow both the text and dissection, making appropriate reference to atlases and textbooks, and see to it that the dissectors are carrying out their work properly. It is essential that each one takes his/her proper turn in dissection. The practice of medicine demands both knowledge and manual dexterity, and it is during the anatomy course that this good habit is acquired.

Before you follow a particular dissection schedule, you should always study the relevant *Overview* in the guide and the relevant section in the textbook in order to become familiar with the major features that you will encounter.

A good dissection should display clearly and cleanly the main features of the region. You should be as neat and accurate as you can, for a slovenly dissector will be a slovenly doctor. There must be no blind dissection, you must always have a preliminary session with the manual to find out what main structures are to be looked for, and where to expect to find them.

During dissection, in addition to reading the dissecting instructions and dissecting, you should all the time be discussing and questioning with your fellow students and with your tutors matters such as the relation of the anatomy that is being dealt with to development, function, and the related practical importance.

The manual gives clear and explicit instruction on how to get the best view of each part. It is quite astonishing how many find themselves in trouble because they have either failed to read the dissecting instructions or failed to understand them. There is no excuse for this. A failure to take in and understand written or verbal instructions can be immensely dangerous in medical practice, and now is the time for the student to train himself/herself to be meticulous. Dissection is something more than merely following instructions, nor is it a purely mechanical task. It is a kind of original visuotactile method of investigation; nobody has ever investigated the particular body you are working on, and it is individual and unique. What you find out for yourself sticks in your mind much better than what is shown to you by somebody else. Dissection provides plenty of mental problems on which you ought to sharpen your wits.

Many make the mistake of believing that gross anatomy can be satisfactorily studied for examination purposes from the textbook alone. These people are readily recognisable at the practical and oral examinations. Gross anatomy is a practical and functional subject, not a theoretical subject, and when you are qualified your patients will not be satisfied with your ability to recite little lists of relationships; the patient will demand someone who knows how and where to find these relationships, and how they function within their own bodies.

In the dissection tutorial you learn to understand the structural relationships and the structure — function interrelationship, and you learn to cultivate the visual memory. It is upon these that you will constantly depend in your clinical work.

You have to consider how the anatomy of soft parts in the region you dissected must change when the part is moved in the living body. How would you attempt to locate the main arteries and nerves from the surface of the living body? What results would follow if the main nerve of a region were cut? If the main artery were tied? Questions such as these help to fix the important features of the region firmly in the mind.

In every dissection it is helpful to build your knowledge of the region as a whole, around a framework provided by certain key structures. These may be muscles, nerves, ligaments or arteries. It is preferable to select those key structures that are of intrinsic functional or professional significance. In addition, thinking should be systematised.

There are three points of view that should be applied to every region of the body: the functional, the clinical and the conceptual.

(a) The *functional aspect*: You should mentally stand back from the details of the dissection and try to take a broad view of the functions of the part upon which you are working. Thus if you are studying the foot, which takes a leading part in walking, running and jumping, it ought to occur to you immediately that one of the most important things about it must be the bony, muscular and ligamentous mechanisms by which the weight of the body is supported and transferred.

(b) The *clinical aspect*: You should adopt a more specifically professional point of view and consider the anatomy of common injuries, infections and other diseases that may occur in the region under consideration. Thus the relationships of the middle ear are of little functional significance, but they are of great practical importance because an infection within the middle ear may endanger hearing or even life.

(c) The *conceptual aspect*: You will find it valuable to remember that the key to a dissection may lie not in an individual structure, but in an idea. Thus one of the most important aids to the understanding of the disposition of the abdominal viscera is the knowledge of the local embryology. Also the understanding of the evolutionary development of humans as primates is important when studying humans structurally and functionally.

In the dissection tutorial facts, principles and their relation to function are discussed. These are the keys to solving problems of an anatomical-clinical nature. The dissection tutorial plays the role that bedside teaching plays in the clinical years.

With regard to the value of dissection *versus* a study of prepared (prosected) parts, there is no doubt as to which is the more rewarding. From experience, it is clear that the knowledge gained from dissecting a cadaver is retained longer and more vividly than that gained from examining prepared specimens. Dissection of the body is an essential basis for the understanding of human structure, organisation and function. It is a visuotactile method of learning and is of value as a discipline and as a training in observation and investigation. It often comes as a salutary shock to discover during dissection that the body does not agree with the textbook.

Dissection is itself a basic research method in application for the student which is carried out nowhere else in the preclinical course — you do your own investigation and confirm or contradict the description in the literature, i.e. actual research in the proper sense, and you use a technique that is analytical in nature. One cannot teach locomotion or the limits of joint movement until the student has dissected the relevant parts. He/she cannot otherwise understand what is happening.

DISSECTION

The Cadaver

When you are assigned to a cadaver, you assume responsibility for its proper care. You will find that the body has already been embalmed with a suitable preservative fluid. Occasionally the arteries have been injected with a red colouring dye.

The whole body has been kept moist by adequate wrappings. Uncover only those parts of the body to be dissected. Inspect every part periodically, and renew and moisten the wrappings as the occasion demands. Do not leave any part exposed to the air needlessly. Give special attention to the face, hands, feet and external genitalia. Once a part is allowed to become dry and hard, it can never be fully restored, and further dissection is impossible. Plastic bags are particularly useful to prevent drying.

Do not be surprised if it turns out that someone has a better-preserved body to dissect than you have (or vice versa). A large number of factors influence the way preservation fluid flows through the body.

Your main concern will necessarily be the cadaver which you are dissecting, but always allow colleagues who are working on other bodies to see what you are doing, and, whenever possible, check your own findings on their dissections.

Anatomy departments in countries where the expectation of life is high, that is to say about seventy years or more, will as a rule receive only senile cadavers. The senile body not only differs from the body of a young person in lacking teeth and having atrophied muscles, but also in the relative proportions of various other structures. Some bodies may be emaciated, others may have a great deal of subcutaneous and other fat. Not surprisingly, many of the bodies which come to the dissecting room reveal the marks of previous disease. You may even find that the cadaver you are dissecting is that of a person who died of cancer. In that case you may have to study the affected parts on some other body.

While the general arrangements of the muscles, vessels and nerves which make up the body follow the same pattern, you will discover during the course of your dissection that anatomical details can vary considerably from one individual to another. So do not be surprised, for example, if in the cadaver you are dissecting, an artery arises from some main trunk differently from the way described.

Another point worth noting is that the appearance of the tissues in the cadaver is very unlike that of the same tissues in the living body. For example, arteries are differentiated more easily from veins in the living body than in the dead; different planes of fascia are separable more readily on the operating-table than you will find possible in the cadaver you are dissecting; and organs and muscles are more fixed in position in the cadaver. Their colour, texture and surface-markings are also different in the living as compared with the body prepared for dissection by the injection of fixatives. Note, too, that the degree of distension of different parts of the alimentary canal are bound to differ in the cadaver you dissect from what would be expected in a healthy person.

You must always remember that former living persons have donated their bodies for medical studies in good faith. Therefore the cadaver must be treated with respect and dignity. Improper behaviour in the dissecting laboratory cannot be tolerated.

Working Conditions

You must protect your clothing by wearing a long laboratory coat. At the same time you must wear disposable latex gloves when handling dead (or living) human material. Adequate light is essential for efficient dissection. And make use of wooden blocks to stabilise parts of the cadaver wherever necessary.

Instruments

The following dissecting instruments should be procured:

1. A *scalpel* designed for detachable knife blades. The scalpel handle should be made of metal. The blade should be about 4 cm long and its cutting edge should be somewhat curved. The blades should be changed frequently. No one can do good work with a blunt scalpel. Therefore a sufficient supply of blades will be needed.

2. Two pairs of *forceps*:
   (a) One pair with blunt and rounded ends whose gripping surfaces should be serrated; and
   (b) a fine pair with sharp-pointed ends for delicate work.

3. Two pairs of *scissors*:
   (a) One large pair about 15 cm in length and with blunt ends; and
   (b) a fine pair with sharp points for delicate dissection.
4. A metal *probe* or seeker with a blunt tip.

Other instruments which you will occasionally need, such as bone forceps, various saws and a long-bladed knife, will be provided as part of the equipment of the dissecting laboratory.

Techniques of Dissection

Before you begin to dissect, it is *essential* that you read these instructions:

Reflection of skin

You are given the exact position of every skin incision you have to make. Cut through the skin, remembering that it is rarely more than 2 mm thick. A decrease in resistance as you cut will tell you when you reach the subcutaneous tissue.

To detach the skin from the subcutaneous tissue, use stout forceps to grip the angle where two incisions meet, and cut with your scalpel between the skin and the underlying subcutaneous tissue or fascia. As you lift the skin away (this is called *reflecting the skin*) pull on it, and continue cutting close to, and parallel with its under-surface, keeping the flap tense as you reflect it away. Most of your reflections will be made so that the flap you lift is left attached by one edge. The skin can then be replaced, between periods of dissection, over the part you are studying.

Reflection of fascia

The subcutaneous tissue between the skin and whatever structure it overlies (usually muscle) consists of fatty connective tissue known as **superficial fascia**, and a deeper layer of non-fatty membranous fascia called the **deep fascia**. The cutaneous nerves and vessels ramify in the superficial fascia, having pierced the deep fascia. Using a scalpel and forceps, the superficial fascia is then reflected from one of the edges of the area laid open by the reflection of skin.

Cleaning muscles, nerves and arteries

By *cleaning* a muscle, a nerve or a vessel, one means completely removing the connective tissue and fat or fascia by which it is ensheathed. This is done with forceps and scalpel, where necessary piecemeal. When you dissect, do not hesitate to remove small veins.

When you are asked to *define* a nerve or artery, or a muscle, you are meant to carry on with the process of cleaning until the whole structure is clearly and cleanly exposed. The same is implied in the word *following* a nerve or artery.

Any tissue that is removed from the body should be put into a receptacle so that it can eventually be buried.

Most of your dissection will be made with a sharp scalpel and forceps.

Blunt dissection means the process of isolating a structure without using the blade of a knife. Blunt dissection often involves pulling a nerve or artery to one side, so it must be carried out with care. One can, for example, separate a vessel which is bound by connective tissue to a nerve by pushing the points of closed forceps or scissors between them, and then gently opening the blades, or one can separate them by pushing gently with the handle of a scalpel.

Do not be rough, but never be afraid to use your fingers to feel the structures which you have to clean and isolate. If, for example, it is necessary to cut through a muscle, be quite certain that you can define its edges, and if possible first insinuate a finger between it and the structures on which it is lying. As a preliminary to inserting your finger, it may be necessary to push gently with the handle of a scalpel.

You may sometimes find that some of the muscles you are dissecting are unexpectedly friable and that they tear. All you can do to overcome this shortcoming is to examine the muscle or part concerned on somebody else's dissection.

Never regard your examination of a particular part or region as completed until you really have exposed the structures described in the text.

Bones

You will find it useful to have at hand the bones of the particular part on which you are working. The bones of the limbs help you to understand the action of the muscles that rise from and become inserted into them, while those of the pelvis and skull help you to understand the position of different soft structures, and the points of emergence of vessels and nerves.

Care of the dissection

After each period of study, it is essential that any individual part that is being dissected should be wrapped up in order to prevent loss of moisture and hardening of the specimen. Also, from time to time, moisten the parts that you are dissecting.

Structures that cannot be adequately dissected

You will have no difficulty in dissecting the muscles, the visceral organs, and the main vessels and nerves of the body. Some anatomical structures that are important functionally cannot, however, be studied adequately by the straightforward methods of dissection which you will be using. The main one is the **lymphathic system**. This consists of a network of minute channels and associated nodes that are found in most parts of the body. All you will see, and then only in some of your dissections, are well-defined solid lumps of matted tissue of varying shape, usually embedded in fascia. These are lymph nodes. When you dissect the thorax, you will also come across the main collecting duct of the whole lymphatic tree. But this is about all you will see of the system.

Your dissection will also fail to reveal some of the more detailed parts of the **nervous system** of the body. The brain and spinal cord, which comprise the **central nervous system**, are dealt with in neuroscience courses. Another major part of the nervous system, the **autonomic nervous system**, cannot be adequately dissecte d.

STRUCTURES ENCOUNTERED DURING DISSECTION

Having studied the techniques of dissection, it will be useful to you to note some of the structures that you will encounter during dissection. In dissecting the human body you will come across various structures such as skin, superficial fascia, deep fascia, muscles, tendons, blood vessels, lymph vessels and nodes, nerves, bones, joints and organs.

Skin

The skin forms the outer covering of the body and is composed of a superficial layer, the **epidermis**, and a deep layer, the **dermis**. The skin is slightly thicker over the extensor than over the flexor surface. However, it is extremely thick over the palms and soles, which are, in fact flexor surfaces.

Superficial fascia

The superficial fascia is deep within the skin. Within this layer lie the superficial nerves, blood vessels and lymphatics. The superficial fascia consists of loose areolar tissue and is filled with fat. In some situations like the anterior abdominal wall and gluteal region (buttock), there is a large accumulation of fat. Since fat is an insulator, the superficial fascia acts as retainer of body heat.

Deep fascia

Deep to the superficial fascia lies the deep fascia. This is a tough connective tissue tunic which covers the underlying muscles. Sometimes the muscles are attached to this fascia. The deep fascia also sends in septa between muscles, providing a covering for them as well as sheaths for blood vessels and nerves. Occasionally the deep fascia sends extensions between different functional groups of muscles. These extensions that gain attachments to bones are called **intermuscular septa**. The deep fascia is also extremely thickened in the region of the wrist and ankle where they form well defined transverse bands extending across bony prominences. These bands are called the **retinacula**. Along with the underlying bone, they form osteofascial tunnels providing a passage for tendons, which are thus prevented from springing out during contraction of the muscles.

Muscle

When the deep fascia has been cleared away you will reach the muscle. This is commonly known as voluntary, skeletal or striated muscle. The muscles contribute to about 50 per cent of the body weight and are composed of muscle fibres. The fibres in individual muscles are arranged in different ways so that the muscles are often described as **strap-like** when the individual fibres are long and arranged in parallel; **fusiform** when a fleshy belly tapers towards both ends, often ending in a tendon; and **pennate** when there is a resemblance to a feather. Pennate muscles are described as *unipennate*, *bipennate* or *multipennate*. These various types will be encountered during dissection.

Muscles are usually connected at their ends to skeletal elements. These attachments of a muscle are usually described as its **origin** and **insertion**. The origin is generally the proximal attachment and is usually the fixed point from which the muscle acts so that the skeletal element into which it is inserted distally is able to move. Usually the origins of muscles are fleshy and their insertions tendinous. The tendons are formed by condensations of fibrous tissue and possess great tensile strength. Sometimes a tendon may be flat and thin, and when it forms a broad sheet, it is called an *aponeurosis*.

Contraction of muscles in the living can be seen and felt. This can be *tested by making a muscle contract against resistance*. Muscles have a rich blood and nerve supply. The point of entry of these into a muscle is called the **neurovascular hilus**. The innervation of muscles is both motor and sensory. The stimulation of the motor nerve causes a contraction of the muscle. The sensory nerve carries information about the nature of the force of contraction, degree of stretch, etc. of the muscle it innervates.

Peripheral Nerves

Knowledge of the anatomy of a nerve must include its **origin**, **course**, **relations**, **distribution** and **surface anatomy**.

Origin

Many peripheral nerves arise as branches of a larger nerve trunk, but others arise directly from a plexus. A knowledge of the segments of the spinal cord from which the motor fibres in the nerve arise and to which its sensory fibres are conveyed is important. This *root value* of the nerve is of value in diagnosing the site of damage to the peripheral or central nervous system.

Course and relations

A knowledge of the pathway followed by the nerve from its origin to its termination is essential to enable you to find it in case of an injury, to avoid it when making injections, or to deduce possible damage to it from a wound or fracture. The relations of a nerve must be given in a logical manner. Nerves are usually suitable key structures around which to build your knowledge of a region.

Distribution

This involves a knowledge of the muscles and skin supplied by the nerve. The autonomic fibres running in the nerve also supply blood vessels, sweat glands and the muscles of the hairs. Nor are the sensory fibres restricted to the skin; they also supply sensory fibres to the deeper tissues, including the muscles.

A degree of sensory overlap exists with neighbouring nerve distributions. This is sometimes so great that very little noticeable change is produced by cutting a single nerve.

An account has to be taken of the effects produced by cutting a nerve. There is first a motor paralysis, which will result in certain specific movements becoming weakened or lost altogether. The paralysed muscles are flaccid and cannot resist the pull of their healthy antagonists; the joint upon which they act may thus be pulled into a position other than its normal position of rest, producing a postural deformity. The wasting of the muscles concerned will also produce a configurational deformity, obvious when the affected region is compared with its healthy counterpart. The tendon reflexes which depend upon the integrity of the nerve will be lost, and the absence of the motor sympathetic fibres leads to vascular disturbances and an absence of sweating in the affected territory.

On the sensory side, the autonomous zone of the nerve will be completely anaesthetic, and the overlap zones manifest themselves as an annulus of partial sensibility surrounding the autonomous zone. The loss of deep sensibility may be of great importance.

Surface anatomy

It is important to be able to map out the course of a nerve, and to outline its cutaneous distribution and elicit the deep and superficial reflexes which it serves. One must know the rough distribution in the skin of each spinal segment; these segmental distributions are known as *dermatomes* and are an aid to diagnosing the level of spinal injury.

The common and simple tests which can be used to tests the integrity of the nerve have to be learned. After an accident, it is often alleged that subsequent paralysis is due to the faulty treatment rather than to the injury itself.

Blood vessels

Blood vessels are of three major types — **arteries**, **veins** and **capillaries**. Arteries are thick-walled vessels which carry blood away from the heart to the tissues. Veins return the blood from the tissue to the heart. Intervening between the arterial and venous sides of the circulation are minutes vessels called capillaries. In the cadaver, the arteries appear paler and are palpably thicker, while the veins are bluish or dark in colour with thin walls. Veins superficial to the deep fascia often run alone while those deep to the deep fascia accompany arteries and are called **venae comitantes**.

In the living, arteries are pulsatile and their pulsations are visible when they lie close to the surface. Such arteries are usually *palpated against an underlying bone*, e.g., pulsations of the radial artery are felt by compressing it against the radius (a *pressure point*).

Lymphatics

The cells comprising the tissue of the body are bathed in fluid called **tissue fluid**, which is derived from **blood plasma**. Tissue fluid provides a medium for transport of nutrients to cells as well as for removal of their waste products. Part of the tissue fluid re-enters the blood circulation but the remainder (**lymph**) is drained by a system of extremely thin walled channels called **lymph capillaries**. They unite to form **lymph channels** which accompany blood vessels. The lymphatic channels lying superficial to the deep fascia generally accompany the superficial veins, while the deeper vessels accompany arteries. *Lymph vessels are not normally seen during dissection*. During their course they are interrupted by **lymph nodes**, containing discrete aggregations of lymphocytes which are a type of white blood cells. Tissue fluid in the lymph channels after filtering through lymph nodes is carried by lymphatic channels of increasing calibre which ultimately enter the large veins in the neck.

Bones

Bones form the major part of the human skeleton and provide the supporting framework for the body. Although they appear to be rigid, they are in fact extremely plastic. During growth and repair this plasticity is easily seen. Even at normal times there is a continuous turnover of the constituents of bone. Bone is in fact an organ and not merely a tissue since it has in its matrix, nerves, blood vessels and lymphatics like any other organ of the body.

Bones are generally classified according to their shapes. **Long** and **short** bones are peculiar to the limbs; **flat** bones are generally found in the girdles of the limbs, ribs and vault of the skull; **irregular** bones are peculiar to the vertebral column and base of the skull. **Sesamoid** bones are those that are developed in some tendons; the knee cap or patella is a good example of a sesamoid bone.

Each long bone has a shaft or **diaphysis**, and two ends or **epiphyses**. The diaphysis and the epiphysis are developed from separate ossification centres. The ossification of the diaphysis invariably begins before birth, whereas the centres for the epiphyses *usually* form after birth. The epiphyses unite with the diaphysis at different times. The epiphysis which begins ossifying first *usually unites with the diaphysis later*. Since this end of the diaphysis continues to grow in length after the opposite end has ceased its growth, it is called the *growing end* of the bone.

The shaft of a typical long bone usually presents a prominent foramen somewhere about its middle. This is called the **nutrient foramen** as it transmits fairly large blood vessels called the nutrient vessels which supply the shaft. The canal for the nutrient artery is invariably directed *away* from the growing end of the bone.

Most of the bony surfaces provide attachments for muscles. Fleshy attachments of muscles usually leave no marks on the bone. Tendinous attachments if flattened or aponeurotic leave rough markings. Thick tendons are usually attached to smooth areas which are either depressed or raised. Admixture of tendon and muscle fibres invariably leave very rough markings on bones.

Joints

Junctional regions between bones develop into joints. Joints can be classified as **fibrous**, **cartilaginous** or **synovial**, depending on the type of tissue present between the articular ends of the bones. Generally, fibrous joints permit very little movement, while synovial joints provide the greatest degree of freedom of movement. The cartilaginous joints form an intermediate group. However, there are exceptions to these general statements.

Terminology

For the purpose of description the body is considered to be in the **anatomical position**. In this position the subject is assumed to be standing, the feet together, the arms to the side, and with the head and eyes and the palms of the hands facing forwards. To ensure consistency of description, it is important to keep the anatomical position constantly in mind.

The position of structures relative to each other in the body is defined in relation to the following planes:

The **Median Plane**: This is the back-to-front vertical plane which cuts through the body in the midline. This plane bisects the body into symmetrical right and left halves.

A **Sagittal Plane**: This is any vertical plane parallel to the median plane.

A **Frontal Plane** or **Coronal Plane**: This is any vertical plane at right angles to the median plane.

A **Transverse Plane**: This is any **horizontal plane** through the body at right angles to both the sagittal and frontal planes.

Any structure lying closer than another to the midline of the body is said to be **medial** to it, and any further from the midline **lateral**. Every structure automatically has a medial and a lateral aspect. A point or plane in space closer than another to the head-end of the body is said to be **superior** to it, and, conversely, the point or plane further away is **inferior**. The terms **cranial** and **caudal** replace the terms ‘superior’ and ‘inferior’ in descriptions of the embryo, and they are also sometimes replaced by the terms **rostral** and **caudal** in descriptions of the brain. The terms **proximal** and **distal** are used in describing parts of the limbs which are closer to or further from the attachment of the limbs to the trunk.

The front surface of the body, or of any structure in the body, is called its **anterior** surface, and conversely the back of any surface is denoted by the term **posterior**. The terms **ventral** and **dorsal** are synonymous with 'anterior' and 'posterior'.

The term **supine** refers to the body lying on its back, i.e. dorsal surface. The term **prone** refers to the body lying on its face, i.e. ventral surface. The hand is said to be **supinated** when the **palmar** surface faces forwards as in the anatomical position. When the hand is rotated so that the palmar surface faces posteriorly, it is said to be **pronated**. The sole of the foot is known as the **plantar** surface. When the plantar surface is turned medially, the foot is **inverted**; when laterally, **everted**.

Structures that lie near to the surface of the body are described as **superficial** to others that lie on a **deep** plane. The term **external** describes structures outside an area, space, or structure, and the term **internal** describes those within.

When referring to structures of the wrist and hand, the terms **radial** and **ulnar** are often used instead of 'lateral' and 'medial'. This avoids any confusion due to the fact that when the hand is pronated, its lateral border (i.e. the side of the thumb) lies 'medial' to the side of the little finger, which in the supinated position is medial. And in the leg and foot, the terms **tibial** and **fibular** are often used instead of 'medial' and 'lateral'.

The term **flexor surface** generally refers to the ventral aspect of the body while the dorsal aspect is referred to as the **extensor surface**; but the lower limb is an exception in that the extensor surface has become ventral, owing to the fact that it has undergone rotation during fetal life. The terms **pre-axial** and **post-axial** borders are used in reference to the margins of the limbs. The pre-axial border is in relation to the thumb (pollux) and first toe (hallux) while the post-axial border is in relation to the little finger and fifth toe.