A METHOD OF ANATOMY

Descriptive and Deductive

BY

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PREFACE TO THE FIFTH EDITION

In this edition the text has been revised throughout; various parts have been clarified, rearranged and shortened, and certain deletions have been made. The volume of the text is not increased.

The new material includes references to the retinacular or link ligaments of the interphalangeal joints, to radiograms of the wrist as a guide to skeletal age, to the nerve supply to various joints, to the ischium-pubis index as an aid to determining the sex of a given pelvis, to the cardinal ligaments, to the pancreatic ducts, to the structure of the anal canal, to the movements of the foot, to the moderator band, to the numbering of the broncho-pulmonary segments, to the mechanism of swallowing and the movements of the epiglottis, and to the lateral pharyngeal space.

Seventy-eight new illustrations have been added and sixty-nine old illustrations have been either redrawn, relabelled, or otherwise improved.

Much of the text has been read by my colleagues, Dr. J. C. Watt, Dr. H. A. Cates, and Dr. J. V. Basmajian, who have made many useful suggestions, most of which have been adopted. I am grateful to them and also to certain students, particularly D. A. Barr, F. B. Fallis, A. L. Halpern and P. Rosen, who have brought to my attention various typographical and other minor errors.

The illustrations are again the work of Miss Nancy Joy, to whom I express my appreciation of her artistic skill and of her ever ready and willing co-operation. To my secretary, Miss Mary McConnell, my thanks are due for the care she has taken with the manuscript, in checking references, and, in collaboration with Miss Joy, in preparing the index. Messrs. Williams & Wilkins have, as always, given me every assistance and shown me every courtesy.

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PREFACE TO THE FIRST EDITION

The study of human anatomy may be attempted in either of two ways. One consists in collecting facts and memorizing them. This demands a memory which is wax to receive impressions and marble to retain them. Even so endowed a student will not master the infinite complexities of the subject. The other way consists in correlating facts, that is, studying them in their mutual relationships. This leads inevitably to the apprehending of the underlying principles involved, and the "raison d'être" of such relationships. The student will thus learn to reason anatomically and will find the acquisition of new and related facts an easier task. It is the purpose of this book to lead the student to approach the subject from this viewpoint, and it involves certain departures from tradition.

The human body is here considered by regions. In most regions some feature predominates. It may be a muscle, a vessel, a nerve, a bony landmark or other palpable structure or it may be a viscus. The regions are for the most part built up around the dominant or central feature.

The markings, lines and ridges, depressions and excrescences, on a bone tell a story as do the scars and irregularities on the earth's surface. Because they are in the main to be interpreted by reference to the soft parts that surround and find attachment to them, the bones are not described together under the heading "osteology" as though they were things apart. The shafts of the bones are considered with the surrounding soft parts; the ends with the joints into which they enter. The bones of the foot are primarily considered as a single mechanism—so are those of the hand and of the skull. The correct orientation of certain bones is given in cases where without this information the actions of certain muscles (e.g. Gluteus Medius, Teres Major) could not be understood.

It is not the mere presence of a ligament or its name that is of interest, but the functions it serves. These depend commonly on the direction of the fibers of the ligament; occasionally on their precise attachments. Many fibrous bands bearing individual names are really members of a community. A challenge thrown at one must be taken up by all. They act in unison and therefore they are considered together as a unit.

In the consideration of viscera the subject is elucidated by reference to comparative anatomy and to embryology. These are cognate sciences which throw light about the existing structure of man. The positions of the viscera are referred to selected vertebral levels, the vertebral column being an ever present and ever ready measuring rod.

Surface Anatomy is largely dispensed with as an independent subject. Its study is undertaken as a review of Gross Anatomy, distances being measured, wherever feasible, in terms of structures. For example, instead of stating that the posterior tibial artery lies half an inch from the tibial malleolus—which would be a new fact to memorize—it is spoken of as being the breadth of two tendons from the malleolus, the tendons being the tibialis posterior and flexor digitorum muscles—a fact already

learned by dissection. Again, by regarding the left renal vein as the vein of the three left paired abdominal glands (adrenal, renal and sex) its length is easily calculated as being the length of the right renal vein, plus the width of the vanished left inferior vena cava, plus the breadth of the aorta, say $1\frac{1}{2} + 1 + 1 = 3\frac{1}{2}$ inches. And, again, the memory is not strained to recollect that the adrenal gland lies at the level of the twelfth thoracic vertebra when the fact can profitably and readily be deduced from a series of related circumstances.

Illustrations to be of value must be simple, accurate, and convey a definite idea. It is for these reasons that they consist entirely of line drawings. Their simplicity encourages the student to reproduce them; and though diagrammatic in nature they are based on measurements and observations of a great deal of carefully dissected material. Their accuracy therefore, in those details they are intended to illuminate, has been the object of very considerable work. Many of the original dissections are to be found in the anatomy museum of the University of Toronto. In many instances the names of the structures in the illustrations have with care been grouped to form tables which are complete in themselves, as in figures 160 and 666. It is hoped that this tabular arrangement will add to the usefulness of the illustrations.

With few exceptions The Birmingham Revision (B. R.) of the B. N. A. terminology is employed in this book. Such synonymous and alternative terms as differ considerably from the B. R. terms, and such as are likely to die hard, are recorded within brackets in the text immediately after the B. R. terms.

The book is meant to be a working instrument designed to make Anatomy rational, interesting and of direct application to the problems of medicine and surgery. The bare, dry and unrelated facts of Anatomy tend rapidly to disappear into forgetfulness. That is largely because its guiding principles are not grasped so as to capture the imagination. Once they are grasped it will be found that details and relationships will remain within certain and easy recall.

I am indebted to many of my friends and colleagues for the help they have given me in this plan and I take this opportunity of expressing to them my very grateful thanks. I mention in particular: Dr. Brock Brown, who has so willingly and ably assisted with most of the illustrations and therein has displayed his artistic skill; Mr. J. G. Watt, who has so successfully executed the illustrations on the thorax; Mr. E. M. Davidson, whose experienced pencil laid the foundation of many of the figures; Dr. J. C. Watt and Dr. H. A. Cates, who have read many sections of the manuscript and have offered valuable criticisms; Dr. C. G. Smith and Mr. H. C. Elliott, who have read the entire proofs with great care; Dr. R. K. George, who has prepared the index; Dr. B. L. Guyatt, who has made many dissections and has helped to verify the innumerable points on which the figures are based; and Mr. H. E. LeMasurier, who has rendered many diverse and valuable services.

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INTRODUCTION

There are few words with a longer history than the word Anatomy. If we write anatome we use the name that Aristotle gave to the Science of Anatomy two thousand three hundred years ago. He made the first approach to accurate knowledge of the subject, although it was derived from dissections of the lower animals only. The word means cutting up—the method by which the study of the structure of living things is made possible.

The boundaries of the subject have widened. Through the use of the microscope and with the aid of stains the field of Anatomy has come to include microscopical anatomy or *histology* and the study of development before birth or *embryology*. The study of the anatomy of other animals, *comparative anatomy*, has been pursued exhaustively partly in an endeavor to explain the changes in form, *morphology*, of different animals including man. *Physical Anthropology*, or the branch of the study of mankind that deals chiefly with the external features and the measurements of different races and groups of people, and with the study of prehistoric remains commands interest of the anatomist. The hereditary, nutritional, chemical, and other factors controlling and modifying the growth of the embryo, of the child, and of animals are within his legitimate field; so also is the growth of tissues in test-tubes, *tissue culture*. Feeding and other experiments on animals play leading parts in many investigations.

Individuals differ in outward form and features; for example, how varied are finger prints and the arrangement of the veins visible through the skin: individuals differ also in their internal make-up. Textbooks, for the most part, describe average conditions where weights and measures are concerned, and the commonest conditions where arrangements and patterns are concerned. Owing to the variety of these the commonest may have less than a 50 per cent incidence—it may, therefore, not be truly representative. As data on variations accumulate the subject of *Statistical Anatomy* emerges. Some variations are so rare as to be abnormalities or *anomalies*. Among the different races of mankind there are percentage differences in the form and arrangement of structures, just as there are among the different races of the apes and other animals. But relatively little is known as yet of *Racial Anatomy*, which is a branch of physical anthropology.

The human body is generally dissected by regions, *Regional Anatomy*, and described by systems, *Systematic Anatomy*. The regions of the body comprise: The head and neck, the trunk, and the limbs. These can be divided and subdivided indefinitely. The trunk is divisible into thorax, abdomen and pelvis. The systems of the body comprise the skeleton, the study of which is osteology; the joints (arthrology); the muscles (myology); the nervous system (neurology), which includes the brain, spinal cord, organs of special sense, the nerves, and the autonomic nervous system; the cardio-vascular system which includes the heart, blood vessels, and lymph vessels. The viscera of the body (exclusive of the heart and parts of the nervous system),

comprise four tubular systems,—the digestive, respiratory, urinary, and genital—and the ductless or endocrine glands. All these are wrapped up in the skin and subcutaneous tissue.

Anatomy considered with special reference to its medical and surgical bearing is called *Applied Anatomy*. Anatomy can be studied profitably, though to a limited extent, by means of cross-sections, *Cross-Section Anatomy*. In the living subject a great deal can be learned by inspection and palpation of surface parts. This and the relating of deeper parts to the skin surface, *Surface Anatomy*, are a necessary part of a medical education. And, the X-ray reveals much that cannot be investigated by other means.

DESCRIPTIVE TERMS

In describing the relationship of one structure to another it is obviously highly necessary—if we would have our description understood—that we employ certain accepted terms. Only by so doing can we avoid ambiguity and misunderstanding.

For descriptive purposes the human body is regarded as standing erect, the eyes looking forwards to the horizon, the arms by the sides, and the palms of the hands and the toes directed forwards: this is the *Anatomical Position.* The cadaver may be placed on the table lying on its back, on its side, or on its face, but for descriptive purposes it is assumed to be standing erect in the Anatomical Position. The palms of the hands can be made to face any direction: resting on the table they face downwards (inferiorly); turn them round and they face upwards (superiorly); as they hang by the sides they may face each other (medially), away from each other (laterally), backwards (posteriorly), or forwards (anteriorly). One of these positions, namely, the forward facing one, is by convention selected as the anatomical one—despite the fact that it is not the most comfortable. That is to say, the palm of the hand is understood to be the anterior surface of the hand and it is not permissible to refer to it variously as the posterior, inferior, superior, medial, or lateral surface according to passing fancy or because it happens temporarily to face one of these directions. From these remarks it should be evident that to misapply terms of relationship is to court confusion.

The body is divided into two halves, a right and a left, by the *median* or *midsagittal plane.* The anterior and posterior borders of this plane reach the skin surface at the front and back of the body at the *median* or *mid line.*

Three pairs of relative terms suffice to express the relationship of any given structure to another (*fig. 2*). They are:

Anterior or in front = nearer the front surface of the body.
Posterior or behind = nearer the back surface of the body.
Superior or above = nearer the crown of the head.
Inferior or below = nearer the soles of the feet.
Medial = nearer the median plane of the body.
Lateral = farther from the median plane of the body.

The foregoing terms are applicable to all regions and all parts of the body—always provided that the body is, or is assumed to be, in the anatomical position.

When it is desired to compare the relationship of some structure in man with the same structure in say a dog, it is necessary to use a different set of terms, terms related not to space but to parts of the body, such as the head, tail, belly, and back. For example: in man standing erect the heart lies above the diaphragm; in the dog standing on all fours it lies in front of the diaphragm; but in both instances its position relative to other parts of the body is the same; so, *speaking comparatively,* one would say that both in man and in the dog the heart is on the head, cranial, or cephalic side of the diaphragm (*fig. 3*).

Hence, the terms *ventral* and *dorsal*, *cranial* and *caudal*, as well as *medial* and *lateral* are applicable to the trunk or torso (thorax, abdomen, and pelvis) irrespective of the position assumed by the body. Moreover, it is desirable to employ these terms in embryology and comparative embryology; and it is quite correct to employ them in human anatomy—for no misunderstanding can arise from their use as synonyms for anterior, posterior, superior, and inferior.

In the limbs, terms are coupled with reference to (a) the proximity to the trunk—*proximal* = nearer the trunk, and is synonymous with superior; *distal* = farther from the trunk, and is synonymous with inferior; (b) the morphological borders—*preaxial* = the lateral or radial border (i.e., thumb side) of the upper limb, and the

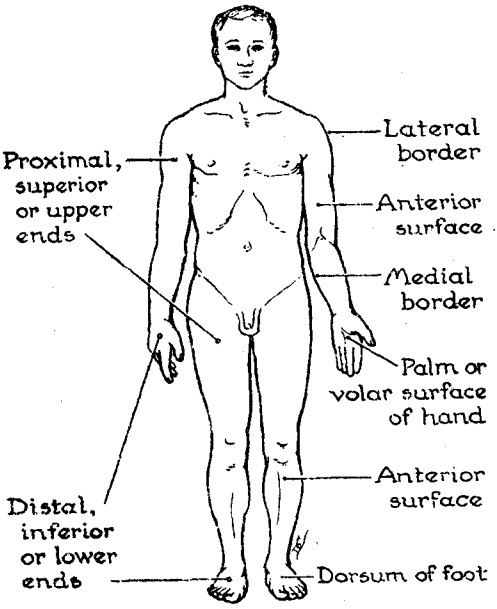

FIG. 1. The subject is in the Anatomical Position—except for the right forearm, which is pronated.

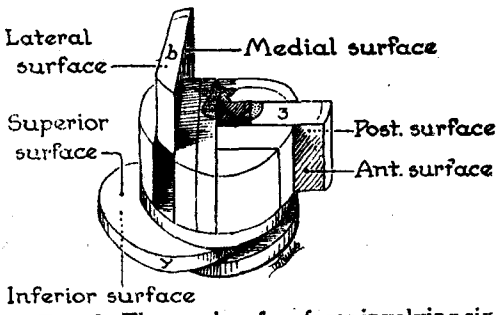

FIG. 2. Three pairs of surfaces involving six essential descriptive terms. They are related to the three fundamental planes in the body.

medial or tibial border (i.e., big toe side) of the lower limb; *postaxial* = the medial or ulnar border of the upper limb, and the lateral or fibular border of the lower limb; and (c) the functional surfaces—*flexor* and *extensor*, the flexor surface being anterior in the upper limb and posterior in the lower limb.

The anterior surface of the hand is generally called the *palmar* (or volar) surface, and the inferior surface of the foot the *plantar* surface. The opposite surfaces are called the *dorsum* of the hand and foot.

OTHER TERMS: *Inside* or *interior*, and *outside* or *exterior* are reserved (a) for bony cavities, such as the pelvic, thoracic, cranial, and orbital, and (b) for hollow organs, such as the heart, mouth, bladder, and intestine (*fig. 4*).

An *invagination* and an *evagination* (L. vagina, = a sheath or scabbard) are inward and outward bulgings of the wall of a cavity.

Superficial and *deep* denote nearness to and remoteness from the skin surface.

On, *over*, and *under* are terms to beware of. They should be used in a general sense and without specific regard to the anatomical position. Just as a fly may be *on* the ceiling, wall, or floor, so a tubercle may be *on* any part of a bone, and a sulcus may be *on* any surface of the brain. A vessel may pass *under* or *over* an arch or bridge; and a

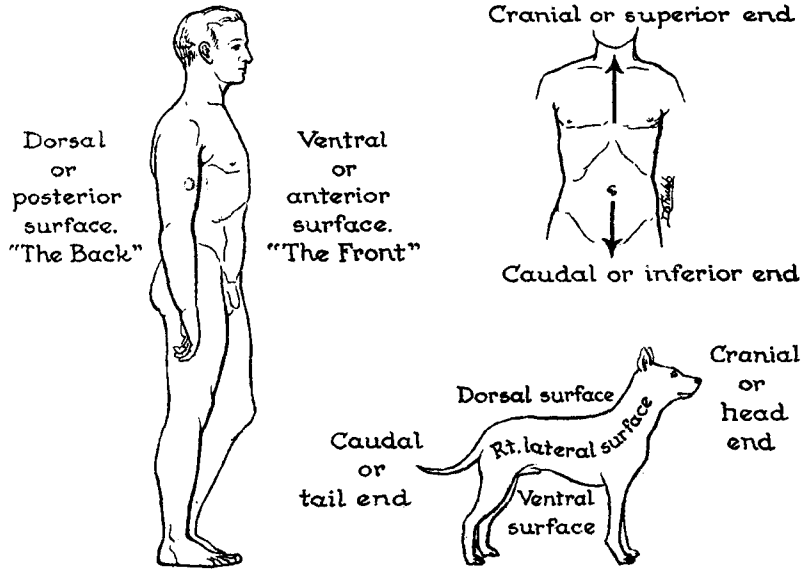

FIG. 3. Three pairs of terms necessary to comparative anatomy and of more general application than those given in figure 2.

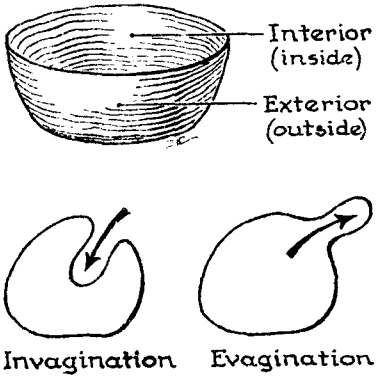

FIG. 4. Four descriptive terms.

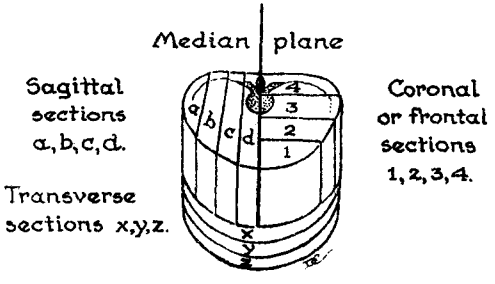

FIG. 5. The three fundamental planes in the body.

nerve may lie *under* the deep fascia. Used in these senses the terms are explicit. Carefully avoid using them loosely in place of "superior to" and "inferior to," for such misuse is the cause of much misunderstanding.

In relation to (related to) is not an informative term unless it is specified what the relationship is, e.g., close, intimate, remote, occasional.

PLANES: (1) *A sagittal plane* is any vertical antero-posterior plane, including the

median plane. It is parallel to the sagittal suture of the skull. (2) *A coronal* or *frontal plane* is any vertical side-to-side plane at right angles to the sagittal plane. It is approximately parallel to the coronal suture of the skull. (3) *A transverse plane* is any plane at right angles to 1 and 2, i.e., at right angles to the long axis of the body or limb. In the case of an organ or other structure a transverse plane or a *cross section* is a plane or section at right angles to the long axis of that organ or structure. (4) *An oblique plane* may lie at any angle.

MUSCLE ATTACHMENTS. Muscles are attached at both ends. The proximal attachment of a limb muscle is its *origin*; the distal end is its *insertion*.

Note. It would be logical to regard the fixed end as the origin and the moving end as the insertion, if they were constant; but they are not constant, they are reversible. Thus, when pulling on an oar, the Latissimus Dorsi draws the humerus backwards, towards the body; but when climbing a tree, it draws the body forwards, towards the humerus. Similar examples are numerous in the lower limb due to the

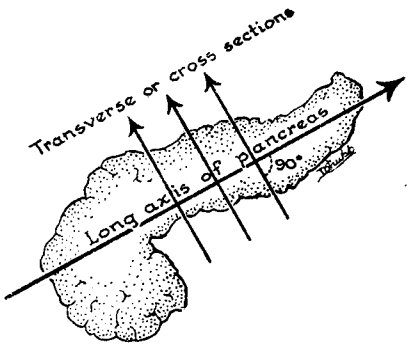

FIG. 6. A cross section of an organ or part is a section made at right angles to its long axis.

fact that in walking the right foot is stationary on the ground while the left foot is advancing; and this condition is reversed when the next step is taken. Hence, the origins and insertions of the lower limb muscles are alternately fixed and moving.

VESSELS. Arteries are likened to trees with branches; veins are likened to rivers with tributaries. Before Harvey discovered that blood moved "in a circle" both arteries and veins were spoken of as having branches, and there is no objection to-day to referring to the branch of a vein.

MOVEMENTS AT JOINTS. *To flex* is to bend or to make an angle.

To extend is to stretch out or to straighten. Movements of flexion and extension take place at the elbow joint.

To abduct is to draw away laterally from the median plane of the body.

To adduct is the opposite movement in the same plane (L. ab = from; ad = to; duco = I lead). Movements of abduction and adduction, as well as of flexion and extension, take place at the wrist joint.

The middle finger is regarded as lying in the *axial line of the hand*; and the 2nd toe as lying in the *axial line of the foot*. Abduction and adduction of the fingers and toes are movements from and towards these axial lines. The thumb movements are named differently, see page 148.

To circumduct (L. circum = around) is to perform the movements of flexion, abduction, extension, adduction, and flexion in sequence, thereby describing a cone, as can be done at the shoulder, hip, wrist, and metacarpo-phalangeal joints.

To rotate is to turn or revolve on a long axis, as—the arm at the shoulder joint, the femur at the hip joint, the radius on the ulna, and certain vertebrae on each other.

To pronate was originally to bend or flex the body forwards as in obeisance in prayer, that is face downwards or prone. Applied to the forearm it means to turn it so that the palm of the hand faces downwards on a table, which is the equivalent of facing backwards when it hangs by the side. Pronation is, therefore, a movement of medial rotation.

To supinate is to rotate the forearm laterally so that the dorsum of the hand rests on the table or faces backwards when the limb hangs by the side. Supine = lying on the back.

To protract (L. pro = forwards; traho = I pull) is to move forwards.

To retract is to move backwards. Protraction and retraction are terms applied to the movements of the jaw and shoulder girdle.

For every reason the student should from the first use, use only, and use correctly the accepted terms.

ADVICE TO THE DISSECTOR

Though not a dissector's guide, this manual is for use in the laboratory and museum where dissected material is available: and some advice to the dissector is ventured.

Wear a long white coat as a protection to your clothes, and keep your nails short.

MATERIAL. You, the dissector, will appreciate the privilege accorded you of being able to study human material and your natural instincts will lead you to treat it with the respect due to the dead.

Before you assume responsibility for the cadaver it has been embalmed with *antiseptics* (probably including carbolic acid), *hardening fluids* (probably spirit and formalin), *hygroscopic agents* (probably glycerine and potassium acetate), and *salts;* the arteries have been filled with a colored mass (probably starch, red lead, and glue) to render them conspicuous. Take intelligent steps to keep the parts allotted for dissection firm and moist but not sodden, because a part that has been allowed to dry cannot be restored to its former state. Keep the part surrounded with cotton waste, which is soaked in lotion (e.g., saline solution containing an antiseptic, glycerine, and spirit, with formalin as required) and held in place with a bandage; and envelope it in a waterproof sleeve open at one end like a pillow-case. Never expose even for half-an-hour more of a part than necessary. For example, keep the forearm and hand properly covered while investigating the axilla and arm, and keep moistened cotton waste in the axilla and about the arm while investigating the forearm and hand. Unwrap and examine the covered parts periodically (every week or two at the start) and moisten if necessary; pour fluid into the nose and mouth; and pay special attention to the hands, feet, nose, scalp, and external genital organs which dry readily. Ignoring holes in the waterproof sack and letting the ends of cloths project beyond the mouth of the sack, so that they act as wicks promoting loss of fluid, is not acting intelligently. Lotion injected hypodermically followed by massage will partially refresh neglected parts. Water is apt to cause mould to grow. Swabbing with carbolic acid and glycerine destroys mould. It is convenient to have at hand a round, 10–12 ounce bottle of lotion fitted with a sprinkler such as laundry maids use.

INSTRUMENTS. Required are a pair of forceps, a seeker, scissors, two knives, and a stone. The *forceps* should be 4½–5 inches long with handles transversely ridged to prevent slipping, ends blunt and rounded, and gripping surfaces ridged and furrowed. A *seeker*, that is a rigid 5 inch steel probe with bent tip, is required for seeking for nerves and vessels in areolar tissue and fat. The finger makes a useful explorer. The *scissors* should be about 5 inches long, preferably with the tip of one blade sharp and the other blunt. *Knives:* Two knives are required. One is for rough work such as cutting skin and tendons. The handle of this knife, if squared at the end so as to have two edges like the end of a microscope slide, can be used for scraping periosteum and fascia from bone and thereby displaying the attachments of tendons and ligaments. The other knife is for the more delicate work, for cleaning vessels, nerves and the like. The handle of this knife, if smooth and rounded at the end, can

be used as a separator or blunt dissector. If the handle of the knife slips in your grasp, winding around it a few turns of thread or adhesive tape will afford a friction surface, or a length of rubber tubing may be slipped over the handle. The blade should be 1½ inches long and narrow throughout. Some convexity is necessary because, in dissecting, the blade usually precedes the handle and in this position a straight edge tends to hook up the tissues. The convexity should however be slight, and the point should be well tapered rather than well rounded. In dissecting, the terminal 3 to 5 mm. of the blade are used almost exclusively. A full bellied edge therefore is excess metal to be worn away on the grindstone.

A good blade is made thin (except at the back) by being hollow-ground. This enables it to be sharpened readily. Its rigidity depends upon the thickness of its back. Detachable blades are very thin throughout. A thick blade requires frequent grinding. While in use the end 3 to 5 mm. should retain the sharpness of a razor. For this a few strokes on the sharpening stone are required many times a day. Make incisions with the belly of the blade; dissect with the end 5 mm.; sever with the heel any tough tissues that would blunt the cutting edge. *The sharpening stone* should be flat, hard, and of fine texture (carborundum is satisfactory). Soap lather may be used for lubricating. Everyone who possesses a knife should also possess a sharpening stone.

SHARPENING THE KNIFE. Viewed under the microscope the margin of a well sharpened blade is ruled with parallel lines to the depth of 1 mm. and the very edge is finely notched, somewhat like a saw. Such an edge cuts with less pressure than a perfectly smooth one. The aim therefore in sharpening a knife is to direct the stroke so as to produce such an edge. The sharpening is best done by making ten strokes alternately on one side of the blade and then on the other, using light pressure. The edge requires to be ground to the depth of 1 mm. only, so by raising the back of the blade just clear of the stone unnecessary grinding can be avoided. The cutting edge should move forwards at an angle of 60°. If the blade were straight the movement would be a simple one, but the blade has a belly and a point. It is especially necessary to maintain an angle of 60° when the belly and point are in contact with the stone and in order to do so *a curve must be described which is identical with the curve of the blade* (*figs. 7, 8, 9*).

When the knife is very dull and considerable grinding is necessary, stroke the blade along the stone, edge leading, because the "wire edge" formed in the process is more readily brushed away than when the edge follows. Continue the grinding until the dull areas and notches are completely worn away. Light pressure only is required. The procedure is as follows: the heel of the blade is applied to the right hand end of the stone, position 1, with the edge making contact at an angle of 60°, and the back of the knife raised free from the stone. The knife is drawn forward and toward the operator.

When the curved portion of the blade is advancing in contact with the stone the guiding hand makes a sweeping movement—describes an arc—thereby maintaining contact at 60°. At the same time the handle as well as the back of the blade is made to rise progressively in order that the margin shall be ground to the same depth (1 mm.) throughout.

The stroke is not completed until the very tip of the blade has made contact. Each stroke is made in exactly the same fashion.

The sharpening is best completed by making about five strokes on one side and then five on the other, using very light pressure and with the back now leading and the edge following. The procedure would be illustrated by figure 9 by reversing the direction of the arrows. It will be observed that the direction of the lines on the blade is not altered thereby. With reference to the foregoing description this might be termed the return stroke.

Care must be taken not to leave the tip unsharpened. Students frequently present blades which are unsatisfactory though "sharpened". In these cases the microscope reveals the last 1 or 2 mm. to have made no contact with the stone. Stropping is not necessary: very delicate work can be undertaken successfully without the aid of a strop. (The foregoing description is by Dr. B. L. Guyatt.)

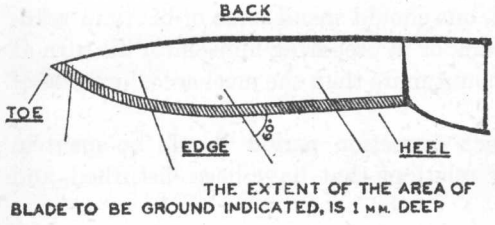

FIG. 7

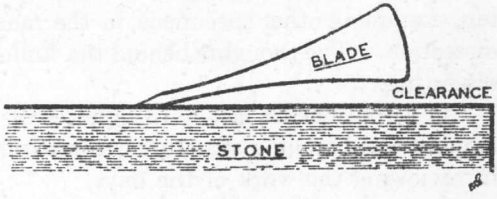

FIG. 8

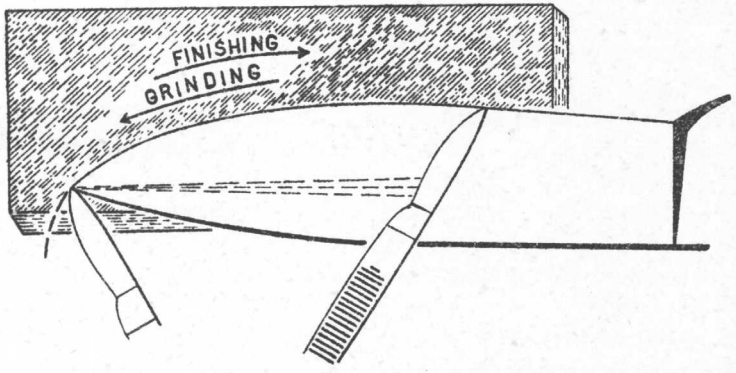

FIG. 9. The excursion of the blade should describe the outline of the blade.

DISSECTION. In dissecting the rule is to begin by locating the important structures and those in danger of damage. Nerves are, for the most part, more important than vessels; motor nerves than sensory nerves; arteries than veins. Where there are so many veins that "the wood cannot be seen for the trees", let all but the chief ones go, thereby saving time and obtaining a clearer picture; e.g., in the axilla keep the axillary and cephalic veins; in the femoral triangle the femoral, profunda femoris, and long saphenous veins. If an important artery has been destroyed, save its companion vein as a substitute. Cutaneous veins are usually superficial to cutaneous nerves. Cutaneous nerves commonly pierce the deep fascia accompanied by arteries, which if well injected serve as guides to the less conspicuous nerves. Every dissection should, so to speak, be set in a frame composed of significant local structures—

such as the borders of muscles, main arteries, and bones—from which one can get one's bearings. After the contents of the frame have been identified, the areolar tissue and fat should be removed from the muscles, and the vessels and nerves should be cleaned with the knife and by drawing the gripping surfaces of the forceps along them. A clean dissection in its frame impresses the eye. The dissection should be ended by defining the bony attachments of the tendons; doing so at the end of a dissection takes no time; it immensely improves one's knowledge of the bones; and it reveals the direction of the pull of the muscles and perhaps their actions. The same apply to ligaments. Muscles being important as landmarks should never be divided without very good reasons.

It is waste of time to clean unidentified structures.

Where two are working on the same part, one should spend some of his time reading, examining other specimens, in the museum, or in preparing himself for his turn at dissection. The thoughts behind the knife count more than the mechanical process of dissecting.

As a routine the last 5–15 minutes of each dissection period should be spent in naming and handling structures, in restoring relations that have been disturbed, and in reviewing the work of the day.

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