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AN

INTRODUCTION

TO THE

STUDY OF HUMAN ANATOMY.

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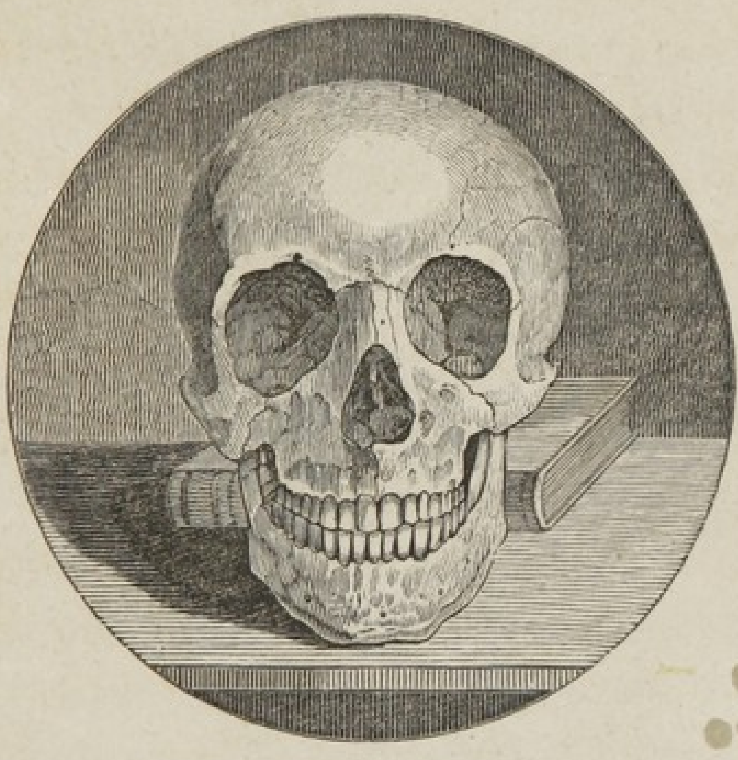
WITH ILLUSTRATIONS.



FIRST AMERICAN EDITION, WITH ADDITIONS.

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BOSTON: CARTER AND HENDEE.

M DCCC XXXII.

1832

ENGRAVED AND PRINTED BY CARTER, ANDREWS, AND CO.
LANCASTER, MASS.

PREFACE OF THE AMERICAN EDITOR.

THE evident utility of the anatomical work of PAXTON, founded on the union of graphic and explanatory designs, must at once be apparent to those, who, without such a guide, have experienced great difficulties in conceiving of the appearances of parts from verbal description alone. The only work on Anatomy re-published in this country, accompanied with plates, is that of CHARLES and JOHN BELL, which are expensive, without being well done, and the student is obliged to turn from the book of the text to that of the plates. In these volumes of PAXTON, at a moderate cost, this is obviated. The reader has, at a *coup d' œil*, the representation of the part before him, with a simple explanation. This work only claims to be of an elementary character, and one to be studied at the very commencement of professional reading: to serve to introduce the student to those more elaborate and excellent systems, with which our own anatomists have enriched this department.

Those of WISTAR and of HORNER are works which may honour any country.

The American Editor of PAXTON has made, he trusts, some useful additions, which he has preferred rather to embody with the work, than to disfigure it, by placing them as notes. Its mechanical excellence will at least bear proof of the skill of the artists.

W. L. Jun.

PREFACE TO THE ENGLISH EDITION.

The present work contains a concise and clear demonstration of the structure of the human body; and on this it grounds its claim to the notice of the professional and the scientific reader. It is admitted that a much larger store of anatomical knowledge is contained in the works of Fyfe, Bell, Lizars, and others, as well as in the splendid publications of continental authors; but no one has given to the public a treatise in its present form, containing graphic and descriptive anatomy on the same page. The principal object of the present undertaking is, to furnish the student with sufficient directions for cultivating this particular department of science, in the shortest and most successful manner; and for this purpose the author has endeavoured to give a correct drawing, as well as an exact description of the parts, by which the mind will be assisted in forming its conceptions, and the memory in retaining or recalling past impressions, when the dissections are imperfectly remembered, or cannot be repeated.

Those who are familiar with the admirable work of J. Cloquet, *Anatomie de l'Homme*, will perceive that frequent use has been made of it, both in figures and description.

Much interest has of late been excited by publications which display the mechanism of nature; indeed, the utility and application of *animal mechanics*, in several branches of science beside those of medicine and surgery, have been frequently pointed out. From the structure and functions of living bodies, writers on Natural Theology find ample materials for showing design and goodness in the creation; and certainly no ground of argument could be better chosen, or afford more striking illustrations of the wisdom and power of the Creator, than the anatomy of man; which, throughout, is but the history of means adapted to certain ends. Those only who study the structure of animated nature, can estimate and admire as they ought the wonderful contrivances of the human frame. "It is evident, therefore, that the more correctly a divine is informed respecting anatomy and physiology, the more effectually will he be enabled to employ his knowledge as an argument in favour of natural religion[a]." And, as a branch of general education also, it deserves the attention of all those concerned in the instruction of youth.

It is acknowledged by most persons, that natural history cannot be advantageously studied unless we are acquainted with the structure of the objects of our research, or with comparative anatomy, so called from its comparing the anatomy of other living creatures with that of man. So, also, the science of geology, which in the present age so much engages the attention of philosophic inquiry, receives great elucidation from the anatomical character of animals.

Natural philosophy has derived aid from the investigation of the human structure, particularly from a knowledge of the formation of the eye and the ear; for "the eye is an organ or instrument by which vision is performed: it is by its nature the most perfect optical instrument, and *the foundation of all others*[b]."

The provisions in the eyes of different animals for regulating the admission of light, the adaptation of their refracting powers to the different media, and the momentary changes in their forms for the vision of near or distant objects, are some of

a Dr. Macartney. b Emerson.

the most interesting points of physiology, and evidently connected with the science of optics.

The organ of hearing may be said to be completely artificial, differing in different animals according to the circumstances in which the function is to be exercised. All these varietes are founded on the general laws for the transmission of sound through various vibrating substances; those laws, therefore, cannot fail to derive elucidation from a knowledge of the mechanism of the ear.

In the fine arts, sculpture and painting receive considerable assistance from a knowledge of anatomy. Without some acquaintance with this science, the artist cannot determine the correctness of his figures; for the bones give the form and the proportion of the joints, and the muscles the intervening outline. The various emotions of the mind naturally call into action certain muscles; and the predominating passion stamps upon the countenance a corresponding indelible impression, though the mind may not be at every instant under its influence. The representation of muscular actions constitutes the anatomy of expression; so that the success of the historical painter must very much depend on his knowing the separate and combined action of the moving powers, in the various attitudes and positions of the human body; for not only the face, but every other part of the person, participates in the mental emotion, and more or less influences the contour and general character of the figure. Many of the ancient statues, as the Lacoon, the Gladiator, and others, display a studied observation and a correct expression of muscular motion.

As a branch of general education, anatomy and physiology are subservient to several other objects. For instance—in many judicial inquiries; in the examination of legal evidence; in the regulation and infliction of punishments; and in the consideration of the best modes of coercion, or the restraints which are most effectual in preventing crime;—the powers of the human constitution should be accurately considered.

I have taken a cursory view of some of the collateral advantages which may accrue from the study of anatomy and physiology; but to the student in medicine, these sciences must be considered indispensable. Not only is it his duty, before entering into practice, to obtain the most perfect knowledge of this department of his profession, by studying the structure and functions of animal bodies, but he must carefully, during the whole course of his professional career, keep up his stock of information. On the importance of anatomical science, the late Dr. BAILLIE has thus expressed himself: "There is not a physician, or surgeon, who can conscientiously discharge his duty to his patient or to himself, who does not occasionally, I ought to say, who does not frequently, inspect the human frame; a knowledge of which is the very foundation of medical science, and a guide to us in the distribution of life and health to our fellow-creatures."

From an acquaintance with the structure and functions of the several parts of the human body when in health, we are able, for the most part, to judge of its state when under deviations occasioned by disease, and thus to act upon just and rational principles in our treatment of the innumerable derangements to which our frame is liable. It is in the pages of death that we read the history of life —it is by taking to pieces the machine that we discover some at least of the wheels which put it in motion: for the same reason we are obliged to examine the body by dissection, before we can explain its constitution and actions. The anatomist, therefore, first studies the apparently simple elements which compose our complex fabric, examining successively all those solid pieces of framework which give to the body its proportions, permit or limit its movements; that by separating the levers of the system, he may be better able to observe their junctures, and the fastenings which retained them in their situation. Next he traces out the moving powers which act on them and direct them, or which enable the animated form to execute the external and internal actions necessary to existence. He then dissects the principal tubes which distribute that vital and regenerating fluid, which repairs the waste of material, by supplying an accession of substance to the complicated machine. Afterwards he investigates those organs which communicate sensation, and transmit, swifter than lightning, the orders of the will, by means of those delicate fibres which establish such intimate relations between us and the bodies with which we are surrounded. Lastly, he analyses those optical, acoustic, and chemical instruments of nature, which produce sensations; and contemplates, in their defunct state, those organs which, under a living principle, exercised a series of functions, excelling each other in the wonder they excite, and following one another in such intimate succession, as gives them the appearance of being connected together by an invisible but most admirable chain.

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* This chapter should, in the text, have been headed Chap. IV. The error was not observed in the English edition, until too late to rectify it in this.

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CHAP. I.

GENERAL OBSERVATIONS.

GENERAL OBSERVATIONS.

The science of anatomy investigates whatever enters into the composition of animated beings; and the dissection of their dead bodies is the chief means of prosecuting the study. The anatomist isolates portions, to display them more distinctly; he injects vessels, to exhibit their course; macerates some parts, to unravel their intimate conformation; dries other parts, to preserve them for future reference; and uses various other processes to facilitate his inquiries into the intricate and complicated machinery of the animal frame. Anatomy, therefore, may be said to be the science of animal organization; and it requires such an examination of the instruments of life, as shall disclose their number, size, situation, form, colour, connection, texture, and functions.

This science comprehends the structure of organized beings in general; but it is the anatomy of man only which forms the subject of the present Introduction.

The anatomy of the human body explains its structure under two different conditions: the first is a healthy state of the organs, termed *special anatomy;* the second is a diseased state producing alterations of structure, termed *morbid* or *pathological anatomy*. I confine myself to a description of the structures and organs of the adult in the former of these conditions.

The human body is composed of solids and fluids, united in different proportions. The solids give the form and consistence to the different parts of our bodies, and they consist of bones, ligaments, muscles, tendons, vessels, nerves, etc. The fluids form the greatest part of the body, and are the blood, chyle, and all the secreted liquids, as urine, sweat, saliva, tears, bile, &c. These are all contained either in vessels, cells, or reservoirs. When the fluids of the animal frame are separated from the solids, their weight is in the proportion of eight to ten. This has been ascertained by an examination of human bodies found buried in the dry sands of Arabia, with their fluids evaporated and their solids remaining perfect; and the fact is confirmed by experiments on inferior animals.

The anatomy of the solids has been divided into various branches, expressive of the parts referred to; as,

Osteology . . .	A description of the bones.
Syndesmology . .	——— the ligaments.
Myology . . .	——— the muscles.
Splanchnology . .	——— the viscera.
Adenology . . .	——— the glands.
Angiology . . .	——— the structure and distribution of the vessels.
Neurology . . .	——— the nerves.
Dermology . . .	——— the skin.

The description and composition of the animal fluids come under the head of Physiology particularly.

The solid parts of the body are named *organs*, or the instruments by which the functions are exercised.

These solid parts of our fabric, when minutely examined, are found to consist ultimately of layers of minute fibres, or filaments, varied in appearance and texture, according to the use and offices of the part which they compose.

As the different organs which constitute the body are of a more simple or complex structure, they are made up of one or more *tissues* or textures, which are the original materials, performing the same function, in whatever part of the body they exist. Most of the organs of the body are composed of a variety of these elementary textures, which are spread out in the form of membranes, collected into cords, or hollowed out into canals; and by their diversity of combination, figure, and colour, they produce all the modifications of structure and functions which different organs possess.

Bichat, an eminent French anatomist, pointed out the simple analysis or division of the body into its elementary parts; and the knowledge of these has been of the utmost importance in the investigation and treatment of diseases, as well as of the greatest convenience in anatomical arrangement.

The systems of texture may be placed in the following order: 1st, the bony system; 2nd, the cartilaginous; 3rd, the fibrous; 4th, the muscular; 5th, the vascular; 6th, the nervous; 7th, the mucous; 8th, the serous; 9th, the glandular; 10th, the adipose; 11th, the cellular; 12th, the dermoid.

These are further subdivided: as the bony system, into the bony and medullary; the cartilaginous, including the fibro-cartilaginous; the vascular is divided into the arterial, the venous, and the lymphatic, etc. But in this place I wish to take a more general view of animal structures, and these twelve divisions will comprehend the whole.

The elementary tissues are variously combined and proportioned; the cellular, vascular, and nervous tissues, give origin to a variety of compound solids, and these solids are furnished with the properties suited to the place they occupy and the offices they discharge.

It is difficult to ascertain the chemical ingredients which enter into the composition of the body; but, according to our present knowledge of animal chemistry, the *inorganic elements* consist of carbon, azote, oxygen, hydrogen, phosphorus, sulphur, iron, calcium, sodium, potassium, etc. These different chemical elements again form *organic elements:* as *gelatin*, or what is called animal jelly; *fibrin*, or a whitish elastic filamentous substance; *albumen*, a vivid transparent fluid like the white of an egg, coagulating by alcohol and heat; *mucous*, a viscid transparent fluid, incapable of coagulation; *fat*, or animal oil, a well-known substance, insoluble in water, and readily melting by the action of heat. More particular notice, however, of the formation and chemical composition of individual structure will subsequently occur[c].

[c] For the several other chemical products, I refer the reader to BERZELIUS on Animal Chemistry.

ANATOMY

OF

THE HUMAN BODY.

CHAP. I.

OF THE BONES IN GENERAL, OR OSSEOUS SYSTEM.

THE bones are the hardest parts of animal bodies: they are a firm and common basis, on which the moving powers are fixed; they constitute a framework for protecting the vital organs, as the heart and lungs, or form complete cases where the more delicate parts of our organization, as the brain and spinal marrow, are securely lodged. They also constitute a series of levers, by means of which, through the agency of the muscles, locomotion and the various and numerous offices of life are performed.

A complete assemblage of conjoined bones form the skeleton: if it is united by its natural ligaments, it is denominated a natural skeleton; if by wires, it is called, though incorrectly, an artificial skeleton, signifying, however, that it is artificially articulated, which indeed is the most useful mode of connecting bones; for, by this means, the joints can be moved and examined at pleasure; on the contrary, bones united by their ligaments have the joints rigid and concealed.

The appearance of the skeleton is different in different subjects, according to the period of life and sex: the present object is to describe its formation and particular organization in the adult, either male or female.

The forms of the bones are sufficiently obvious in many parts of the body so as to give the points to the outline; determining the size, proportion, and motions of its several members.

The bones afford attachments to the moving powers, *i.e.* the muscles to their tendons, and also to the ligaments.

OSSIFICATION.

The bones experience many changes before they arrive to the term of their perfection, which is not until about the twentieth year.

In the first periods, their consistence does not exceed that of the other parts. In four weeks they harden and appear cartilaginous, their form is perfect, and they are covered by their peculiar membrane, the periosteum. Towards the eighth week their vessels commence to carry red blood, instead of the colourless fluid which before circulated in them. It is at this period that the true ossification begins, departing from certain centres which are called the *points of ossification*, and these vary according to the forms of the bones. In the flat bones, the ossific matter is deposited in a radiated manner; in the long bones, in parallel lines.

The larger bones are the first formed, with the exception of the minutest in the body, viz. those of the ear. In these ossification is the soonest completed; and they exceed all the others in density, and in the proportion of the hard matter of bones which they contain.

The use for which a bone is destined, appears to have some influence on the degree of rapidity with which it is formed and developed. The jaw bones are thus early matured, as they are so soon in life required for use. On the other hand the sternum and coccyx are tardily perfected, because it is necessary that the cavities which they help to inclose should be kept somewhat in a cartilaginous state until a later period.

Most of the bones are formed of several pieces, as may be more particularly observed in the long ones, which have their extremities[a] separated from their body by a thin partition of cartilage, and it is some time before the whole is united.

In the skull, some of the bones, in the first rudiments of ossification, display a radiated calcareous phosphate, diverging from the centre to the circumference. Unossified substance at first occupies the interstices left between them, but subsequently additional bony fibres proceed until the cranium is perfect.

When ossification is completed, the bones still continue to undergo different changes. The general growth in stature is completed with the the process of ossification; but increase of bulk is still for a long time advancing to middle age, when the bone is stronger and less vascular; and the different elevations of the surface become more prominent and marked, particularly in individuals accustomed to strong exercise. Finally, as we advance in years, vitality progressively decreases; and in extreme old age the earthy substance predominates, and the bones become extremely fragile.

EMINENCES AND DEPRESSIONS OF BONES.

A variety of *eminences* and *depressions* characterise a number of the bones. The eminences are all those projections, prolongations, or productions, observable on their surfaces; and different names have been assigned to these, derived from their figure, situation, and use.

[a] Termed epiphyses or apophyses.

These *eminences* are termed *heads*, when they are convex, roundish, and smooth on their surface. *Necks*, when smallest at the middle, and gradually increase toward the extremity. *Condyles*, when the head is rather long and unequally rounded. *Tubercles* or *tuberosities*, when uneven, rough, and irregular. *Spines* or *spinous processes*, when sharp or pointed. Long elevations with sharp edges are called *cristæ*. Such processes as terminate in a sharp point or rather edge, receive the general name of *coronoid*, though most of them receive particular names from their resemblance to other things, as *mastoid*, *styloid*, *coracoid*.

Processes are also named from their *situation*, as oblique, transverse, &c.

Some from their *uses*. Thus two tubercles on the os femoris are designated as *trochanters*, because they serve to turn that bone.

The *depressions* are either *deep* or *superficial*. Of the *deep* depressions or cavities, some are termed *cotylæ* or *cotyloid*, from their being like a cup, such as the greater cavity which receives the head of the former. Others are named *alveoli* or *sockets*, as those in which the teeth are lodged.

The more *shallow* or *superficial* cavities are called *glenæ* or *glenoid*, as that part of the scapula which receives the head of the humerus. The cavities of the interior of bones will be described when considering their structure.

These eminences and depressions are most strongly marked in those persons who take very robust exercise, and in the male more than the female, in the adult more than the infant.

The eminences of articulation are generally the expanded extremities of bones, forming surfaces of union with other bones, in which there are corresponding depressions. The mode of union varies with the form and use of the bones thus united; some being immoveably united, others having a limited or a free motion.

Muscular depressions are in proportion to the strength or action of the muscles to which they give origin; and the degree of projection of the eminences for insertion are always a sure sign of the strength of the muscles attached to them, and the energy of their motion. Asperities on the surface of bones in general show where tendons or muscles are implanted. An extended line usually indicates the attachment of a broad tendon; projecting points have tendons or ligaments corresponding.

It may be easily conceived that the moving powers must act with greater advantage by being removed farther from the centre of the bone, by means of such projecting points. The eminences for the insertion of ligaments also afford a similar advantage, by removing, in some degree, the ligament from the articulation, thus facilitating the motion of the latter, as we may observe in the elbow and the knee.

Eminences and depressions from apparent impression, are such as the irregularities of the inner surface of the skull, or such as muscular impressions on other bones present. They are supposed to be occasioned by the pressure of different organs on the surface in their growth or actions. If these impressions are not actually the result of the compression of he organs on the bone, they show that the bones are provided with forms admirably accommodated to the adjacent parts.

FORMS OF BONES.

Viewed in respect to form, bones have been arranged under four classes—the long, the broad, the short, and the mixed bones.

The first in general belong to the parts of locomotion, where they become levers moved in various directions by the muscles. These have all a medullary canal, and their extremities are considerably larger than their bodies, and are porous and reticulated, which gives them a greater degree of lightness, increases the articulating surfaces, and consequently diminishes their liability to luxation. The body of these bones is usually round. The greater distance these are from the trunk of the body, the less is their volume, but the greater their number.

The second, or broad bones, are little connected with locomotion, serving chiefly for the insertion of muscles which proceed to the long bones, and form ordinarily by their union the walls or parietes of certain cavities, as the cranium and pelvis. They are nearly equal in length and breadth, but vary in thickness. They have two lamina; and in the cranium the internal is thinner and harder, and has therefore the name of *tabula vitrea*.

The third, the short bones, are situated in those parts in which solidity and motion must be united, as in the spine, the wrist, and the instep, where their number insures these two properties, namely: solidity, because the force of external mechanical shocks is expended on the wide surface by which they are connected; and mobility, because from their individual partial motions, there results collectively a very extensive general one.

Besides these three classes of bones, there is a fourth, termed by Meckel mixed bones, for they seem to be formed by the union of the bones of the other classes, chiefly of the second and third, being composed of flat and short portions, viz. the sphenoid, temporal, and ethmoid bones.

COLOUR OF BONES.

The colour of the bones depends upon the age, or the manner in which they have been prepared. In the adult the colour is of an opaque white, when fresh, more or less tinged with red; in younger subjects, however, the bones are more vascular and coloured than in those of more advanced years.

TEXTURE OF BONES.

The texture of the bones, like every other animal structure, has a fibrous appearance. The nature of bony fibre is everywhere the same, but being differently arranged admits of two essential modifications: in one bone, or in part of the bone, the fibres, more or less distant from each other, display a profusion of cells; in other parts, closely compressed together, they form a kind of compact substance, in which they cannot easily be discerned. By sawing a cylindrical bone in the longitudinal direction, the arrangement of the fibres is evident. Fig. 1 is a section of the thigh bone; *a*, *a*, the extremities, having to some extent a shell of compact texture, crowded with small cells, diminishing in size but increasing in number as they approach the articulation. They are named *cancelli*, or spongy structure. *c*, the cavity for containing the marrow. The hollowness increases the diameter, consequently the comparative strength of the cylinder. *b*, *b*, the *walls* or sides of the shaft, very solid. Observe, the compact texture is thicker near the middle of the bone, where the greatest forces are most frequently applied.

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The short bones are almost entirely of a cellular structure, covered only by a thin layer of compact texture; in this respect their organization is similar to the heads of long bones.

The broad bones are usually composed of two compact plates of a moderate thickness, having a cellular structure interposed; but in general wherever broad bones are thin, and there is a deficiency of cancelli, very powerful muscles meet, and by their thick layers compensate for the want of solidity in the bone, as in the occiput, ilium, scapula, etc.

PERIOSTEUM.[b]

This is a fibrous membrane, so called from its surrounding all the bones, and providing them with a covering everywhere extended over them, except in such parts as are tipped with cartilage, and the teeth which are protected by enamel.

The ancients had figured to themselves the periosteum as extending from one bone to another over the articulation, and thus forming a continued bag for the whole skeleton. This idea is nearly correct; for although the periosteum ceases at the joint, it is interwoven with the ligaments that surround the joints: in this manner continuity may be conceived.

The periosteum in infancy is slightly united to the bone, and is removed from it with the utmost facility. In the adult the adhesion is more firm; it is excessively so in an aged person. The inner surface of this membrane is firmly fixed to the bone by numerous vessels and fibrous threads, particularly in the extremities of the long bones and on the short bones, which we can easily conceive by the great number of apertures we see in them. The connexion between the periosteum and the adjacent organs is much

[b] In the English edition the description of the Periosteum is deferred until the author is on the subject of Fibrous Membranes; but as so immediately connected with the Osseous System, it was considered proper to place it where it now is.

varied; for the most part the muscles are attached to, or glide upon it, and it is more or less united to them and to the integuments by cellular membrane.

The periosteum borrows its vessels from those adjacent. Their innumerable branches form an intricate net-work, which is rendered very striking by injections, especially in infants; they are then lost in the compact texture of the bone, or are returned to the surrounding parts.

This membrane is no doubt supplied with nerves, though so minute as not to be easily demonstrated. Like bone in its healthy and natural state, it possesses little or no sensibility; yet when inflamed its feeling is exceedingly painful, so that we cannot but allow it to be endued with nerves.

That absorbent vessels also penetrate the periosteum, is argued from its restoration from diseases. In some cases it attains an unnatural thickness, and in process of time regains its natural tenuity, which can be the result only of the action of the absorbents.

The periosteum is subservient to several uses. 1st. It is the nutritious membrane of the bone; it endows its exterior with vitality; and if it is separated from it, the surface of the bone perishes. 2d. It gives convenient insertion to nearly the whole of the fibrous system; viz. the tendons, ligaments, aponeuroses, and also muscles, are attached to this organ. 3d. By means of the smooth surface of the periosteum, the action of the muscular fibres and the tendons is easy, and the effects of friction are averted.

COMPOSITION OF BONES.

The composition of bones, whatever may be their forms, is of the same nature: they consist of a mixture of earthy and animal matter.

The existence of the first is proved by burning bones in fire: combustion destroying the animal matter, leaves a brittle substance, which is the earthy part, of the same form with that of the bone.

The animal part of bone is not less evident, for by immersion in a weak acid the earthy matter is dissolved, and there remains a cartilaginous body, flexible and elastic, bearing the same form as the bone.

These two substances are the essential component parts of bones. The earthy is intended to provide them with the degree of strength and solidity that characterise them; the animal parts endow the bone with the principles of vitality, growth, and nutrition.

The skeleton consists of about two hundred and fifty-two[c] bones, which are divided into those of the *head*, the *trunk*, and *extremities;* some of them are single, and others are in pairs. There are

fifty-five bones of the head.

Frontal	*Os frontis*	1
Parietals	*Ossa parietalia* . .	2
Occipital	*Os occipitis*	1
Temporal	*Ossa temporum* . .	2
Sphenoidal	*Os sphenoides* . .	1
Ethmoid	*Os ethmoides*	1
Nasal	*Ossa nasi*	2
Malar	*Ossa malarum* . .	2
Lachrymal	*Ossa lachrymalia* . .	2
Upper jaw bones . .	*Ossa maxillaria superiora*	2
Palate bones	*Ossa palatina* . .	2
Inferior turbinated bones .	*Ossa turbinata* . .	2
Vomer	. . . . . .	1
Lower jaw	*Os maxillare inferius* . .	1
Teeth	*Dentes*	32
Tongue bone	*Os hyoides*	1

c The exact number of bones in the human frame is variable: the sesamoid bones and ossa wormiana are not constant; and in reckoning the bones of the skeleton, the small bones of the ear are usually omitted.

CHAP. II.

BONES OF THE HEAD.

These comprehend the bones of the *cranium* and *face*, consisting of twenty-two in number. Some of them are in pairs, but others are only single bones.

In the cranium or skull there are two pairs and four single bones, viz.

2 Parietals.
2 Temporal.
1 Frontal.
1 Occipital.
1 Ethmoid.
1 Sphenoid.

To the face there are six pairs and two single bones, viz.

2 Nasal.
2 Lachrymal.
2 Malar.
2 Superior maxillary.
2 Palatine.
2 Turbinated.
1 Vomer.
1 Inferior maxillary.

The cranium is the vaulted cavity for lodging the brain, its membranes and vessels.

The inner and outer surfaces of the bones are composed of compact layers, Fig. 2, *a* called the *external* and *b* the *internal tables* of the skull. They are not parallel to each other, but in some places very compressed. There is an intermediate cellular texture, *c*, between them, termed *diploe*, which is similar to the cancelli of other bones,

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and it serves a like purpose, viz. to convey vessels and nerves from one region to another. The character of the two tables differ; the external is *fibrous*, the inner exceedingly compact and brittle, so as to obtain the name of *vitreous*.

THE SUTURES.

Upon the surface of the skull we observe various lines, dividing it into different portions, as in Fig. 3, the upper part of the skull. These lines are the joining of the several bones to each other, and form a resemblance, on a superficial view, to the stitches of a seam; they are denominated *sutures*. Their origin is this: the radiated fibres of the bones in their growth approach each other, the fibres of one bone entering the interval of the fibres of another bone, forming the serrated line of union called suture.

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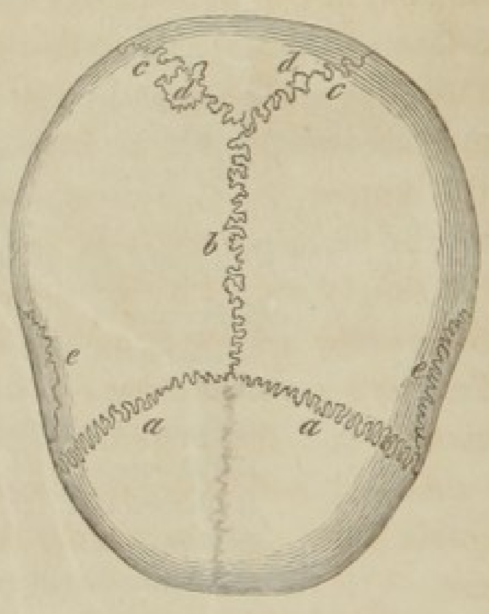

a, *a*, The *coronal suture*, has its name from being situated at that part of the head upon which the ancients were used to place the laurel or olive crown, given to the victors in their games. It passes transversely over the skull, and joins the frontal with the parietal bones.

b, The *sagittal suture*, named from its straight course. It extends from the middle of the superior margin of the frontal, to the angle of the occipital bone. It is the union of the two parietal bones. This suture is occasionally continued down the frontal bone to the nose: this part of it is then named the *frontal suture.*

c, The *lambdoidal suture*, receiving this name from its resemblance to the Greek *Λ*. It commences at the termination of the sagittal suture, and extends on each side to the base of the cranium. It joins the occipital to the parietals above, and to the temporal bones below. There is great irregularity in this suture: it is frequently diverted from its regular course by the interposition of little bones (separate ossifications), *d*, *d*, which, from being of a triangular shape, have been called *ossa triquetra,* or ossa wormiana, in compliment to Olaus Wormius, an anatomist, who first particularly described them.

The superior portions of the temporal bones are joined to the parietals by a thin, indented, yet scaly overlapping of the former, *e*, *e*, hence named the *squamous* suture. Near the occipital angle it loses its squamous character, and is simply united by a serrated line, under the name of *additamentum suturæ squamosæ.*

Two other sutures are sometimes reckoned, viz. the ethmoidal and the sphenoidal; but they are a union of the ethmoid and sphenoid bones to those adjacent, by irregular lines, by no means having the character of a suture.

FRONTAL BONE. *Os frontis.*

This bone forms the forehead, part of the temples, and the roof of the orbits; its shape has been compared to a clam shell. Fig. 4 is a front, Fig. 5 a back view. Two eminences, *a*, *a*, mark the situation of the *frontal sinuses*. These are formed by an apparent separation of the two tables of the skull, leaving very considerable cavities, which communicate with the nose.[d] On each side of the forehead we observe *b*, Fig. 4, the *temporal arch*, at first strongly marked, but less so as it passes upwards. The

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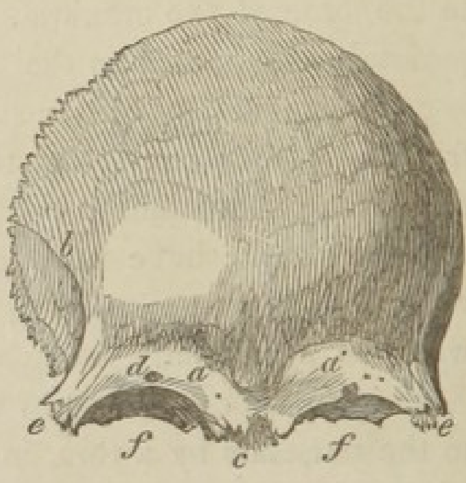

hollow forms part of the temporal fossa. In the middle and at the lower edge of this bone is *c*, the *nasal process*, and *ethmoidal notch*. On the ridge over which the eyebrow is placed we observe *d*, a hole; sometimes it is only a notch in the bone, as on the other side of this specimen, though it is there completed by a ligament, so as to form a hole called the *upper orbitary hole*[e]. The ridges just mentioned terminate at *e*, *e*, the *external angular processes*. The angles opposite are the *internal angular processes*. Between these are *f*, *f*, the *orbitar plates*, slightly concave, and have near the outer angle a *depression*[f] for the reception of the lachrymal gland.

[d] These cavities increase the intensity of the sound of the voice, and render it more melodious.

[e] Foramen supra-orbitarium. For the passage of first branch of fifth pair of nerves.

[f] Fossa lachrymalis.

On the *internal surface*, Fig. 5, are slight depressions, answering to the convolutions of the brain. *h*, the frontal *spine*, is a sharp ridge commencing at the ethmoidal notch, and extending upwards about an inch, where it divides into two ridges with a shallow groove between them, called the *frontal furrow*. At the root of the spine at *h*, is a small hole, which not perforating the bone or leading to any cavity, is called the *blind hole*[g]. *i*, *i*, the *opening* of the frontal sinuses. The os frontis is joined above and behind with the ossa parietalia, which junction terminates at a line running horizontally backwards from the point of the angular process; between those two points and behind as far as the ethmoidal notch, it joins with the sphenoid bone on each side; within the ethmoidal notch it receives the ethmoid bone, which joins to the orbitar plates, at the anterior part of which it unites with the os lachrymale; in front it joins its nasal process and spine with the ossa nasi and ethmoid bone, and by its outer angular processes with the malar bones.

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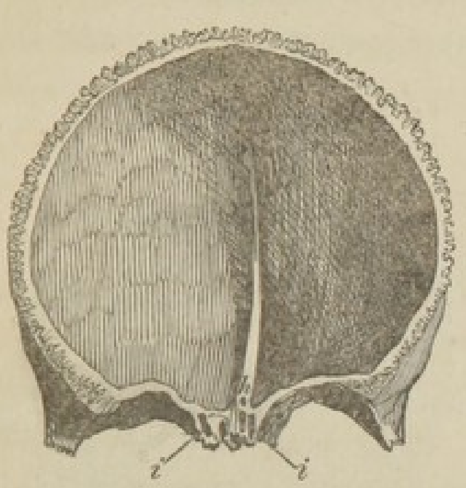

The muscles attached to the os frontis are three pairs, viz. the *temporal* muscle, the *corugator supercilii*, and *orbicularis palpebrarum*. It is also covered by the *occipito-frontalis*.

g Foramen cæcum.

THE PARIETAL BONES, *ossa parietalia,*

Are a pair, forming the sides and vertex, or top of the head. *Externally,* Fig. 6, each bone is convex; and as it has four angles, they are denominated according to their relative situation in the skull, the *frontal* and *temporal angles,* and the *superior* or *inferior occipital angles.* The marginal edges also are named from their connexions, as *a* in this and the subsequent figure; the anterior edge is called the *frontal margin; b,* the *parietal margin; c,* the *occipital margin; d,* the *temporal margin.* On the convex surface is a *transverse arched impression, e,* which marks the attachment of the temporal muscle.

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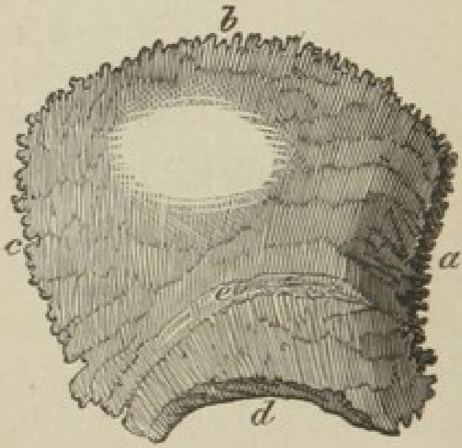

On the *internal* and concave surface, Fig. 7, *f, f,* are *impressions* or furrows, which are for the ramifications of the artery of the dura mater, or outer membrane of the brain. Sometimes part of the artery runs in a canal in the bone, as in this specimen at the temporal angle. Near the superior margin there is commonly a small hole, through which a vein passes from the integuments of the head to the longitudinal sinus.

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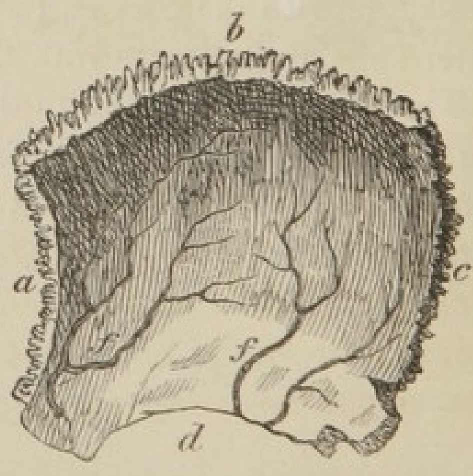

The parietal bone is joined by its frontal edge to the os frontis; by the parietal edge to its fellow; by its occipital edge to the os occipitis: and by its temporo-sphenoidal edge to the temporal and sphenoid bones.

The only muscle attached to the parietal bone is the *temporal.*

THE OCCIPITAL BONE, *os occipitis,*

Is situated at the back part of the head, and forms part of the base of the skull It is convex externally, Fig. 8; concave internally, Fig. 9.

The most remarkable parts to be noticed on the exterior, Fig. 8, are *a*, the *occipital angle*; *b*, a prominence called the *tubercle*, from each side of which there is a *transverse arched ridge*[h], and below is another *ridge*, following nearly the same direction. These are to be borne in mind as indicating the attachment of some of the muscles of the head. There are also several depressions, shewing the insertion of muscles. At the under and fore part of the bone is *c*, the *great opening*[i], through which passes the medulla oblongata, or upper part of the spinal marrow, its membranes, the vertebral arteries, and the spinal accessory nerves; *d*, the *anterior condyloid*

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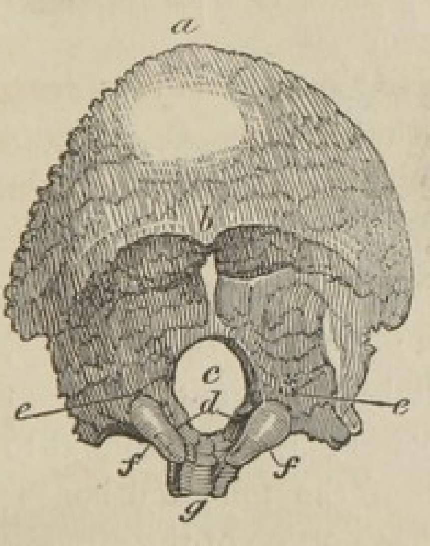

h Linea semicircularis, or arcus traversus.

i Foramen magnum occipitis.

holes, through which the lingual nerves pass; *e, e*, the *posterior condyloid* holes, for the passage of the veins of the neck: frequently one or both of the latter holes are wanting, in which case the veins proceed through the foramen magnum; *f, f*, the *condyles* or smooth eminences for articulating with the first bone of the neck; *g*, the *basilary* or *cuneiform process.*

The *inner surface*, Fig. 9, is concave, and divided by a crucial ridge, *b*. To the crucial ridge are attached processes of the dura mater, viz. from *a* to *b*, a portion separating the posterior lobes of the cerebrum; from *b* to *c*, a portion dividing the cerebellum; and from *b* to *g* each side, another, which separates the cerebrum from the cerebellum. In this curved ridge from *b* to *g*, are seen *transverse grooves*, shewing the situation of the lateral sinuses; *c*, the *great foramen*; *e, e*, the *condyles*; *f*, the *basilary process.* The occipital bone is united by its parietal margin to the parietal bones; by its temporal to the margin of the mastoid portion of the temporal bones; by its basilary margin to the petrous portion of the same bone; and by its basilary process to the sphenoid bone.

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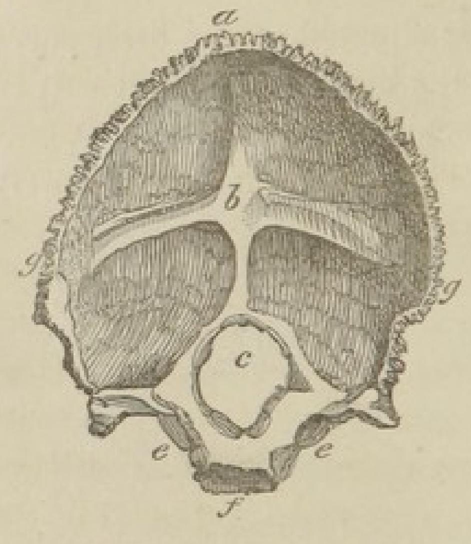

The muscles attached to the os occipitis are ten pairs, viz. the *trapezii*, *complexi*, *splenii*, *recti postici majores*, *et minores capitis*, *obliqui superiores capitis*, *recti laterales*, *recti interni majores*, *et minores capitis*, and the *occipito-frontales*.

THE TEMPORAL BONES, *ossa temporum*,

Are a pair. They are so named because they occupy the region of the head where the hair usually commences to whiten, thus indicating the period of life. They are irregular in their form, and unequal in their thickness. Fig. 10 is an outer view. Each bone is distinguished by two distinct portions: the upper part is thin and of a scaly character, hence named the *squamous portion;* the other half of the bone is of a triangular form, passing inwards and downwards, and being of a close texture and rocky hardness, is called the *petrous portion.* If a horizontal line was drawn from *b*, the squamous portion would be all that part above the line. It forms the chief part of the temple. The squamous portion is bounded at its base by *b*, the *zygomatic process*, which is a thin and narrow projection of bone; at its root it has *c*, a *tubercle* or eminence, and terminates in *b*, an indented process, which, from its union with the malar or cheek bone, is called the *malar process.* Immediately behind the eminence *c*, is a *cavity* for the articulation of the lower jaw. At the back part of this cavity is an apparent division in the bone, the *glenoid fissure*, through which passes a nerve called the *corda tympani.* On the lower surface of the eminence just mentioned, the jaw moves when brought forwards. *d* is a deep hole, the *external auditory passage*[j]. From the lower part of the bone

10

[j] Meatus auditorius externus.

is a remarkably long and pointed process, *e*, which, from having some resemblance to an ancient style, or iron writing pen, is named *styloid process.* Several muscles are attached to this slender portion of bone, and derive their names from it. At the root of the process, *f*, is a ridge of bone termed the *vaginal process*, imagination having formed it into the likeness of a sheath to the styloid process. Further behind is *g*, the *mastoid process;* it is a very considerable prominence, the texture of which is cellular, but the cells are seen only in a section of the part. There is one or more holes at the back part of this process, seen at *c*, Fig. 11, called the *mastoid foramen*, or *foramina.* Between the root of the styloid and mastoid processes, is the *stylo-mastoid foramen:* it is the passage of the portio dura of the seventh pair of nerves.

Fig. 11 is the inside view. On the squamous portion we observe marks of the convolutions of the brain, and *a*, the edge bevelled off where it overlaps in joining to the parietal bone. On the petrous portion is *b*, the *internal auditory passage*[k], by which the nerves of hearing have access from the brain to the ear. Posterior to this is a foramen, called the *aqueduct of the cochlea:* it serves for the entrance and exit of the blood-vessels of the ear. On the opposite side, in the anterior part of the petrous portion, is a small hole called the *vidian foramen.*

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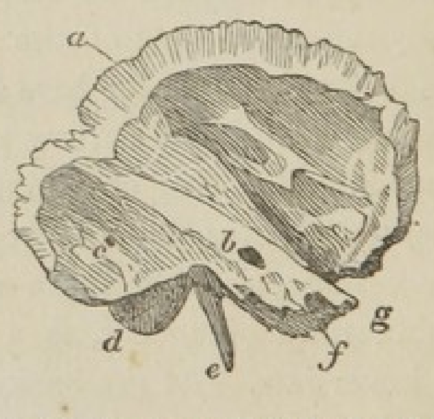

[k] Meatus auditorius internus. It should be observed, that this opening soon divides into two: the first, called the *aqueduct of* FALLOPIUS, for that division of the seventh pair of nerves, the portio dura, which is distributed to the face; the second foramen admits the other division of this nerve, the portio mollis, by several small apertures, into the intricate passages of the ear, to become the proper organ of hearing.

Near the point called the inferior angle is *f*, the entrance of the *carotid canal*, for the passage of the chief artery of the brain; *g*, the bony part of the *eustachian tube*[1]. At the base of the bone is the *jugular fossa*, or thimble-like depression, made by the first turn or commencement of the jugular vein. The temporal bone is united by its malar process to the zygomatic process of the os malæ; by the inferior edge of the squamous portion to the spinous process of the os sphenoides; by the superior edge of the same part to the temporo-sphenoidal edge of the os parietale; by the superior edge of the mastoid portion to the temporal angle of that bone; by the inferior part of the mastoid portion, and the petrous portion, to the temporal and basilar edges of the os occipitis, and the posterior clinoid process of the os sphenoides.

There are sixteen muscles attached to the temporal bone, viz. the *temporalis*, *masseter*, *retrahens auris*, *occipito-frontalis*, *sterno-cleido mastoideus*, *complexus minor*, *splenius*, *digastricus*, *stylo-hyoideus*, *stylo-glossus*, *stylo-pharyngeus*, and the *constrictor pharyngeus superior;* and the muscles moving the small bones of the ear, the *tensor tympani*, *laxator tympani*, *externus mallei*, and *stapedius*.

Besides the parts which have been described, the temporal bone contains the organ of hearing, which includes the *ossicula auditus*, etc. As, however, these parts cannot be understood till several sections of the temporal bone have been made, I shall refer the reader for a further description to the article on the senses.

1 Iter a palato ad aurem. It is named the eustachian tube from Eustachius, an eminent anatomist, who discovered it.

THE SPHENOID BONE,

Fig. 12 and 13,

So called from its situation in the base of the skull, where it wedges in and locks together most of the other bones, for it is united to fourteen distinct bones. Its general resemblance to a bat with extended wings, has given names to different parts of the bone. Fig. 12, *a*, the *pituitary fossa* or *sella turcica*, a slight concavity in the centre of the bone for the lodgement of the pituitary body; *b*, *b*, points having the name of the *anterior*; *c*, *c*, the *posterior clinoid processes*, so called from their supposed resemblance to the knobs of a bedstead. An eminence in front, *d*, is called the *olive-shaped process*, upon which the optic nerves meet and unite; *e*, *e*, the *optic foramina*, through which these nerves and an artery pass to the eye. The points *f*, *f*, continued from the anterior clinoid processes, are the *transverse processes*, or the smaller wings. In front of the body is *g*, the *ethmoidal spine*; *h*, the *basilar process*, which joins the occipital bone: on each side of that process is a deep notch, forming part of the carotid foramen. Between the transverse spinous process and the temporal portion of the bone is *i*, *i*, the *sphenoidal fissure*, or *foramen lacerum*, which transmits the third, fourth, and sixth pairs of nerves, and the first branch of the fifth pair; behind and below is *k*, *k*, the *round foramina*, which transmits the second branch of the fifth pair of nerves; *l*, *l*, the *oval foramina*, through which pass the third branch of the

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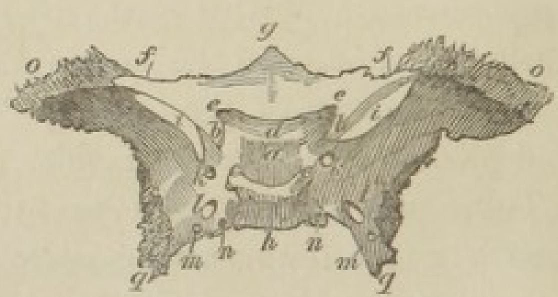
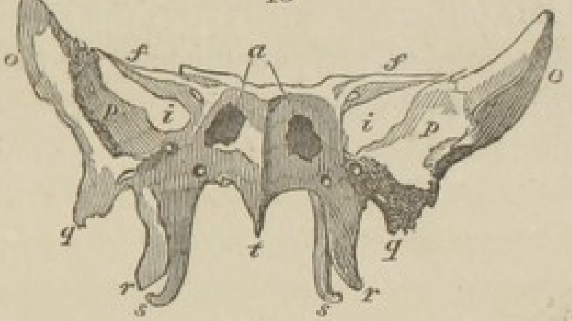


fifth pair of nerves; *m, m,* the *spinal foramina,* by which the middle artery of the dura mater passes; *n, n,* the entrance of the *pterygo-palatine canals,* by which the palatine nerves pass to the mouth; *o, o,* the *temporal portions,* or *plates,* or the larger wings; *q, q,* the *spinous processes.*

In the posterior view, Fig. 13, *f, f,* is a profile of the *transverse processes; i, i,* the *sphenoidal fissure; o, o,* the *temporal plates,* or alæ; *p, p,* the smooth surfaces which constitute part of the orbit of the eye, the *orbitar plates; q, q,* the *spinous processes; r, r,* the *external pterygoid processes; s, s,* the *internal pterygoid processes,* each of which terminates in a little curved process, called the *hooklike process*[m], over this a tendon of the extensor muscle of the palate plays; *t,* the *azygos process; u,* the body containing the *sphenoidal cells:* the lines point to their openings.

13



There is a foramen at the base of each pterygoid process, called the *vidian foramen,* from Vidius, who discovered it. This transmits a nerve that does not go from the cavity of the cranium, but returns into it. The second branch of the fifth pair, after passing out of the cranium, sends back, through this foramen, a branch called the *vidian,* which, upon its arrival in the cranium, enters the temporal bone.

The sphenoid bone is united by its ethmoidal spine to the nasal plate of the os ethmoides; by its transverse process and the orbitar plates to the os frontis; and at the back part of its temporal to the sphenoidal angles of the ossa

m Hamular process.

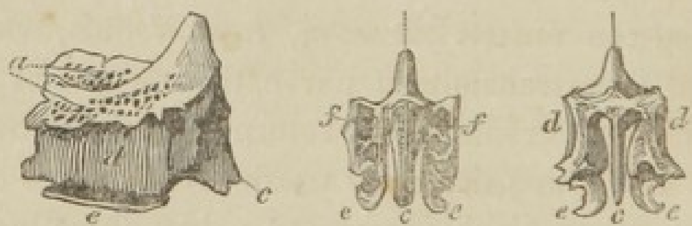
parietalia: by the posterior edges of the same plates, and its spinous process, it joins the squamous portions of the temporal bones. From its spinous processes to the roots of the pterygoid processes, it touches the inferior angles of the petrous portions of the temporal bones; and by its basilar process it is connected with the sphenoidal process of the os occipitis: by the anterior edges of its orbitar plates it is united to the ossa malarum; by the anterior surfaces of its pterygoid plates to the ossa palati; and by the azygos process to the vomer.

There are thirteen pairs of muscles attached to the os sphenoides; viz. the *levator palpebræ superioris*, the *recti* muscles of the eyes, the *superior oblique* muscle of the eyes; the *temporal* and *pterygoid muscles*, *buccinator*, *externus malei*, *constrictor pharyngis superior*, and *tensor palati*.

THE ETHMOID BONE. *Os ethmoides.*

Fig. 14, a side view; Fig. 15, a posterior; Fig. 16, an anterior view. The letters refer to the same parts in each figure.

14 15 16



The ethmoid bone derives its name from the upper surface resembling a sieve, being full of small holes; it is of a cubical form, and consists principally of numerous cells.

a. The *cribriform plate*, perforated by *numerous little holes*[n] to transmit the olfactory nerves, or nerves of smelling,

[n] Foramina cribrosa, from cribrum, a sieve.

into the nostril. In the middle at *b* is a sharp process, the *ethmoid crest*[o]. From the lower part descends *c*, the *nasal plate*, making part of the central partition of the nose; *d*, the *flat or orbitar plates*[p], which form the principal portions of the inside of the orbits. We see on each side of the nasal septum, *e*, *e*, the *turbinated plates*, thin, pendulous, and convex; and on the back part, this bone has numerous *cells*, *f*, *f*, consisting of many convoluted plates of bone, called labyrinths, very deserving of an attentive examination, being perhaps the most curious bone of the human body. The nerves of smelling, after passing through the cribriform foramina, are expanded on the perpendicular septum, and throughout the whole extent of the cells. A very considerable surface is thus provided for the distribution of the nerves, occupying little space.

The ethmoid bone is joined by the edges of its cribriform plate to the ethmoidal notch of the os frontis, and to the os sphenoides; and by the posterior part of its nasal plate to the latter bone, and to the vomer; by the fore part of the same plate to the back part of the nasal crista of the os frontis; by its anterior edge to the os lachrymale, and by the lower edge of the same plate to the superior maxillary bone.

There are no muscles attached to or covering this bone.

THE WORMIAN OR TRIANGULAR BONES.

Ossa Wormiana, ossa triquetra.

These are little irregular bones found in the course of the suture formed by the parietal and occipital bones, see Fig. 3, *d*, *d*: their existence is not constant.

[o] Crista galli. [p] Ossa plana.

THE BONES OF THE FACE

Are in pairs, except two bones, one of which forms part of the partition of the nose, the other is the lower jaw.

The union of the bones of the face has been called sutures, and named according to their connexion with each other; but they are united rather by simple irregular lines, than by sutures.

THE NASAL BONES. *Ossa nasi.*

17 18

Fig. 17, the external surface; Fig. 18, the internal surface. These bones form the bridge of the nose; they are convex externally, thereby giving greater resistance to violence from without; and they are concave internally for enlarging the cavity of the nose[q]; at their middle part each presents a small foramen which passes through the bone, and transmits a vein to the pituitary membrane. The superior margin of this bone is joined to the nasal process, and spine of the os frontis, and nasal plate of the os ethmoides; its external edge is received into the nasal process of the superior maxillary bone; its inner edge is united to its fellow, and its lower edge is joined only by the alar cartilages of the nose.

There are two muscles attached to it, viz. the *occipito-frontalis*, and *compressor naris*.

q It has been stated that the inhabitants of Java, the Hottentots, and South-sea islanders, compress the nose immediately after birth, conceiving a broad nose conducive to beauty.

THE LACHRYMAL BONES. *Ossa lachrymalia.*

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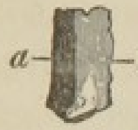

Fig. 19. This bone is nearly the size, shape, and indeed thickness of the finger nail, therefore has the name also of *os unguis.* It is called lachrymal because *a*, the *anterior concave portion*, supports the lachrymal duct, which conveys the tears from the inner corner of the eye into the nose ; *b*, the *orbitar plate*, which assists in forming the orbit of the eye.

THE CHEEK BONES. *Ossa malarum.*

Fig. 20. The bone of the left side. Its several angles are named as follows: *a*, the *superior orbitar process ; b*, the *inferior orbitar process ; c*, the *maxillary process ; d*, the *zygomatic process.* The concave surface, *e*, forms a portion of the orbit, called the *internal orbitar process.*

20

There is but one foramen, *f*, the *malar foramen*, through which the malar nerve passes.

The cheek bone is joined by its zygomatic process to the malar process of the temporal bone ; by its superior orbitar process to the external angle of the os frontis ; by the posterior edge of its orbitar plate to the os sphenoides ; and by the inner edge of the same plate to the os maxillare superius.

There are four muscles attached to it ; viz. *obliquus inferior oculi, zygomaticus major* and *minor*, *masseter*, and that of the *orbicularis palpebrarum* is extended over it.

THE UPPER JAW BONES, *ossa maxillaria superiora*[r].

The superior maxillary bones constitute the principal part of the bones of the face. Fig. 21, the outer; Fig. 22, the inner view. The body of the bone is of an irregular form, having a large cavity, *a*, opening into the nostrils, commonly called the *antrum of Highmore*[s]. On the outer surface is *b*, the *infra orbitar foramen*, for the passage of the second branch of the fifth pair of nerves to the face; *c*, the *malar process*; *d*, the *nasal process*; *e*, a depression contributing to form the small cavity for lodging the lachrymal sac; this cavity descends, and becomes at *f* part of the *nasal duct*. Between the malar and nasal processes, extending backwards, is *g*, the *orbitar plate*. The posterior surface of the bone at *i* is rounded, therefore termed the *tuberosity*, the inner edge of which is rough, to join with the pterygoid process of the os palati, forming with it the palato-maxillary canal. From the inner and lower part of the body extends horizontally *h*, the *palatine process*, forming the greater portion of the floor of the nose, and hollowed below, to form an equal part of the roof of the mouth. On the upper surface is a crest or ridge, which is grooved to receive the septum of the nose. Immediately behind the front teeth is the *foramen incisivum*; the *ductus incisivus* is a continuation of this foramen between the palatine processes into the nose. There are usually eight *alveolar cavities* in each bone to receive the teeth.

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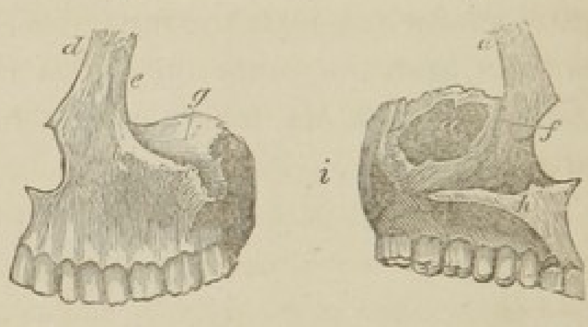

[r] Superior maxillary bones. [s] Sinus maxillaris.

The superior maxillary bone is united by its malar process to the inferior orbitar process of the os malæ; by its anterior inner edge to the os nasi, and on the inside to the os turbinatum; by the upper part to the os frontis, and the os lachrymale; by the inner edge of its orbitar plate to the flat plate of the os ethmoides; by the posterior point of the same plate to the os palati. It is connected by its tuberosity, body, and palatine process with the same bone; by the inner edge of its palatine process with that of its fellow; and by the nasal crest with the vomer.

There are ten muscles attached to this bone; viz. the *constrictor pharyngeus superior*, *pterygoideus externus*, *buccinator*, *masseter*, *levator anguli oris*, *levator* and *depressor labii superioris alæque nasi*, *orbicularis palpebrarum*, *obliquus oculi inferior*, and *compressor naris*.

THE PALATINE BONES. *Ossa palatina.*

Fig. 23. the anterior; Fig. 24, the posterior view of the palate bone. The letters refer to the same part in each figure.

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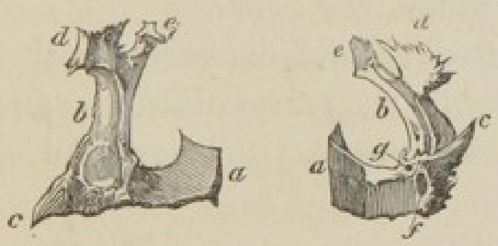

This bone is placed at the lower and back part of the last described bone, and below the middle region of the base of the skull; *a*, the *palatine process*, wide at its outer edge to join its fellow; from the outer edge of the palatine rises up *b*, the *nasal process*, which forms a thin partition between the cell of the superior maxillary bone and the nose; it is marked internally by a strong ridge, to which the turbinated bone is attached: behind the nasal process, backwards and outwards at *c*, is a projecting point of bone, the *pterygoid process;* it has two grooves, one of which terminates in *f*, the *palato-maxillary foramen*, through which the palatine nerve and vessels proceed to the palate. There is another small foramen near the last, marked *g*, the *palatine foramen*, to transmit branches of the same vessels and nerves to the soft palate. The upper part of this bone is divided by a notch into two portions, *d*, the *sphenoidal process*, which is united to the body of the sphenoidal bone; *e*, a small triangular portion, which, entering into the formation of the socket of the eye, is termed the *orbitar process*.

The os palati is joined to its fellow by the palatine process; and by the nasal crest to the vomer; by the anterior part of the palatine process to the superior maxillary bone; by the ridge on the inside to the os turbinatum; by the nasal and pterygoid processes to the body and tuberosity of the os maxillare superius; by its pterygoid, sphenoidal, and orbitar processes, to the pterygoid process and body of the os sphenoides; and by its orbitar process to the same process of the os maxillare superius, and the flat plate of the ethmoidal bone.

Five muscles are attached to, and connected with the os palati; viz. the *buccinator*, *pterygoideus externus* and *internus*, *constrictor*, *pharyngeus superior*, and *azygos uvulæ*.

TURBINATED BONES. *Ossa turbinata*[1].

Fig. 25.

Sometimes called the inferior spongy bones, to distinguish them from the upper spongy bones, which belong

[1] Ossa spongiosa inferiora.

to, and are a part of, the ethmoidal bone. They are pendent in the nostrils, curved, and exceedingly porous in their texture. This bone is joined on the upper and on the outer side to the body of the superior maxillary bone; anteriorly to the nasal process of the same bone, and to the os lachrymale; and posteriorly to the nasal process of the os palati.

25

THE VOMER.

Fig. 26 is thus named from its shape resembling a ploughshare. It is divided into four edges, *a*, the *sphenoidal*, the broadest, and hollowed to receive the azygos process of the sphenoidal bone; *b*, the anterior or *nasal* process, grooved to receive the nasal plate of the ethmoid bone, and the cartilaginous septum of the nose; *c*, the inferior or *crista*, uniting with the crest of the superior maxillary bone; *d*, the posterior or *pharyngeal* margin, concave and facing the *pharynx*.

26

THE LOWER JAW. *Os maxillare inferius.*

This is by far the largest bone in the face, but it is here divided, to shew to greater advantage the outer and inner surfaces. Fig. 27, 28. The letters refer to each. *a, a,* the *basis,* is the boundary of the face ; *b, b,*

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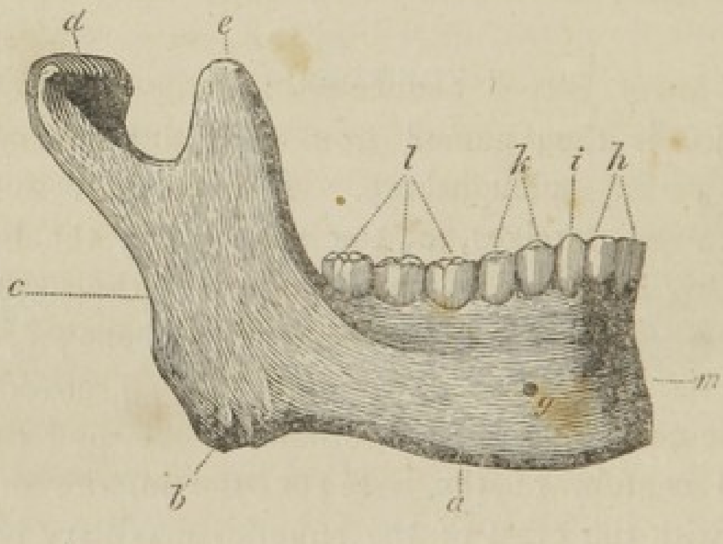

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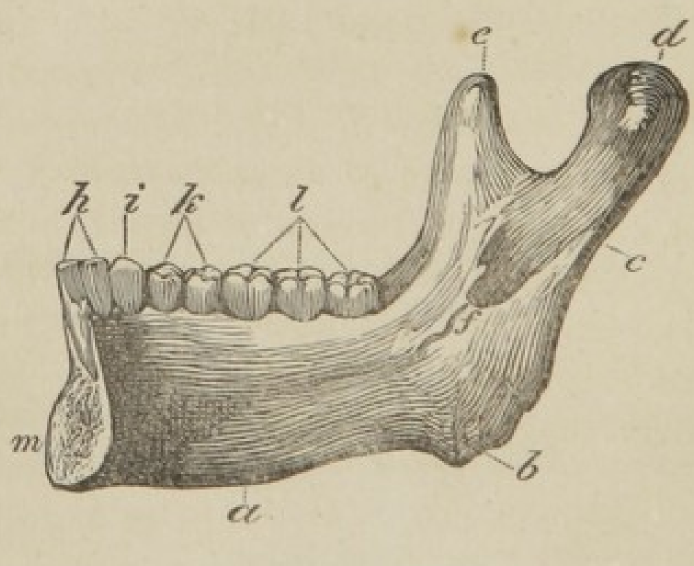

the *angle; c, c*, the *ramus; d*, the *condyle; e, e*, the *coronoid process*. Fig. 28, *f*, the *inferior maxillary foramen;* nerves and vessels enter into this canal to supply the teeth, and afterwards pass out at *g*, the *mental foramen*. There are the same number and kind of teeth in the lower as in the upper jaw, and consequently cavities or alveoli to receive them. The teeth may be reckoned aa follows, viz. (on each side of the jaw,) *h, two incisors* or cutting teeth; *i, one canine* or dog tooth; *k, two small molar; l, three large molar* or grinding teeth[u].

The lower jaw is connected by capsular and lateral ligaments with the glenoid cavities of the ossa temporum, having an interarticular cartilage between them.

There are twelve pairs of muscles attached to this bone; viz. externally, the *masseteres, depressores anguli oris, depressores et levatores labii inferioris;* internally, the *temporales, pterygoidei externi et interni, buccinatores, mylo-hyoidei, genio-hyoidei, digastrici, et genio-hyo-glossi:* the *platysma myoides* passes over it.

CHAP. III.

THE BONES OF THE TRUNK.

The trunk is composed of the spine or back bone, the thorax or chest, and the pelvis or hips.

The spine, though spoken of as a single bone, consists of twenty-four bones, which turn or play upon each other, and hence have been called *vertebræ*. The vertebral column supports the trunk, head, and arms, and

u The teeth will be particularly described at the end of the osseous system.

admits of the turning and bending of the body; indeed, it has a movement in every direction: it forms a secure canal for conducting the delicate structure of the spinal marrow through its whole length; and it is remarkable for combining those two opposite yet very essential qualities, strength and flexibility.

The vetebræ are arranged into three classes, according to their situation. 1st. The *cervical*, or those of the neck, of which there are seven. 2nd. The *dorsal*, or those of the back, which are twelve. 3rd. The *lumbar*, or those of the loins, consisting of five bones.

As a general description of a vertebra, each has a *body*, a *large foramen* to contain the spinal marrow, and several *processes*. By the junction of the processes and the bodies of the vetebræ, the canal is formed for the spinal marrow and its membranes. The roots of those processes, called the articular processes, are hollowed out above and below into notches; these, when the vertebræ are fitted together, form apertures on each side of the spine, through which the nerves pass out from the spinal canal.

THE VERTEBRÆ OF THE NECK.

These are smaller than the other vertebræ. Fig 29 is the third, selected as an example; *a*, the body, is longest from side to side; *b*, the *spinous process*, forked; *c*, *c*, the *transverse processes*, double, and having *d*, *d*, *circular foramina*, for the passage of the vertebral artery; *e*, *e*, the *superior;*

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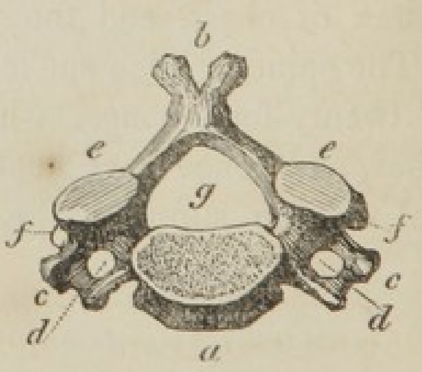

f, f, the *inferior articular* or *oblique processes; g,* the *spinal foramen,* large and triangular, and, as before stated, contributing to the formation of the canal for the spinal marrow.

THE PECULIARITIES OF THE VERTEBRÆ OF THE NECK.

FIRST VERTEBRA, OR ATLAS.

The first vertebra, which, from its use in supporting the head, has the name of *atlas,* consists of a ring of bone, as we observe in Fig. 30, the upper, Fig. 31, the lower surface. As it receives the commencement of the spinal marrow, the opening *a* is large, and in place of the body at the front it is further hollowed out at *b,* for the reception of the dentiform process of the next vetebra; *c, c,* the *superior articular processes,* irregularly oval, and concave; these articulate with corresponding processes of the skull, by which the head has the power of bending backward and forward. In Fig. 31, we observe *e, e,* the *inferior articular surfaces,* are flat, and thus adapted to the superior articular surfaces of the adjoining vertebra, allowing of a horizontal motion of the head; *d, d,* the *transverse processes,* broad, a little forked, and perforated.

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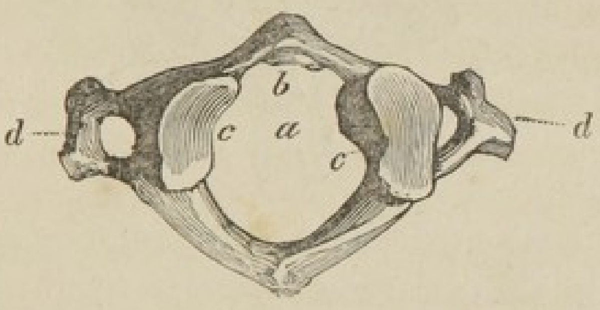

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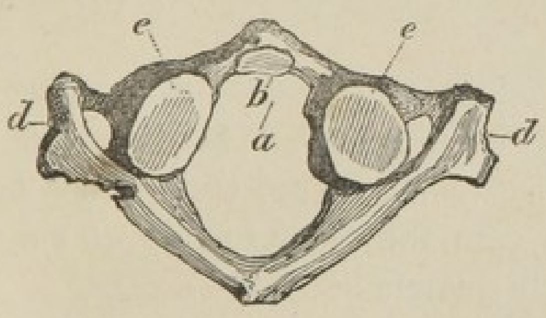

THE SECOND VERTEBRA, OR DENTATA[v].

The most remarkable characteristic of this vertebra is *a*, a projecting point called the *tooth-like* process[w], which rises from the upper part of the body, and has an articulating surface on its front, which is received into the hollow of the atlas. Fig. 32, *b*, *b*, the *superior articular processes* of the dentata, are flat,

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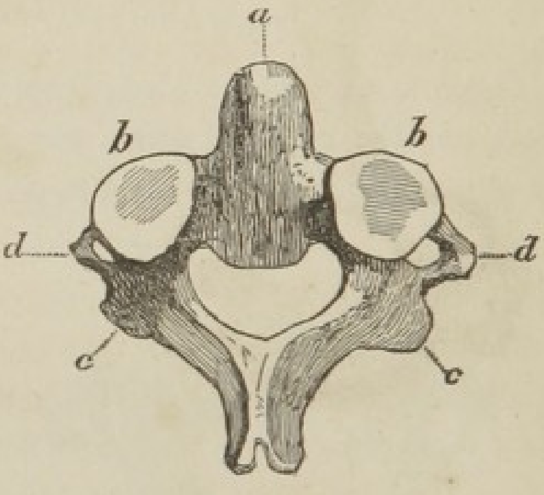

for on these planes the atlas rotates; *c*, *c*, the *inferior articular processes*; *d*, *d*, the *transverse processes*, small and single: the foramina in them are not perpendicular, but pass upwards and outwards, and the spinal foramen is large.

Thus two distinct motions are perfectly accomplished, without interfering with each other. When we nod the head, we use the joint between the head and the first bone of the neck; when we turn the head round, we use the pivot joint formed by the dentata and atlas.

v Named dentata from its projecting tooth-like process, *a*.

w Processus dentatus.

THE SEVENTH VERTEBRA OF THE NECK.

Fig. 33. The seventh vertebra is larger than the others ; it resembles in form the third, which has been given as an example and general description of a cervical vertebra. In this before us, neither *a*, *a*, the *transverse processes*, nor *c*, the *spinous process*, are double ; but the latter is so much longer than the others, that this bone has obtained the name of *vertebra prominens.*

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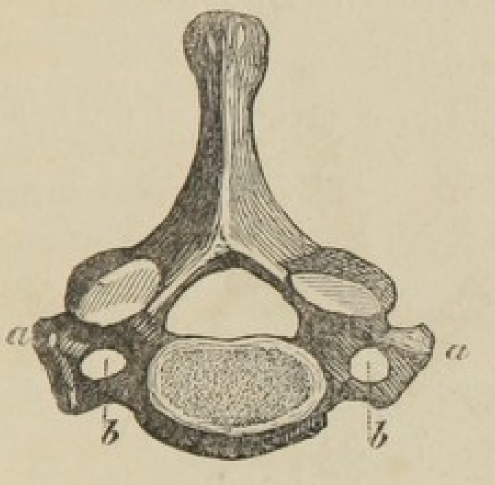

THE VERTEBRÆ OF THE BACK.

Fig. 34. The twelve vertebræ particularly belonging to the back are termed *dorsal*. They are named in numerical order, and diminish in size from the first to the fourth, from which they increase to the twelfth, which is the largest : *a*, the *body*, is longer from front to back, than transversely ; *b*, the *superior*, *c*, the *inferior articular surface*. The body somewhat flattened on either side presents small *semicircular depressions*, *d*, *e*, for receiving the heads of the ribs : *f*, the *superior articular process*, vertical, and directed back-

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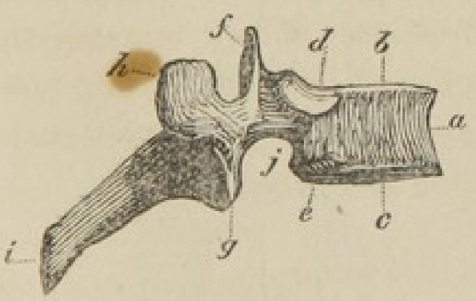

wards; *g*, the inferior articular process, directed forwards; *h*, the *transverse process*, thicker as it extends backwards; *i*, the *spinous process*, long and inclining downwards; *j*, the notch under which pass the nerves of the spinal chord.

THE VERTEBRÆ OF THE LOINS.

Fig. 35, 36.

We have here two views of a vertebra of the loins[x]; the lumbar vertebræ are the lowest five of the spine: *a*, *a*, their *bodies*, though of a circular form in front, are somewhat oblong from side to side, and larger, and of a more spongy texture, than any of the other classes: *b*, *b*, *b*, the *superior*; *c*, *c*, *c*, the *inferior articular processes*, strong and deep: the superior, concave; the inferior, convex; *d*, *d*, *d*, the *transverse processes*, are small and long; these, like bony processes in general, serve as levers for the moving powers; *e*, *e*, the *spinous processes*, strong, ho-

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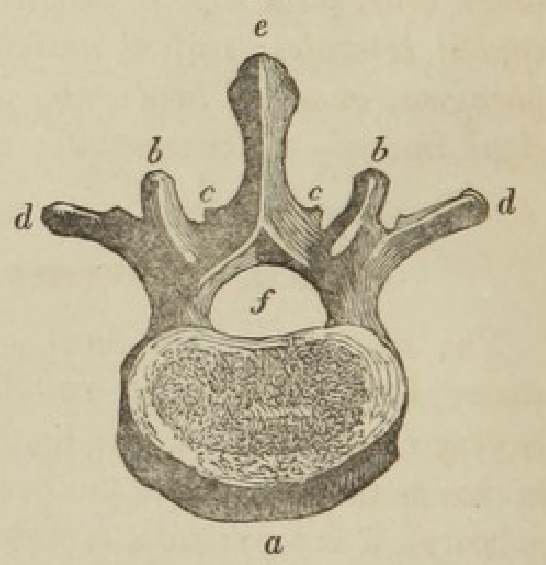

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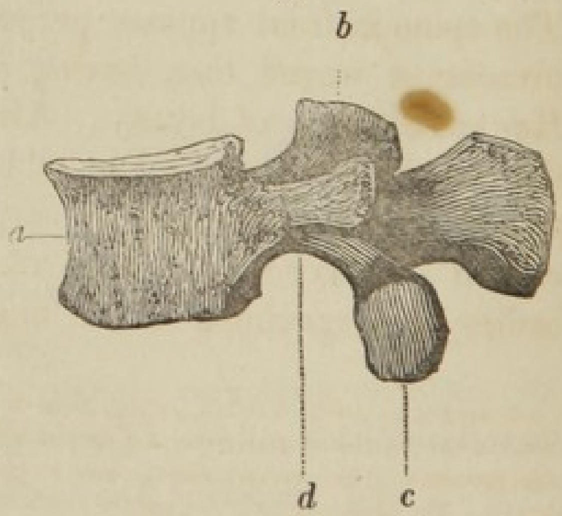

x Vertebra lumbaris.

rizontal, and flattened at the sides; *f*, the *spinal foramen.* Numerous muscles are attached to the back part of the spine, viz. the *trapezii, latissimi dorsi, rhomboidei majores et minores, levatores scapulæ, serrati postici superiores et inferiores, splenii, complexi, sacro lumbales, cervicales descendentes, trachelo mastoidei, longissimi dorsi, transversales colli, spinales et semispinales colli, recti capitis postici majores et minores, obliqui capiti superiores et inferiores, multifidi spinæ, interspinales, intertransversales, et levatores costarum;* on the fore part, *longi colli, recti capitis interni majores et minores, recti capitis laterales, scaleni antici, medii, et postici, diaphragma, quadrati lumborum, psoæ magni et parvi, obliqui interni, et transversales abdominis.*

GENERAL OBSERVATIONS ON THE SPINE.

The twenty-four vertebræ[y], united by an elastic substance, form the spine, or vertebral column: their volume is very considerable in the lumbar region, but decreasing in size as they ascend to the head, though with some irregularity: it is a pyramid, reposing its base on the sacrum, as a sort of pedestal, and having on its summit the head. The spine in front appears perpendicular; a lateral view presents a waved line, having a very near approach to HOGARTH's line of beauty. Altogether, the structure of the vertebral column is admirable, so that after an attentive examination we are not surprised that all writers on natural theology should have selected this part of animal bodies as a specimen of the most exquisite mechanism[z].

y If we find a separate vertebra, we may know to which class it belongs by the following rule, viz. the peculiar characteristic of a cervical vertebra is the perforations in the transverse processes. The dorsal are distinguished by having articular surfaces for the heads of the ribs. The lumbar by their size, and the length of the transverse processes.

z See Paxton's Paley's Nat. Theol. ch. viii.; Derham's Phys. Theol. ch. viii.

THE RIBS, *costæ*,

Are placed on each side of the vertebræ of the back, and with them form the posterior and lateral parts of the chest. They are commonly divided into seven true and five false, or into *sterno-vertebral* and *vertebral:* of these, the *sterno-vertebral* or true ribs, the seven superior, are united by means of a portion of cartilage[a] directly with the sternum; the *vertebral* or false ribs, the five inferior, are either joined by their cartilages to each other, or, as we see in the two lowermost, are totally unconnected with the sternum, and are sometimes called loose or floating ribs.

The *fourth rib* is here taken for general description. Fig. 37, the lower; Fig. 38, the upper edge. It is flat

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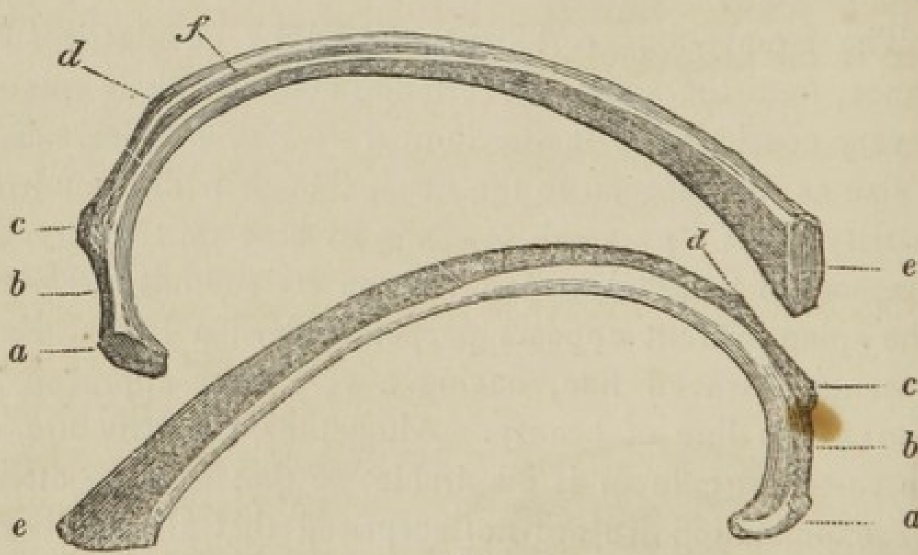

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within and without. The vertebral extremity, *a*, *a*, is called the *head*, which has an articular surface divided by a middle ridge to articulate with the bodies of the two contiguous dorsal vertebræ. The bone at *b*, *b*, is contracted, forming the *neck;* at the back of the rib is *c*, *c*,

a Gristle.

the *tubercle*, having a plain articular surface for the transverse process of the vertebra ; further outward the bone suddenly bends forward, producing *d*, *d*, the *angle*, from which proceeds the body, which in its natural situation passes forwards and downwards to *e*, *e*, the *sternal extremity*, where it has a slight oval concavity to which the cartilage adheres, and which cartilage joins the rib to the sternum or breast bone. At the under edge of each rib we find, Fig. 37, *f*, a groove for the intercostal vessels and nerves.

From the first to the seventh pair, the ribs increase in length ; this gives the chest its conical shape : from the seventh they begin to decrease in length to the twelfth, which is as short as the first : and with regard to the direction of their inclination, that of the first is nearly horizontal, whilst the lower ones dip down more and more at their points. But there are other remarkable distinctions in the first, eleventh, and twelfth ribs—as

THE FIRST RIB.

Fig. 39. The *first rib* is very short, and much curved.

39

It is flat above and below ; *a*, the *head ;* *b*, the *tubercle*, large and placed at the angle of the bone ; *c*, the *sternal extremity*, which is united to the breast bone by a short portion of cartilage at a right angle.

THE ELEVENTH AND TWELFTH RIBS.

Fig. 40. is the *twelfth rib;* the eleventh is like it, only a little longer. They do not articulate with the transverse processes of the vertebræ, and are unconnected with the breast bone. These ribs are much shorter than all the others, except the first; their heads have only single articular surfaces to join with the whole articular cavities of the two lowest dorsal vertebræ.

40

The muscles attached to the ribs are; the *pectorales majores et minores, subclavii, sterno thyroidei, scaleni antici, medii, et postici, latissimi dorsi, serrati majores antici, superiores et inferiores postici, sacro lumbales, accessorei ad sacro lumbalem, longissimi dorsi, levatores et depressores costarum, intercostales, sterno costalis, diaphragma, obliqui externi et interni, transversales, et recti abdominis, et quadrati lumborum.*

THE BREAST BONE.

The situation of the *sternum* or breast bone is well known. It is connected with the cartilages of the ribs, and with the collar bones, and is usually divided into two or three parts. In the position before us, Fig. 41, it con-

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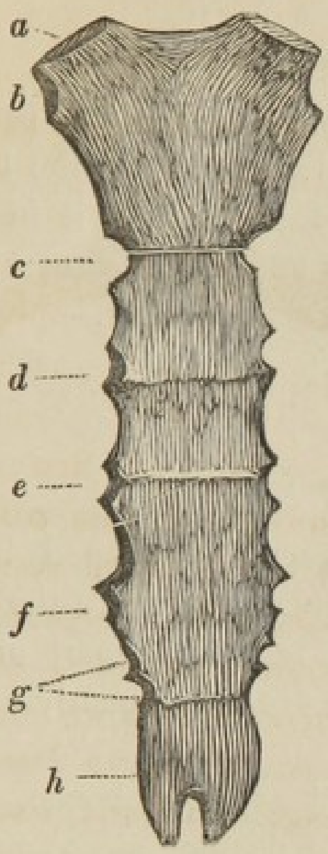

sists of two bones. The first is broad and thick above, and a little contracting as it descends. It is irregularly convex before, and concave behind. At the upper angle, *a*, the collar bone, is articulated; *b*, the articular surface for the cartilage of the first rib; *c*, the depression, which, with the depression of the second bone, form an articular surface for the cartilage of the second rib: *d*, *e*, *f*, *g*, mark the concave articular surfaces of the third, fourth, fifth, sixth, and seventh ribs; *g*, points to the two last depressions of articulation, which are contiguous.

There are transverse lines on the lower bone, which indicate its further division in early life.

h. The *ensiform cartilage*, terminates the lower extremity in the sternum. In the adult it is frequently ossified.

The sternum, ribs, and dorsal vertebræ, form the bones of the chest or thorax, the offices and uses of which are multiplied; for it is the centre of motion for directing the animated machine, protects the heart, lungs, and other important parts; but its agency in respiration must be considered its most important function. The muscles attached to the sternum are the *pectorales majores*, *sterno-cleido mastoidei*, *sterno hyoidei*, *sterno thyroidei*, *et intercostales interni*.

THE BONES OF THE PELVIS.

The large bony cavity situated at the lowest part of the trunk, by which its weight is transferred to the lower extremities, is called the *basin* or *pelvis;* for it in part contains and supports the bowels and other viscera. It consists of a pair and two or more single bones.

UNNAMED BONES. *Ossa innominata.*

The two large, broad, and irregularly shaped bones called *ossa innominata* or hip bones, constitute the fore part and sides of the bason, and the lower part of the sides of the abdomen—the upper edge is frequently called the hip.

Each bone is usually described as three bones, from its having been composed of three distinct pieces in the first period of life: these portions retain the same name though united in one solid broad bone. To obtain therefore a knowledge of the terms employed in this description, we must advert to its original construction. Fig. 42 shews the three portions united by cartilage: *a*, the *ilium ; b*, the *ischium; c*, the *os pubis ;* the subsequent description will have a reference to these terms.

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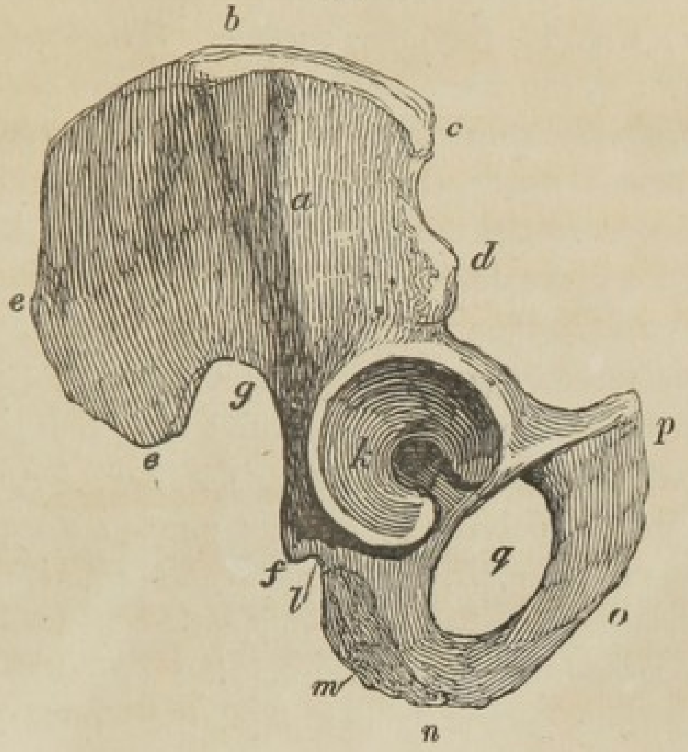

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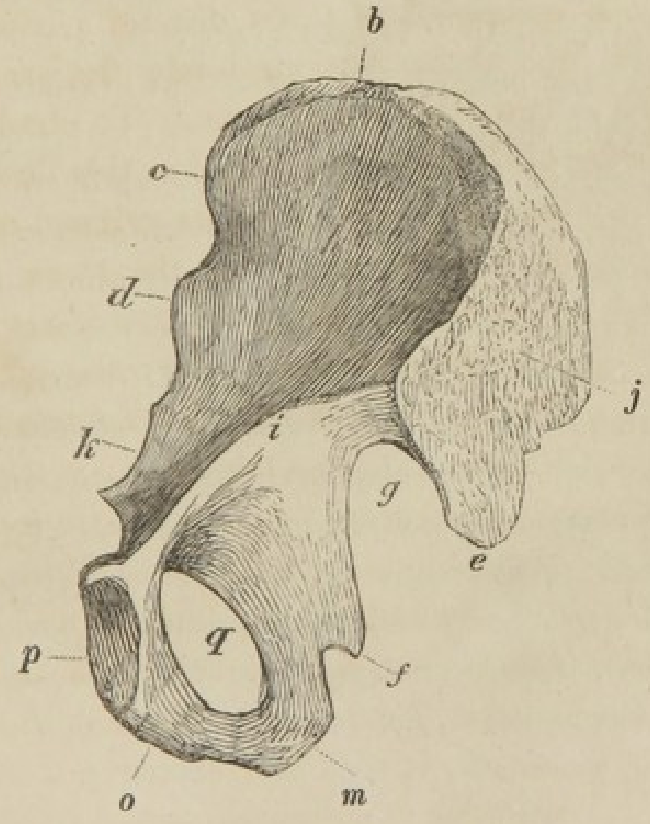

Fig. 43, the outer surface of the *hip bone* or *os innominatum;* Fig. 44, the inner surface. The letters refer to each view: *a*, the *back* of the ilium; *b*, the *crest; c*, the *anterior superior spinous process; d*, the *anterior inferior spinous process; e, e*, the *posterior superior* and *inferior spinous processes; f*, the fifth *spinous process*, but is distinguished by the term of the *ischium; g*, the *greater ischiatic notch.* The inner surface, *h*, of the os innominatum, or rather that portion of it called the ilium, is concave and smooth; *i*, an elevated line, the *linea innominata*, which, when joined to its fellow, forms part of the brim of the pelvis; *j*, a large uneven *articular surface* for the sacrum; *k*, a large and deep hollow, the socket for the head of the thigh bone, called the *acetabulum*, from its resemblance to a measuring cup used by the ancients. The margin is not perfectly circular, but appears deficient at the under part, forming a *notch*, which in the recent subject is filled up with ligament to complete the edge of the cup. In the centre of this cavity, and continued to the notch is a *depression*, to which the round ligament of the thigh bone is fixed; *l*, the lesser *ischiatic notch; m*, the *tuberosity* of the ischium; *o*, the *ramus* of the pubis; *p*, the *pubis; q*, the *obturator foramen.* The muscles attached to and covering the os innominatum, are the *psoas magnus et parvus, iliacus, levator ani, obturator internus, pyriformis, coccygeus, obliquus externus et internus, transversalis, rectus, et pyramidalis abdominis, quadratus lumborum, longissimus dorsi, sacro lumbalis, et latissimus dorsi, tensor vaginæ femoris, sartorius, gluteus maximus, medius, et minimus, rectus femoris, gemini, quadratus femoris, biceps flexor cruris, semitendinosus et semimembranosus, transversus perinæi et transversus perinæi alter, ischiocavernosus, levator ani, triceps adductor femoris, gracilis, pectineus, et obturator externus.*

OS SACRUM.

Fig. 45. The *sacrum* is the basis which supports the vertebral column.

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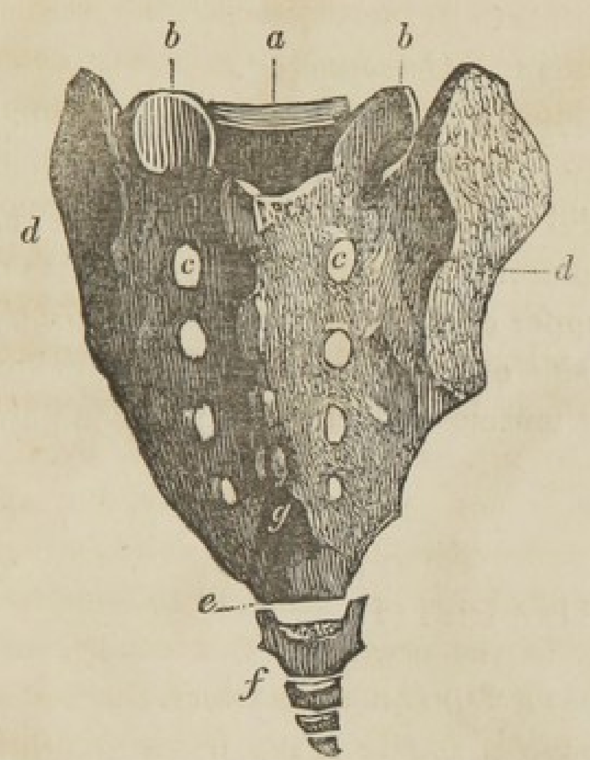

The sacrum is placed between the ossa innominata, to form the posterior part of the cavity of the pelvis. On the front and concave surface are four lines, indicating the junction of the different pieces of which it is composed during infancy[b]. Here we have a posterior view of the adult bone; *a*, the part with which the body of the last vertebra of the loins articulates, *b*, *b*, the *articular processes*, which correspond with the inferior articular processes of the lowest vertebra of the loins; *c*, *c*, the uppermost of eight foramina, called the *posterior sacral foramina*, for the passage of small nerves and vessels. Between these are four eminences, short and horizontal, forming a continuation of the line of spinous processes of the vertebræ. Above is the commencement of the *sacral canal*, terminating below at *g*; this canal receives the extremity of the spinal marrow, which in this situation is exceedingly fibrous, and from the nearly parallel disposition of the nerves that issue from it has obtained the name of *cauda equina*,

b These have been called the false vertebræ.

or horse's tail; *d*, *d*, the lateral surfaces, irregular and rough, articulating with the hip bones; *e*, an oval surface uniting with the os coccygis. The muscles attached to the sacrum are the *longissimi dorsi*, *sacro lumbales*, *multifidi spinæ*, *glutei maximi*, *pyriformes*, *et coccygei*.

THE COCCYX. *Os coccygis*[c].

The *os coccygis*, *f*, Fig. 45, is divided into several bones which are appended to the sacrum; and although in advanced age it is one solid bone, yet in the prime of life, as is represented in the present instance, it consists of four distinct bones. The upper one is united to the sacrum by a flat surface, on each side of which are projections called the cornua. The only muscles attached to this bone are the *coccygei*.

CHAP. III.

THE BONES OF THE UPPER EXTREMITY.

The upper extremity consists of the collar bone, the shoulder blade, the arm, the fore arm, and the hand.

THE COLLAR BONE, *clavicula*,

Termed *clavicle* from its resemblance to an ancient key, has a body and two extremities. Fig. 46, *a*, the *sternal*

46

c So called from its figure being somewhat like a cuckoo's beak.

extremity, presenting a triangular surface for its articulation, by means of an intervening cartilage, to the sternum; *b*, the *rhomboid process*; *c*, the *tubercle*; *d*, the *scapular* extremity, which is the flattest part of the bone, and has a narrow articular surface for the acromion of the scapula.

The muscles attached to the clavicle are six; to its under part the *pectoralis major*, *deltoides*, and *subclavius*; and to its upper part, the *trapezius*, *sterno-cleido-mastoideus*, and *sterno-hyoideus*.

The clavicle tends to prevent the arm from falling forward on the breast; and increases the sphere of action of the arm, by enabling it to describe a circle, the centre of which is the connexion of the clavicle with the shoulder.

THE SHOULDER BLADE. *Scapula.*

The scapula or shoulder blade is situated on the back and upper part of the ribs, and forms the posterior part of the shoulder. Its form is an irregular triangle; it is flat, and so very thin as to be transparent in its greatest extent. This bone is retained in its situation merely by muscles that unite it to the head, the os hyoides, the ribs, the vertebræ, and the upper arm bone; by means of these muscles it consequently has the power of moving upwards, downwards, backwards, and forwards; and by a quick succession of these motions the arm is rotated. Thus the scapula serves not only as a support, but a fulcrum for every action of the superior extremity.

Fig. 47, the front; Fig. 48, the back view.

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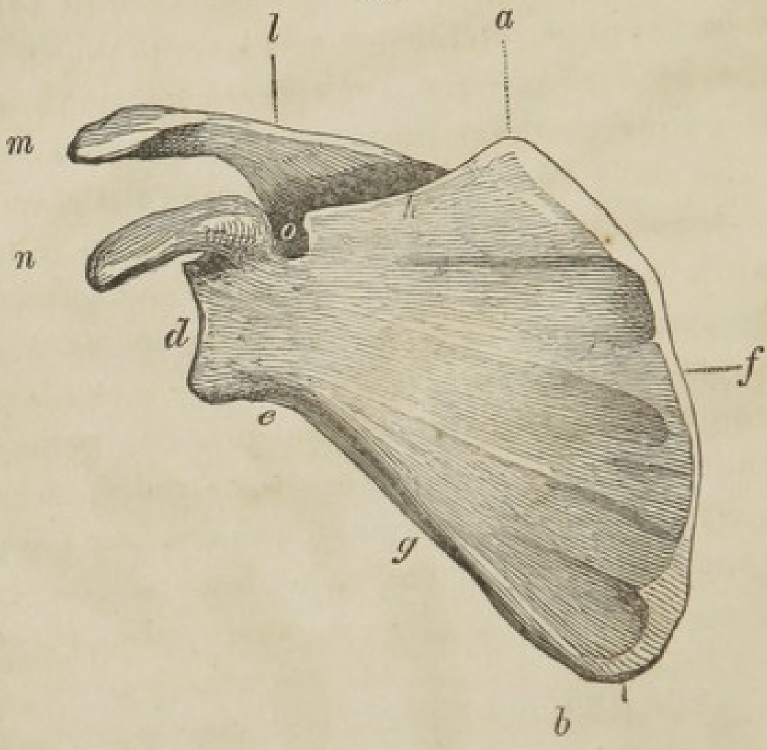

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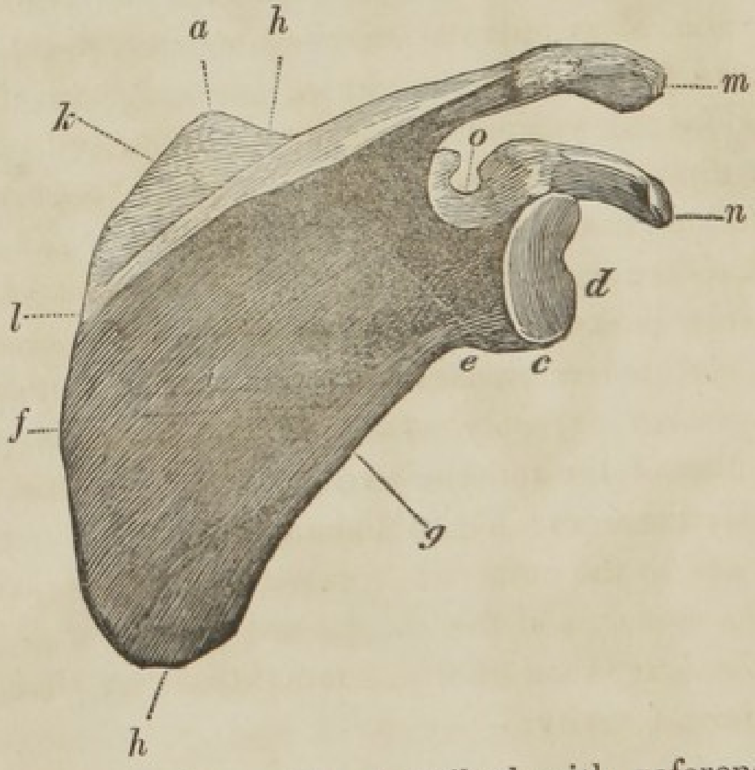


The scapula is usually described with reference to its triangular figure ; *a*, *a*, the *superior angle* ; *b*, *b*, the *infe-*

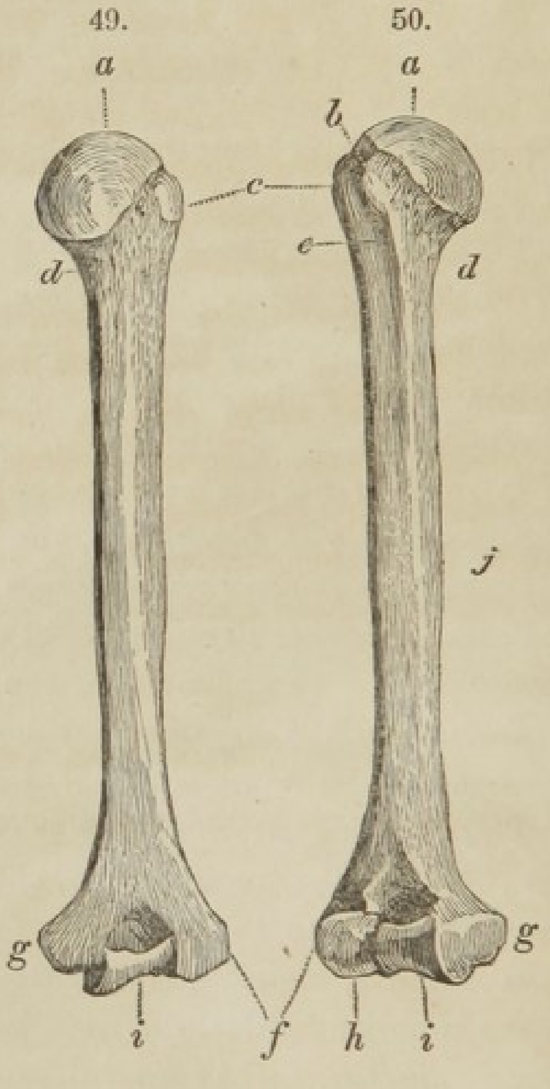
rior angle; c, the *outer angle*, having an oval concave articular surface; *d, d,* the *glenoid cavity*, or socket in which the head of the arm bone is articulated; around which the bone becomes contracted at *e, e,* forming the *neck*. The sides of the triangle are thus denominated: *f, f,* the *basis; g, g,* the *inferior border* or *costa; h, h,* the *superior border; i,* the *fossa* for the attachment of the infra-spinatus muscle: *k,* the *fossa* for the attachment of the supra-spinatus muscle; *l, l,* the commencement and course of the *spine*, terminating in a flat projection; *m, m,* the *acromion*[d], which we see extended over the glenoid cavity, protecting the joint, and forming the point of the shoulder to which the collar bone is articulated. There is another projection, *n, n,* compared to the beak of a crow, therefore termed the *coracoid process;* this also guards the shoulder joint, and with the acromion gives advantageous points of attachment to muscles which move the arm. Between the coracoid process and the superior border is *o, o,* an indentation, the *semilunar notch*, which is formed into a foramen by a ligament, and affords a passage for the supra-scapular artery, vein, and nerve.

The muscles attached to this bone are sixteen in number; viz. to the spine above, the *trapezius*, and below, the *deltoides;* to the base, the *levator scapulæ, rhomboideus minor et major*, and *serratus magnus;* to the notch in the superior border, the *omo-hyoideus;* to the foss, the *supra spinatus, infra spinatus*, and *subscapularis;* to the inferior border, the *teres minor*, and the *long head of the triceps extensor cubiti;* to the inferior angle, the *teres major;* and to the coracoid process, the *coraco-brachialis, pectoralis minor*, and the *short head of the biceps flexor cubiti*, the *long head* of which muscle has an attachment to the glenoid cavity.

[d] The point of the shoulder.

THE UPPER ARM. *Os brachii.*

The upper arm consists of a single bone, called also *os humeri*. Fig. 49 represents the back, Fig. 50 the front view; *a*, *a*, the *head*, is hemispherical, standing obliquely backwards from the bone, and when received into the glenoid cavity of the scapula constitutes a ball and socket joint; *b*, the *smaller tubercle; c*, the *greater tubercle;* they are separated by *e*, a *channel*[*] in which the tendon of the long head of the biceps muscle plays. The bone is contracted at *d*, *d*, and forms the *neck*. The body of the bone is nearly cylindrical.—The lower extremity of the bone is flattened, and constitutes with the ulna a perfect hinge joint; *f*, the *outer condyle; g*, *g*, the *inner condyle*, more projecting than the outer, as it gives attachment to the flexor muscles of the fingers. The lowest part of the bone has *two articular surfaces:* that on the outside, *h*, convex, for the head of the radius; that on the inside, *i*, concave from side to side, but convex



[*] The bicipital groove.

from back to front, for the reception of the sigmoid cavity of the ulna. Above the articulation, and in front, Fig. 49, there is a depression for the coronoid process of the ulna. Behind, Fig. 50, is another depression for the olecranon of the ulna; *j*, the *foramen for the medullary artery*, which supplies the circulation of blood to the marrow of the bone.

There are twenty-four muscles attached to the os humeri; viz. the *deltoides, supra spinatus, infra spinatus, teres minor, subscapularis, pectoralis major, latissimus dorsi, teres major, coraco brachialis, triceps extensor cubiti, brachialis internus, palmaris longus, flexor carpi radialis, flexor carpi ulnaris, flexor digitorum sublimis perforatus, flexor longus pollicis, pronator radii teres, supinator radii longus et brevis, extensor carpi radialis longior et brevior, extensor carpi ulnaris, extensor digitorum communis*, and *anconeus*.

THE FORE ARM

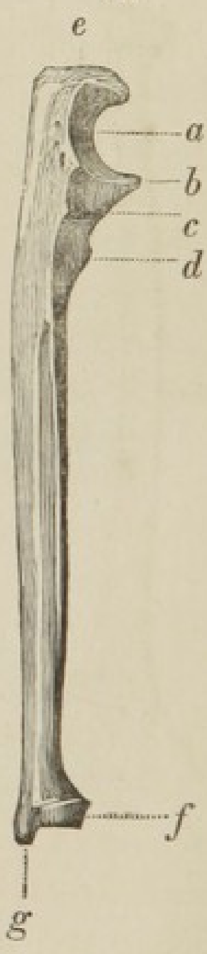
Consists of two bones, the *ulna* and *radius*.

THE ULNA OR LARGER BONE OF THE FORE ARM.

Fig. 51.

The ulna is placed on the inside of the fore arm by the side of the radius. The upper extremity is large and scooped out in front, *a*, forming the *greater sigmoid cavity;* this is the cavity which articulates with the base of the os humeri. Below, this apparent excavation is bounded by *b*, the *coronoid process*, above, by *e*, the *olecranon*, or elbow; this point serves as a lever for the extensors of the fore arm. There is a smaller concave articular surface for the head of the radius at *c*, the *lessor sigmoid cavity; d*, a small eminence, called the *tubercle.* The body or shaft of this bone is strongly marked by muscles, and by the ligament interposed between the bones. The lower end has a *rounded articular surface, f,* for the radius, and beneath a shallow cavity for an inter-articular cartilage, the medium of connection with the wrist. On the inside, its lengthened point, *g*, forms the *styloid process.*

51.

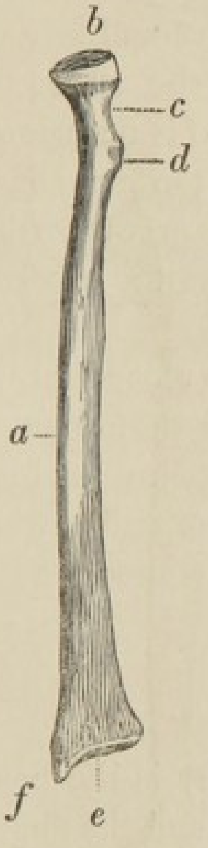


There are fourteen muscles attached to the ulna; viz. the *brachialis internus, triceps extensor cubiti, anconeus, pronator radii teres, flexor carpi radialis, flexor carpi ulnaris, flexor digitorum communis, sublimis, et profundus, pronator quadratus, extensor carpi ulnaris, extensor ossis metacarpi pollicis, extensor primi internodii pollicis,* and *indicator.*

THE RADIUS.

The *radius*, or smaller bone of the arm, is supposed to be so named from its imaginary resemblance to the spoke of a wheel, or to a measure used by the ancients. It is placed on the outside of the fore arm; *a*, the *body* of the bone, inclines to a triangular form; *b*, the upper extremity, or *head*, presents a circular cavity, articulating with the smaller condyle of the humerus; its circumference joins with, and turns in the smaller sigmoid cavity of the ulna; below, at *c*, the bone is contracted, forming a *neck*, which terminates in *d*, the *bicipital tubercle*, to which is fixed the biceps muscle. The lower end has *e*, a *superficial cavity*, articulating with the scaphoid and semilunar bones of the wrist. On the inner side there is a narrow concavity, in which the lower extremity of the ulna rotates. The extreme point, *f*, is termed the *styloid process*.

52.



There are eight muscles attached to the radius; viz. the *supinator radii longus et brevis*, *pronator teres et quadratus*, *biceps flexor cubiti*, *flexor digitorum communis sublimis*, *flexor longus*, *extensor ossis metacarpi pollicis*.

Paley has not passed unobserved the remarkable mechanical contrivance of the fore arm. For the perfect use of the fore arm two motions are wanted; a motion at the elbow backward and forward, which is called a reciprocal motion; and a rotatory motion, by which the palm of the hand, as occasion requires, may be turned upward. How is this managed? The fore arm consists of two bones lying along side each other, but touching only near the ends. One, and only one, of these bones is joined to the humerus at the elbow; the other alone to the wrist. The first, at the elbow, by means of a hinge joint, which allows of motion in the same plane, swings backward and forward, carrying along with it the other bone, and the whole fore arm. In the mean time, as often as there is occasion to turn the palm upward, the bone to which the hand is attached, rolls upon the first, by the help of a groove or hollow near the end of one bone, to which is fitted a corresponding prominence in the other.

The first is at liberty at one end, the second at the other; by which means two actions may be performed together. The os brachii may be swinging with its hinge joint at the elbow, at the very time that the radius which carries the hand, may be turning round in its groove.

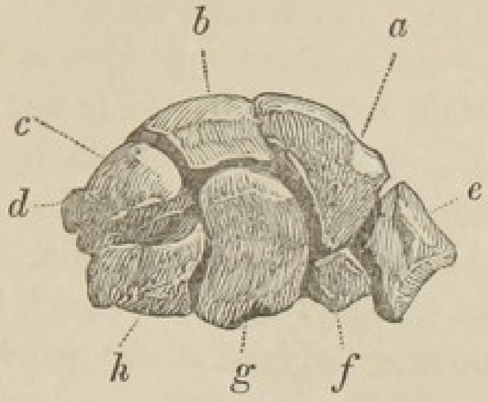
THE HAND.

The last division of the superior extremity is the hand; it includes the wrist, the palm of the hand, and the fingers.

THE BONES OF THE WRIST. *Carpus.*

The wrist or *carpus* consists of eight small bones disposed in two rows, forming an arch supported by ligaments. Fig. 53 is the back of the wrist, (as the shape of

53.



the several bones are best seen in this direction); *a*, the boat-shaped or *scaphoid bone*; *b*, the half-moon or *semi-lunar* bone; *c*, the wedge-like or *cuneiform* bone; *d*, the *pisiform bone*, from its size and figure resembling a large pea. In the second range we observe on the outside, *e*, the *trapezium*; *f*, the *trapezoid* bone: these two last are named from their figure; *g*, the large bone, *os magnum*; *h*, the *unciform bone*, named from its hook-like process, which projects into the hand. From the figure before us we may form a tolerably correct idea of their union and arrangement: on the back of the hand the wrist bones are convex, in front concave, the arch giving additional strength, while the projecting *pisiform* bone and unciform process increase the concavity for the passage of the flexor tendons of the fingers.

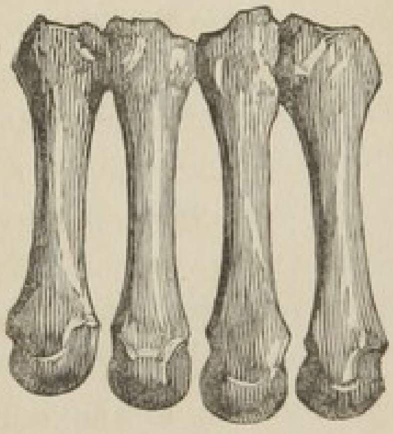
The bones of the carpus have a gentle motion on each other, and on the fingers; they also admit of a limited motion in every direction with the bones of the arm.

There are two muscles attached to the os pisiforme; viz. the *flexor carpi ulnaris*, and *abductor minimi digiti*: to the trapezium four; viz. the *flexor ossis metacarpi pollicis*, *abductor pollicis*, *abductor indicis*, and *extensor ossis metacarpi pollicis*. The only muscle attached to the trapezoid bone is the *flexor brevis pollicis*. To the os magnum also the same muscle is attached. The muscles inserted into the unciform bone are three; viz. the *flexor brevis pollicis*, *flexor proprius pollicis*, and *abductor minimi digiti*.

THE BONES OF THE PALM OF THE HAND. *Metacarpus.*

The bones called the metacarpus, Fig. 54, form the palm and back of the hand; they sustain the fingers. We observe each bone long and rounded, the ends larger than the bodies. Their upper ends have *plane surfaces* to unite with the carpus; and where the metacarpal bones are contiguous to each other, they have also flat articular surfaces; their lower ends articulate with the fingers by *convex heads,* to allow of a free motion in every direction; we have at this joint a lateral motion, as well as flexion and extension[f].

54.



There are eleven muscles attached to the metacarpal bones, viz. *seven interossei*, common to all; to that of the fore finger, the *flexor carpi radialis* and *extensor carpi radialis longior;* to that of the middle finger, the *extensor carpi radialis brevior;* and to that of the little finger, the *extensor carpi ulnaris.*

f Those anatomists who reckon five metacarpal bones include the first bone of the thumb.

THE BONES OF THE FINGERS. *Phalanges digitorum.*

55.

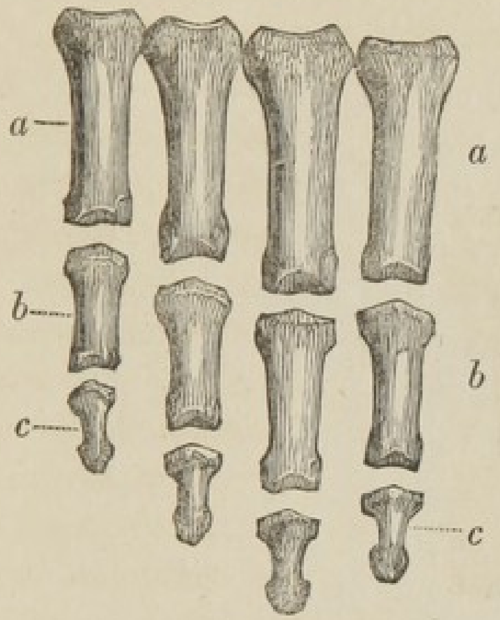


Fig. 55. The fingers consist of twelve bones, arranged in three rows, termed *phalanges*. They are rounded on the back, as we see in this figure, but flat and somewhat concave in front, as may be observed in Fig. 56.

The *first phalanx* or row, *a*, *a*, has sockets at the superior extremities to articulate with the metacarpal bones; the inferior extremity is convex from back to front, concave from side to side.

The *second phalanx*, *b*, *b*, has on the upper ends concave articular surfaces, with a little rising in the middle, dividing it into two smaller concavities, adapted to the lower extremities of the first phalanx. The lower ends of the second phalanx are similar to the lower ends of the first.

The *third phalanx*, *c*, *c*, has a joint similar to the second; their points are rough in front, but rounded at their backs to receive the nails.

There are eighteen muscles attached to the phalanges, or finger bones; viz. in front, the *flexor brevis digitorum sublimis, et profundus, flexor longus, et brevis, abductor,* *et abductor indicis, flexor proprius, et abductor minimi digiti,* four *lumbricales,* and seven *inter-ossei.* At the back the *extensor digitorum communis* and *indicator.*

THE BONES OF THE THUMB.

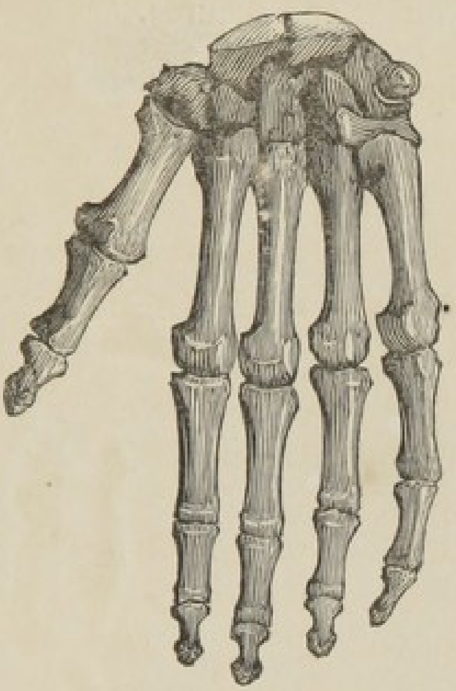
56.

The bones of the thumb, Fig. 56, *a, b, c,* very much resemble the bones of the fingers; but as the thumb is the antagonist of the fingers, it is much thicker and stronger. The first bone is connected by a double articular surface to the trapezium.

The muscles attached to the front of the thumb are the *flexor brevis et flexor ossis metacarpi pollicis, and abductor indicis;* to the back of the thumb the *extensor primi internodii pollicis.*

Fig. 57, a front view of the bones of the hand.

57.



CHAP. IV.

THE BONES OF THE LOWER EXTREMITY.

The lower extremity consists of the thigh, leg, and foot.

THE THIGH BONE. *Os femoris.*

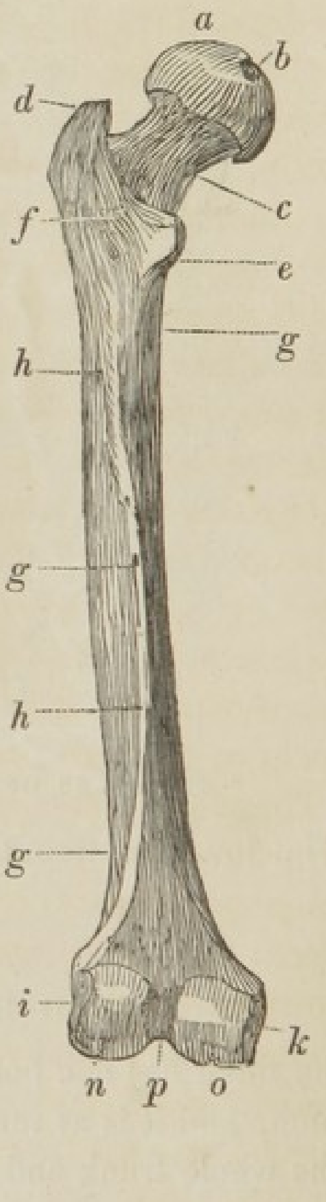
The thigh has one bone; it is the longest of the human skeleton, and it is as remarkable for its strength, supporting the whole trunk and upper extremities, and often with the addition of burdens greater than the weight of the body itself. This bone is placed obliquely[g], from the great

[g] See Tab. i, ii.

breadth of the pelvis; and this obliquity of the shaft of the bone is necessary to bring it more immediately under the centre of gravity, and to render our steps not only more direct, but more quick and secure[h].

58.

59.



[h] "Whilst a man stands on both his legs, the thigh bones are oblique to the gravitation of the body; but when one foot is raised, the whole body being then balanced on one foot, a change takes place in the position of the thigh bone, and the obliquity of that bone is dimi nished; or in other words, now that it has the whole weight to sustain, it is perpendicular under it, and has therefore acquired greater strength." *Animal Mechanics.*

Fig. 58 the front, Fig. 59 the back of the *femur* or thigh bone ; *a*, *a*, the *head* of the bone, forming the greater portion of the sphere ; it articulates with the hip, and is the most complete instance of the ball and socket joint that we can produce. Besides a surrounding ligament, common to all joints, it has an additional security in a short, strong, yet flexible ligament, inserted by one end into the ball, at the *depression*, *b*, *b*, by the other end into a cup, or acetabulum of the hip bone ; *c*, *c*, the *neck ; d*, *d*, a large process, called the *trochanter major ; e*, *e*, a smaller projection, the *trochanter minor*. The curved line at *f*, Fig. 59, the *linea quadrata*, extending from one trochanter to the other, shows the attachment of the capsular ligament, and the quadratus femoris ; *g*, *g*, the body of the bone ; *h*, *h*, a long, rough, elevated line, the *linea aspera ; i*, *i*, the *outer*, *k*, *k*, the *inner condyle ;* these have four articular surfaces : *l*, *m*, the two upper on the fore part, for the patella or kneepan ; *n*, *o*, the two lower, for the large bone of the leg. The latter articular surfaces are separated by *p*, a *deep recess*, into which the cross ligaments are inserted ; it also affords protection to the large vessels and nerves passing to the leg. The medullary artery enters at *q*, about the middle of the bone.

There are nineteen muscles attached to this bone, viz. the *gluteus medius et minimus* to the trochanter major ; the *psoas magnus* and *iliacus internus* to the trochanter minor ; the *quadratus* to the linea quadrata ; the *obturator internus et externus*, *gemini*, and *pyriformis*, to the fossa trochanterica ; the *gluteus maximus*, *pectineus*, and *triceps femoris*, *vasti*, and *biceps flexor cruris*, to the linea aspera ; the *gastrocnemii*, *plantaris*, and *popliteus*, to the condyles ; the *crureus*, *sartorious*, *gracilis*, and *tensor vaginæ femoris*, are situated on the fore part of the femur, but are not adherent to it.

THE KNEE PAN. *Patella.*

The small round bone at the knee is called *patella;* it is situated at the front of the knee joint.—Fig. 60, the *anterior surface,* convex and rough from the adhesion of the fibres of a tendon which is spread over it. Fig. 64, the *posterior surface,* which indeed is divided by a perpendicular ridge into *two slightly concave articular surfaces.* This bone gives to the tendons which bring forward the leg a very considerable mechanical advantage, by altering the line of their direction, and by advancing it farther out from the centre of motion, and this upon the principles of the resolutions of force, upon which principles all machinery is founded.

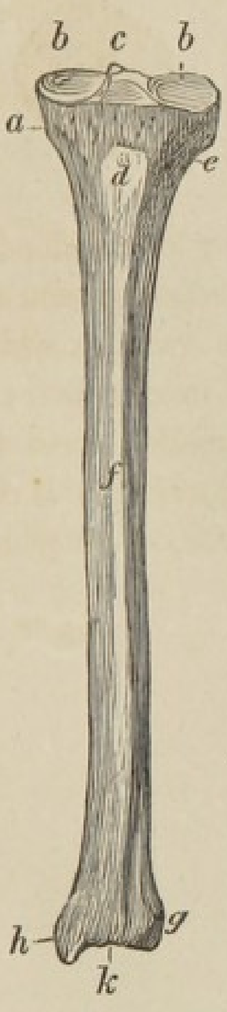
60.

61.

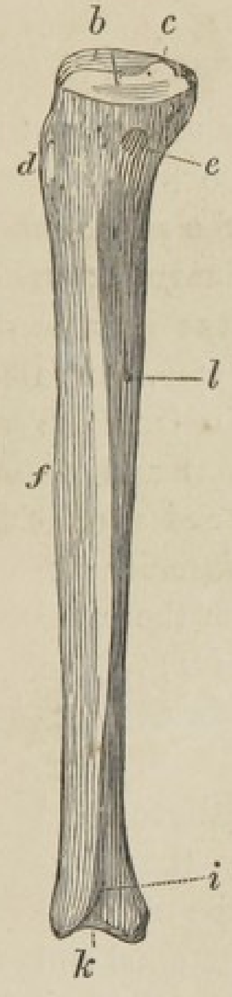
THE SHIN BONE. *Tibia.*

The tibia is the large bone of the leg, situated at the inner side; Fig. 62, the front; Fig. 63, the side view.

62.



63.



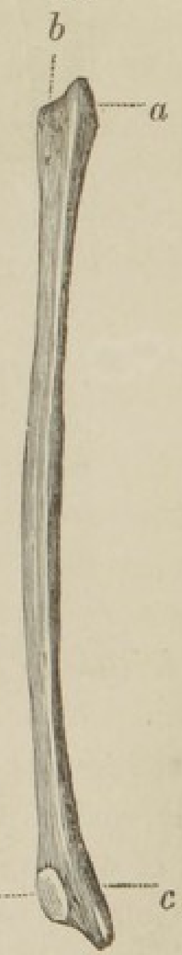
a, the *head*, having *two semicircular articular concavities*, *b*, *b*, *b*, for the condyles of the thigh bone; these concavities are separated by *c*, *c*, a middle ridge or *spine*, to which the cross ligaments of the knee are secured; *d*, *d*, the tubercle which gives attachment to the ligament of the patella; *e*, *e*, a small articular surface for the head of the fibula or small bone of the leg; *f*, *f*, the *spine* or shin; *g*, the outer side of the base, having *i*, a depression, or articular surface for the lower extremity of the fibula; *h*, the inner ankle, called the *inner malleolus*, on the under and back part of which is a groove, for the passage of the tendon of the tibialis posticus muscle; *k*, *k*, the *surface* for connecting it with the astragalus, or bone of the foot; *l*, the *foramen for the medullary artery.*

There are ten muscles attached to the tibia, viz. the *sartorius*, *gracilis*, and *semitendinosus*, immediately below the tubercle; the *semimembranosus*, to the back part of the head of this bone; the *popliteus*, *soleus*, *tibialis posticus*, and *flexor longus digitorum pedis*, to the back part of its head and body; the *tibialis anticus* and *extensor longus digitorum pedis*, are situated on the fore part of its head and body.

THE SPLINT BONE. *Fibula.*

Fig. 64. The small bone of the leg is called *fibula*, from its resemblance to the pin of a brooch; it is placed on the outside of the leg; the shape of the bone is irregularly triangular; *a*, the *head* or upper extremity: it has a smooth *articular surface* at *b*, on its inner side, to join with the tibia. The body presents several ridges and depressions for the lodgment and attachment of muscles; *c*, the *inferior* extremity, lengthened to form the outer ankle, or *external malleolus*; *d*, an oblique *articular surface*, for the outside of the astragalus.

64.



The ankle joint is strengthened and defended from injuries by those remarkable prolongations of the tibia and fibula which we name the external and internal malleoli, the outer and inner ankle. If the joint is in danger of dislocation outward, it is curbed by the inner projection, i.e. that of the tibia; if inward, by the outer projection, i.e. that of the fibula; between both it is locked in its position.

Eight muscles are inserted into this bone, viz. to the upper extremity the *biceps flexor cruris*; to the fore parts of its body the *extensor longus digitorum* and *extensor proprius pollicis pedis;* on the outside the *peroneus longus et brevis;* and behind, the *soleus, tibialis posticus,* and *flexor longus pollicis pedis.*

THE BONES OF THE FOOT.

65.

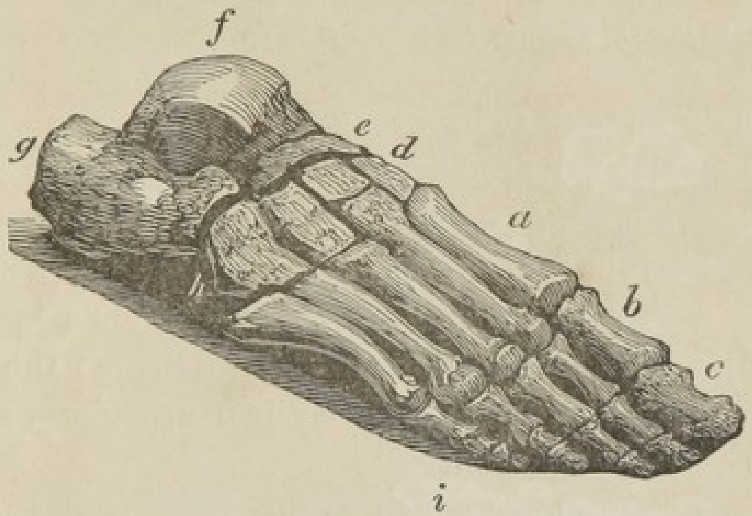


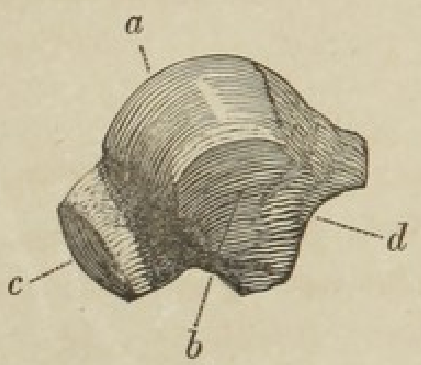
Fig. 65 is a general view of the skeleton of the foot, which consists of twenty-six bones: *d, e, f, g, h,* and two intervening bones, called the *tarsus* or instep; *a,* the *metatarsus* or middle row of bones of the foot; and *b, c, i,* the *three phalanges* of the toes. The bones of the foot somewhat resemble the hand, but they are stronger, larger, and less calculated for motion.

BONES OF THE TARSUS.

The tarsus or instep consists of seven bones, and when joined they form an arch, under which tendons, vessels, and nerves pass into the sole of the foot.

THE ASTRAGALUS.

Fig. 66.

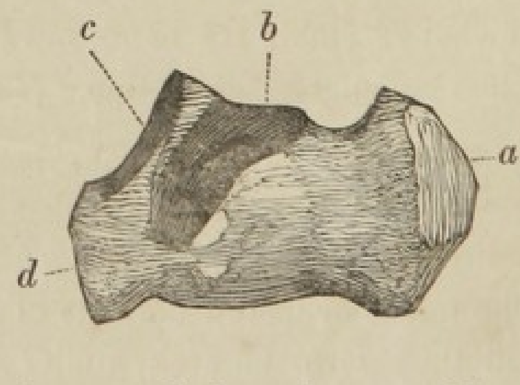


1st. The *astragalus*, so called from its resemblance to an ancient die; or rather, I am inclined to think, because a game of dice was played with the talus or hucble bone of animals, to which this corresponds. *a*, a large *articular surface*: above, it is convex from front to back, forming its largest articular surface for the base of the tibia; *b*, the *articular surface* for the lower extremity of the fibula: on the opposite side is a surface for articulating with the inner malleolus; the fore part of the bone, *c*, is rounded, to articulate with the scaphoid bone; the under part, *d*, rests on the heel bone by two articular surfaces, separated by a deep groove.

The only muscle attached to this bone is the *tibialis posticus.*

THE HEEL BONE. *Os calcis.*

Fig. 67



2d. The *os calcis* is the largest bone of the foot; *a*, the *tuberosity* or heel; on the fore part are *two articular surfaces*, at *b*, *c*, for the astragalus; *d*, an *articular surface* for the cuboid bone.

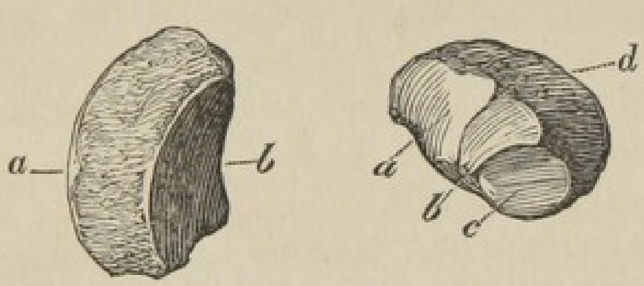
There are eleven muscles attached to the os calcis, viz.

to the upper part, the *extensor brevis digitorum pedis;* to the under part, the *abductor, flexor brevis, abductor pollicis pedis, flexor brevis digitorum, flexor digitorum accessorius,* and *abductor minimi digiti pedis;* posteriorly, the *gastrocnemii, soleus,* and *plantaris.*

THE SCAPHOID, *or navicular bone.*

3rd. The *os scaphoides,* or boat-shaped bone, is placed on the inner part of the foot, before the astragalus; at *b*

Fig. 68. Fig. 69.



it is concave, to articulate with that bone; in front, at *a,* its general aspect is convex, but its convexity is divided into *three flat articular surfaces,* for the three cuneiform bones. See Fig. 69, *a, b, c.*

The *tibialis posticus* muscle is attached to this bone.

THE CUNEIFORM BONES.

The cuneiform or wedge-like bones are three in number, denominated from their position the *inner,* the *middle,* and the *outer* cuneiform bones. They are applied to each other like the stones of an arch.

THE INNER CUNEIFORM BONE.

4th. This bone is the largest of the three; it has four articular surfaces: one behind, to form part of the articulation for the scaphoid bone; another before, with a plain articular surface for the metatarsal bone of the great toe: its outer surface, i.e. the side towards the centre of the foot, has a flat articular surface for the middle wedge-like bone, and a smaller surface for the metatarsal bone of the second toe; posteriorly, the three cuneiform bones form a cup, into which is received the rounded articular surface of the scaphoid bone; anteriorly, they join with the three large metatarsal bones, and, in consequence of the shortness of the middle cuneiform bone, they are locked together like a mortice and tenon. The middle bone articulates on the inside with the inner, and on the outside with the outer cuneiform bones; and the outer cuneiform is connected by its outer surface with the cuboid bone.

Fig. 70.

There are five muscles attached to these bones, viz. to the inner, the *tibialis anticus* and *peroneus longus;* to the outer, the *flexor brevis* and *abductor pollicis pedis;* and the *tibialis posticus* to all three bones.

THE MIDDLE CUNEIFORM BONE.

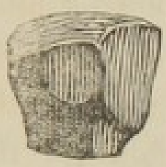
5th. This is the smallest of the cuneiform bones; it has four articular surfaces: one behind for the scaphoid bone, one before for the metatarsal bone of the second toe, and one on each side for the first and third cuneiform bones.

Fig. 71.

THE OUTER CUNEIFORM BONE.

6th. This bone has five articular surfaces: one behind for the scaphoid, one before for the third metatarsal bone, two for the inside, i.e. for the middle cuneiform and second metatarsal, and one on the outer surface for the cuboid bone.

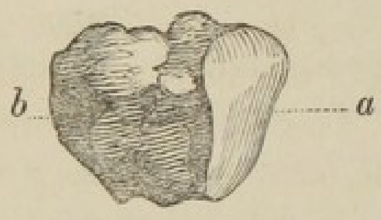
Fig. 72.



THE CUBOID BONE. *Os cuboides.*

7th. Though this bone is so named from its shape, it is a very irregular cube: it has three articular surfaces, *a*, the largest of which, is posterior, and connected to the os calcis; *b*, the anterior, for the fourth and fifth metatarsal bones; the smallest is articulated on the inner surface to the scaphoid and outer cuneiform bones. This bone is convex on its upper surface, and on the lower surface it has a deep groove, in which the tendon of the peroneous longus muscle plays.

Fig. 73.



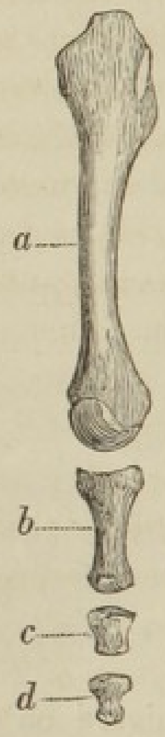
There are two muscles attached to the os cuboides, viz. the *flexor brevis minimi digiti* and *adductor pollicis pedis*.

THE METATARSAL BONES.

a. The *metatarsus* consists of five bones. Fig. 74, *a*, the first, or that of the great toe, is the largest and thickest; the other metatarsal bones are long and slender. Fig. 75, *a*, the second, is the longest; the others decrease in length to the fifth, or little toe. Each bone has flat articular surfaces to unite with the metatarsus, and a rounded articular surface for the first bone of the toe. The metatarsal bones also have flat articular surfaces at these posterior extremities for connecting them with each other.

Fig. 74.

Fig. 75.



There are fourteen muscles attached to these bones, viz. the *seven interossei* and *transversalis pedis*, common to all; the *tibialis anticus* and *peroneus longus* are attached to the first metatarsal bone; the *adductor pollicis pedis* to the second; the *peroneus brevis*, *adductor*, and *flexor brevis minimi digiti*, to the fifth.

BONES OF THE TOES.

There are fourteen bones of the toes: two to the great toe, Fig. 74, *b, c;* three to each of the other toes, Fig. 75, *b, c, d;* their division and arrangement are similar to that of the fingers.

There are nineteen muscles attached to the phalanges of the toes, viz. on the upper surface the *extensor proprius pollicis* and *extensor longus, et brevis digitorum pedis*, and *seven interossei*. On the lower surface, the *flexor longus et brevis*, and *abductor pollicis*, the *flexor longus et brevis digitorum pedis*, and *four lumbricales.*

SESAMOID BONES[i].

Besides the bones we have described, there are others seldom preserved in the skeleton: such are the *sesamoid bones*, which are very small, and found at the roots of the first joint of the thumb and of the great toe. These are under or rather in the flexor tendons: they serve as pulleys for increasing the angle of insertion, therefore add considerably to the force of the muscles, and protect the articulations.

These bones give insertion to the *flexor brevis pollicis manus*, and to the *flexor brevis, abductor, et abductor pollicis pedis.*

i Because they resemble the grains of *sesamum*, or Indian corn. This term occurs in several parts of descriptive anatomy. "Sesamoid bones are sometimes found at the origin of the gastrocnemii muscles, and occasionally they are connected with the ossa pubis." MONRO.

THE TONGUE BONE. *Os hyoides.*

76.

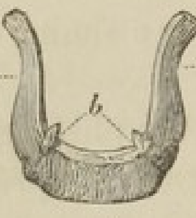


Fig. 76. There is another bone not immediately connected with the skeleton, situated at the root of the tongue, the *os hyoides*[j]. It serves for the attachment of the muscles of the tongue, and of deglutition; *a*, *a*, the *great cornua*; *b*, the *smaller cornua*; *c*, the *basis*.

The os hyoides is not immediately connected with any other bone, but is kept in its situation by numerous muscles and ligaments.

There are ten muscles attached to this bone, viz. the *hyo-glossus*, *constrictor pharyngeus medius*, *sterno-hyoideus*, *omo-hyoideus*, *stylo-hyoideus*, *genio-hyoideus*, *thyro-hyoideus*, *genio-hyo-glossus*, *digastricus*, and the *mylo hyoideus*.

j So called from its resembling the Greek letter υ.

CHAP. V.

THE TEETH.

The teeth are the most solid parts of the body; in their formation they bear a certain analogy to the horns of animals, and thus differ in many respects from the bones. Some anatomists have described them as an appendage to the skin, since they are, in fact, exterior to it, and are exposed in a great part of their surface to the contact of the air, and to the mechanical and chemical action of bodies. The greater part of their surface is inclosed in alveoli or sockets, which tightly embrace them, and form the articulation termed gomphosis. That part which is thus contained in the socket is named the *root;* the middle, which is somewhat contracted, is the *neck;* and all above, the *crown.* All the teeth have a form more or less elongated, terminating in a pointed manner, and in this point or end of the root is a small hole. This opening leads to the *hollow of the tooth*, or *dental cavity*, an excavation which extends from the point of the root to the crown; and this cavity represents the form of the tooth, and lodges its ves sels and nerves.

The teeth, when all are developed, are thirty-two in number, sixteen in each jaw.

STRUCTURE OF THE TEETH.

They are formed of two substances: one exterior, called *enamel;* the other interior, and of the same texture as bones.

ENAMEL OF THE TEETH.

The enamel is only found round the crown of the tooth; it covers the whole surface of the crown, is moulded exactly upon it, and thus represents all its inequalities. It is thickest on that surface where trituration takes place, and diminishes in this respect towards the neck. This disposition is a protection to the surface which is most worn in mastication. The fibres of the enamel are small, parallel to each other, and perpendicular to the surface of the tooth; by this arrangement the enamel is not liable to scale off, and is better calculated to resist attrition. In Fig. 77, may be seen the enamel, marked *a*, and extending to *b*.

THE OSSEOUS SUBSTANCE OF THE TEETH.

This forms the most considerable portion of the tooth, as the whole of the root and the interior of the crown. It is composed of an exceedingly dense and compact tissue, bearing an analogy to ivory; for it has no cancelli, and its fibres, when seen by the assistance of a microscope, appear concentric, parallel to the surface of the tooth.

By chemical analysis, the osseous substance gives nearly the same results as the other bones, with the exception of a small quantity of fluate of lime.

Like the medullary organs of bones, the central part of the teeth contains a soft spongy substance, formed by a network of vessels and nerves. The vessels are derived from the internal maxillary artery; the nerves, from the second and third branches of the fifth pair. Fig. 77, is a section of an incisor and molar tooth, showing the cavity which contain the nerve and vessels marked *c*, *c*.

77.

CLASSES OF TEETH.

The teeth are divided into three classes: incisors, canine teeth, and grinders.

INCISORS.

The front or cutting teeth are eight in number, four in each jaw. They vary from the others in the form of the crown, which is like a wedge. They are convex in front, concave posteriorly. The layer of enamel which covers the crown is thinner behind than in front. The roots of these teeth are always single, very long, and of a conical form, slightly compressed at the sides, and a little thicker before than behind.

Fig. 78, shews a front, and Fig. 79, the profile of an incisor. The lower incisors are smaller than the upper, their roots larger, and laterally more compressed, sometimes deeply furrowed.

78. 79.

CANINE TEETH.

These are called also *cuspidati*, from their being spear-pointed. There are two in each jaw, placed next in order at the sides of the incisors. They have each but one root, which is longer than the corresponding portion of any of the other teeth. Fig. 80, the front, Fig. 81, the profile. The canine teeth of the upper have longer roots than those of the lower, and are vulgarly called eye-teeth, and those of the lower jaw stomach-teeth.

80. 81.

THE GRINDERS,

Or *molar teeth*, are twenty in number, ten in each jaw, five on each side.

The two first pairs of grinders are called *bicuspidati*. Their crown is surmounted by two conical tubercles; the root is generally simple, but has a well-defined groove on each of its lateral surfaces. Fig. 82, a front view, and Fig. 83, the profile of a small grinder.

82.

83.

The next three, which terminate the row, are called *multicuspidati*. They are remarkable for their great size, and on the surface of their crown are four pyramidal tubercles, separated by very distinct grooves; their root is divided into two, three, four, or five parts or fangs, each of which presents an aperture for the passage of the dental nerve and vessels. Fig. 84, a view of a large grinder. The root of the last grinder *(dens sapientiæ)* in the lower jaw is simple, short, and conical; but in the upper jaw it is generally divided into four short roots.

84.

OF THE FORMATION OF THE TEETH.

The teeth are formed in a manner different from that of any other part of the body, and their development presents many remarkable phenomena.

Before they are visible, they are formed in the interior of the maxillary bones. They are developed in small rounded sacs, which sacs are composed of two membranes; both these membranes are vascular, according to Meckel and Fox, but the external is the more so. The internal membrane is the firmest, but thinner than the external;

its connexions with the teeth are more intimate, for strictly speaking, this is the formative organ. The dental vessels branch out on it; and when it is injected, it appears entirely red. The external is of a more spongy, looser, softer, and thicker texture, than the internal; it is continuous with the gums, lines the interior of the alveoli, and forms their periosteum.

At the first, these small sacs inclose a reddish fluid simply; but at about the fourth month of pregnancy, there appears from the base of the internal membrane a small body, which is vascular and soft. This is the germ, or pulp of the tooth. Numerous nerves and vessels, supplied by the internal membrane, ramify in this pulp, which gradually assumes the appearance of a tooth, this being the nucleus around which a tooth is moulded.

The ossification of the tooth commences about the middle term of pregnancy, and begins on as many points of the pulp as the future tooth will have eminences on its surface; thus the incisores and cuspidati commence with one point, and the molares with several. The several points increase until they come in contact, then the tooth grows as an entire body. The pulp elongates at its base to form the root. In those teeth which have only one root, a conical shell of bone is formed around the pulp, which continues to increase in length in proportion as the ossification advances; while in those which have several roots, a division of the pulp takes place at this part into a corresponding number of processes.

The outer lamina of bone is first completed; and then lamina after lamina is deposited, one within the other, the pulp still receding, until at length there remains only the permanent cavity of the tooth, lined with its proper membrane, and filled with the remaining portion of the pulp, which now serves as the bed upon which the vessels and nerves ramify previously to their entering the bony substance of the tooth.

The secretion of the enamel begins shortly after the development of the bony matter; this substance is secreted by the internal face of the internal capsule which envelopes the crown of the tooth, so that it is moulded exactly to the projections and depressions on that part. The fluid which is poured out from this internal membrane is thickish, and it is soon consolidated into a dark chalky substance, which afterwards becomes white and hardened by more perfect crystallization. This is the enamel; but at an early period this enamel is not very hard, and can be easily separated, and can in its perfect state be readily detached by heat. The glandular apparatus which forms this substance is not demonstrable.

OF THE DECIDUOUS TEETH.

Infants have teeth which are the deciduous or milk teeth, twenty in number, ten in each jaw, five on each side, viz. two incisors, one cuspidatus, and two molares. These commence to appear ordinarily about the sixth month, and generally in pairs, those of the lower jaws first, and then the similar ones in the upper; and the whole twenty appear at about the thirtieth month.

OF THE PERMANENT TEETH.

The deciduous teeth drop from the gums, and are followed by the permanent; and the whole process of dentition is not completed until about the age of twenty years, the last appearing being the dentes sapientiæ. These permanent teeth are developed, and appear nearly in the same order as the milk teeth.

Nature has limited the duration of life in the teeth more than in the other bones. The power of nutrition becomes gradually enfeebled in these organs, and they perish by their nutritious foramina being obliterated. Being no longer retained in their alveoli by any organic connection, they become loose and fall out; their sockets are absorbed. But the tone of the stomach being weakened naturally at this advanced period of life, man is thereby reduced to feed upon soft substances, accommodated to the languid state of the gastric powers and the loss of the teeth.

CHAP. VI.

THE MEDULLARY SYSTEM,

OR THE MARROW OF BONES.

I shall first describe the deposition of marrow occupying the cellular structure of the short and flat bones, and the extremities of the long bones. The medullary membrane of this structure appears to be a continuation and expansion of the vessels that penetrate the foramina, and which, on reaching the internal surface of the spongy part of the bone, ramify ad infinitum, and unite a thousand different ways. Their interweavings give to the interior of the cellular tissue its peculiar florid aspect, which is more evident as we examine it nearer to the period of infancy, because the vascular system of bones is then very conspicuous, while it gradually contracts and fades away as age advances[k].

This vascular extension can be distinctly seen in the injected bone, forming, as it were, a membrane throughout the innumerable cellulæ of the bone; and the exhalation of the medullary fluid or marrow, which fills the interstices I have just mentioned, seems to proceed from this vascular network.

The medullary system of the middle of long bones, whose largest cavity it fills, somewhat differs from the preceding, in having less vascularity; while a thin trans-

k The blood vessels of bones are much more numerous than we should expect from their colour, for the earth of the bone conceals them; and hence they are not apparent even after being filled with a red injection, until by immersion in diluted muriatic acid the earth of the bone has been destroyed. When a bone has been thus prepared, and put into oil of turpentine, its vascularity is shown to great advantage.

parent membrane lines the whole cavity, and is repeatedly folded upon itself, giving rise to numerous extensions, some of which surround the very minute filaments of the cancelli of the sides of the cavity, others pass from the one side of the membrane to the other without adhering to any ossified portion, the whole of which forms spherical cells filled with marrow, and when viewed through a microscope resembles a cluster of pearls.

The medullary system of bones, in a healthy state, possesses little sensibility, or only such a degree of organic sensibility as is indispensable to its functions. As a proof of this, the marrow may be irritated in a living animal without any sign of feeling being expressed. The sawing of the skull with the trephine, and the division of the bone in amputations, are not attended with pain.

Marrow, according to BERZELIUS, is a species of fixed oil, possessing peculiar properties, and something like butter. It consists of the following ingredients:

Pure marrow or fixed oil	0.96
Skin and blood vessels	0.01
Albumen Gelatine Extractive Peculiar matter }	0.03
Water	1.03

The use of the marrow in bones, I believe to be the same as the use of the fat in or about other parts of the human body, viz. it is a mere deposit of superfluous nutritious matter.

ART. II.

CHAP. I.

CARTILAGINOUS SYSTEM, OR THE GRISTLE OF BONES, ETC.

In order to render the motions of the bones on each other more easy, the ends are incrusted with a substance of a white or pearly colour, hard, yet very elastic. This is a peculiar substance found in various parts of the body, especially on the articular surfaces of bones, the end of the nose, the edges of the eye-lids, the ear, the wind-pipe and air passages, the ends of the ribs, etc. Cartilage forms a considerable share of those parts where flexibility and firmness are to a certain degree combined, in order that the organ may, after being bent, recover its determined form.

The cartilaginous tissue is a network of fibres, so closely interwoven that at first sight it appears completely homogeneous, and formed of a mass of albumen without any particular order or direction; however, a more attentive examination will discover longitudinal fibres, crossed by others in a transverse direction. The fibrous arrangements of the cartilage of joints are perpendicular to the surface of the joint, and after maceration for six or eight weeks, may be observed to be placed at right angles in respect to the bone to which they are united.

The surfaces of cartilage which are in contact are finely polished, that by its smoothness it may facilitate the sliding motion of the two bones on each other. The elasticity reflects a considerable part of the motion, which by a little yielding becomes extended, and thus moderates the effects of violent shocks to which the limbs are often liable in active exertions.

The elasticity of cartilage is very conspicuous, particularly in youth and adult age. If the blade of a scalpel is thrust into cartilage, the two edges of the division will re-act upon it, and repel the instrument; when pressed it becomes flattened, but resumes its primitive shape as soon as the cause of compression is removed. Thus has nature placed cartilages where, to answer particular purposes, it is requisite that a physical property should be united to the vital powers, as in the larynx; and in the nasal partition, to produce a kind of vibration in the passage of air; at the end of the ribs, to maintain that kind of contortion indispensable to mechanical respiration; and in the articular extremities, to resist the effects of external violence, for in those situations they serve as a kind of elastic cushions, yielding on compression, and regaining their form on that compression being removed.

During life this elasticity of cartilage is most apparent, although it remains after death.

The cartilages are divided into *articular*, *interarticular*, *connecting cartilages*, and *cartilages of particular cavities.*

Articular cartilages cover the surfaces of bones in the moveable joints.

Interarticular cartilages are interposed between the ends of bones to form a moveable socket, which, like the friction wheels of machinery, aid the motion of the joint.

Connecting cartilages unite the articular surfaces of bones by an immoveable union, as in the sutures of the skull, the connections of the bones of the pelvis, etc.

Cartilages of cavities are such as form the larynx, trachea, part of the nose, etc.

The number and the thickness of cartilages interposed between each bone, renders the acts of running, jumping, and performing other feats of activity, much more easy.

Severe blows on the ribs do not break them, for their cartilaginous extremities recoil, and yield to the violence; as, however, in age the quantity of cartilage diminishes, and some cartilages entirely disappear, so the bones lose that elastic medium, their extremities are unyielding and inelastic, and any degree of violence is frequently attended with fracture. For instance, a child falling twice its height, from the elasticity of its frame would receive little or no injury; the condition of old age is very different: the bones are consolidated, and a fall of the same nature might prove the most disastrous.

The blood-vessels, nerves, and absorbent vessels of cartilage, are so small as to elude observation; but there cannot be a doubt of their existence, of which there is the clearest evidence from the phenomena of its inflammation and absorption in disease; but in its natural state its vitality is very obscure, sensibility and contractility being such only as are necessary for its growth and nutrition. When divided, if the edges be brought into contact, after a length of time re-union will take place, as I have observed in wounds of the cartilage of the nose and of the ear.

ART. III.

CHAP. I.

FIBROUS SYSTEM.

All the fibrous organs are absolutely of a similar nature, and the same fibres contribute to the composition of all the forms; yet, in their arrangement, they vary in an astonishing degree; and it is the variety in their form, situation, and office, that has caused them to be denominated and designated by the names of tendons, aponeuroses, ligaments, etc.

The fibrous parts of the human system everywhere display a whitish, or shining silvery appearance. The basis is a dense fibre of a peculiar nature, rather elastic, insensible, hardly admitting of contractility, sometimes arranged in juxta-position, and assembled together in bundles parallel to each other, as in the tendons and ligaments; at other times they are intersected and spread out in sheets, the fibrous web of which turns in diversified directions, as in the membranes, the capsules, the fibrous sheaths, etc.

The strength of the fibrous tissue renders every organ it composes fitted to sustain the utmost efforts its uses require. Thus the ligaments strongly retain the articular surfaces in apposition. The aponeuroses prevent the displacement of the muscles, and give attachment to their fibres. The tendons, incessantly exposed to the contraction of the muscles, are placed between the power they conduct and their attachments, offering a resistance that frequently proves stronger than the bone itself. For by muscular exertions the patella, the olecranon, and the os calcis, have been sometimes fractured.

The several forms of the fibrous membranes are—

1st. Those which include the periosteum, the dura mater, the tunica sclerotica, the tunica albuginea, the proper membranes of the kidneys, spleen, etc. They are generally intended to cover certain organs, to the texture of which they contribute.

2nd. The fibrous capsules, very different, as will be shown, from the synovial surfaces, are a kind of cylindrical bags that are found around some articulations, especially round those of the humerus and the femur, where they are connected with the scapula and ilium, inclosing both their articular surfaces.

3rd. The fibrous sheaths are intended to confine the tendons in their situation, particularly on their passing over the bones, where they undergo flexion, as in the fingers and toes; for without this contrivance they would be liable to deviate, and thus transmit but imperfectly muscular motion. The fibrous sheaths have been divided into two species: those which confine a number of tendons, as at the wrist, instep, etc. others, like those of the fingers, are intended for an isolated tendon, or for the reception of two only.

4th. The aponeuroses are a kind of fibrous canvass, more or less extended, and always connected with locomotion, and disposed in such a manner that they sometimes form coverings for different parts, at other times they provide the muscles with points of insertion.

The fibrous organs formed in fasciculi are—

1st. The tendons found at the extremities, or in the centre of muscles; these are either single, in the form of extended strings, or compound, as in the rectus femoris, flexors, etc.

2nd. The ligaments which secure the articulations, round which they are placed; these are formed of regular fasciculi, as the ligaments of the jaw, elbow, knee, etc. or of irregular fasciculi, as those of the ribs, pelvis, etc.

CHAP. II.

PERICHONDRIUM.

This is a membrane perfectly similar to the periosteum; it covers the cartilages in the same manner, and serves the same general purposes to cartilage as the periosteum does to bone. The perichondrium of the larynx, the ribs, etc. is a thin tissue of fibres, intersected in every direction, is highly vascular, and can be injected. But the vessels of this membrane, where it covers the articular surfaces, cannot be demonstrated; indeed, it adheres so closely as to appear like the cartilage itself, although it can be proved to be a reflection of the synovial membrane of the joint.

CHAP. III.

THE LIGAMENTS.

The ligaments are that apparatus which connects the articular ends of the bones and cartilages, by which they are all united into one admirable structure, the individual parts of which are firmly maintained in such particular relative situations as are best calculated to admit with safety the numerous motions that are required.

The bones are united by strong investing membranes, and by flexible and elastic bands, composed of dense fibres intimately interwoven with each other, and passing in different directions, the greater number of which pass in direct lines between the parts which the ligaments connect. The ligaments then may be described as an assemblage of strong fibres, firmly joining together the articular surfaces of bones, and giving that security which will prevent displacement, and yet such a latitude of motion as will admit of the easy movement of one bone on the other.

The ligaments receive their supply of blood from the vessels in their immediate vicinity; they possess but a very small share of elasticity, and in a sound state are nearly destitute of sensibility. Bichat asserts that no nerves can be discovered in them; but Dr. Monro traced them distinctly into their substance, and we know under diseased excitement they are extremely sensible.

CAPSULAR LIGAMENTS.

I have mentioned the periosteum as covering the bone: the same periosteum, as it were, is continued over the joint, and forms a loose bag termed the *capsular ligament*, which contains the glairy fluid[1] with which the joint is lubricated. The capsular ligaments are strengthened by the addition of irregular fasciculi of fibres which cross over the joints in different directions ; not to mention that the further security of the joint is provided for by the muscles and tendons which pass over it.

LATERAL LIGAMENTS.

These ligaments are strong skeins of fibres, firmly united to the periosteum, and passing from one extremity of bone to another, and are always found in the hinge-like joints. The lateral ligaments moderate, and in some measure limit, the movements of the joint.

LIGAMENTS WITHIN THE JOINTS.

These ligaments are for giving additional strength, and regulating the movements of certain articulations, as the round ligament of the hip, and the cross ligaments of the knee.

These are the principal species of ligaments of the body ; there are, however, others that unite the bones which do not move on each other, as the os sacrum and os innominatum. There is also an elastic substance, which is an antagonist to the muscles, and by which they are restored to their original situation, or supported in it. These sometimes form part of the muscles ; thus the head is supported by a strong elastic ligament appended to the muscles of

1 The synovial membrane which produces this fluid must be distinguished from the capsular ligament. The former is allied by structure and function to the serous membranes, the latter to the fibrous.

the back. In those animals which have long necks, this is particularly strong, as in the ox and the horse ; for the head acting at the end of a long lever, could not be supported for any length of time, or would be in danger of dislocation, were it not for this elastic tape, which supports the head without the expense of muscular power. Those ligaments usually denominated *interosseous ligaments*, placed between the radius and ulna, tibia and fibula, etc. are simply aponeurotic membranes, serving for the attachment of muscles ; and thus supplying the place of bones, save an unnecessary weight and incumbrance.

CHAP. IV.

PARTICULAR LIGAMENTS.

LIGAMENTS OF THE HEAD.

These may be divided into two classes : the first connects the lower jaw to the temporal bones ; the second, the head to the neck.

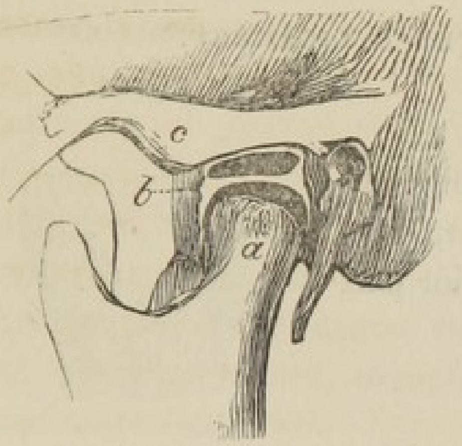
LIGAMENTS OF THE LOWER JAW.

The condyles of the jaw are fixed to the articular cavities of the temporal bone by a capsular and two lateral ligaments, with the addition of an interarticular cartilage.

CAPSULAR LIGAMENT.

The capsular ligament consists of dense fibres, which are superiorly attached to *c*, the margin of the zygomatic eminence, and to the fissure in the glenoid cavity. It is again attached to the edge of *b*, the interarticular cartilage, and inserted inferiorly at *a* into the neck of the condyle of the lower jaw. Fig. 82 exhibits a section of the joint.

82.

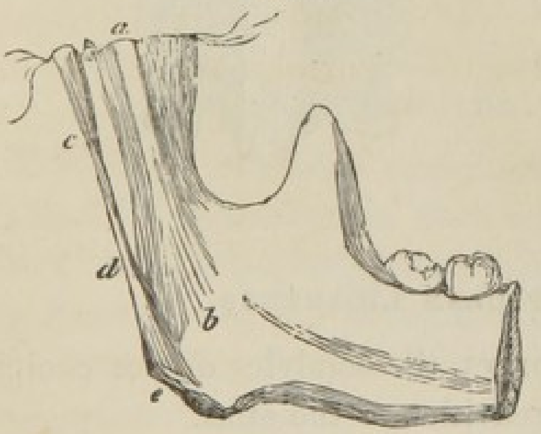


INTERARTICULAR CARTILAGE.

This cartilage, *b*, forms a sort of moveable cover over each condyle of the jaw, separating the capsule into two parts, by its circumference adhering strongly to it.

INTERNAL LATERAL LIGAMENT.

Fig. 83.



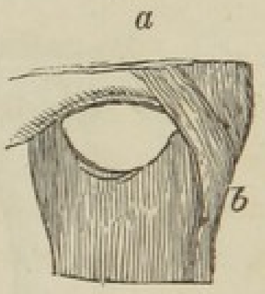
This ligament is attached above at *a*, the edge of the glenoid cavity; below at *b*, the margin of the posterior dental foramen, in the ramus of the jaw.

STYLO-MAXILLARY LIGAMENT.

This ligament is extended from *c*, the styloid process of the temporal bone, to *e*, the angle of the jaw.

EXTERNAL LATERAL LIGAMENT.

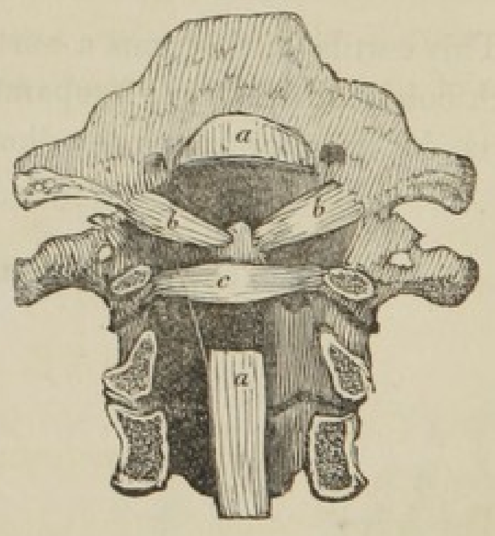
Fig. 84.



This ligament passes obliquely across the capsular ligament, from *a*, the zygoma, to the posterior part of *b*, the neck of the jaw.

LIGAMENTS CONNECTING THE HEAD AND NECK.

Fig. 85.



The ligaments connecting the head to the neck may be arranged as follows:—the capsular, perpendicular, and lateral ligaments.

TWO CAPSULAR LIGAMENTS.

These ligaments connect the condyles of the occipital bone to the articulating cavities of the atlas.

ANTERIOR PERPENDICULAR LIGAMENT.

A broad ligament attached superiorly to the anterior edge of the foramen magnum, and inferiorly to the ring of the atlas; its fibres extend some distance down the cervical vertebræ.

POSTERIOR PERPENDICULAR LIGAMENT.

A broad and strong ligament, extending from the posterior edge of the occipital foramen to the upper vertebræ of the neck. Its direction and attachments are shown in Fig. 85, from *a* to *a*, though a part of it is removed to show other ligaments.

TWO LATERAL LIGAMENTS.

These ligaments, Fig. 85, *b*, *b*, are seen extending from the margin of the occipital foramen to the odontoid process of the dentata or second vertebræ.

CHAP. V.

LIGAMENTS OF THE VERTEBRÆ.

The spinal column is composed of numerous bones, so wonderfully connected to each other, that motion is permitted to a requisite extent, without the safety of the spinal marrow, or the strength of the column, being in the least impaired. Several ligaments are required to effect these important purposes: these differ from each other in form and in use: some are common to all the vertebræ, others are confined to two of them, others again are peculiar to the cervical vertebræ.

LIGAMENTS OF THE SECOND VERTEBRA.

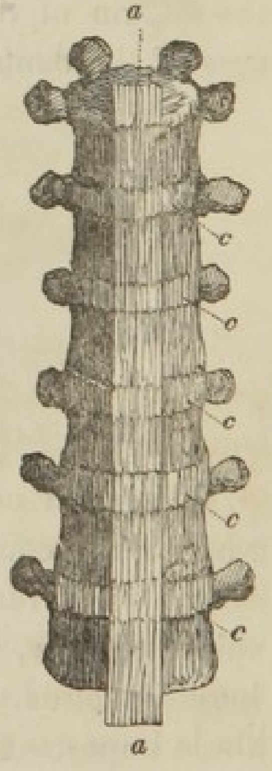
TRANSVERSE LIGAMENT.

This is a strong fasciculus of ligamentous fibres, Fig. 85, *c*, extending from one side of the articular process of the atlas to the opposite side; it is narrow at the extremities, but wide in the centre, where it is almost of a cartilaginous hardness. This ligament secures the odontoid process in its proper place, and prevents the possibility of its pressure on the spinal chord.

LIGAMENTS COMMON TO ALL THE VERTEBRÆ.

ANTERIOR COMMON LIGAMENT.

Fig. 86.

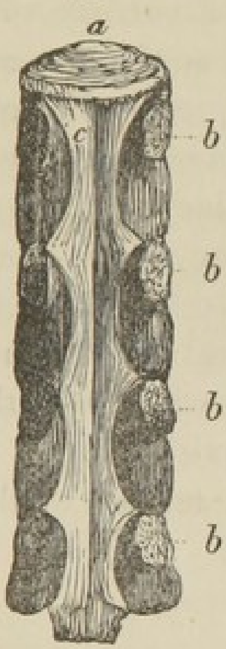


This is a smooth, resplendent, broad ligament, *a*, *a*, which extends along the anterior convex surface of all the vertebræ. This ligament is composed of parallel fasciculi, which, however, seldom extend beyond two or three vertebræ, where one set terminates and another commences; thus its entire extent receives an access of fibres from almost every vertebra it covers. It is attached only to the anterior part of the spinal column, though occasionally it sends off small oblique processes, which are lost on its sides. A profile of this ligament is seen in Fig. 91, *c*.

POSTERIOR COMMON LIGAMENT.

This is somewhat similar to the anterior, except that it passes along the inner concave part of the bodies of the vertebræ, and terminates at the sacrum; *a*, the intervertebral fibro-cartilage, cut transversely; *b*, *b*, *b*, *b*, the part from which the arch of the spinal canal is removed; *c*, *c*, the *posterior vertebral ligament*, situated behind the bodies of the vertebræ, smooth and resplendent, broader on a level with each fibro-cartilage than with the body of the vertebra.

87.



There are numerous short and strong igamentous fibres crossing each other obliquely, joining the vertebræ together upon the outer edges of the vertebral substance, called by Fyfe, *crucial intervertebral ligaments.*

INTERVERTEBRAL LIGAMENT.

Fig. 86, *c*, *c*, *c*, *c*, *c*.

There is placed between the bodies of the vertebræ a peculiar substance, described by most authors as a texture between cartilage and ligament, partaking of the property of both, hence sometimes very properly called *intervertebral fibro-cartilage.* It is composed of white shining fibres, arranged in laminæ of different thicknesses, but in very regular order. If this substance is divided by a horizontal section, its fibrous structure is very distinctly seen, the laminæ running in regular concentric circles, or rather the circle is a little concave posteriorly, corresponding to the form of the articular surface of the bodies of the vertebræ. Although the external laminæ are of a cartilaginous firmness, and offering great resistance on pressure, the internal laminæ are more soft and delicate, and at a greater distance from each other, in the interstices of which there is a peculiar substance, not so firm as cartilage, nor quite so soft as gelatin. The smaller circles of fibres are gradually softer in their texture as they approach the centre, where nothing is seen except a nucleus of semi-liquid or mucous form. Thus each vertebra resting on a sort of fluid fulcrum, or pivot, the motion to either side is easy, and quickly performed. The motions of the back bone or bones, therefore, are performed on an almost fluid centre, surrounded by a perfectly elastic medium, which remarkable union of flat surfaces admits of the requisite degree of motion, and prevents injury to the delicate texture of the spinal chord and brain in violent exercise.

LIGAMENTA SUBFLAVA.

These ligaments are of a pale yellow colour; they are attached superiorly and inferiorly to the opposite margins of the arch of the spinous processes of the vertebræ, completing those deficiencies of the spinal canal which are observed in the skeleton at the posterior part of the spine, and extending as far forwards as the oblique processes, the articulations of which they strengthen. These ligaments possess great elasticity, yet resist too much flexion of the vertebral column.

INTERSPINOUS LIGAMENTS.

88.

The interspinous ligaments, Fig. 88, *b*, *b*, *b*, are attached to the upper and lower margins of each spinous process. Like the interosseous membranes of the fore arm and leg, they present an extensive surface for the attachment of muscles, and connect one spinous process with another.

SUPRASPINOUS LIGAMENTS.

The supraspinous ligaments, Fig. 88, *a*, *a*, are extended from the point of one spinous process to that of another, in the whole line from the seventh cervical vertebra to the sacrum.

LIGAMENTS OF THE OBLIQUE PROCESS.

The articulations of the oblique articular processes of the vertebræ are secured by a strong capsular ligament, composed of short fibres, which permit but little motion, except between the first and second vertebra, the articular processes of which are very large, and the ligament allows of a considerable rotatory motion.

CHAP. VI.

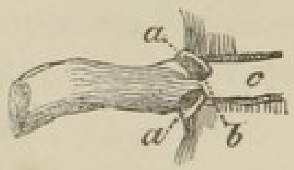
LIGAMENTS OF THE THORAX.

LIGAMENTS OF THE RIBS WITH THE VERTEBRÆ.

CAPSULAR LIGAMENTS.

The capsular ligaments are attached to the heads of the ribs; and as there are two articular surfaces to the head of each rib, so there are two regular capsular ligaments, which are opened in the figure, *a, a;* their fibres are radiated, one portion of its fasciculi being extended to the vertebra above, another to that below. The fibres of the capsule extend along the bone for some way, and mix with their anterior common ligament. The back of the rib is articulated to the transverse process; consequently there is a *capsular ligament* belonging to this joint also.

Fig. 89.

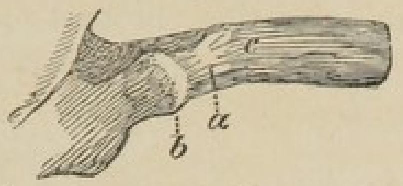


INTERARTICULAR LIGAMENT.

The interarticular ligament, Fig. 89, *b*, is fixed to the central projecting angle on the head of each rib, connecting it to the intervertebral substance. This ligament has no existence in the first and two last ribs: as the capsular ligaments are single, each has but one articular surface on its head, and is connected with one vertebra only.

MIDDLE TRANSVERSE LIGAMENT.

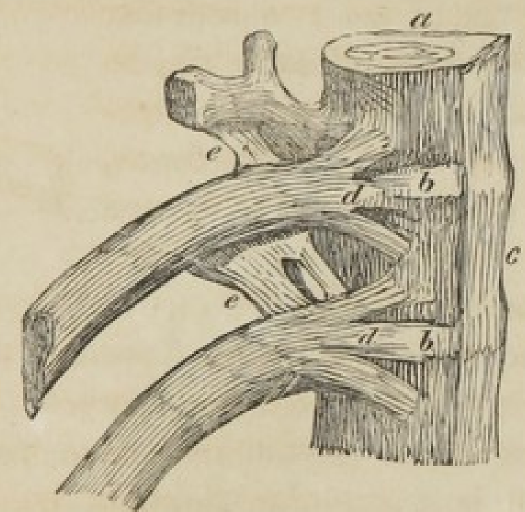
Fig. 90.



This ligament, *a*, consists of irregular fasciculi of fibres, which occupy the interval between the rib at *c*, and the anterior surface of the corresponding transverse process at *b*. It cannot be well seen until the rib is forcibly separated from its attachments.

INFERIOR TRANSVERSE LIGAMENT.

Fig. 91.



This ligament, *e*, *e*, is composed of two fasciculi, the one extending from the lower edge of the transverse process of the vertebra to the upper edge of the rib above, near its articulation with the body of the vertebra. The other fasciculus is smaller, and is attached to the base of the transverse process, and is extended to the head of the rib beneath.

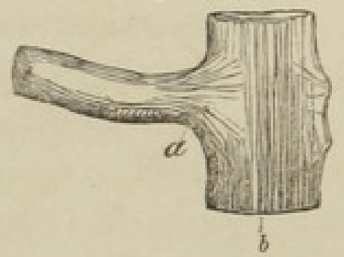
ANTERIOR OR RADIATED LIGAMENT.

This ligament, Fig. 91, *d*, *d*, is formed of three flat fibrous fasciculi, which are fixed separately to the two vertebræ, and to *b*, the fibro-cartilage; these strongly secure the rib, by converging and attaching themselves to its head and neck. The eleventh and twelfth ribs, however, in this situation, present only a single order of fibres.

LIGAMENTS OF THE CARTILAGES OF THE RIBS WITH THE STERNUM.

The cartilages of the seven superior ribs are joined to *b*, the sternum, by strong ligamentous bands at *a*, which cover the synovial membranes; although this articulation has but a very obscure motion, it has a regular socket and capsule. These cartilages are united to the ribs by symphysis, or an immoveable articulation.

Fig. 92.



The upper part of the sternum receives some ligamentous fibres from its articulations with the clavicles. The sternum is also covered, both on its anterior and posterior surfaces, by a strong aponeurosis, which is inseparably connected to the periosteum; its fibres are very conspicuous anteriorly, and resemble tendinous bands, taking a longitudinal direction, and uniting those portions of the bone which in young persons it is found to consist of.

Some fasciculi extend beyond the margins of the sternum, and are attached to the cartilages of the ribs. The aponeurosis which covers the internal surface of this bone is more smooth and polished, and its fibres take a longitudinal course.

The xiphoid or ensiform cartilage is connected to the sternum by the above-mentioned aponeurosis, and has radiated ligamentous fasciculi connecting it with that bone, and with the cartilage of the seventh rib.

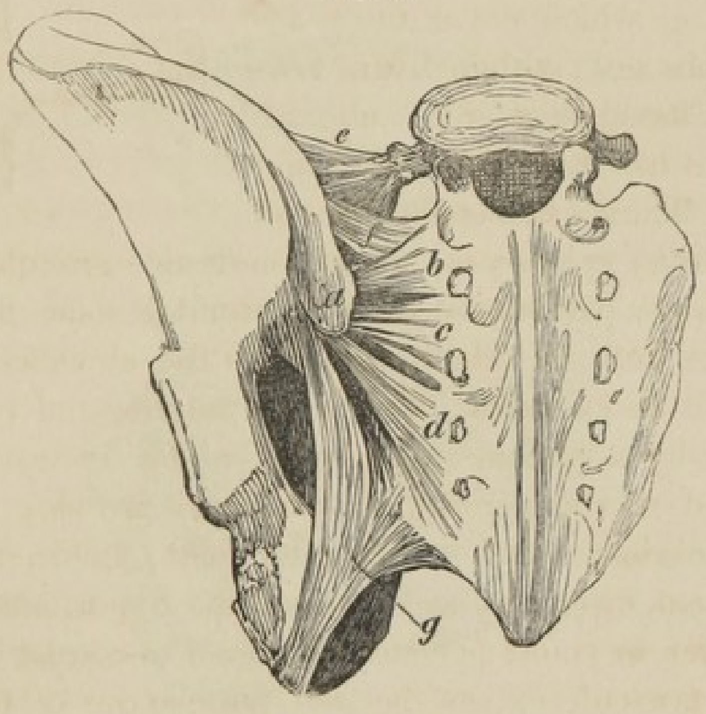
CHAP. VII.

LIGAMENTS OF THE PELVIS.

These consist of the ligaments connecting the ossa innominata, the sacrum, and coccyx.

LONG POSTERIOR LIGAMENT OF THE ILIUM.

Fig. 93.



This ligament is attached outwardly at *a* to the posterior superior spine of the ilium, descends obliquely inwards, and is inserted at *d* into the third and fourth transverse tubercles of the sacrum; *g*, the great sacro-sciatic ligament.

SHORT POSTERIOR LIGAMENT.

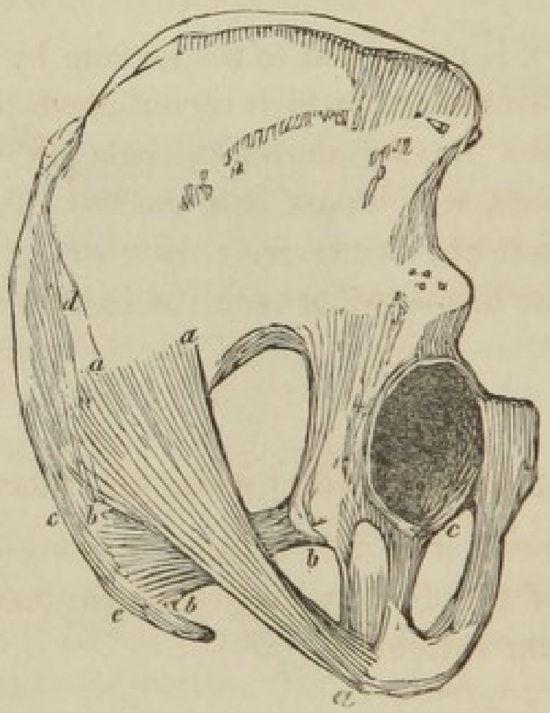
This ligament is attached inwardly in common with the preceding, and extends to the third tubercle of the sacrum at *c*.

POSTERIOR LATERAL LIGAMENT.

This is a narrow ligament, extending from the internal surface of the same spinous process of the ilium at *a*, to the lower margin of the first division of the sacrum, *b*.

GREAT SACRO-SCIATIC LIGAMENT.

Fig. 94.



This ligament is situated at the lower and posterior part of the pelvis; it is of a triangular form, attached superiorly at *a*, *a*, the posterior and inferior iliac spine, to the fourth and fifth tubercles of the sacrum, to the lower portion of this bone and to the coccyx. The fibres converge, and pass obliquely outwards and downwards to be inferiorly attached at *a*, the tuber ischii.

SMALLER SACRO-SCIATIC LIGAMENT.

This ligament is attached inwardly at *b*, *b*, to the margin of *e*, *e*, the sacrum and coccyx; its converging fibres are outwardly inserted at *b*, into the spinous process of the ischium. The figure shows the crossing of the sacro-sciatic ligaments about their centre, giving great support to the contents of the pelvis; these ligaments also give attachment to some fibres of the levator ani and coccygeus muscles.

The coccyx is connected to the sacrum by a strong tendinous aponeurosis, *e*, *e*, which is continued down from the tendons of the lumbar muscles; beneath this are two strong ligaments, which pass from the last spinous tubercle of the sacrum to the first bone of the coccyx; and there is also a capsular ligament between the sacrum and coccyx.

SUPERIOR ILIO-LUMBAR LIGAMENT.

This ligament, Fig. 93, *e*, runs transversely from the upper edge of the ilium to the transverse processes of the two last lumbar vertebræ.

INFERIOR ILIO-LUMBAR LIGAMENT.

This ligament, *f*, is situated immediately below the former, runs the same course, and has nearly the same attachments.

ILIO-SACRAL LIGAMENTS.

The anterior part of the surface of the sacrum and ilium are mutually connected by cartilage, the posterior by strong ligaments, which pass in every direction from one bone to the other. This synchondrosis in front, and syndesmosis behind, is so very strong, as to prevent any motion between the ilium and sacrum.

SYMPHYSIS OF THE OSSA PUBIS.

The fibro-cartilaginous connection of these bones consists of concentric layers, which unite the two oval surfaces which the ossa ilii present anteriorly, and they are further secured by strong ligamentous fibres, crossing from one side to the other; an examination of which must lead us to deny the possibility of any separation taking place in parturition.

MEMBRANE OF THE THYROID FORAMEN.

This is a fine, smooth, tense membrane, attached to the circumference of this opening; it consists of two laminæ, the use of which is to give origin to the external and internal obturator muscles.

LIGAMENT OF FALLOPIUS OR POUPART.

This has been considered as a tendon at the inferior border of the external oblique muscle; it may, however, be strictly considered as a distinct ligament, extending from the anterior superior spinous process of the ilium to the ossa pubis. To its upper edge the abdominal muscles are attached, and to its lower the fascia lata of the thigh. It is subtended like a cord across the cavity between the spine of the ilium and the pubis, thus protecting the femoral vessels and nerves as they leave the pelvis along with the psoas and iliac muscles.

CHAP. VIII.

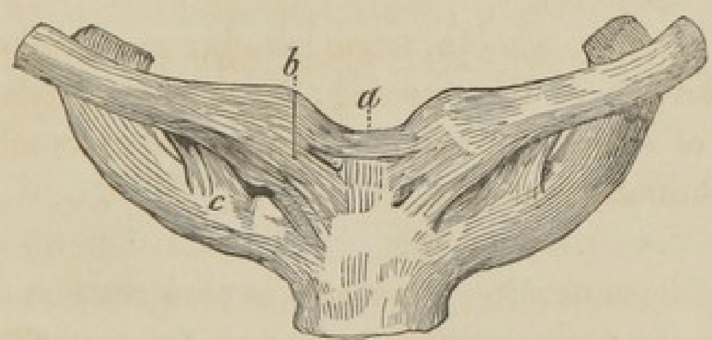
LIGAMENTS OF THE SUPERIOR EXTREMITIES.

Under this head I shall describe the ligaments of the clavicle, shoulder, arm, fore-arm, wrist, and hand.

LIGAMENTS OF THE CLAVICLE.

INTERCLAVICULAR LIGAMENT.

Fig. 95.



The interclavicular ligament, *a*, is a fasciculus of strong ligamentous fibres, extending in a transverse direction above the sternum, from one clavicle to the other, connecting them together, and attaching those bones to the sternum.

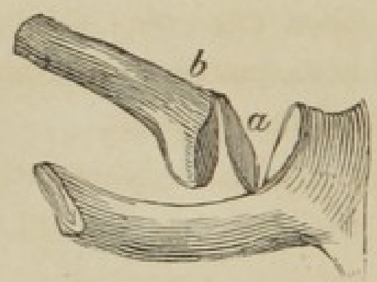
STERNO-CLAVICULAR LIGAMENT.

This ligament, *b*, forms an imperfect capsule, its fibres extending over the articulation from the triangular or sternal end of the clavicle, to the anterior and posterior surfaces of the sternum; a few fibres are also attached to the first rib.

INTERARTICULAR CARTILAGE.

This is an apparatus similar to the articulation of the jaw; it is a moveable cartilage, *a*, thick at its circumference, and thin in the centre, adapting the extremity of one bone to the other. It is fixed at one edge to *b*, the clavicle; and the capsular ligament is adherent to the root of the border. In the figure this ligament is cut, and the bones separated, to exhibit the cartilage.

Fig. 96.



COSTO-CLAVICULAR LIGAMENT.

The chasm between the clavicle and first rib is closed by this ligament, Fig. 95, *c*. It is of a rhomboid figure, extending from the inferior surface of the clavicle near its sternal end, to the upper and anterior part of the cartilage of the first rib. Some fibres also adhere to the interarticular cartilage.

ACROMIO-CLAVICULAR LIGAMENT.

This ligament, Fig. 97, *f*, is attached to the superior and outer rough surface of the clavicle, extending a considerable length, to connect the corresponding surface of the acromion scapulæ.

CORACO-CLAVICULAR LIGAMENT.

This ligament, *d*, is very strong, and is formed by a conoid fasciculus of diverging fibres fixed to the tuberosity on the outer extremity of the inferior surface of the clavicle, and is extended to the internal part of *b*, the coracoid process of the scapula.

LIGAMENTS OF THE SCAPULA.

ACROMIO-CORACOID LIGAMENT.

This ligament, *e*, is attached to the superior convex surface of *b*, the coracoid process; its fibres, which are thick and strong, ascend obliquely outwards, and are inserted into *f*, the inferior surface of the acromion scapulæ.

CORACOID LIGAMENT.

This is merely a ligamentous chord, *g*, extended over the semilunar notch so as to convert the latter into a foramen. The supra-scapular vessels and nerves pass under this ligament.

LIGAMENTS BETWEEN THE SCAPULA AND HUMERUS.

CAPSULAR LIGAMENT.

Fig. 97.

This ligament, *h*, consists of an oblong sac, surrounding the neck of the scapula, and inclosing the head of the humerus; the capsule is perforated by *i*, the long tendon of the biceps muscle passing through it, i.e. between the fibrous and synovial membrane, to be attached to the edge of the glenoid cavity of the scapula.

ACCESSORY LIGAMENT.

The accessory ligament is formed of a strong fasciculus attached to the coracoid process of the scapula, and directing itself forwards and outwards; it is expanded over the upper and anterior part of the joint, giving the capsule additional strength.

The capsular ligament forms but a loose and weak connection between the humerus and shoulder, were it not for the several muscles whose tendons adhere to and strengthen it; the infra-spinatus and teres minor by their united tendons cover it externally, the supra-spinatus superiorly, and the subscapularis internally; in addition to these muscles, the deltoid, the coraco-brachialis, and biceps, all co-operate in no small degree to strengthen the connection between these two bones.

There is a fibro-cartilaginous rim which increases the depth of the glenoid cavity of the scapula, termed by CLOQUET the *glenoid ligament;* although I consider it merely a cartilaginous border to the socket of the scapula, not only useful in rendering the socket deeper, but for preventing fractures of the rim in robust exercises, to which, were it bony, it would be very liable.

LIGAMENTS BETWEEN THE HUMERUS ANE BONES OF THE ARM.

CAPSULAR LIGAMENT.

The capsular ligament, *a*, envelopes the entire articulation of the elbow joint; on the posterior surface of the humerus it is attached to the margin of the great sigmoid notch which receives the ulna, and passing obliquely downwards beneath the condyles, round to the fore part of the bone, descends to the ulna; it is inserted into the olecranon process, into the margin of the sigmoid cavity, and into the orbicular ligament which connects the radius to the ulna. Externally this capsule is rough, and strengthened by bands which run in irregular directions; internally it is lined by the smooth synovial membrane. It is very loose anteriorly and posteriorly, to

Fig. 98.

admit of a free flexion and extension; but on either side it is tense, and strengthened by lateral ligaments, which prevent any lateral motion.

EXTERNAL LATERAL LIGAMENT.

This ligament, Fig. 98, *e*, is attached to the most prominent point of the external condyle, and descending expands itself so as to be inserted into *f*, the orbicular ligament, and not into the radius: the rotatory motion of the fore arm on the humerus is thus permitted.

INTERNAL LATERAL LIGAMENT.

This ligament, *b*, is longer and broader than the preceding, and extends from the internal condyle of the humerus, in a radiated direction, to the inside of the coronoid process of the ulna; a few fibres descend a little backwards, and are attached to the margin of the olecranon. The lateral ligaments adhere so firmly to the capsular, that they appear to form part of its texture.

Fig. 99.

The two ligaments called the *anterior* and the *posterior*, are both thin and irregular fibrous bands, the one placed in front and the other behind the articulation; the former is fixed in front of the internal condyle of the humerus, and to the annular ligament of the radius; the latter to the posterior part of the external and internal condyles of the humerus.

LIGAMENTS BETWEEN THE RADIUS AND ULNA.

SUPERIOR ARTICULATION.

ORBICULAR LIGAMENT.

This ligament, Fig. 98, *f*, surrounds the upper extremity of the radius, and with the small sigmoid cavity forms a sort of ring, in which the radius turns with ease. The superior margin is attached to the capsular ligament, the inferior to the neck of the radius. Its use is to confine the head of the radius in its proper situation.

ANTERIOR AND POSTERIOR ACCESSORY LIGAMENTS.

These are ligamentous fibres which run in various directions upon the fore and back parts of the joint, and contribute exceedingly to its strength; the anterior extending from the coronoid process to the orbicular ligament; the posterior from the lower border of that ligament to the lateral smooth surface of the olecranon.

MIDDLE ARTICULATION.

ROUND LIGAMENT.

Chorda transversalis cubiti.

This is a small round fibrous chord, Fig. 99, *c*, extending from the outer side of the tuberosity of the ulna to the radius, a little below the tubercle for the insertion of the biceps. It prevents too great a degree of supination of the radius.

INTEROSSEOUS LIGAMENT.

This ligament occupies the space which exists between the radius and ulna, although it is not quite so long, being deficient at its upper part. It has the appearance of a thin aponeurotic resplendent membrane, extending from the sharp edge of the radius to the opposite edge of the ulna. It constitutes a medium of connection between these bones, and affords an extensive surface for the attachment of muscles.

INFERIOR ARTICULATION.

INTERARTICULAR CARTILAGE.

Cartilago intermedia triangularis.

This is a fibro-cartilage, placed transversely between the lower extremity of the radius and ulna; the superior surface is continuous with the cartilaginous covering of the end of the radius, and together with this bone completes the cavity for receiving the upper part of the carpus; each extremity is connected by strong ligaments to the radius and carpus. The apex of this cartilage is firmly attached to the depression which separates the styloid process of the ulna from the articular surface of that bone.

CAPSULAR OR SACCIFORM LIGAMENT.

This ligament passes from the radius to the ulna, form ing between them a very loose cul-de-sac, which allows the radius to turn upon the ulna.

EXTERNAL LATERAL LIGAMENT.

This ligament, Fig. 100, extends from the styloid process of the radius to the scaphoid bone and annular ligament of the carpus.

INTERNAL LATERAL LIGAMENT.

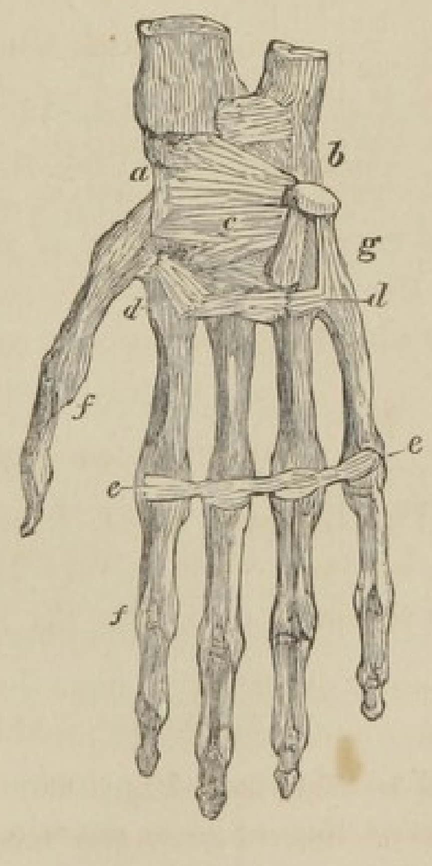
This ligament, *b*, extends from the styloid process of the ulna to the cuneiform bone and annular ligament of the carpus. There are other and more delicate fibres, termed the *anterior and posterior ligaments*, and there is a *synovial membrane* for the whole articulation.

LIGAMENTS OF THE CARPUS.

LIGAMENTS OF THE FIRST ROW OF THE CARPAL BONES.

Fig. 100, *a*, *b*, *c*, *d*.

100.



The three upper bones of the carpus are united together, 1st, by *interosseous ligaments* placed in the intervals between the scaphoid, semilunar, and cuneiform bones; 2nd, by *dorsal ligaments* extending transversely, the one between the scaphoid and semilunar bones, the other between the latter and the cuneiform bone; 3d, by *palmar ligaments*, *c*, similar to the preceding. The pisiform bone is articulated to the cuneiform by a loose *capsular* or *synovial membrane*, strengthened by some irregular bands of fibres.

LIGAMENTS OF THE SECOND ROW OF THE CARPAL BONES.

These are united: 1st, by *dorsal* and *palmar ligaments*, three on either side, which extend inwards and backwards; and 2nd, by *interosseous ligaments;* of these there are only two: both are irregular fasciculi, intermingled with adipose tissue.

LIGAMENTS OF THE TWO ROWS OF CARPAL BONES.

1st. There are two short lateral ligaments, the one *external*, the other *internal*. 2nd. Two fibrous fasciculi, one in front, the other behind, termed the *anterior* and *posterior ligaments;* these last-mentioned ligaments form a fibrous membrane, enveloping the whole carpus. 3rd. There is also a synovial membrane which lines the surface, by means of which the two rows of the carpal bones are in contact. Lastly, we find at *g*, *two ligaments of the pisiform bone*, connecting it to the cuneiform bone and the metacarpal bone of the little finger.

THE ANNULAR LIGAMENT OF THE CARPUS.

The annular ligament is situated on a plane much anterior to that of the other ligaments of the carpus; it is composed of strong and tense fibres, which are attached principally to the cuneiform bone internally, and the trapezium externally; near the latter, some of the fibres are also fixed into the scaphoid bone, and assist in completing the annular passage or channel in which the flexor tendons of the fingers pass, covering and confining them in their course.

LIGAMENTS OF THE HAND.

The metacarpal bones are very securely joined to the carpus, not only by their wedge-like surfaces, but also by strong ligaments.

CAPSULAR LIGAMENTS.

These ligaments are seen distinctly to surround the upper extremity of each metacarpal bone, and are inserted into the opposite bones of the carpus; they are secured by *accessory bands*, which pass in various directions.

SUPERIOR TRANSVERSE LIGAMENTS.

These ligaments, *d*, *d*, extend across the upper extremities of the four metacarpal bones, and are attached to each of them[m].

INFERIOR TRANSVERSE LIGAMENTS.

These ligaments, *e*, *e*, present exactly the same arrangement, connecting the inferior extremity of the four metacarpal bones with each other, not indeed so closely as at the upper end, for there is greater freedom of motion at the lower than at the upper part. The metacarpal bones are also united to each other by a strong transverse apo-

[m] The *capsular ligament* is the only ligament which connects the trapezium with the metacarpal bone of the thumb. This joint, however, derives much strength from a number of small muscles around it, as well as by accessory bands.

neurosis, which is connected with the sheath of the flexor tendons, and covers the tendons of the lumbricales and interossei muscles.

LIGAMENTS OF THE FINGERS.

The first phalanges or rows of the finger bones are attached to the metacarpal bones by loose but strong *capsular ligaments*, which are strengthened anteriorly by a *semicircular ligament* embracing the anterior part of each articulation, and posteriorly by the extensor tendons, which expand very much while passing over these articulations; also at the sides by *lateral ligaments, f, f,* which are attached to slight depressions on the lower end of the metacarpal bones, and into the condyles of the first phalanx. Similar ligaments to these exist at the articulations of the finger bones with each other, viz. each joint has an anterior ligament, two lateral ligaments, and a capsular ligament or synovial membrane.

The flexor tendons also are confined in their course along the fingers by *circular* and *vaginal ligaments.* The former adhere on each side of the tendon to the proper ligaments of the joint, the latter inclose the flexor tendons of each finger in a strong sheath: each sheath is composed of circular fibres, and strengthened by oblique and cuneiform bands, and are attached on each side to the ridge which separates the anterior concave from the posterior or convex surface of each phalanx; by this means the tendon is confined in the mesial line of the finger. All these sheaths are lined by a smooth synovial membrane.

CHAP. IX.

LIGAMENTS OF THE LOWER EXTREMITY.

ILIO-FEMORAL LIGAMENTS.

The hip joint has great freedom of motion, and requires powerful ligaments; it is therefore furnished with a synovial membrane, a capsular ligament, an interarticular ligament, and a cotyloid ligament.

COTYLOID LIGAMENT.

This is a fibro-cartilaginous substance, attached to the whole circumference of the acetabulum, except at its internal and inferior part, where the bony part also of the margin is deficient; it projects a considerable distance beyond the bone, so as to deepen the cavity very much.

There is another strong band of fibres situated at the lower and internal part of the acetabulum, where the last-described ligament is deficient; it is attached to the pubis, where this bone forms the sinus over the obturator ligament, and into the ischium or inferior margin of the notch of the acetabulum: this ligament is superficial to the former, and between both an oblique fissure is left for the passage of vessels to and from the cavity of the joint.

CAPSULAR LIGAMENT.

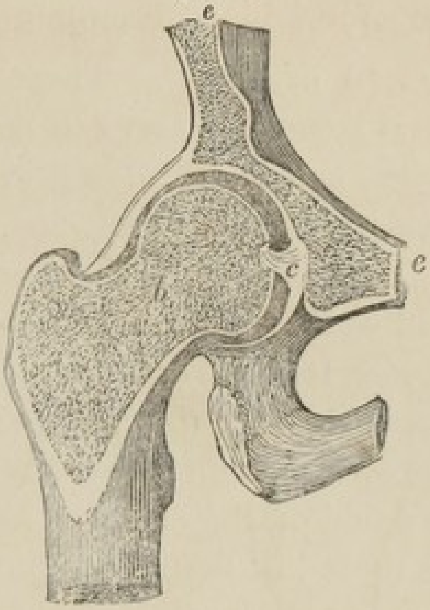
The capsular ligament, *a*, embraces the whole articulation of the hip. Excepting the capsular ligament of the knee, it surpasses all similar ligaments in strength, extent, and capacity: it is attached at a considerable distance from the margin of the cavity, particularly in front, where it extends as far as *d*, the inferior spine of the ilium; inferiorly it is inserted into the femur, incloses the neck of that bone, and descends as far as *c*, the line which lies between the two trochanters. The *synovial membrane* does not descend so low as the external capsule, but is reflected on all sides towards the head of the bone; in this course it is bound by folds, and immediately behind the head of the femur it is confined by circular bands. There is a fasciculus of fibres, *a*, taking an oblique course over the capsule towards the lesser trochanter, sometimes called the *accessory ligament:* it adds strength to this part of the capsule.

Fig. 101.

INTERARTICULAR LIGAMENT.

Ligamentum teres.

Fig. 102.

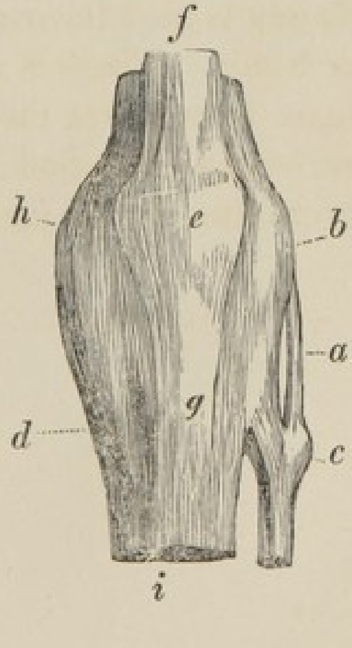


The interarticular ligament is a strong triangular fasciculus of fibres, perfectly concealed within the cavity of the acetabulum; in the figure there is a section of the head and neck of the femur, *b*, and os innominatum, *e*, *e*, to show the attachments of *(c)* this ligament to the bottom of the acetabulum and to the head of the femur.

LIGAMENTS OF THE KNEE JOINT.

CAPSULAR LIGAMENT.

Fig. 103.



This ligament or membrane is of great extent, since the knee joint is the largest of the whole body; it is attached at *b*, *h*, *d*, to the whole circumference of the condyles of the femur; anteriorly to *e*, the patella; inferiorly to the tibia, and to the semilunar cartilages. Above the hollow for the reception of the patella it lines *f*, the tendon of the extensor muscles: it adheres also to the articular surface of the patella in such a manner that this bone seems to form part of the capsule of the joint; lastly, it is reflected over the articular surface of *i*, the tibia, and ligaments within the joints. It is very loose on either side, but tense posteriorly, where it is closely connected with the flexor tendons and posterior crucial ligaments. These connections, as well as the lateral ligaments, serve to confine this membrane in its situation, and to preserve it in the motions of the joint, from being compressed between the bones.

This capsule of the knee, which in itself is very fine and weak, receives considerable strength from additional fibres, termed *accessory ligaments*. These appear like duplicatures of the capsule at the sides of the patella; they are also called *ligamentum alare, majus et minus*. There is a fold of the capsular membrane of the same character as those just described, but inclosing a little fat, for which reason some anatomists have given it the name of *adipose* or *mucous ligament;* it is situated very near the external condyle, and in front of the anterior crucial ligament; it retains the synovial substance in its proper place in the actions of the joint. Another accessory fasciculus of fibres covers the capsular membrane posteriorly, called the *posterior ligament of Winslow*.

LATERAL LIGAMENTS.

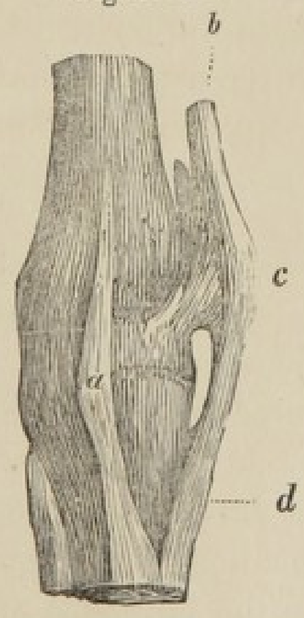
The lateral ligaments, as the name implies, are situated at the sides of the joint, and adhere to the capsular ligament.

EXTERNAL LATERAL LIGAMENT.

The external lateral ligament, Fig. 103, *a*, is a thick round chord, attached to a tubercle on the upper part of *b*, the external condyle of the femur; it is adherent to the semilunar cartilage on that side, and is inserted into *c*, the fibula, a little below its head.

INTERNAL LATERAL LIGAMENT.

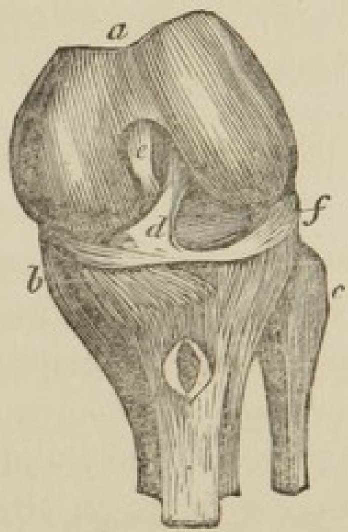
Fig. 104.



The internal lateral ligament, *a*, is attached superiorly to the internal condyle, inferiorly to the tibia, the fibres passing obliquely forwards till they have reached the head of the bone, *b*, *c*, *d*, the ligament of the patella.

CRUCIAL LIGAMENTS.

Fig. 105.



The crucial ligaments, *e*, *d*, are exposed in this figure by throwing down the patella, and removing the adipose substance; they are very strong fibrous chords, crossing each other: hence their name.

ANTERIOR CRUCIAL LIGAMENT.

The anterior crucial ligament, *d*, is extended from the depression between the two condyles of the femur to the spine in the middle of the articular surface of the head of the tibia.

POSTERIOR CRUCIAL LIGAMENT.

The posterior crucial ligament, *e*, is also extended from the depression above named, to a groove behind the spine on the tibia. In Fig. 106, *a*, the crucial ligaments are separated from the femur, to show their direction and insertion into the head of the tibia.

The ligament of the patella, Fig. 103, *f*, *g*, is merely a continuation of the tendon of the extensor muscles of the leg, in the substance of which, *e*, the patella seems to be formed, in a similar manner to the sesamoid bones. In

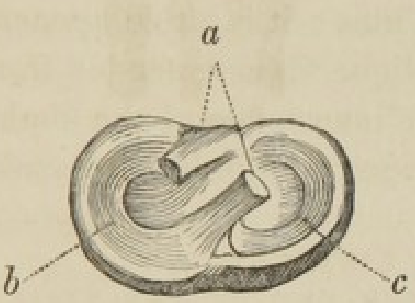
Fig. 105, the patella is represented turned down over the head of the tibia; *h*, a synovial bursa opened: this is a remarkable bag, extremely loose, and plentifully supplied with synovia.

INTERARTICULAR OR SEMILUNAR CARTILAGES.

Fig. 105, *b*, *f*, Fig. 106, *b*, *c*.

These are two fibro-cartilages, placed between the condyles of the femur and the superior extremity of the tibia; they are of a crescent shape, flexible and elastic; each of these cartilages is broad in the middle, and narrower at their extremities; the outer convex edge is thick, the inner concave edge thin, thus rendering the cavities for the condyles of the femur deeper, and adapting the tibia more accurately to that bone. The extremities of these cartilages are fixed by ligaments to the spine in the centre of the articular surface of the tibia; the anterior extremities are joined to each other by a transverse ligament; the outer edges adhere to the capsular and the other ligaments, so as to allow a little play or slight motion upon the tibia, which, by favouring the general motion of the joint, has been compared to the friction wheels of machinery.

106.



LIGAMENTS BETWEEN THE TIBIA AND FIBULA.

The tibia and fibula are united at their extremities by capsular and other ligaments, and in the middle by an intervening fibrous membrane.

CAPSULAR LIGAMENT.

The capsular ligament of the upper end of the fibula is continuous with the periosteum; some irregular fibres have been called *anterior* and *posterior ligaments*. This articulation is moreover secured by the external lateral ligament of the knee, and by the tendon of the biceps flexor cruris, part of which passes from the fibula to the tibia.

INTEROSSEOUS LIGAMENT.

The interosseous ligament of the leg resembles that which is between the radius and ulna; it is a thin aponeurotic membrane, composed of oblique fibres extended from the outer edge of the tibia to the inner edge of the fibula. This membrane presents several apertures for blood vessels.

THE LIGAMENTS OF THE LOWER END OF THE TIBIA AND FIBULA.

These ligaments are *anterior* and *posterior*, which may be divided into superior and inferior, according to their situations.

The *superior ligaments* are attached to the fibula and tibia, where these two bones are in contact: the anterior having a triangular form, the fibres being the shortest.

The *inferior ligaments* have the same direction as the superior; they are not so broad, but are thicker and longer; they both extend from the extreme point of the tibia to the lowest part of the external malleolus. These four ligaments connect the tibia and fibula so closely to one another, that they appear as one firm piece, whose base is supported by two projections called malleoli, between which the astragalus and os calcis, and of course the whole foot, are firmly secured.

LIGAMENTS OF THE ANKLE JOINT.

Strong ligaments pass from the malleoli to the bones of the tarsus; there is also a *capsular membrane* for the whole articulation.

LIGAMENTS BETWEEN THE FIBULA AND TARSUS.

The ligaments between the fibula and tarsus are three in number; the *anterior* passing from the point of the external malleolus forwards to the upper part of the astragalus. The *middle* is a strong fasciculus of fibres, which descends perpendicularly from the lowest point of the fibula to the side of the os calcis. The *posterior* is concealed by the tendo Achillis: it passes from the external malleolus horizontally inwards, to the back part of the astragalus.

LIGAMENTS BETWEEN THE TIBIA AND TARSUS.

DELTOID OR TIBIO-TARSAL LIGAMENT.

Fig. 107.

This ligament, *b*, is an assemblage of fibres extending from the internal malleolus to the astragalus; inferiorly, its fibres diverge, and are attached to the os calcis; and by *c*, to the os naviculare.

CAPSULAR LIGAMENT.

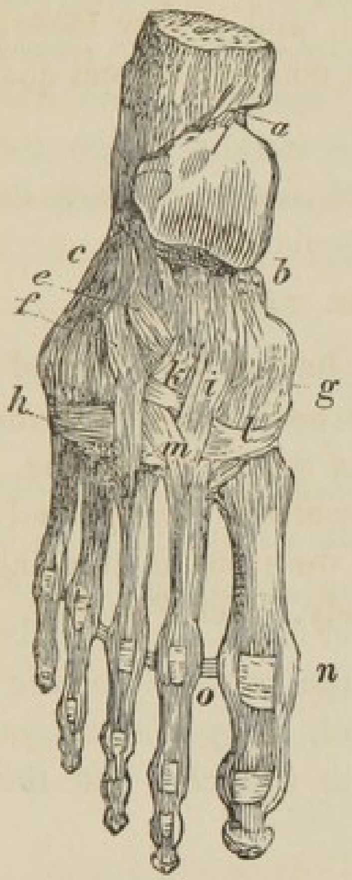
The capsular ligament, *a*, *a*, is situated within the former ligaments ; it covers the opposed surface of the bones which enter into the articulation, and is very loose : the synovial membrane which lines it contains a great quantity of synovia.

LIGAMENTS OF THE TARSUS.

The seven bones of the tarsus have a very limited motion between one another, or only such a degree of motion as gives pliancy and elasticity in walking, running, etc. They are united in a manner peculiarly strong, and well adapted to support the weight of the trunk in standing, or in the different motions of the body. See Fig. 107.

LIGAMENTS BETWEEN THE OS CALCIS AND ASTRAGALUS.

Fig. 108.



There is, 1st, a *capsular membrane*, *b*, *c*, connected to the edges of the articular surfaces of the two bones; it is closely covered by the lateral ligaments of the ankle, and by the sheaths of the tendons; 2nd, an *interosseous ligament*, formed of a thick fasciculus of fibres, attached by one part to the groove which separates the two surfaces of the astragalus, and by the other to that which is between the surfaces of the os calcis; 3rd, by a *posterior ligament*, composed of parallel fibres, *a*, inserted into the posterior part of the astragalus and into the adjacent part of the os calcis.

LIGAMENTS BETWEEN THE ASTRAGALUS AND OS NAVICULARE.

This articulation has considerable motion; for the convex head of the astragalus is received into the cavity of the navicular bone, in which it is secured by a *capsular* and *accessory ligaments*.

LIGAMENTS BETWEEN THE OS CALCIS AND NAVICULARE.

We find two ligaments passing from one of these bones to the other; they are also connected by a fibro-cartilaginous trochlea, or *inferior ligament*, supporting the side of the head of the astragalus, and affording a passage for the tendon of the tibialis posticus muscle; below this ligament there are two *external ligaments*, which proceed from the anterior internal part of the os calcis to the external inferior part of the os naviculare.

LIGAMENTS BETWEEN THE OS CALCIS AND OS CUBOIDES.

There is, 1st, a *superior ligament*, extending from the anterior part of the os calcis to the superior part of the os cuboides; 2d, an *inferior ligament*, composed of a superficial and deep-seated fasciculus of fibres, passing from one bone to the other, and partly to the extremity of the third and fourth metatarsal bones; 3rd, a *capsular* or *synovial membrane*, covering the articular surfaces, and the two preceding ligaments.

LIGAMENTS BETWEEN THE NAVICULAR AND CUBOID BONES.

These bones are connected by a *dorsal ligament, l*, composed of transverse fibres, extending from the navicular to the cuboid bone; and by a *plantar ligament*, extending obliquely from the inferior part of the one bone to the neighbouring part of the other.

LIGAMENTS BETWEEN THE NAVICULAR AND CUNEIFORM BONES.

The three surfaces of the naviculare are articulated with those of the three cuneiform bones,—1st, by *three dorsal ligaments*, *g*, *i*, *k*; 2nd, by *three plantar ligaments*, similar to the preceding, extending from the inferior part of the naviculare to the inferior surfaces of the three cuneiform bones; 3d, by a *synovial membrane*, folded on the articular surfaces, and on the plantar and dorsal ligaments.

LIGAMENTS BETWEEN THE CUNEIFORM BONES.

The cuneiform bones are maintained in apposition by *synovial membranes*; and by three *superior ligaments*, *e*, *f*, *k*, extending transversely over thin superior surfaces; and by *inferior ligaments*, similar to the preceding, but less distinct.

LIGAMENTS BETWEEN THE CUBOID AND EXTERNAL CUNEIFORM BONES.

The cuboid and external cuneiform bones are united together by strong ligamentous fasciculi, *h*, which pass from the edge of one bone to that of the other. The superior are termed *dorsal*, the inferior *plantar ligaments*.

LIGAMENTS OF THE TARSUS WITH THE METATARSUS.

The tarsal and metatarsal bones are articulated together in a similar manner to the carpus and metacarpus; i.e. there are, 1st, *capsular membranes*; 2nd, *dorsal*, *m*; 3rd, *transverse ligaments*, *l*, each of the metatarsal bones receiving one from the tarsal bone with which it is connected;

4th, *plantar ligaments:* these are equal in number to the preceding, and disposed nearly in the same manner.

LIGAMENTS OF THE METATARSAL BONES WITH EACH OTHER.

All the bones of the metatarsus, except the first, are articulated together at their posterior extremities by small cartilaginous surfaces, covered by prolongations of the capsular membranes of the preceding articulations, and maintained, 1st, by *dorsal* and *plantar ligaments:* these extend transversely in each region from the second to the third, and from the third to the fourth, and from the fourth to the fifth metatarsal bones; 2nd, by *interosseous fibres*, found between the inarticulated points of the posterior extremities of these bones; and 3d, by *transverse metatarsal ligaments*, *o*, situated at the anterior extremities of the metatarsal bones, and are in all respects similar to those I have described as belonging to the heads of the four last metacarpal bones.

LIGAMENTS OF THE METATARSUS WITH THE PHALANGES OF THE TOES.

The posterior extremities of the first phalanges are connected to the metatarsal bones at *n* by capsular and lateral ligaments.

LIGAMENTS OF THE PHALANGES OF THE TOES.

These ligaments are similar to those of the fingers.

The tendons of the foot also are provided with nearly the same *sheaths* and *ligaments* as those in the hand, for the purpose of confining them in their situation, and directing them in their proper course. The tendons which pass in front and at each side of the ankle joint, are firmly secured by ligaments and tendinous sheaths, which are attached to the adjacent bones; anteriorly, the extensor tendons are bound down by a strong *annular ligament*, whose fibres take a circular direction.

The *plantar aponeurosis* is composed of strong ligamentous fibres, extending from the os calcis as far as the first phalanges of the toes, where it is lost in the tendinous sheaths. Each of the flexor tendons is confined by a strong *ligamentous sheath*, which is continued along the phalanges in the same manner as in the hand; these sheaths are strengthened by *circular bands* at different situations. On the sides of each articulation of the phalanges with the metatarsus, a fascia is sent off from the extensor tendon: it is composed of glistening fibres, which run towards the sole of the foot, and unite with the plantar aponeurosis; these fasciæ are of important service in retaining the extensor tendons in their situation.

ART. IV.

CHAP. I.

MUSCULAR SYSTEM.

THE organs which we distinguish by the term muscles, are composed of that substance which is commonly known by the name of flesh ; those, therefore, who have not seen the muscles of the human body, may form a very good idea of them by an examination of the flesh of quadrupeds.

The muscles are instruments or active agents in producing the various movements of our body ; by their means we are endued with the power of moving from place to place, and of performing every manual exercise or bodily exertion. Not only are they the prime moving powers in loco-motion, but speech, singing, and the acts of chewing, swallowing, etc. are performed by muscles ; indeed, by means of these organs the blood is circulated, the stomach and intestines urge on their contents, and the different conduits of the glands propel their fluids.

The most characteristic property of muscles is *contractility :* in whatever position our limbs may repose, it must be muscular contraction to produce their action. Muscular contractility also is displayed in the amputation of a limb ; for immediately the muscles are divided, the two ends contract in opposite directions, leaving between them a space proportionate to their retraction, and the retraction therefore is more or less, according to the length of the muscular fibres.

This contractility of muscles constitutes muscular action, and consists in drawing the more moveable towards the most fixed point to which it is connected. Every moveable point in the animal frame is constantly situated between two muscular powers opposed to each other: between those of flexion and extension, of elevation and depression, of adduction and abduction, etc.; this opposition is a condition essential to motion: for in whatever direction the limb is to be moved, the *moveable point* must necessarily be in the opposed direction; the act of flexion requires it should be first extended, and *vice versa.* But when flexors and extensors are both in a state of action, they counterbalance each other; there is a rigid state of the muscles, and the limb is fixed. The effect of every muscle that contracts, is not only to act upon the bone into which it is implanted, but also on the opposite muscle, and this constitutes the phenomena of antagonist muscles; the muscles are so situated that the one class cannot be extended without the other contracting, and reciprocally. I shall be pardoned if I give the familiar but clear explanation of PALEY in reference to antagonist muscles:— "Every muscle is provided with an adversary. They act like two sawyers in a pit, by an opposite pull: the nature of the muscular fibre being what it is, the purposes of the animal could be answered by no other. And not only the capacity for motion, but the aspect and symmetry of the body, is preserved by the muscles being thus marshalled according to this order; e. g. the mouth is holden in the middle of the face, and its angles kept in a state of exact correspondency, by several muscles drawing against and balancing each other. In a hemiplegia, when the muscles on one side of the face are weakened, the muscles on the other side draw the mouth awry."

The muscles, on contracting, become evidently harder; they increase in thickness and decrease in length, but their volume remains nearly the same; what is lost in length is compensated in thickness. PREVOST and DUMAS describe their fibres, in a state of repose, as straight lines; but, when acting, all at once bending themselves in a waved direction, and presenting in an instant a great number of angular and regularly opposed undulations, thus, ; if the cause which led to the contraction ceases, the right lines of the fibres are restored with the same rapidity as the waved lines were produced.

This contractility, on which depends all the phenomena of animal motion, and which also promotes many of the exterior and interior functions, is exclusively seated in the muscular system. It possesses the faculty of moving under the influence of the brain, whether that influence be determined by the will or by other causes. If the brain of a man is compressed, the faculty of contracting the muscle ceases. The intensity of muscular contraction, that is, the degree of power with which the extremities of the fibres approximate, is in proportion to the excitement of the brain; it is generally regulated by the will, according to certain limits, which are different in different individuals. When the organization of the muscles is strongly fibrous, and they are of a deep red colour, such muscles, with an equal power of the will, produce much more powerful efforts than muscles whose fibres are fine, pale, and smooth. The cerebral influence and the structure of the muscular tissue, therefore, are the two elements on which depend intensity of muscular contraction.

Irritability of muscles, called by HALLER the *vis insita*, is the latent power inherent in the muscular fibres, producing that tremulous motion which is often felt in various parts of the body, without any evident cause, and independent of the will. It is to be distinguished from muscular contractility by being more permanent, and by occurring on the application of chemical or mechanical stimuli. A muscle may be separated from the limb, or the heart removed from the body, and for some time afterwards, on pricking it with a needle or passing the electric shock through it, there will be seen convulsive twitchings of its fibres. The irritability of a muscle is present after death; and, though doubtless a phenomenon worthy of study, is not to be confounded with the muscular contraction I have just described.

FORM OF THE MUSCLES.

The muscles, like the bones, with reference to their forms, may be divided into long, wide, and short muscles.

THE LONG MUSCLES.

These muscles are generally placed on the limbs, to the conformation of which they very much contribute. Separated from the skin by a strong membrane called aponeurosis, and from the bone by periosteum, they are contained in a fibrous envelope, which strictly maintains them in their respective situations, and in which they are disposed in layers more or less numerous. In proportion, however, as they are deeper seated they also become shorter; they are separated by cellular layers, loose in parts in which extensive motions are performed, and tight wherever the motion is more confined. The long muscles are in some instances a single bundle of fibres, in others they result from an assemblage of many; scarcely any of the fibres run the whole length of the fleshy mass; in most of the muscles they are disposed in an oblique direction, between two aponeuroses, or between a tendon and an aponeurosis. Some muscles have tendinous intersections, which are placed at different distances in the course of the fibres.

THE WIDE MUSCLES.

These muscles are generally situated on the parietes of the cavities, especially on those of the chest and abdomen, whose parietes are chiefly formed by them; they protect the internal organs, aid their functions, and move the body or limbs according as the one or the other is the fixed point. They have always short tendons.

The wide muscles are not very thick; the greatest part of them representing muscular membranes, sometimes disposed in layers, as on the abdomen, at other times applied over the long muscles, as on the back. When the wide muscles are attached to, or are inserted into one of the great cavities, they preserve in all the parts nearly the same width; but if from a cavity a muscle extends to a long bone, the fibres concentrate by degrees, grow narrower and thicker, and the muscle terminates in a tendon, and thus contracts into a narrow compass the fibres which were largely disseminated. The pectoral and great dorsal muscles are instances of this form and disposition.

THE SHORT MUSCLES.

These muscles are commonly met with in parts where considerable power on the one hand, and a limited extent of motion on the other, is required, as in the movements of the jaw, the hip, the thumb, and the foot; and most of them have a square or triangular shape. Numerous muscles attached to the spine, as the interspinales, recti, etc. display the form I am here describing. They are the most powerful of all the muscles, and are placed where great force is required, as at the articulation of the jaw, in the vertebral column, &c. Though the division of the muscles into long, wide, and short, is similar to that of the bones, and is generally applicable, yet it is liable to a multiplicity of modifications: since nature varies according to the functions which the organs are intended to perform.

There are further distinctive characters of muscles, viz. they are *simple* when the fibres have a parallel direction, as the sartorius or the quadratus lumborum; if they proceed from an extended surface, and converge to a small tendon, they are termed *radiated*, as the temporal muscle. When the tendon occupies the middle of the muscle, and the fibres are placed obliquely to the tendon like a feather, they are named *penniform*, as the rectus femoris; where the muscular fibres are placed on one side of the tendon, it is called *half-penniform*, as the peroneus longus. In the *compound* muscles there is a single mass of muscular fibres and several tendons, like the flexors of the fingers, or there are several muscular and tendinous portions, as in the sacro-lumbalis, etc. Sometimes the bundles of fibres and tendons are variously and often intricately woven, as in the lingual muscles.

VOLUNTARY, INVOLUNTARY, AND MIXED MUSCLES.

The division of muscles into voluntary and involuntary is sufficiently accurate to convey a distinct idea of the two classes of exciting causes. In ordinary circumstances those under the influence of the will must be *voluntary muscles*, such as the muscles of loco-motion. But there are other muscles over which the will has no dominion: the vital organs, the heart, stomach, and intestines, afford examples of this description, and are brought forward by writers on natural theology as marks of the Divine wisdom; for were the action of these organs within the control of the will, and the vital functions left to man's government, I need not say they would be subject to a thousand interruptions; these organs, therefore, are furnished with *involuntary muscles*. There is another class of muscles which are termed *mixed*, as the diaphragm and other muscles of respiration, the orbicularis oculi, etc.; of the action of these muscles we are not sensible, unless the attention of the mind be directed to them; yet we have the power of increasing or suspending their action for a certain length of time.

TEXTURE OF MUSCLES.

The muscular or fleshy fibres are soft, red, downy, linear, and possess a small degree of elasticity; they retain little tenacity in the dead body, and are easily torn asunder, but during life they resist very great force without breaking. A muscle is composed of a number of muscular *fasciculi*, which are formed of fibres still smaller; these result from fibres of less volume; at last, by progressive division, we arrive at a fibre no longer practically divisible, but which, were our means of division more perfect, possibly might be reduced to such a degree of tenuity as to elude even the microscope. However, the last of these filaments which can be perceived is the *muscular fibre*. Numberless researches have been made to determine with certainty the volume of this fibre; I need not mention the result of these researches: the correctness cannot be relied on, and the investigation could add nothing to our notions respecting muscular motion.

Every muscular fibre runs its extent without ramifying: it is merely in juxta-position with the adjoining ones. The intimate nature of this fibre, upon which so much has been written, is still unknown to us. PROHASKA[n] found the

[n] Operum minorum pars i, p. 198.

muscular fibre $\frac{1}{4000}$ part of an inch in diameter, while Mr. Bauer[o] estimates it at only $\frac{1}{2000}$. The latter describes the fibres as moniliform, that is, consisting of globules lineally and closely arranged, like the beads of a necklace. Sir E. Home is inclined to consider these globules to be the remains of the globules of the blood from which they have originated, an opinion which the facts of the case by no means warrant; and all that has been affirmed respecting the continuation of the muscular fibre with the nervous or vascular organs, is supported by no positive proofs, and is unworthy of claiming a moment's attention. "To arrive at correct conclusions, we must study nature where she comes within the cognizance of our senses[p]."

CELLULAR TISSUE OF MUSCLES.

The fibres of muscles are united by this substance; it is one of the most important elements of the animal system, consisting of very minute, soft, white filaments, crossing each other in a multitude of different directions, and leaving between them certain interstices, which serve for the reception of fat. The muscles are abundantly supplied with this cellular web: it forms a very considerable layer round every muscle; it is most generally loose, or filled with fat; sometimes it is tighter, and actually spread in the form of a membrane, and then the dissection becomes difficult for the young student. Besides affording this general covering to the muscles, it extends into the substance of these organs themselves, and largely contributes to their structure; each fasciculus is provided with a continuation of sheaths of cellular tissue, and not only surrounds and binds the muscles together, but also unites each of

o Phil. Trans. 1818, p. 175.

p Bichat.

their fibres with those adjoining. These coverings accommodate the motions of the fibres, which they separate from each other, either by the fat which they contain, or by the serum of the cellulæ.

The quantity of intermuscular cellular tissue varies very considerably ; sometimes it is so abundant among the muscles as to divide them into separate portions, and consequently has confused anatomists in the division of these organs[q].

BLOOD-VESSELS OF MUSCLES.

With the exception of certain viscera, as the lungs, liver, spleen, etc. few organs, in proportion to their size, receive more blood than the muscles; the blood being essentially necessary to keep up excitement, and by this fluid the human muscles are coloured. The arteries are exceedingly apparent: they penetrate their substance from all points of its surface. The principal branches creep at first between the largest fasciculi of fibres; then they divide and subdivide into an almost infinite number of ramifications, which, reduced to capillary tubes, supply the secondary skeins, twine among the most minute fibres, and deposit the nutritive substance of the muscle.

The veins of muscles constantly attend the arteries, but surpass them, as they do in all other parts of the body, in number and magnitude.

The absorbent vessels may be traced, but not without difficulty. They are most readily injected in the muscles of the face, the tongue, and the diaphragm.

q In consequence of these cellular intersections, some authors have divided the deltoid muscle into three distinct muscles. As another instance, I may mention also the pectoralis major, which is thus divided into a clavicular and sternal portion.

NERVES OF MUSCLES.

The muscles are liberally endued with nerves; indeed, excepting the skin and organs of sense, no part of the body is so abundantly supplied with them. Each branch, on reaching the fleshy fibres, first divides, then subdivides in the interstices, until they entirely disappear. DR. MONRO thought that each individual fibre had its corresponding nervous filament: and the observation of BICHAT may induce one to believe it, namely, that on the principal nervous branch being irritated, every fibre of the muscle comes into play.

TENDONS OF MUSCLES.

The tendons are a part of the muscle; they are a kind of fibrous cord, conducting the motions of the muscle to the bone, particularly where there is not room for the insertion of the muscular fibres which are necessary for the motion of the joints; they frequently concentrate the whole power of a very large muscle on a small bony surface: indeed, without such a medium of attachment, the articulations would be encumbered in their actions. The tendons are composed of small white fibres, closely united to each other, having a beautiful shining silvery appearance; they differ from the ligaments chiefly in this particular, that one of their extremities is attached to the muscle.

Tendons possess very little elasticity or sensibility; they have few blood-vessels, in fact none are observed in their ordinary state; nor have nerves or lymphatics been traced into them.

Some muscles form a complete circle, and have no tendinous structure, and are termed *sphincters*.

Usually the tendons are at the extremities of muscles, but sometimes are found in the middle, as the digastric muscles, the diaphragm, omo-hyoideus, &c.

APONEUROSES.

Aponeuroses are precisely similar to tendons; frequently they seem to result from the expansion of a tendon. They may be divided into two classes: 1st, *Aponeuroses of insertions,* those fibrous expansions which receive fleshy fibres, so as to afford the greatest advantage in multiplying prodigiously the points of insertion, without increasing the extent of bony surface, as the tensor vaginæ femoris; others collect the muscular power into a line of attachment, as in the oblique and transverse muscles of the abdomen. 2nd, *Enveloping aponeuroses:* these are found round the limbs, where they maintain the muscles in their respective situations, so that in great exertions the muscles are not liable to displacement; their inner surface often sends between the muscles fibrous partitions, which extend to the periosteum of the neighbouring bone; and at the same time that they retain the muscular fibres in their situation, they give points for their insertion. Like the tendons, their hue is of a resplendent white; in a healthy state they have little vascularity, and may be considered as destitute of sensibility.

CHEMICAL COMPOSITION OF MUSCLES.

Owing to the difficulty of separating the muscular fibres from the fat, blood, cellular membrane, etc. with which they are very intimately blended, the organic elements of the muscular tissue are still involved in obscurity; but when freed as much as possible from those substances which adhere to them, they consist of albumen, a great quantity of fibrin, and a principle of a peculiar nature, coloured, soluble in alcohol, giving to broth its taste and smell, named *osmazome*. There also occur in these organs a colouring matter, carbonàte, hydrochlorate, and phosphate of soda, phosphate of lime, and oxide of iron.

SHEATHS OF TENDONS.

In general these sheaths form a semi-cylindrical canal, completed by the bone in the opposite part in such a manner that the tendon slides in a canal, which is partly bony and partly fibrous; this canal is lined with a synovial membrane. On their external surfaces the fibrous sheaths correspond to the adjacent parts with which they are united, and adhere to them by loose cellular tissue. All the sheaths are composed of dense and strong fibres; indeed, stronger than might be supposed to be sufficient to restrain the efforts of the tendons that act upon them; the tendons are thus kept down in their proper places, and are prevented from deviating from their destined course. Some of these sheaths, as those at the wrist and on the instep, contain the united tendons of several muscles: these bear the name of *annular ligaments;* the tendons of the hand and foot having to pass a narrow space, it was indispensably necessary they should be there maintained. Other sheaths, as those of the fingers, are intended for a single tendon, or for two only. Besides these uses, the sheaths in some cases change the direction of the tendon, as we observe in the trochlea of the eye, and the sheaths of the tendons of the thumb and little finger.

STRENGTH OF MUSCLES.

The natural strength of muscles probably depends on the number of fibres which enter into their composition; but the effect of habit and exercise of the muscles in giving strength, mobility, and dexterity, is astonishing. The muscles grow stronger in proportion to their being used, provided they are well used, and not exhausted by violence or over exertion; but the same muscles in different individuals, though of the same length and thickness, and as far as we are able to examine composed of the same number of fibres, are by no means uniform in the degree of power they are capable of exercising. Under particular excitement the muscular efforts may be carried to a wonderful degree: we know the strength of an enraged person, of maniacs, and of persons in convulsions; but such violent contractions cannot be carried beyond a certain time, after which a painful feeling of weariness takes place, which goes on increasing until the muscle refuses to act; by rest, however, the feeling of fatigue subsides, and the muscles recover their wonted energies. If, however, the brain of a man be compressed, the faculty of contracting the muscle ceases; the nerve of a muscle being cut, the muscle loses all power of contracting, thus showing that muscular action depends on the brain, and that it is generally regulated, to a certain degree, by the will[r].

[r] "There are many muscles given to us which the common customs and habits of life seldom render it necessary to exert, and which, in consequence, grow stiff and immoveable. Tumblers and buffoons seem to be aware of this fact; and it is principally by the cultivation of these neglected muscles that they are able to assume those outrageous postures and grimaces, and exhibit those feats of agility, which so often amuse and surprise us." Dr. Good's Book of Nature.

ACTIONS OF MUSCLES.

Many muscles acting together, producing the same kind of motion, are called *congeneres;* those which act in the opposite direction are termed *antagonistes.* The first ordinarily arise from the same fixed point or from the same region, the second or antagonists from the opposite.

The various movements produced by the contraction of muscles are, *adduction* and *abduction*, *flexion* and *extension*, and *rotation*, etc. These various motions are not usually effected by the action of one muscle alone, but by the co-operation of several congeneres.

The flexors are commonly stronger than the extensors, and it is for this reason, that when the extremities are at rest, or in a state of freedom, or in paralysis, or during sleep, that they are bent or slightly flexed. And the flexors are attached further from the centre of motion than the extensors, and their direction is less parallel to the bone; consequently the angle is more open, and the power more favourably applied.

NOMENCLATURE OF THE MUSCLES.

The denomination of the muscles is derived from several considerations, as, viz. from their

Size, as great, small, long, broad, thin.

Figure, as triangular, scalenus, deltoid, orbicular, rhomboidal, etc.

Direction, as straight, oblique, transverse.

Composition, as complexus, triceps, biceps, semimembranosus, perforans, etc.

Attachment, as stylo-hyoideus, pterygoideus, sterno-cleido-mastoideus.

Uses, as flexors, adductors, rotators, etc.

The inconvenience from such a multiplicity of names from such different sources, has long been felt among anatomists, and many nomenclatures have been suggested to remove it. All the synonyms of muscles may be found in Lizars' System of Anatomy.

CLASSIFICATION OF THE MUSCLES.

The muscles have been distributed into classes, according to the different parts of the body which they occupy: each of these parts has received the name of a *region*. The following table presents a general view of the names and classification.

CHAP. II.

TABLE OF THE MUSCLES.

The total number of the muscles amount to 527, of which 257 are pairs, and lie on either side of the body. There are four single muscles situated on the middle line, independent of those muscles which perform the internal vital functions.

MUSCLES OF THE HEAD.

1. Cranial region.	Occipito-frontalis.
2. Auricular region.	Attollens auris. Attrahens auris. Retrahens auris.

MUSCLES OF THE FACE.

1. Palpebral region.	Orbicularis palpebrarum. Corrugator supercilii. Levator palpebræ superioris.
2. Ocular region.	Rectus superior. Rectus inferior. Rectus internus. Rectus externus. Obliquus superior. Obliquus inferior.
3. Nasal region.	Pyramidalis nasi. Compressor nasi. Levator labii superioris, alæque nasi. Depressor alæ nasi.
4. Superior maxillary region.	Levator labii superioris. Levator anguli oris. Zygomaticus major. Zygomaticus minor. Orbicularis oris.
5. Inferior maxillary region.	Depressor anguli oris. Depressor labii superioris. Depressor labii inferioris. Buccinator. Levator menti. Masseter.

6. Temporo maxillary region.	Temporalis.
7. Pterygo maxillary region.	Pterygoideus externus. Pterygoideus internus.
8. Lingual region.	Hyo-glossus. Genio-glossus. Stylo-glossus. Lingualis.
9. Palatine region.	Circumflexus palati. Levator palati. Levator uvulæ. Palato pharyngeus. Constrictor isthmi faucium.

MUSCLES OF THE NECK.

1. Anterior cervical region.	Platisma myoides. Sterno-cleido mastoideus.
2. Superior hyoidean region.	Digastricus. Stylo-hyoideus. Mylo-hyoideus. Genio-hyoideus.
3. Inferior hyoidean region.	Omo-hyoideus. Sterno-hyoideus. Sterno-thyrioideus. Thyro-hyoideus.
4. Pharyngeal region.	Constrictor pharyngeus inferior. Constrictor pharyngeus medius. Constrictor pharyngeus superior. Stylo-pharyngeus.
5. Deep cervical region.	Rectus capitis anticus major. Rectus capitis anticus minor. Longus colli.
6. Lateral cervical region.	Scalenus anticus. Scalenus posticus. Rectus capitis lateralis.

MUSCLES OF THE TRUNK.

1. Anterior thoracic region.	Pectoralis major. Pectoralis minor. Subclavius.
2. Lateral thoracic region.	Serratus magnus.
3. Intercostal region.	Intercostales externi. Intercostales interni. Triangulares sterni. Levatores costarum.
4. Diaphragmatic region.	Diaphragma.

MUSCLES OF THE ABDOMEN.

1. Abdominal region.	Obliquus abdominis externus. Obliquus abdominis internus. Transversalis abdominis. Rectus abdominis. Pyramidalis.
2. Lumbar region.	Psoas magnus. Psoas parvus. Iliacus internus. Quadratus lumborum.
3. Anal region.	Levator ani. Coccygeus. Sphincter ani.
4. Genital region.	1st. (In the male.) Cremaster ischio-cavernosus. Bulbo-cavernosus. Transversus perinei. 2nd. (In the female.) Ischio-cavernosus. Constrictor vaginæ.

MUSCLES OF THE POSTERIOR PART OF THE TRUNK.

1. Lumbo-dorsal region.	Trapezius. Latissimus dorsi.
2. Dorso-cervical region.	Rhomboideus. Levator anguli scapulæ. Serratus posticus superior. Serratus posticus inferior. Splenius. Complexus. Trachelo-mastoideus.
3. Posterior occipito-cervical region	Rectus capitis posticus major. Rectus capitis posticus minor. Obliquus capitis superior. Obliquus capitis inferior. Interspinalis cervicis.
4. Vertebral region.	Longissimus dorsi. Sacro-lumbalis. Transversus colli. Multifidus spinæ. Intertransversales colli et lumborum.

MUSCLES OF THE EXTREMITIES.

Muscles of the Superior Extremities.

MUSCLES OF THE SHOULDER.

1. Posterior scapular region.	Supra-spinatus. Infra-spinatus. Teres minor. Teres major.
2. Anterior scapular region.	Subscapularis.
3. External scapular region	Deltoides.

MUSCLES OF THE ARM.

1. Anterior brachial region.	Coraco-brachialis. Biceps flexor cubiti. Brachialis internus. Triceps extensor cubiti.

MUSCLES OF THE FORE-ARM.

1. Anterior region of the fore-arm.	Pronator teres. Flexor carpi radialis. Palmaris longus. Flexor carpi ulnaris. Flexor digitorum sublimis vel perforatus.
2. Anterior deep region of the fore-arm.	Flexor digitorum profundus vel perforans. Flexor longus pollicis manus. Pronator quadratus.
3. Posterior superficial region of the fore-arm.	Extensor digitorum communis. Extensor proprius minimi digiti. Extensor carpi ulnaris. Anconeus.
4. Posterior deep region of the fore-arm.	Extensor ossis metacarpi pollicis. Extensor primi et secundi internodii pollicis manus. Indicator.

MUSCLES OF THE HAND.

1. External palmar region.	Abductor brevis pollicis manus. Opponens pollicis. Flexor brevis pollicis manus. Adductor pollicis manus.
2. Internal palmar region.	Palmaris brevis. Abductor minimi digiti. Flexor proprius minimi digiti. Adductor ossis metacarpi minimi digiti. Lumbricales.
3. Middle palmar region.	Interossei. 1. Abductor indicis. 2. Adductor indicis. 3. Abductor digiti medii. 4. Adductor digiti medii. 5. Abductor digiti annularis. 6. Adductor digiti annularis. 7. Abductor minimi digiti.

MUSCLES OF THE INFERIOR EXTREMITY.

MUSCLES OF THE HAUNCH AND THIGH.

1. Region of the hip.	Gluteus maximus. Gluteus medius. Gluteus minimus.
2. Pelvi-trochantric region.	Pyriformis. Obturator internus. Obturator externus. Gemellus superior. Gemellus inferior. Quadratus femoris.
3. Anterior femoral region.	Sartorius. Rectus femoris. Triceps extensor cruris.
4. Internal femoral region.	Pectineus. Gracilis. Adductor longus. Adductor brevis. Adductor magnus.
5. Posterior femoral region.	Biceps femoris. Semitendinosus. Semimembranosus.

MUSCLES OF THE LEG.

1. Anterior region of the leg.	Tibialis anticus. Peroneus tertius. Externus longus digitorum pedis. Extensor proprius pollicis pedis.
2. Peroneal region.	Peroneus longus. Peroneus brevis.
3. Posterior region of the leg.	Gastrocnemius externus. Gastrocnemius internus. Soleus. Plantaris. Popliteus. Flexor longus digitorum pedis. Tibialis posticus. Flexor longus pollicis pedis.

MUSCLES OF THE FOOT.

1. Dorsal region.	Extensor brevis digitorum pedis. Interossei externi.
2. Plantar region.	Flexor brevis digitorum pedis. Abductor pollicis pedis. Abductor minimi digiti pedis. Flexor digitorum accessorius. Lumbricalis pedis. Flexor brevis pollicis pedis. Adductor pollicis pedis. Flexor brevis minimi digiti pedis. Transversus pedis. Interossei interni.

MUSCLES OF THE HEAD.

Cranial Region.

OCCIPITO-FRONTALIS.

Fig. 109.

This is the only muscle which properly belongs to the scalp; it consists of two distinct parts, an anterior and a posterior, which are united by an aponeurosis or tendinous membrane. The posterior portion, *a*, has an aponeurotic and fleshy attachment to the transverse ridge of the occipital bone; it forms, *b*, the cranial aponeurosis, a broad fibrous expansion which covers the whole upper part of the cranium: the anterior portion, seen in Fig. 111, *a*, is attached to *c*, the circular muscle of the eyelid, and to the skin; and by *b*, to the inner angle of the frontal bone, and the os nasi. The *outer surface* of this muscle is covered by the integuments, the *inner* rests on the cranium.

The anterior portion of this muscle raises the brow, wrinkles the forehead, and brings forward the integuments of the head; the posterior draws back the skin to its original situation. The direction of the muscular fibres and the aponeurosis are also seen, Fig. 112, *a*, *b*[a].

AURICULAR REGION.

ATTOLLENS AURIS.

Fig. 112. The attollens auris, *c*, is of a triangular figure, situated on the temple above the ear; superiorly it is attached to the cranial aponeurosis, and inferiorly to the cartilage of the ear. The *outer surface* of this muscle is covered by the skin, the *inner* covers the temporal aponeurosis.

The action of this muscle raises the ear.

ATTRAHENS AURIS.

The attrahens auris, *d*, is situated before the ear, and has the same form as the preceding; anteriorly it is attached to the border of the cranial aponeurosis, and posteriorly to the cartilage or anterior helix of the ear.

This muscle draws the ear forward and upward.

The *outer surface* of this muscle is covered by the skin; the *inner* is situated upon the temporal muscle and temporal artery.

RETRAHENS AURIS.

This muscle, *e*, is situated behind the ear, and is extended from the mastoid process of the temporal bone to the back of the ear. It frequently consists of two small bundles of fibres, and is then described as two muscles.

[a] This is sometimes divided by anatomists into two muscles, the *occipital* and *frontal* muscles.

This muscle is covered by the integuments, and is separated from the temporal bone by cellular tissue. The action of this muscle carries the ear backwards[t].

MUSCLES OF THE FACE.

PALPEBRAL REGION.

ORBICULARIS PALPEBRARUM.

Fig. 111, *c*, Fig. 112, *f*.

The fleshy fibres of this muscle surround the orbit of the eye, and form part of the eyelids ; superiorly it is attached to the frontal bone, and inferiorly to the superior maxillary bone, where it has a tendinous point of insertion into the nasal process.

The *anterior surface* of this muscle is covered by the integuments ; the *posterior* is applied upon the corrugator supercilii, the fibro-cartilage of the upper eyelid, the malar bone, the muscles of the superior maxillary region, the ligament and fibro-cartilage of the lower eyelid, the ascending process of the superior maxillary bone, and the lachrymal sac.

This muscle shuts the eye, by bringing down the upper eyelid and raising the lower, the fibres contracting towards the inner angle ; it also depresses the eyebrow at the same time it raises the cheek.

CORRUGATOR SUPERCILII.

Fig. 111.

This muscle, *p*, is placed on the arch of the orbit, in the thickness of the eyebrow ; it is attached on the one part to the superciliary ridge, and on the other to the occipito-frontalis and orbicularis muscles.

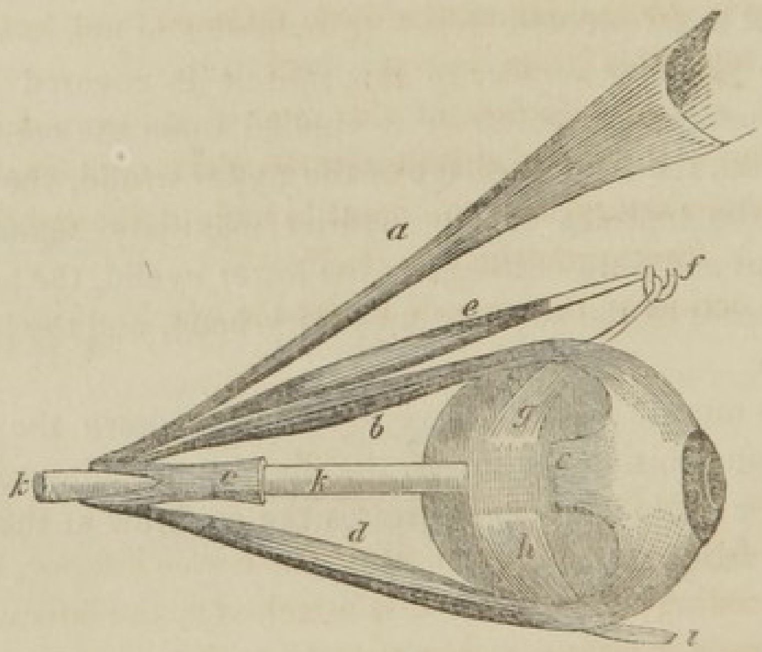
t The other muscles of the ear will be described with the organ of hearing.

The *anterior surface* of this muscle is covered by the orbicularis palpebrarum, the occipito-frontalis, and the pyramidalis nasi muscles; the *posterior* is in contact with the frontal bone, the superciliary artery, and the frontal branch of the ophthalmic nerve.

This muscle draws down the brow in the expressions of anger and the malevolent passions.

LEVATOR PALPEBRÆ SUPERIORIS.

Fig. 110.



This muscle, *a*, is situated in the superior part of the orbit, and is fixed to the bottom of it; it is then spread out into a broad tendon, which is attached to the cartilage of the upper eyelid, as is seen also in Fig. 111, *n*.

The *superior surface* of this muscle is connected with the orbit and frontal branch of the ophthalmic nerve; and more anteriorly it is separated from the orbicularis palpebrarum by the palpebral ligament; the *inferior* is connected with the rectus superior and conjunctiva.

The action of this muscle raises the upper eyelid.

OCULAR REGION.

RECTUS SUPERIOR.

Fig. 110.

This muscle, *b*, is situated in the orbit above the eye, under the levator palpebræ; it is broad and thin, tendinous at its extremities, and fleshy in the rest of its extent. Posteriorly it is attached to the optic foramen, and anteriorly to the sclerotica.

The *superior surface* of this muscle is covered by the preceding; the *inferior* is placed upon the optic nerve, the ophthalmic artery, and the nasal branch of the ophthalmic nerve, in front upon the eye itself.

The action of this muscle raises the eye.

RECTUS INFERIOR.

The figure and structure of *d*, the rectus inferior, is like the preceding; posteriorly it is attached to the inferior part of the optic foramen, and anteriorly to the sclerotica.

The *inferior surface* of this muscle is separated from the floor of the orbit by adipose tissue; the superior is in connection with the optic nerve, a branch of the third pair of nerves, and the eye.

This muscle is the antagonist to the rectus superior, and draws the eye downwards.

RECTUS INTERNUS.

This muscle, *c, c,* is similar to the two described; it is situated on the inner side of the eye, and is attached posteriorly to the margin of the optic foramen; anteriorly, to the inner side of the eye. In this figure the central part is removed to show *k*, the optic nerve, but its attachments are preserved.

This muscle draws the eye towards the nose.

RECTUS EXTERNUS.

The rectus externus is similar in its figure and attachments to the other recti, but is situated on the outer side of the eye. In this figure the muscle is supposed to be removed.

The *outer surface* of this muscle is in apposition with the orbit and lachrymal gland; the *inner* with the optic nerve, the sixth pair, and the lenticular ganglion.

The office of this muscle is to carry the eye outward.

OBLIQUUS SUPERIOR.

This muscle, *e*, is situated at the internal and superior part of the orbit; posteriorly it is attached to the optic foramen, passes forward horizontally to the internal orbitar process, where it forms a thin round tendon, which passes through *f*, a cartilaginous ring[u]; runs obliquely downwards and backwards, and is inferiorly attached at *g*, by a radiated tendon, to the globe of the eye. On the inside of the pulley or ring is a synovial capsule, which is reflected over the tendon.

[u] At least this loop forms a ring with the superciliary notch.

This muscle is situated between the orbit and the optic nerve, the superior and internal recti muscles, and the globe of the eye.

The office of this muscle is to roll the eye, and to turn the pupil downwards and outwards.

OBLIQUUS INFERIOR.

This muscle is situated at the anterior part of the orbit. Anteriorly it is attached at *i*, the inner edge of the orbitar process of the superior maxillary bone, near its union with the os unguis; it is directed backwards and outwards, under *d*, the rectus inferior, and is attached posteriorly by *h*, a thin tendon, to the sclerotic membrane.

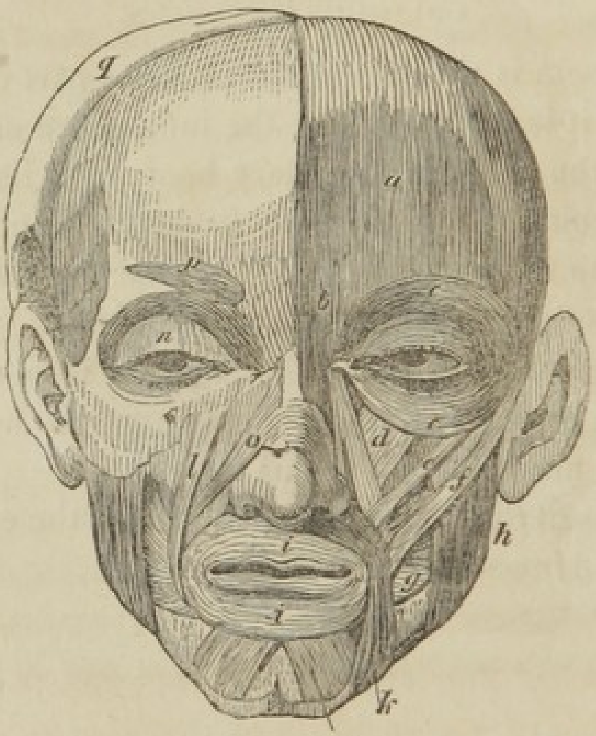
The *inferior surface* of this muscle is placed on the floor of the orbit; the *superior* corresponds with the ball of the eye, and with the rectus inferior.

By means of the inferior oblique muscle the eye is turned upwards and inwards.

NASAL REGION.

PYRAMIDALIS NASI.

Fig. 111.



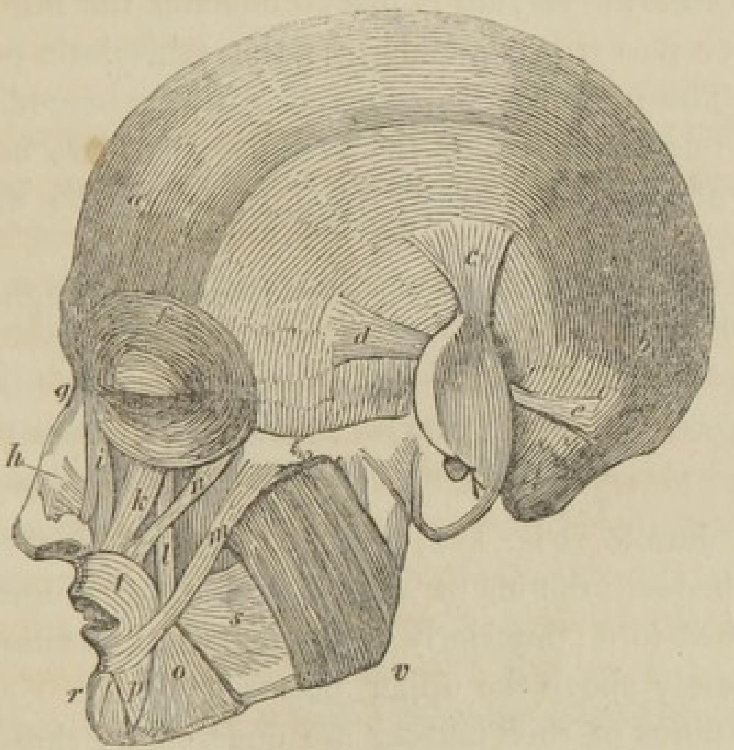
This muscle, *b*, is confounded with the occipito-frontalis; its figure is thin and triangular; it is attached by its summit to the last-named muscle, covers the nasal bones, and is fixed by its base to the compressor nasi. This muscle is sometimes regarded as merely a portion of the frontal muscle; the upper part is certainly intermixed with it, but the lower part is very distinct.

The *anterior surface* is connected with the skin; the *posterior* with the corrugator supercilii, the os frontis, and the proper bones of the nose.

This muscle assists in bringing down the integuments of the forehead, and in raising the skin of the nose.

COMPRESSOR NASI.

Fig. 112.



This muscle, Fig. 111, *o*, Fig. 112, *h*, is attached on the outer side of the cartilage of the nose to the adjacent part of the superior maxillary bone, and on the inner side to the bridge of the nose, where it meets its fellow.

The *anterior surface* is covered by the skin, the *posterior* lies upon the superior maxillary bone and upon the lateral cartilage of the nose.

This muscle compresses the nostrils; it sometimes acts with the pyramidal and frontal muscle, to which it is connected, and then it raises the nostril.

LEVATOR LABII SUPERIORIS ALÆQUE NASI.

This muscle, Fig. 112, *i*, is attached by a small tendon to the nasal process of the superior maxillary bone, close by the tendon of the orbicular muscle of the eyelids; as it approaches the nose it is spread out into two portions, one of which is inserted into the ala or cartilage of the nostril, the other into the upper lip.

The *anterior surface* is placed beneath the skin, and at its upper part it is concealed by the orbicularis palpebrarum. The *posterior* is connected with the preceding muscle, the nasal process of the superior maxillary bone, the border of the levator labii superioris, and the depressor nasi.

This muscle raises the ala of the nostril and upper lip.

DEPRESSOR ALÆ NASI.

This muscle, Fig. 113, *e*, is a small fleshy fasciculus, placed beneath the ala or wing of the nose. Superiorly it is attached to it; inferiorly to the superior maxillary bone immediately above the upper incisor teeth.

The fibres of this muscle are covered by those of the levator labii superioris alæque nasi, and by the mucous membrane of the mouth, and are applied to the superior maxillary bone.

The contraction of this muscle depresses the ala of the nose.

SUPERIOR MAXILLARY REGION.

LEVATOR LABII SUPERIORIS.

This muscle, Fig. 112, *k*, is situated in the middle of the face; superiorly it is attached to the lower part of the orbit, inferiorly to the upper lip; it contracts as it descends, and its fibres are confounded with the circular muscle of the lips, between the nose and angle of the mouth. At the *upper part*, this muscle is covered by the orbicularis palpebrarum, and at the *lower part* by the skin. The *posterior surface* is in connection with the levator anguli oris, from which it is separated by the infra-orbitar vessels and nerves.

LEVATOR ANGULI ORIS.

This muscle, Fig. 112, *l*, is situated near the middle of the face; superiorly it is attached to the canine fossa; inferiorly to the angle of the lips.

The *anterior surface* is connected, as we see in the figure, with other muscles of the face; the *posterior surface* with the canine fossa, the mucous membrane of the mouth, and the buccinator muscle.

This muscle raises the angle of the mouth.

ZYGOMATICUS MAJOR.

This is a long and slender muscle, Fig. 111, *f*, Fig. 112, *m*, situated on the side of the face, and passing downwards and inwards; superiorly it is attached to the upper part of the cheek bone; inferiorly to the corner of the mouth.

ZYGOMATICUS MINOR.

This muscle, Fig. 111, *e*, Fig. 112, *n*, is not found in all subjects. It is situated on the inner side of the preceding muscle between *k*, the elevator of the upper lip, and *m*, the great zygomatic muscle. It passes in the same direction as the last-mentioned muscle, and has nearly the same attachments.

The *anterior surface* of the zygomatic muscles is generally covered by a great quantity of fat as well as skin; the *posterior surfaces* are placed on the malar bone and the buccinator muscle; their connection with the other muscles of the face is obvious in the figure.

The zygomatic muscles raise the angle of the mouth, as in laughing, etc.

ORBICULARIS ORIS.

The form of this muscle, Fig. 111, *i*, Fig. 112, *t*, is elliptical; its fibres are found in the substance of the lips, and is completely interlaced and confounded with those other muscles which terminate near the angle of the mouth.

The skin adheres firmly to the *anterior surface* of this muscle; the *posterior surface* is lined by the mucous membrane of the mouth, and its free edge is invested by the red membrane of the lips. The connection with the other muscles of the face is intricate.

This muscle is as an antagonist to the other muscles of the lips; it is a true sphincter muscle, contracting the aperture of the mouth; its action is evident in playing the flute, in sucking, in masticating, &c.

INFERIOR MAXILLARY REGION.

DEPRESSOR ANGULI ORIS.

This muscle, Fig. 111, *k*, Fig. 112, *o*, is of a triangular form, situated at the lower part of the face; superiorly it is attached to the lower jaw; inferiorly to the angle of the mouth, where the fibres are confounded with those of the levator angulis oris.

The *outer surface* adheres to the skin and the platysma myoides; the *inner* is connected with the buccinator and the depressor labii inferioris.

This muscle depresses the angle of the mouth, and its action expresses grief.

DEPRESSOR LABII INFERIORIS.

This muscle, Fig. 111, *m*, Fig. 112, *p*, is thin, and nearly quadrilateral; its situation in the face is obvious in the figures referred to. Inferiorly it is attached to the lower jaw; superiorly to the lower lip, where its fibres are confounded with the orbicularis.

The *anterior surface* is connected with the skin and part of the preceding muscle. The *posterior surface* is connected with the lower jaw, the mental vessels and nerves, the levator menti, and the labial muscles.

The use of this muscle is to pull the lip downwards.

BUCCINATOR.

This muscle, Fig. 112, *s*, is situated in the cheek; superiorly it is attached to the sockets of the molar teeth of the upper jaw; inferiorly to the corresponding part of the lower jaw; behind, it is connected with the constrictor muscle of the pharynx, and in front with the angle of the mouth. The middle fibres are horizontal, the superior and inferior a little converging to the angle of the lips. It is perforated in the middle by the duct of the parotid gland.

The *outer surface* is covered by a thick layer of fat, the zygomaticus major, the platysma myoides, the depressor anguli oris, the skin, and the labial artery and vein. The *inner* is lined by the mucous membrane of the mouth.

This muscle is seen remarkably dilated in blowing the horn or trumpet: its use is to force the air out of the mouth by contracting its cavity, to draw the angle of the mouth backwards, and in mastication to press the food within the line of the teeth.

LEVATOR MENTI.

This muscle, Fig. 112, *r*, is placed on the chin; *superiorly* it is attached to the depression on the side of the symphysis of the jaw, under the alveoli of the incisor teeth. The fibres diverge downwards, and are inserted into the skin of the chin.

Anteriorly it is covered by the skin; *posteriorly* by the mucous membrane of the mouth.

This muscle raises the chin.

MASSETER.

This muscle, Fig. 111, *h*, Fig. 112, *v*, is composed of aponeurotic and fleshy fibres, situated on the side of the face; it is very thick, and attached superiorly to the two anterior thirds of the inferior part of the zygomatic arch, to its internal surface, and to the aponeurosis of the temporal muscle; inferiorly to the angle of the lower jaw, to its external surface, and to the inferior border of the ramus of the same. The masseter is sometimes described as two distinct portions which decussate one another; the anterior portion running backwards, is fixed into the side of the lower jaw as far as the angle; the posterior portion passing forwards, is united to the coronoid process.

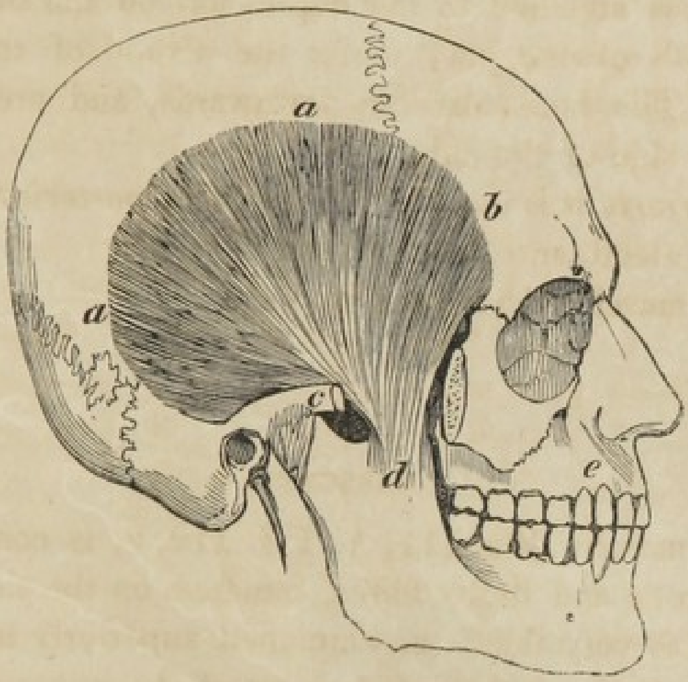
On the *outer side* is found the parotid gland and its duct, the platysma myoides, the facial nerve, the transverse facial artery, etc. The *inner surface* is placed on the ramus of the inferior maxilla, the tendons of the temporal, and the buccinator muscles.

This muscle raises the lower jaw, and acts powerfully during mastication.

TEMPORO MAXILLARY REGION.

TEMPORALIS.

Fig. 113.



The situation and direction of the fibres of this muscle is described in the annexed figure: a portion of *c*, the zygoma, is removed to show the whole of the muscle. It occupies the whole temporal cavity, and is covered with a strong aponeurosis, while another is placed in the midst of the fleshy fibres, dividing it into two planes, terminating inferiorly in a strong tendon. It is attached superiorly to the temporal fossa, and to *a*, *a*, *b*, the semicircular line bounding it; inferiorly at *d*, the coronoid process of the inferior maxilla.

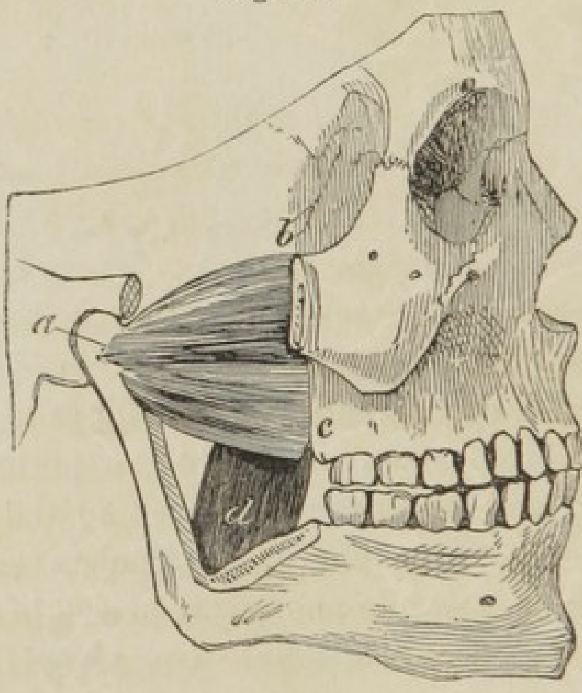
The *outer surface* of the temporal muscle is covered by the epicranial aponeurosis, the superior and anterior auricular muscles, and a portion of the orbicularis palpebrarum and masseter muscles; the superficial temporal vessels and nerves also ramify over it. The *inner surface* is situated upon the temporal fossa and the internal maxillary artery. The pterygoideus externus, and buccinator muscles, are separated from it by a considerable quantity of fat.

The office of this muscle, as well as the preceding, is to draw the lower jaw upwards. In carnivorous animals the temporalis is the strongest muscle in the whole body.

PTERYGO-MAXILLARY REGION.

PTERYGOIDEUS EXTERNUS.

Fig. 114.



This muscle is situated in the zygomatic fossa; it is attached by one portion at *b*, *c*, to the external surface of the pterygoid process, and by the other to the zygomato-temporal surface of the sphenoid bone; from thence the muscle is directed outwards and backwards, and is inserted into *a*, the anterior part of the neck of the condyle of the lower jaw, and into the fore part of the circumference of the interarticular cartilage.

The *outer surface* is in contact with the temporal muscle, and frequently with the internal maxillary artery. The *inner surface* corresponds with the pterygoideus internus, the inferior maxillary nerve, and the middle meningeal artery. The *upper surface* touches the zygomatic fossa and the deep temporal and masseteric nerves.

This muscle brings forward, and to the opposite side, the condyle of the jaw, and the interarticular cartilage; when the pair of muscles act together, the jaw is drawn directly forwards.

PTERYGOIDEUS INTERNUS.

This muscle, *d*, is placed at the inner and posterior part of the branch of the inferior maxillary bone. It is attached superiorly by tendinous and fleshy fibres to the inner plate of the pterygoid process of the sphenoid bone, and to the pterygoid process of the os palati, filling all the space between the two plates: inferiorly it is attached by tendinous and fleshy fibres to the inside of the angle of the lower jaw.

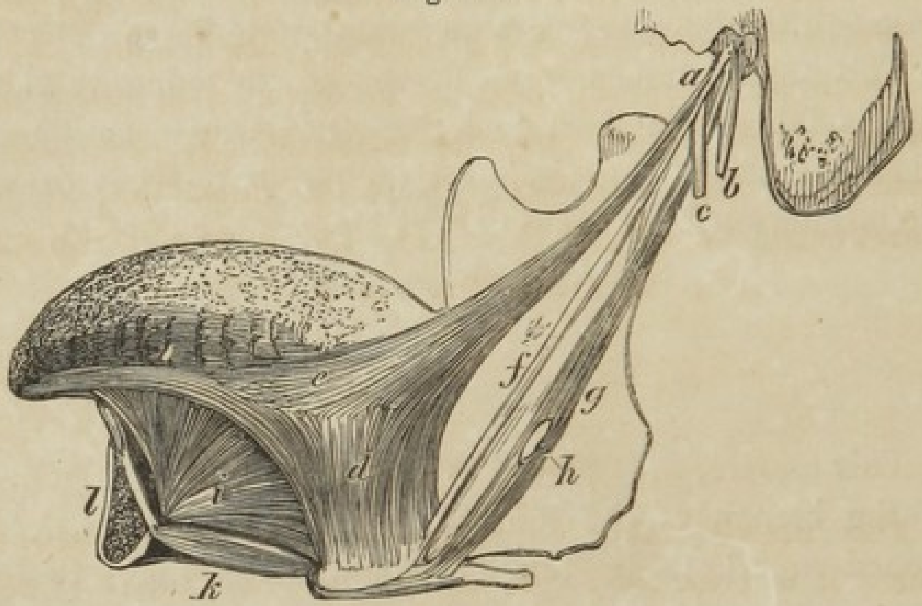
The *inner surface* is connected with the circumflexus palati, the constrictor pharyngis superior, and the submaxillary gland. The *outer surface* lies upon the inner part of the branch of the lower jaw, much in the same manner as the masseter does upon the outer part.

When the pair of muscles act together, they bring the jaw horizontally forwards; when they act singly, the jaw is moved obliquely to the opposite side. The pterygoid muscles move the jaw from side to side, and perform the motion of grinding with the teeth.

LINGUAL REGION.

HYO-GLOSSUS.

Fig. 115.



This muscle, *d*, is situated at the front and upper part of the neck; it is thin, flat, and quadrilateral. Inferiorly, its fibres are attached to the os hyoides; superiorly, to the side of the tongue, and mixes with *a*, *e*, the fibres of the stylo-glossus.

The *outer surface* is covered by the hyo-glossus, the mylo-hyoideus, the genio-hyoideus and digastricus, the hypo-glossal nerve, and the sub-maxillary gland. The *inner surface* is connected with the constrictor pharyngis medius, the genio-glossus, the lingual artery, and the glosso-pharyngeal nerve.

The hyo-glossus draws the tongue inwards and downwards.

GENIO-GLOSSUS.

This muscle, *i*, *k*, is situated between the tongue and *l*, the lower jaw; its fibres are radiated, extending from the mental process to the inferior surface of the tongue and the os hyoides.

The *external surface* of the genio-glossus is connected with the sublingual gland, and the stylo-glossus, hyo-glossus, lingualis, and mylo-hyoideus muscles; the *internal surface* is in contact with that of the opposite side.

According to the direction of its fibres, so it moves the tongue: those which go to the point draw it backwards; those which pass backwards thrust the tongue out of the mouth; and the central fibres have the power of rendering the upper surface of the tongue concave.

STYLO-GLOSSUS.

This muscle takes an oblique direction from above, where it is attached, at *a*, to the styloid process of the temporal bone, and to *f*, the stylo-maxillary ligament; the muscular fibres are finally lost, at *e*, in the substance of the tongue.

The *outer surface* is covered by the digastricus, the lingual nerve, the submaxillary gland, and the mucous membrane of the mouth: the *inner surface* covers the constric tor pharyngis superior, the hyo-glossus, and the lingualis.

The stylo-glossus moves the tongue sideways and backwards, when it acts alone; but when it contracts at the same time with the corresponding muscle, the tongue is carried upwards and backwards.

LINGUALIS.

The fibres of this muscle run from the root to the tip of the tongue, and are intermixed at its lateral parts with the muscles just mentioned.

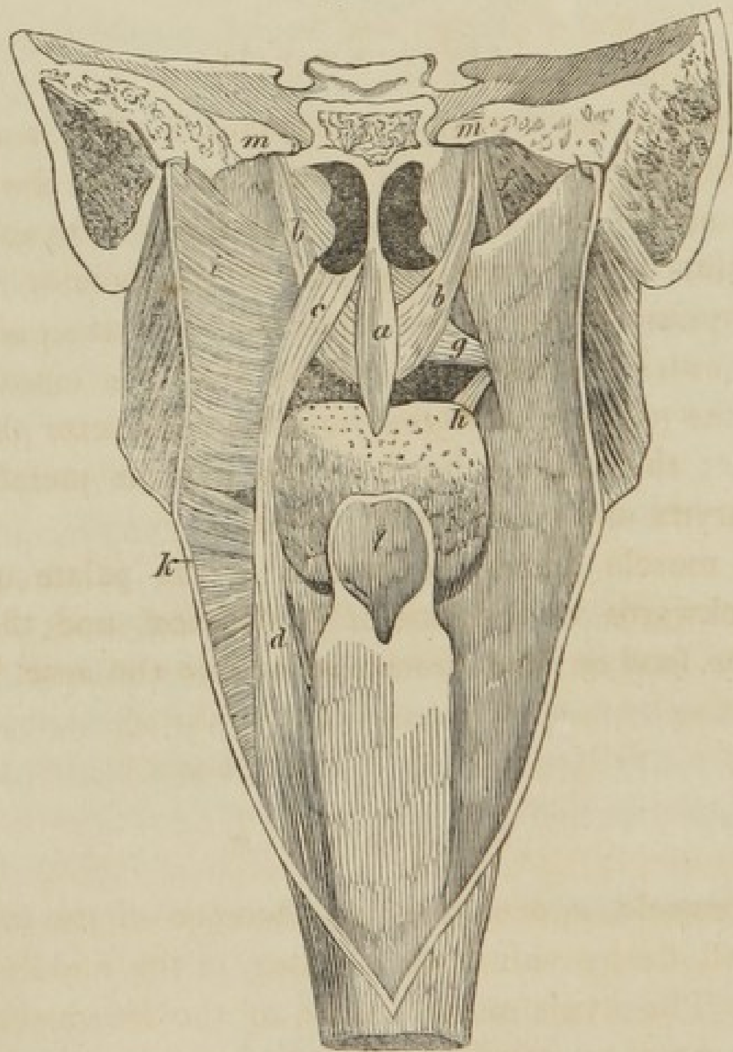
The *upper surface* is confounded with the fleshy texture of the tongue; the *lower surface* is covered by the mucous membrane of the mouth.

This muscle contracts the tongue and depresses its point.

PALATINE REGION.

CIRCUMFLEXUS PALATI.

Fig. 116.



This muscle is placed in the substance of the velum of the palate. Superiorly it is attached to the wing of the sphenoid bone and to the Eustachian tube; its tendon, *f*, passes round the hook of the internal plate of the pterygoid process of that bone, and spreads into *g*, a tendon at the semilunar edge of the os palati and velum palati.

The *external surface* is covered by the pterygoideus internus; the *inner surface* is in apposition with the levator palati and constrictor pharyngis superior, the mucous membrane of the pharynx and of the velum palati.

This muscle stretches the palate horizontally.

LEVATOR PALATI.

The shape and direction of this muscle, *b*, *b*, is apparent in the figure. Superiorly it is attached at *m*, the petrous portion of the temporal bone; the inferior fibres are inserted into *a*, the pendulous part of the palate, its fibres being confused with the other muscles in that situation.

The *outer surface* is connected with the circumflexus palati, the palato-pharyngeus, and the constrictor pharyngis superior; the *inner* is lined by the mucous membrane of the pharynx and of the velum palati.

This muscle draws the curtain of the palate upwards and backwards in the time of swallowing, and thus prevents the food or drink from passing into the nose.

LEVATOR UVULÆ.

This muscle, *a*, occupies the substance of the uvula, or that small fleshy substance hanging in the middle of the palate. The uvula muscle is one of the four instances of a single muscle; it is attached to the palate bones, and runs down the whole length of the uvula, adhering to the tendons of *g*, the circumflex muscle.

It is connected *anteriorly* with the levator palati, and is covered *posteriorly* by the membrane of the velum palati.

This muscle raises the uvula.

PALATO-PHARYNGEUS.

This muscle is placed in the substance of the velum palati and that of the pharynx; superiorly it is attached, at *c*, to the arch of the palate; inferiorly, at *d*, to the thyroid cartilage, and the bag of the pharynx.

The *posterior surface* of this muscle is covered by the mucous membrane of the velum palati, and the constrictores pharyngis; the *anterior surface* is connected with the aponeurosis of the circumflexus palati and the mucous membrane of the pharynx.

This muscle draws the uvula downwards and backwards, shuts the passage of the posterior nostrils, and assists in swallowing.

CONSTRICTOR ISTHMI FAUCIUM.

This is a small fleshy fasciculus, *h*, attached to the curtain of the palate and to the base of the tongue.

The action of this muscle lowers the velum palati, and assists in raising the tongue.

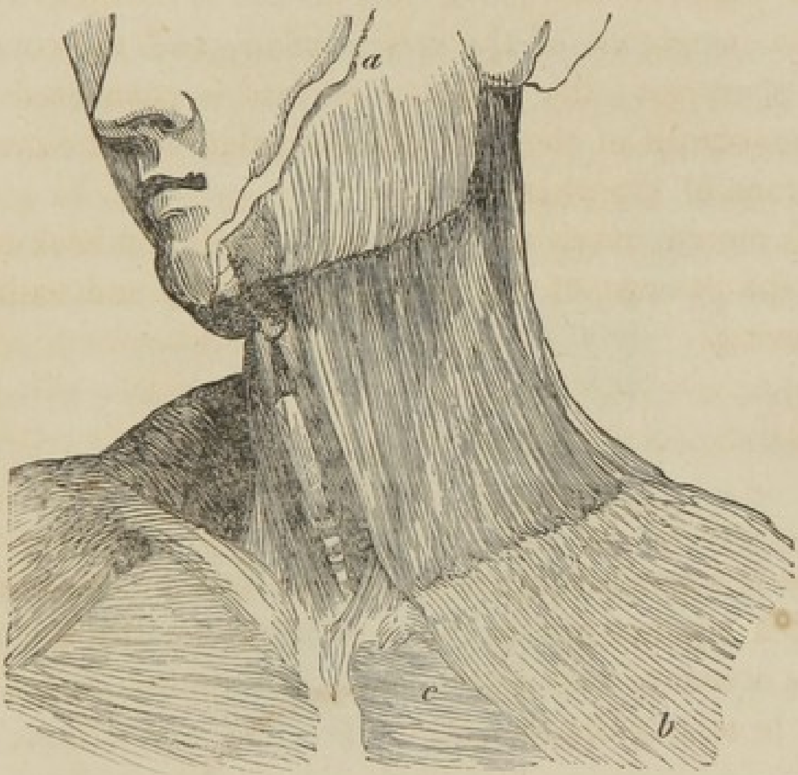
CHAP. III.

MUSCLES OF THE NECK.

ANTERIOR CERVICAL REGION.

PLATYSMA MYOIDES.

Fig. 117.



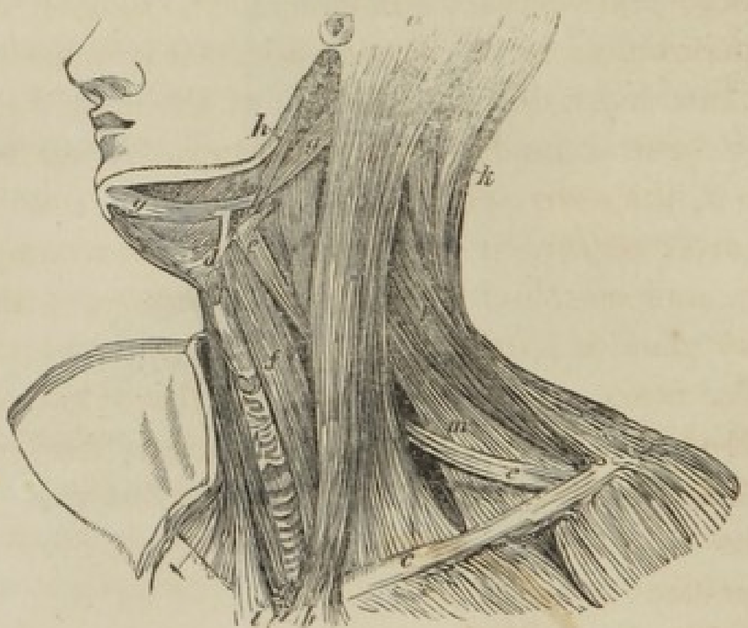
This is an extremely thin layer of fleshy fibres, spread over the other muscles, and attached to the cellular membrane of the neck; it requires some skill in dissection to display this muscle, for as it is merely a web of muscular fibres, it is frequently removed with the integuments unnoticed. Superiorly it extends to *a*, the face, where its fibres are lost in the cellular tissue of the cheek, and inferiorly at *b;* its fibres cover a portion of *c*, the pectoral, and of *d*, the deltoid muscles.

The *outer surface* of this muscle is covered by the skin; the *inner* is placed over the deltoides, pectoralis major and sterno-cleido-mastoideus muscles, the clavicle, the muscles of the hyoidean and maxillary regions, and the submaxillary and parotid glands.

This muscle draws the skin of the cheek downwards, and when the mouth is shut, brings the skin under the lower jaw upwards.

STERNO-CLEIDO-MASTOIDEUS.

Fig. 118.



This muscle is situated at the side of the neck. Superiorly it is attached, at *a*, to the mastoid process of the temporal bone, and to a part of the occipital bone; inferiorly, at *b*, to the summit of the sternum, and at *c*, to the internal third of the superior border of the clavicle.

The *outer surface* is covered by the platysma myoides, excepting at its upper extremity, which lies under the skin and parotid gland; between it and the preceding muscle the external jugular vein and some nervous filaments of the cervical plexus are situated. The *inner surface* is connected to the articulation of the sternum with the clavicle, the sterno-thyroideus, sterno-hyoideus, and omo-hyoideus muscles, the internal jugular vein, the carotid artery, the pneumo-gastric nerve, the cervical plexus, the great sympathetic nerve, the scaleni, the levator scapulæ, the splenius and digastric muscles.

DIGASTRICUS.

This muscle is so called from having two *bellies*, *g*, *g*, one of which is attached to the mastoid groove of the temporal bone, and becomes tendinous in the middle, traversing a perforation in *h*, the stylo-hyoideus muscle; the other is inserted into the inner part of the chin, Fig. 119, *h*. The central tendon is braced down by aponeurotic fibres to *d*, the os hyoides.

The *outer surface* is covered by the lesser complexus, splenius, and sterno-cleido-mastoideus muscles; the submaxillary gland is lodged in the angle formed by the tendon. The *inner surface* is placed upon the stylo-hyoideus, the stylo-glossus, and the stylo-pharyngeus muscles, the external and internal carotid arteries, the internal jugular vein, the hypo-glossal nerve, and the hyo-glossus and mylo-hyoideus muscles.

When the mouth is shut the action of this muscle raises the os hyoides, and the pharynx at the time of deglutition; when these parts are fixed it opens the mouth.

STYLO-HYOIDEUS.

The form of this muscle, Fig. 118, *h*, is long and slender, having a tendinous attachment superiorly to the styloid process, and inferiorly to *d*, the os hyoides. Its perforation to admit the tendon of the digastricus has been mentioned in the preceding description of that muscle, and is also represented in Fig. 115.

The digastric muscle is extended across the *outer surface;* the *inner* is connected with the external carotid, labial, and lingual arteries, the internal jugular vein, the stylo-glossus, stylo-pharyngeus, and hyo-glossus muscles, and the hypo-glossal nerves.

MYLO-HYOIDEUS.

This is a broad, thin, triangular muscle, Fig. 115, *i;* superiorly it is attached to nearly the whole extent of the inside of the lower jaw, between the molar teeth and the chin; inferiorly the fibres converge, and are inserted into the os hyoides. This muscle unites with its fellow in a middle line, which extends from the os hyoides to the chin.

The *outer surface* is covered by the digastricus, the platysma myoides, and the submaxillary gland; the *inner* is placed in contact with the genio-hyoideus, genio-glossus, and hyo-glossus, the sub-lingual gland, the prolongation of this gland, and the lingual nerve.

This muscle raises the os hyoides, or depresses the jaw.

GENIO-HYOIDEUS.

This muscle, Fig. 115, *k*, Fig. 119, *i*, is placed above the preceding; its figure is thin and narrow. Anteriorly it is attached to the mental process of the lower jaw; posteriorly to the surface of the body of the os hyoides.

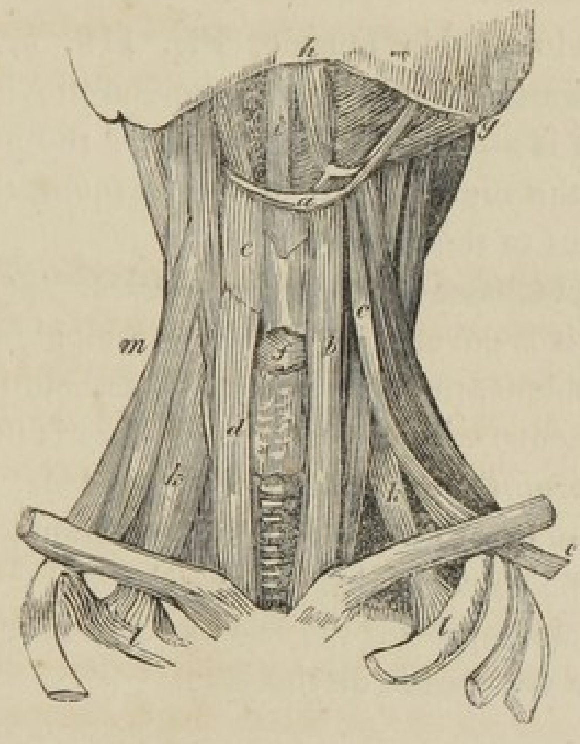
The *anterior surface* is covered by the mylo-hyoideus; the *posterior* is in contact with the genio-glossus and hyo-glossus; the *inner edge* meets that of the opposite side.

The action of this muscle raises the os hyoides, carrying it forward, or it depresses the lower jaw.

INFERIOR HYOID REGION.

OMO-HYOIDEUS.

Fig. 119.



This muscle, *c*, *c*, and in the preceding figure, *e*, *e*, is situated at the side of the neck; it is very long, thin, and narrow. Superiorly it is attached to the hyoid bone, descends obliquely across the neck, and forms a tendon in its centre, where it passes behind the sterno-cleido-mastoideus, and becoming fleshy again, is inserted into the root of the coracoid process and semilunar notch of the scapula.

The *outer surface* is covered by the trapezius, the platysma myoides, and the sterno-cleido-mastoideus; we see in the figure the clavicle lying across it. The *inner surface* corresponds to the scaleni muscles, the anterior branches of the inferior cervical nerves, the primitive carotid artery, the internal jugular vein, the superior thyroidean vessels, the sterno-hyoideus and sterno-thyroideus muscles.

This muscle depresses the hyoid bone, drawing it a little backwards.

STERNO-HYOIDEUS.

This is a long, thin muscle, Fig. 119, *b*, presenting generally towards its middle an aponeurotic intersection. Superiorly it is attached to the body of the hyoid bone; inferiorly to the superior part of the sternum, the clavicle, and sometimes to the first rib.

The clavicle passes across the *anterior surface* of this muscle, and it is covered by the sterno-cleido-mastoideus, the omo-hyoideus, the platysma-myoides, and by the common integuments. The *posterior surface* is in apposition with the sterno-thyroideus, crico-thyroideus, and thyro-hyoideus muscles, the thyro-hyoid membrane, the thyroid gland, and the superior thyroid vessels.

This muscle depresses the larynx, and furnishes a fixed point for the depressors of the jaw.

STERNO-THYROIDEUS.

This muscle, *d*, is placed behind the former, and its form is like it; superiorly it is attached to the thyroid cartilage; inferiorly to the upper and posterior part of the sternum, opposite the cartilage of the first rib. It frequently presents at its lower part an oblique or transverse aponeurotic intersection.

The *anterior surface* is covered by the sterno-hyoideus, sterno-cleido-mastoideus, and omo-hyoideus muscles. The *posterior surface* covers the subclavian and internal jugular veins, the primitive carotid artery, the trachea, the thyroid gland, the crico-thyroid muscle, and a part of the constrictor pharyngis inferior.

This muscle draws the larynx downwards.

THYRO-HYOIDEUS.

This is a small oblong muscle, *e*, attached superiorly to the hyoid bone, inferiorly to the thyroid cartilage.

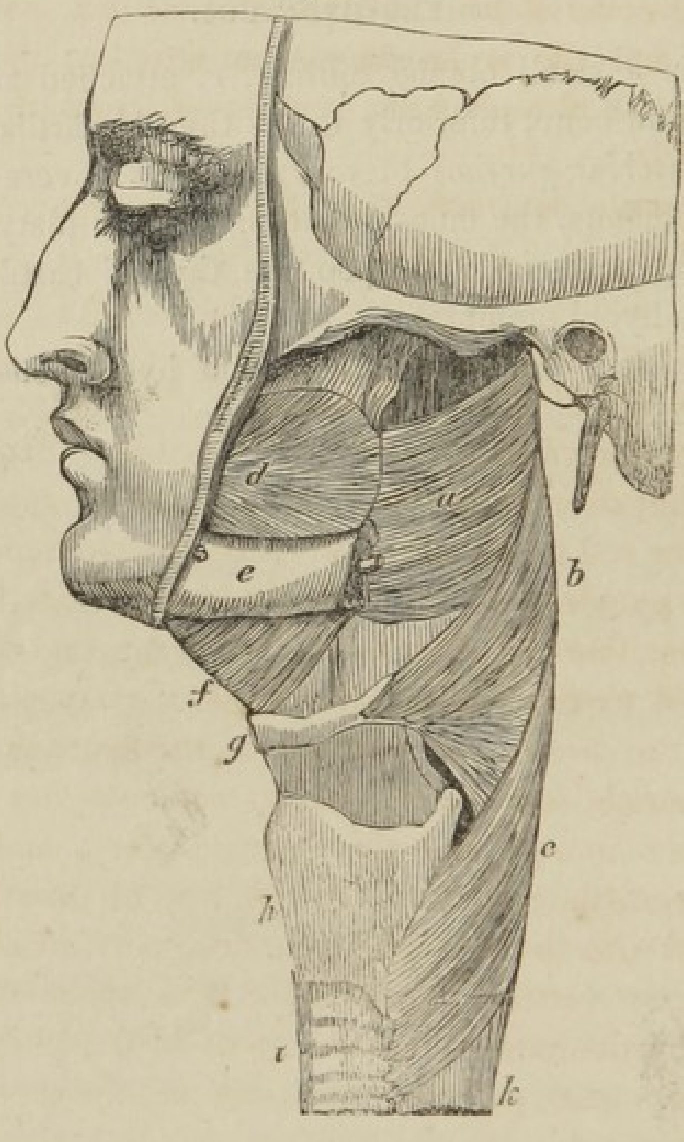
The *anterior surface* of this muscle is covered by the sterno-hyoideus, the omo-hyoideus, and the platysma myoides; the *posterior* lies upon the thyroid cartilage, and the thyro-hyoid membrane.

This muscle brings the larynx and hyoid bone towards each other.

PHARYNGEAL REGION.

CONSTRICTOR PHARYNGEUS INFERIOR.

Fig. 120.



This is the largest muscle, *c*, of the pharynx. It is broad and membranous; anteriorly it is attached to *h*, the thyroid and cricoid cartilages, and to *i*, the upper rings of the trachea; posteriorly it is united to its fellow, in a vertical tendinous line. The direction of its fibres is expressed in the figure.

The *exterior surface* is covered by the sterno-thyroideus, the thyroid gland, and the primitive carotid artery. The *posterior surface* is connected with the rectus capitis, anticus major and longus colli muscles, and with the anterior vertebral ligament by cellular tissue. The *interior surface* is covered by the constrictor medius, palato-pharyngeus, and the stylo-pharyngeus muscles, the mucous membrane of the pharynx, and the thyroid and cricoid cartilages.

This muscle contracts that part of the pharynx which it covers.

CONSTRICTOR PHARYNGIS MEDIUS.

This muscle, *b*, is of a triangular shape, situated at the middle part of the pharynx. It is attached anteriorly to the greater and lesser cornea of *g*, the hyoid bone, and to the stylo-hyoidean ligaments; posteriorly to its fellow, in a tendinous line at the back of the pharynx, and superiorly it is fixed to the basilar process of the occipital bone. Observe the direction of its fibres in the figure.

This muscle is connected on its *outer surface* with the hyo-glossus muscle and the lingual artery, and by the inferior constrictor below; in the rest of its extent it is connected with the muscles of the deep cervical region and the anterior vertebral ligament. The *inner surface* is covered by the mucous membrane of *k*, the pharynx, the stylo-pharyngeus, palato-pharyngeus, and the superior constrictor muscles.

This muscle compresses that part of the pharynx which it invests.

CONSTRICTOR PHARYNGIS SUPERIOR.

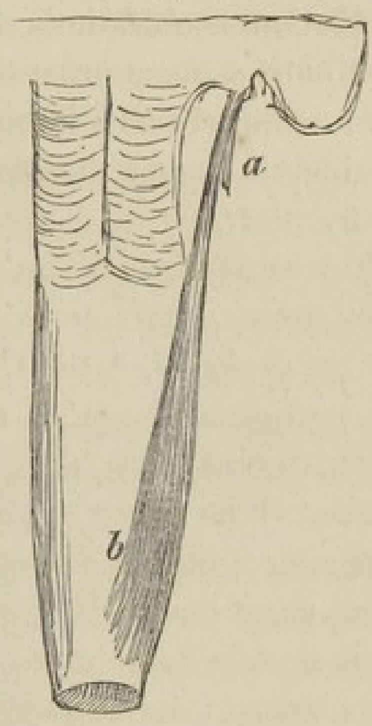
Like the other constrictors, this muscle, *a*, is broad and thin; its figure is nearly quadrilateral. It is partly covered by the middle constrictor, and its connections are most extensive. Superiorly, it is attached to the occipital bone before the large foramen; lower down, to the pterygoid process of the sphenoid bone, to the upper and under jaw near the last molar teeth, and to *d*, the buccinator muscle. Some fibres also are fixed to the root of the tongue and palate. Posteriorly, like the two preceding, its fibres are united in a line to the corresponding muscle.

The *outer surface* is connected with the preceding muscle, the stylo-glossus, the stylo-pharyngeus, the internal carotid artery, the internal jugular vein, the pneumo-gastric, hypo-glossal, and spinal nerves. These different parts occupy a triangular space, which is found between the constrictor pharyngis superior and the pterygoideus internus. The *inner surface* is connected with the palato-pharyngeus and the levator palati, and is lined by the mucous membrane of the pharynx.

This muscle compresses the pharynx at the upper part; the constrictors act in succession, and contract that portion of the alimentary canal when it is filled with food, and force it downwards into the esophagus.

STYLO-PHARYNGEUS.

Fig. 121.



This muscle is situated at the side and back part of the pharynx; it is attached superiorly to *a*, the styloid process, and inferiorly it is expanded on the pharynx and back part of the thyroid cartilage.

The *outer surface* is covered by the stylo-hyoideus, constrictor medius, and external carotid artery; the *inner* is connected with the internal carotid artery, the internal jugular vein, the mucous membrane of the pharynx, and the superior constrictor and palato-pharyngeus muscles.

This muscle raises the pharynx, and also draws upwards the thyroid cartilage.

DEEP CERVICAL REGION.

RECTUS CAPITIS ANTICUS MAJOR.

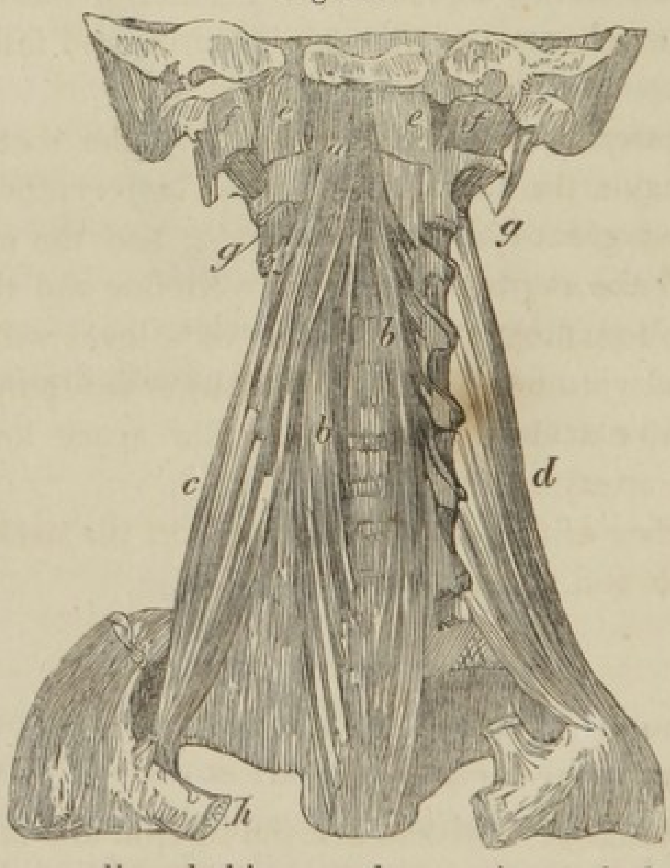
This muscle, Fig. 122, *a*, is placed on the anterior and lateral part of the cervical column; superiorly it is attached to the basilary process of the occipital bone; inferiorly by small tendons to the anterior tubercle of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ. It is a little drawn aside in the figure to show the muscle to be next described.

The *anterior surface* corresponds to the carotid artery, the internal jugular vein, the pneumo-gastric nerve, the superior cervical ganglion, and the pharynx; the *posterior surface* covers the longus colli, the rectus capitis anticus minor, the articulations of the atlas with the occiput, the articulation also of the axis or dentatus with the atlas, and also the transverse process of the cervical vertebræ.

If this muscle acts in conjunction with that of the opposite side, it bends the head forward; and laterally, if it acts by itself.

RECTUS CAPITIS ANTICUS MINOR.

Fig. 122.



This is a small and thin muscle, *e*, situated close to the uppermost vertebra; it is tendinous at its insertions, aponeurotic at its anterior surface, fleshy in the rest of its extent. Superiorly it is attached to the occipital bone near the condyle; inferiorly to the atlas, or first vertebra.

It is connected *anteriorly* with the preceding muscle; *posteriorly* with the articulation of the atlas and occiput.

This muscle assists the preceding in supporting or bending the head.

LONGUS COLLI.

This muscle, *b*, *b*, lies behind the esophagus, and the great vessels and nerves of the neck. Superiorly it is attached to the tubercle on the interior arch of the atlas; inferiorly to the anterior surface of the bodies of the three first dorsal and four last cervical vertebræ, to the intervertebral fibro-cartilages, and to the anterior border of the transverse processes of the third, fourth, and fifth cervical vertebræ.

The *anterior surface* is covered by the rectus capitis anticus major, the pharynx, the carotid artery, the pneumogastric and great sympathetic nerves, and the esophagus. The *posterior surface* covers the vertebræ and their fibro-cartilages to which it is attached: on a level with the two first dorsal vertebræ, its external border is separated from the anterior scalenus by a triangular space lodging the vertebral artery and vein.

The office of this muscle is to support the neck, to bend it forwards and to one side.

LATERAL CERVICAL REGION.

SCALENUS ANTICUS.

This muscle, *c*, is situated at the inferior and lateral part of the neck. It is elongated and divided above into several portions; superiorly it is attached by tendons to the anterior tubercle of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ; inferiorly to the superior border of *h*, the first rib.

On the *anterior surface* of this muscle we find the subclavian vein, transverse and ascending cervical arteries, the diaphragmatic nerve, the omo-hyoideus and the sterno-cleido-mastoideus muscles. The *posterior surface* forms with the following muscle a triangular space, in which are lodged the subclavian artery and those cervical nerves which form the brachial plexus. The inner side is separated from the longus colli by the vertebral artery and veins.

This muscle bends the head and neck laterally, and raises the first rib.

SCALENUS POSTICUS.

This muscle, *d*, is placed behind the preceding; superiorly it is attached to the posterior tubercle of the transverse processes of the six last cervical vertebræ, by six small tendons; inferiorly to the surface of the first rib, and to the superior border of the second rib.

The *anterior surface* of this muscle is connected with the preceding muscle, from which it is separated by the subclavian artery and the anterior branches of the cervical nerves; the *posterior surface* is connected with the transversus cervicis, splenius, and *levator* scapulæ muscles; on the *inner side* with the first dorsal and summit of the six lower transverse cervical processes.

The anterior and posterior scaleni muscles bend the neck to one side; but when the muscles of both sides act they incline the neck forwards; or when the neck is fixed, they have the power of raising the ribs and expanding the chest.

RECTUS CAPITIS LATERALIS.

This is a short, flat, and thin muscle, *f*, extending from the occipital bone to the transverse process of the atlas.

It is connected *anteriorly* with the jugular vein; *posteriorly* with the vertebral artery.

This muscle bends the head sideways.

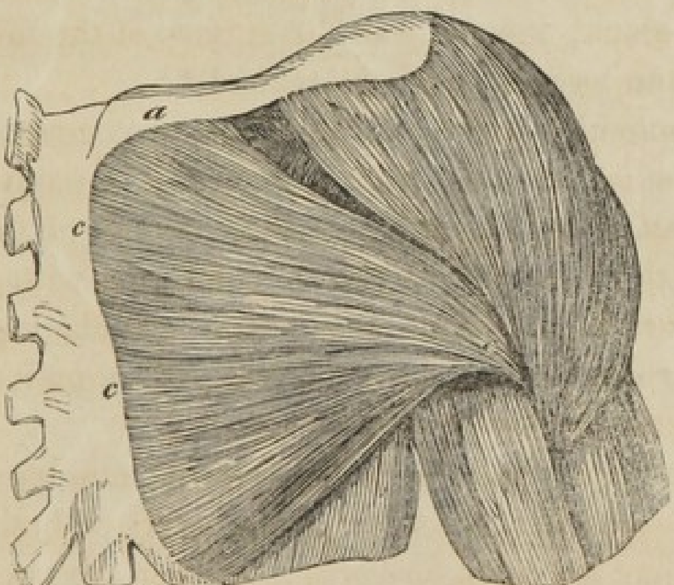
CHAP. IV.

MUSCLES OF THE TRUNK.

ANTERIOR THORACIC REGION.

PECTORALIS MAJOR.

Fig. 123.



This muscle is very large; its triangular form and the direction of its fibres are marked in the figure at *a*, *b*, *c*. 1st, it is attached to the inner half of *a*, the clavicle; 2nd, to the middle part of *c, c*, the whole length of the sternum; 3rd, at *b*, to the cartilages of the true ribs, excepting the first, and a little to the bony portion of the fifth rib; and lastly, from an aponeurosis common to it with the abdominal muscles. The fleshy fibres run obliquely across the breast, and converging form a small tendon which is fixed to the outer border of the bicipital groove of the os humeri.

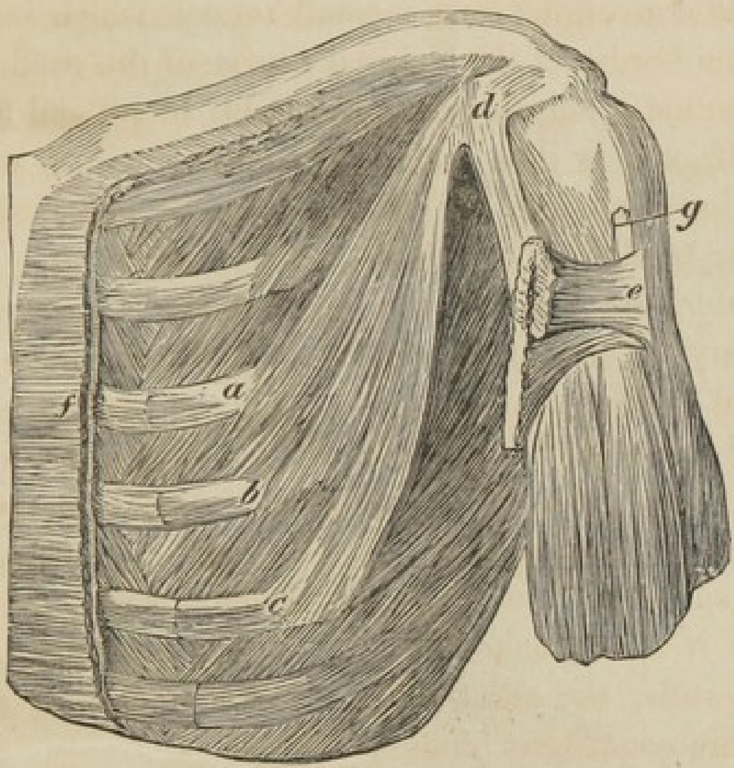
This tendon is shown in the Fig. 124, broad and folded upon itself, and is thus composed of two laminæ, which, with the insertion into the humerus on the inner side of *g*, the long tendon of the biceps, is very apparent.

The *anterior surface* of the pectoralis major is covered by the platysma myoides, see Fig. 119, by the mammary gland, and common integuments. The *posterior surface* is situated on the sternum, the cartilages of the ribs, a part of their osseous portions, the thoracic vessels and nerves, the subclavius, pectoralis minor, external intercostal, serratus magnus, rectus, and obliquus abdominis muscles . the axilla it is connected with the axillary ganglia, the axillary vessels, the nerves of the brachial plexus, and a considerable quantity of cellular tissue.

The pectoralis major is a most powerful muscle in moving the arm; it carries the arm inwards and forwards, and when raised it lowers it, as in striking a blow. When the humerus is fixed it acts upon the thorax, and becomes a muscle of inspiration; or it can raise the trunk upon the limbs, when holding by the hands in climbing a tree, etc.

PECTORALIS MINOR.

Fig. 124.



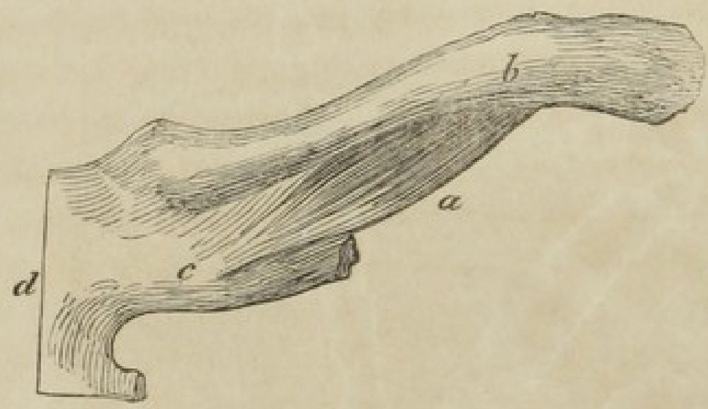
This muscle, *a, b, c, d,* is situated behind the preceding muscle; its shape and the direction of its fibres are obvious in the figure. Superiorly it is attached by a strong flat tendon to *d,* the coracoid process of the scapula; inferiorly by three divisions at *a, b, c,* to the third, fourth, and fifth ribs.

The *anterior surface* is covered by the preceding muscle; between them we find some of the thoracic vessels and nerves. The *posterior surface* is connected with the ribs, the external intercostals, the serratus magnus, the axillary vessels, and the brachial plexus of nerves.

The pectoralis minor draws the shoulder bone forwards and downwards, and when that bone is fixed it elevates the ribs.

SUBCLAVIUS.

Fig. 125, *a*.



This muscle is placed obliquely under the clavicle. It is attached by its external extremity to the inferior surface of *b*, the clavicle; by its internal extremity it is fixed by a flat tendon at *c*, to the cartilage of the first rib.[v]

The *anterior surface* of the subclavius is covered by the pectoralis major; between them we observe a thin aponeurosis extending from the clavicle and coracoid process of the scapula towards the first rib. The *posterior surface* is placed upon the axillary vessels and the nerves of the brachial plexus; indeed, these separate it from the first rib.

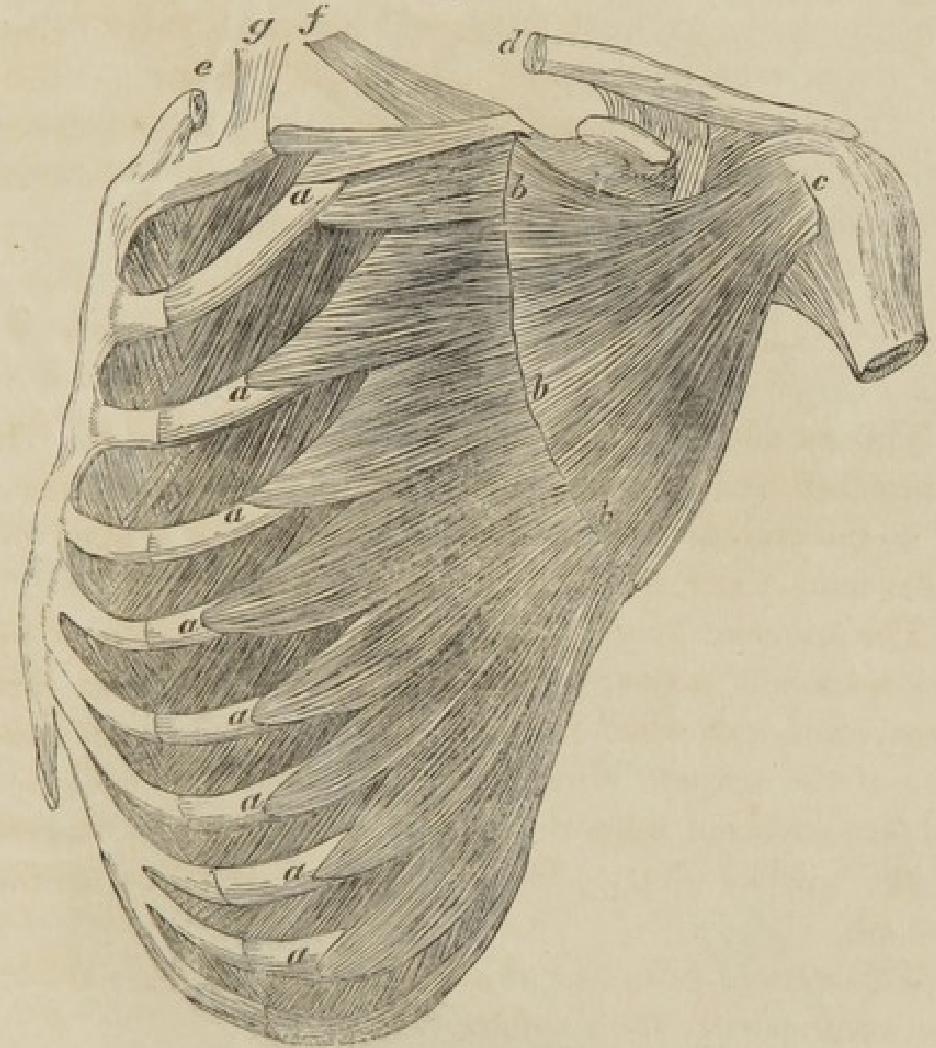
This muscle brings forward and downward the clavicle, and consequently the shoulder.

[v] *d*, the sternum.

LATERAL THORACIC REGION.

SERRATUS MAGNUS.

Fig. 126.



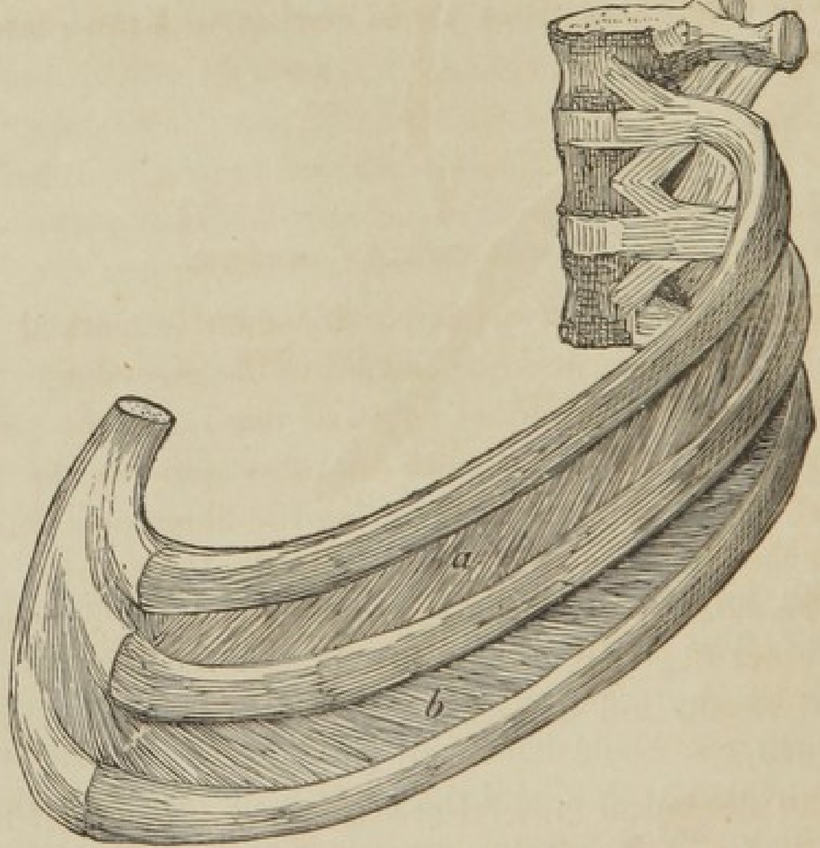
The serratus magnus is situated on the side of the chest. The form of this muscle and the direction of its fibres are represented in the figure; but as part of it lies between the blade bone and the ribs, the collar bone is here divided at *d*, *e*, and the blade bone thrown back from the trunk. The serratus magnus is anteriorly attached to eight or nine of the first ribs, *a*, *a*, *a*, *a*, *a*, *a*, *a*, *a*, by as many digitations; posteriorly to *b*, *b*, *b*, the whole length of the base of the scapula[w].

The *outer surface* of this muscle is covered by the two pectoral muscles, the latissimus dorsi, and subscapularis, the axillary vessels, and the brachial plexus; the *inner surface* is placed over seven or eight of the first ribs, the corresponding external intercostal muscles, and a portion of the serratus posticus.

The office of this muscle is to bring the scapula forward; when that bone is fixed, it becomes a muscle of inspiration: the obliquity of its fibres contributes to raise the ribs.

INTERCOSTAL REGION.

Fig. 127.



[w] *f*, the inferior portion of the levator scapulæ, *g*, the inferior portion of the scalenus anticus, *b*, *b*, *b*, *c*, the subscapularis.

INTERCOSTALES EXTERNI.

Fig. 127.

These muscles are the external layers of fleshy fibres which fill up the space between the ribs, a specimen of which is marked *a*. They are attached on one part to the inferior border of the rib; on the other, to the superior border of the rib beneath; the fibres are oblique from above downwards and from behind forwards.

The *outer surface* of these muscles is covered by the pectoral muscles, serratus magnus, obliquus externus abdominis, serratus posticus superior and inferior, and sacro-lumbalis. The *inner surface* is in contact with the pleura, from the tuberosity as far as the angle of the ribs; in the rest of their extent they are in contact with the internal intercostal muscles.

INTERCOSTALES INTERNI.

These muscles, a specimen of which is marked *b*, are similar in number and in situation to the preceding. They extend from the inferior margin of one rib to the superior margin of the rib below, and from the spine to the breast bone. They differ only in having the fibres pass obliquely from above downwards and from before backwards.

The *outer surface* of this set of muscles is covered by the preceding muscles, and is in contact with the intercostal vessels and nerves. The *inner surface* is lined by the pleura.

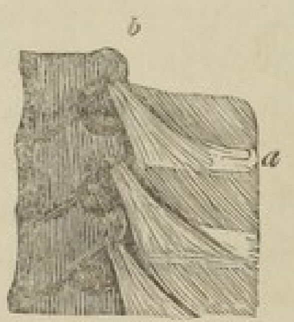
The intercostal muscles are two sets of muscular fibres, the one external, *a*, the other internal, *b*, passing in contrary directions, as the old anatomists describe them like St.

Andrew's cross; excepting that between the cartilages of the ribs, see Fig. 126, there is merely the internal layer, and at a small space from the spine the external layer only.

The offices of both the external and internal intercostals are the same; they elevate or depress the ribs, in the motions of inspiration or expiration, according as the upper or lower attachment is the line from which they act.

LEVATORES COSTARUM.

Fig. 128.



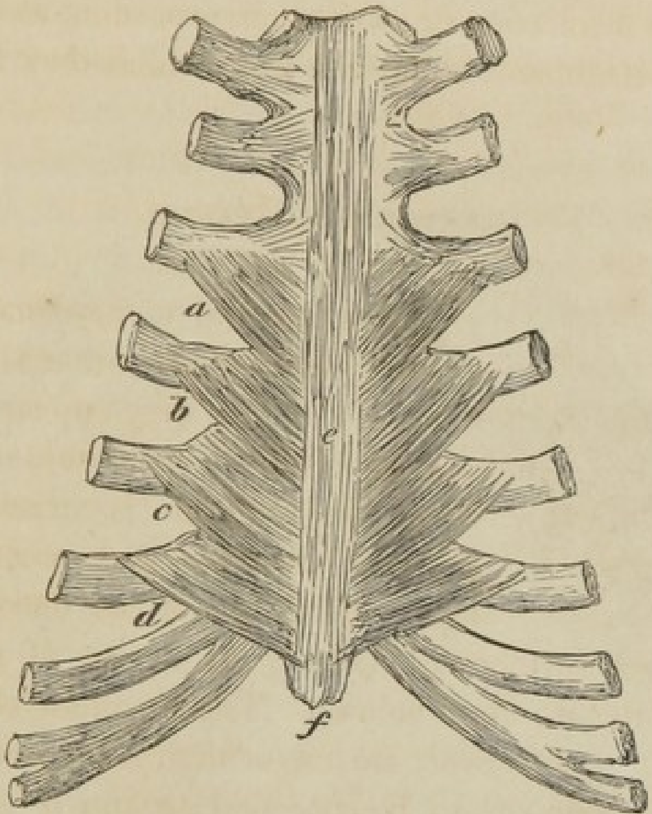
These are twelve very small thin triangular muscles on either side of the dorsal vertebræ; they appear as if they were portions of the external intercostals. Each muscle is attached superiorly to the transverse process of the lowest cervical and the eleven uppermost dorsal vertebræ; inferiorly to a part of the upper border of the rib next below[x]. Three or four of the inferior elevators, however, are longer than the others, and run down over one rib, to be attached to the alternate rib; hence ALBINUS denominated this set of muscles *levatores costarum breviores et longiores.*

The action of these muscles assists in raising the ribs and in supporting the spinal column.

A specimen of these muscles is given in the figure *b*, the transverse process, *a*, the rib. The whole are represented in Fig. 143, *b*, *b*, *b*, *b*, *b*, *b*, *b*.

TRIANGULARIS STERNI.

Fig. 129.



This muscle is situated within the thorax, behind the cartilages of the ribs. It is attached on the outer side at *a, b, c, d*, by four triangular tendinous and fleshy portions, to the cartilages of the third, fourth, fifth, and sixth ribs; on the inner side to the posterior and inferior part of *e*, the sternum, and at *f*, to the ensiform cartilage.

We have here a posterior view of the triangularis sterni, and *this surface* is covered by the pleura, and a small part by the diaphragm. The *anterior surface* is covered by the cartilages of the ribs, the inner intercostal muscles, and internal mammary vessels.

This muscle depresses the cartilages and lowers the extremities of the ribs, and is consequently subservient to expiration.

REGION OF THE DIAPHRAGM.

DIAPHRAGMA.

Fig. 130.

This is a broad, thin muscle, dividing the cavity of the chest from the abdomen. Its form is nearly circular, it is fleshy at its circumference, aponeurotic in the middle. The direction of its radiated fibres is represented in this figure. Anteriorly it is attached at *o*, to the ensiform cartilage; laterally to the internal surface of the cartilages of the six last ribs; posteriorly to the transverse processes of the first lumbar vertebra; by its left pillar at *c*[y], to the bodies of the three first vertebræ of the same region; by its right pillar at *d*, to the bodies of the four first. The structure of the diaphragm consists in part of a three-lobed aponeurosis, *b*, *b*, termed the *phrenic centre*, having an opening for the vena cava, *l*; it is fleshy at *a*, *a*, *a*, in the rest of its extent, and presenting posteriorly two openings, one at *m*, for the esophagus and pneumo-gastric nerves, the other traversed by *n*, the aorta; the vena azygos and throracic duct also pass through it.

The *upper surface* of the diaphragm is connected with the pericardium, the mediastinum, and the pleura; it supports the heart and the base of the lungs. The *lower surface* posteriorly is in contact with the kidneys, the surrenal capsules, the pancreas, and the duodenum, on the right side with the liver; on the left side with the spleen and stomach; in its whole extent it is covered by the peritoneum.

The diaphragm performs a most important office in the phenomena of respiration; every time we draw in our breath it contracts, and changing its vaulted form to that of a plane, it enlarges the capacity of the chest so as to admit of the dilatation of the lungs; it may therefore be called the principal muscle of inspiration. On the other hand, when it relaxes, the abdominal muscles press their

y Termed also tendinous feet, or crura, *c*, *d*, *e*, *f*. These feet or crura run obliquely upwards and forwards into two fleshy portions called alæ, which mixing and crossing fibres terminate in *b*, *b*, the tendinous centre.

viscera upwards, and the diaphragm ascends in the thorax and compresses the lungs, and thus contributes to expiration. It also acts in coughing, vomiting, laughing, and speaking, and assists in various other functions, as in the expulsion of the contents of the uterus, bladder, and intestines.

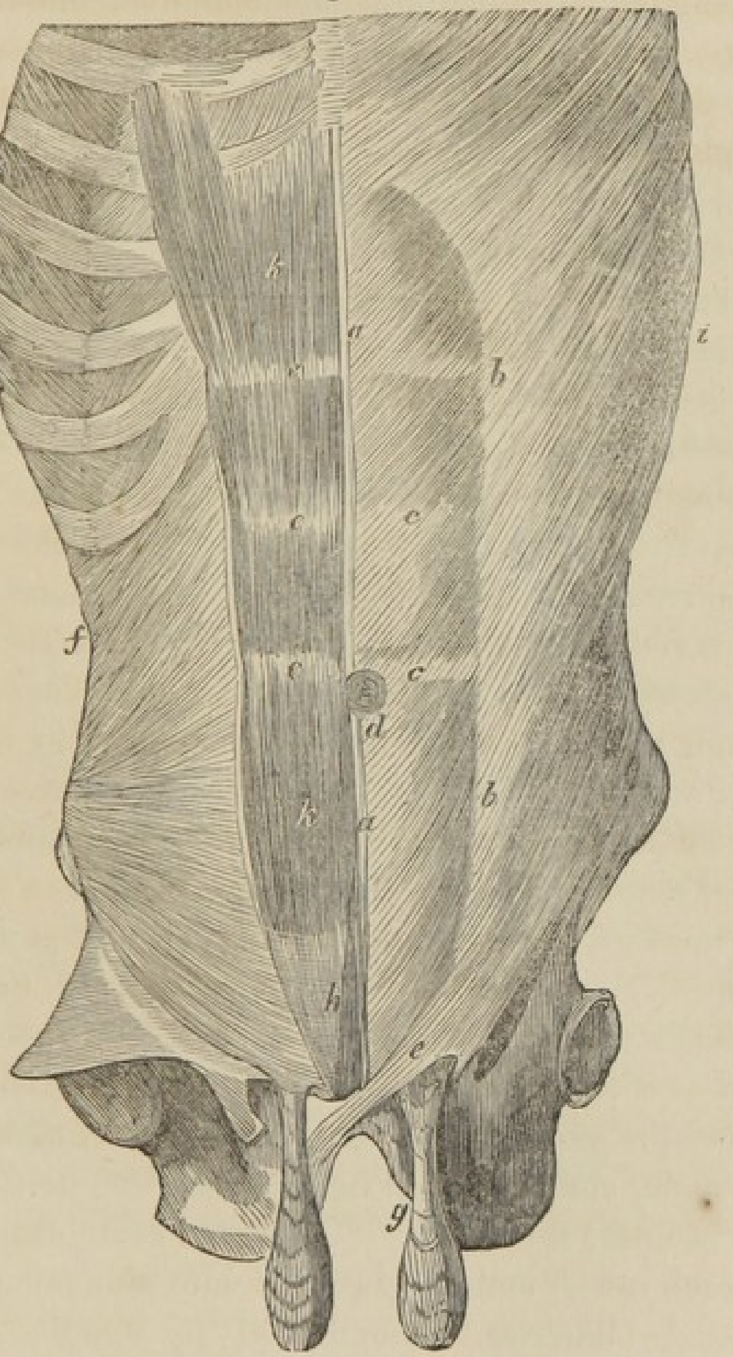
The motion of the diaphragm is moreover subservient to snuffing odours, to sighing, yawning, coughing, sneezing, hiccup, and all those actions connected with inspiration and expiration.

MUSCLES OF THE ABDOMEN.

ABDOMINAL REGION.

OBLIQUUS ABDOMINIS EXTERNUS.

Fig. 131.



This muscle is situated on the anterior and lateral parts of the abdomen; its figure is broad, thin, and irregularly quadrilateral. It is attached superiorly by fleshy triangular slips, called digitations, to the external surface and inferior margin of the seven or eight last ribs; inferiorly to the two anterior thirds of the edge of the hip bone. The muscular fibres, *i*, are directed obliquely from above downwards and from behind forwards, and about the middle terminate abruptly at *b*, *b*, the semicircular line *(linea semicircularis)*, which runs from the pubis to the ribs. A flat tendinous expansion or aponéurosis is then continued to meet with that on the opposite side, where it forms a central tendinous cord, *a*, *a*, termed the white line *(linea alba)*, which extends from the ensiform cartilage to the pubis. This line appears to be the result of the reunion of the aponeurosis of the two oblique and transverse muscles upon the median line of the abdomen; and it is composed of inextricable fibres of a very strong texture, forming a kind of ligament to unite the sternum to the pelvis. There are lines of a similar nature, passing from the linea semicircularis to the linea alba, marked with the letters *c*, *c*, and termed *lineæ transversales*. The letter *d*, marks the umbilicus or navel, consisting of condensed cellular membrane: in the fœtus it was a foramen which gave passage to the nutrient vessels, which connected the fœtus with the placenta. Inferiorly the external oblique muscle is fixed to the *Fallopian ligament*, which appears like a strong resistent fold, stretched from the anterior superior spine of the ilium to the pubis. Near this insertion there is a small oblique opening at *e*, formed as it were by the splitting of the aponeurosis; it is named the *abdominal ring*: it allows the spermatic cord in the male, and the round ligament of the uterus in the female, to pass through it. The fibres being again united, cross each other, and are inserted into the pubes. This opening is likewise strengthened by tendinous fibres, which pass transversely, and in various directions, forming it into an elliptical aperture.

The *outer surface* of this muscle is covered by the common integuments, and at the back part by the latissimus dorsi; the *inner surface* is placed on the anterior part of the last eight ribs and their cartilages, the corresponding intercostal muscles, and the oblique internus.

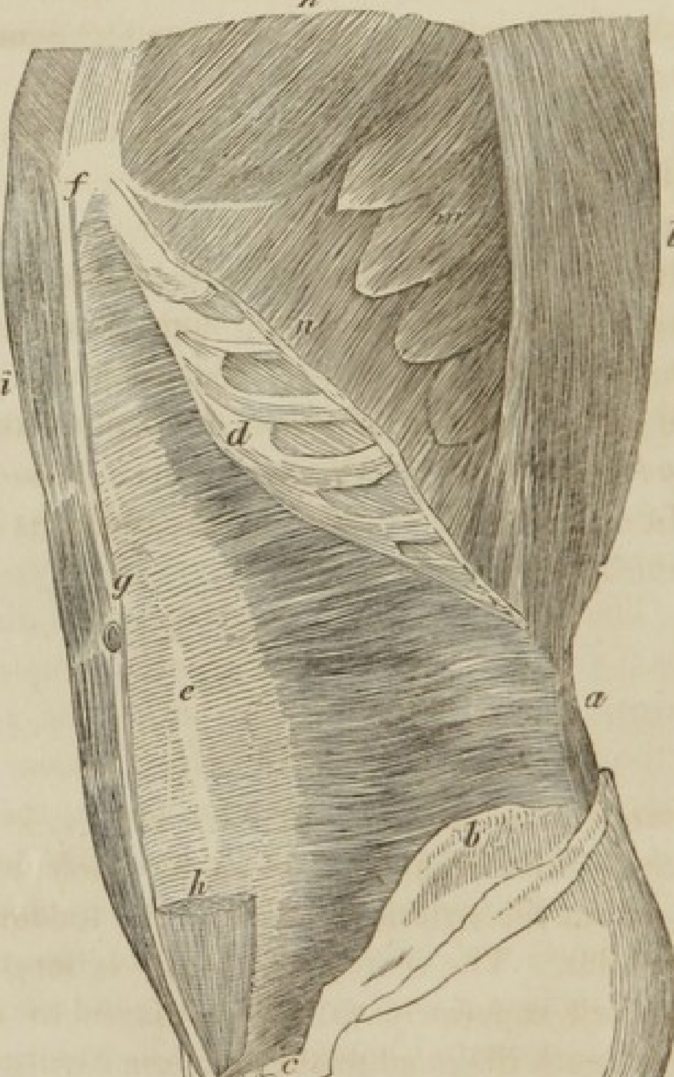
OBLIQUUS ABDOMINIS INTERNUS.

This muscle, Fig. 131, *f*, is placed behind the preceding, and like it is broad, thin, and somewhat quadrilateral. It is attached superiorly to the border of the cartilages of the eighth, ninth, tenth, and eleventh ribs; inferiorly, to the spine of the ilium, to the crural arch, and to the pubis; posteriorly, to the spinous processes of the lumbar vertebræ, and to the sacrum; anteriorly, to the linea alba. The figure expresses by its lines the direction of the fibres; viz. the superior fibres are oblique from below upwards, and from behind forwards; the middle, horizontal; the inferior, a little oblique from above downwards. The muscle becomes aponeurotic at the linea semicircularis, and adheres firmly to it, then divides into two layers. The anterior layer unites with the tendon of the external oblique, the internal adheres to the muscle behind it; they inclose a long muscle, *k*, *k*, and are finally reunited at *a*, *a*, the central linea alba. The anterior tendon is here removed to show the rectus muscle.

The *outer surface* is covered by the preceding muscle and by the latissimus dorsi; the *inner surface* is in contact with the transversalis abdominis and sacro-lumbalis.

TRANSVERSALIS ABDOMINIS.

Fig. 132.



This muscle is situated behind the oblique muscles; its form is similar, and is attached superiorly to *d*, the cartilages of the seven lower ribs; inferiorly, to the crest of *b*, the ilium, and at *c*, to the two internal thirds of the crural arch; posteriorly, to the summit of the transverse and spinous processes of the four first lumbar vertebræ. The fleshy fibres proceed transversely, and end in *e*, a flat sheet of tendon or aponeurosis, which, after being connected to the tendons of the two oblique muscles at the semicircular line, it then divides into two laminæ to form a sheath for the rectus abdominis; the anterior lamina is united with the aponeurosis of the external oblique muscle, and is extended over the front of the rectus; the posterior lamina is united with the aponeurosis of the internal oblique, and is extended behind the rectus, excepting at its lower part; for at the middle distance between the umbilicus and pubes, a slit or fissure is formed at *h*, in the aponeurosis of the transversalis, through which the rectus passes, so that the remainder of the aponeurosis passes before the rectus, and is anteriorly inserted into *f*, the ensiform cartilage, and *g*, the linea alba. The *external surface* of this muscle is covered by the obliquus internus, the *internal* by the peritoneum.

RECTUS ABDOMINIS.

This muscle, Fig. 131, *k*, *k*, Fig. 132, *i*, is situated immediately in front of the abdomen, on each side of the linea alba, under the anterior laminæ of the tendons of the oblique muscles. The rectus abdominis is long and flat, and is attached superiorly to the cartilages of the fifth, sixth, and seventh ribs, and to the ensiform cartilage; inferiorly to the pubes. It is divided by three or four tendinous intersections, marked in Fig. 131, *e*, *e*, denominated the transverse lines; by these divisions the muscle is connected firmly to the anterior part of the sheath, while it adheres very slightly by loose cellular substance to the posterior layer.

The *anterior surface* of this muscle is covered by the aponeurosis of the pectoralis major, and by a lamina of the abdominal aponeurosis, except at the lower part, where we commonly find the pyramidalis. The *posterior surface* is extended over the cartilages of the three last true ribs, a portion of the cartilages of the last two false ribs, the ensiform cartilage, the posterior fold of the abdominal aponeurosis, the internal mammary and the epigastric arteries, and the peritoneum.

The office of the last-mentioned muscles, viz. the external and internal oblique, the transversalis, and rectus, is to draw down the ribs in expiration: to bend the body obliquely, or to one side when one set acts singly, but when they act together they bend the thorax directly forwards. They have the power, when the ribs are fixed, of raising the pelvis; they also compress the abdominal viscera, so as to raise the diaphragm and expel the air from the lungs; lastly, they assist in the expulsion of the fœtus, urine, and fœces.

PYRAMIDALIS.

This is a very small muscle, Fig. 131, *h*, placed over the pubes. It is attached superiorly, near half-way between the pubes and umbilicus, to the linea alba; inferiorly to the pubes.

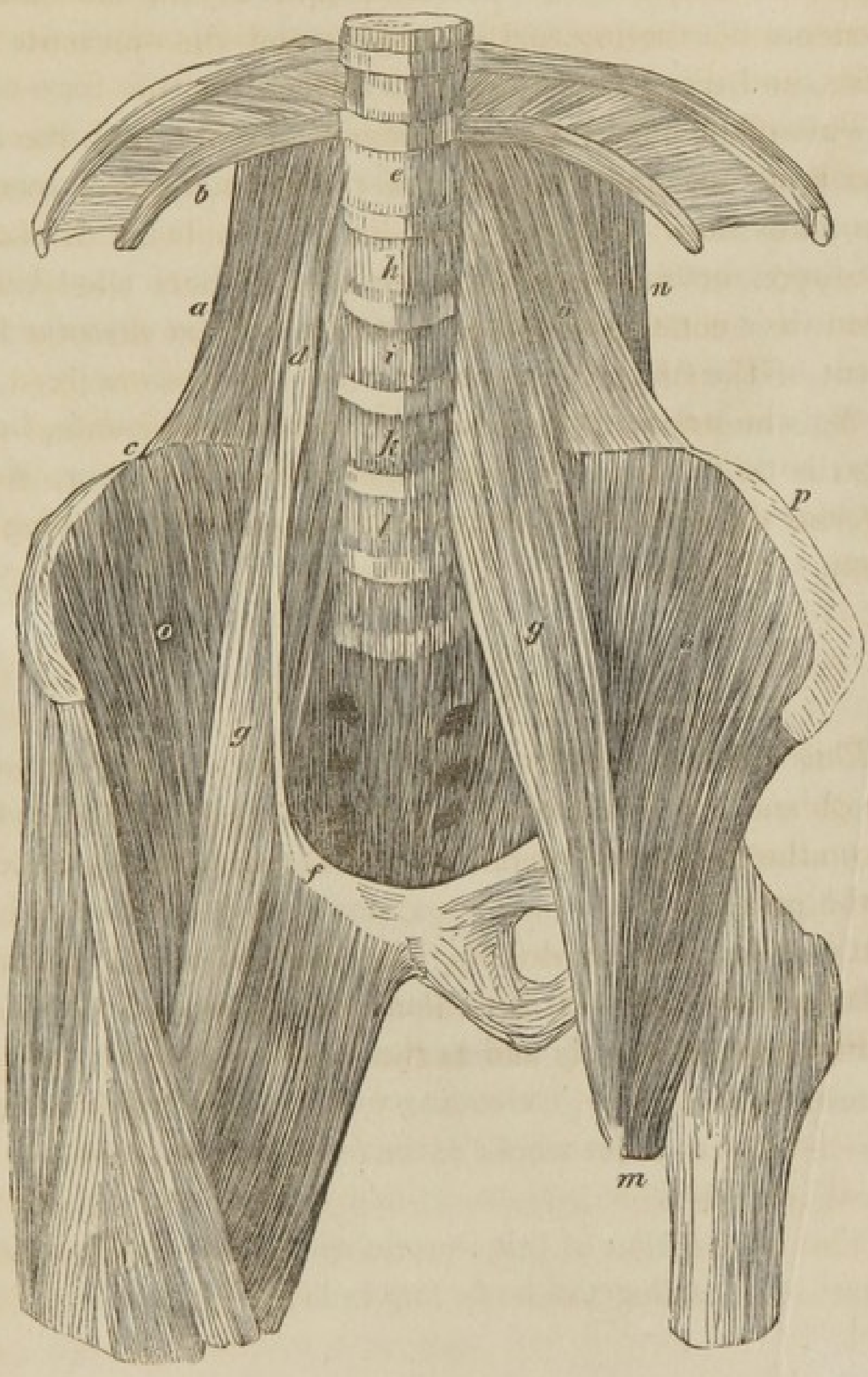
It is connected *anteriorly* with the abdominal aponeurosis; *posteriorly* with the rectus abdominis.

This muscle merely assists the recti muscles.

LUMBAR REGION.

PSOAS MAGNUS.

Fig 133.



This muscle, *g*, *g*, is situated on the side and lower part of the vertebral column. It is attached superiorly, at *e*, to the last vertebra of the back, and at *h*, *i*, *k*, *l*, to the four superior vertebræ of the loins; inferiorly, at *m*, to the smaller trochanter of the os femoris.

The *anterior surface* of the psoas magnus is connected with the diaphragm, peritoneum, kidney, psoas parvus, external iliac artery, crural artery and vein; the inner side with the bodies of the lumbar vertebræ and the fibro-cartilages which separate them, and with the external iliac vein and the pectineus; the *posterior surface* with the quadratus lumborum, lumbar nerves, and the anterior lamina of the aponeurosis of the transversalis abdominis. Lower down it is connected with the os ilii and the capsular ligament of the hip joint.

This muscle is a flexor of the thigh on the pelvis, bending the thigh forwards, and rolling it outwards; or, if the inferior extremities are fixed, it will assist in bending the body.

PSOAS PARVUS.

This muscle, *d*, does not exist in every subject: it is small and thin, and placed before the preceding muscle. It is attached superiorly, at *e*, to the last dorsal vertebra and fibro-cartilage, which separates it from *h*, the first lumbar vertebra; inferiorly, at *f*, to the brim of the pelvis[z].

The *anterior surface* of the psoas parvus has the diaphragm, renal vessels and nerves, the peritoneum, and the external iliac artery, extending over it; the *posterior surface* is united in its whole extent by cellular tissue to the psoas magnus.

The contraction of this muscle will assist the great psoas muscle in bending the body forwards on the pelvis.

z This edge is also named the linea ilio-pectinea.

ILIACUS INTERNUS.

This muscle, *o*, is placed in the cavity of the ilium, from which it is named; it is large, thick, and radiated. It is attached superiorly, at *p*, to the two anterior thirds of the crest of the ilium, and to the principal part of the concave surface of that bone; its converging fibres join *g*, the psoas magnus, and are inserted inferiorly with it by one common tendon into *(m)* the small trochanter of the thigh bone.

The *anterior surface* of this muscle is covered above by the peritoneum on the right, and by the cœcum; on the left, by the sigmoid flexure of the colon; more inferiorly, that is, below the crural arch, by the sartorius, the pectineus, and by the crural vessels and nerves. The *posterior surface* is extended over the iliac fossa, the superior part of the rectus femoris, and the hip joint.

This muscle powerfully assists in bending the thigh on the pelvis, or the latter on the thigh; it acts strongly in progression, and in maintaining the body in the erect position.

QUADRATUS LUMBORUM.

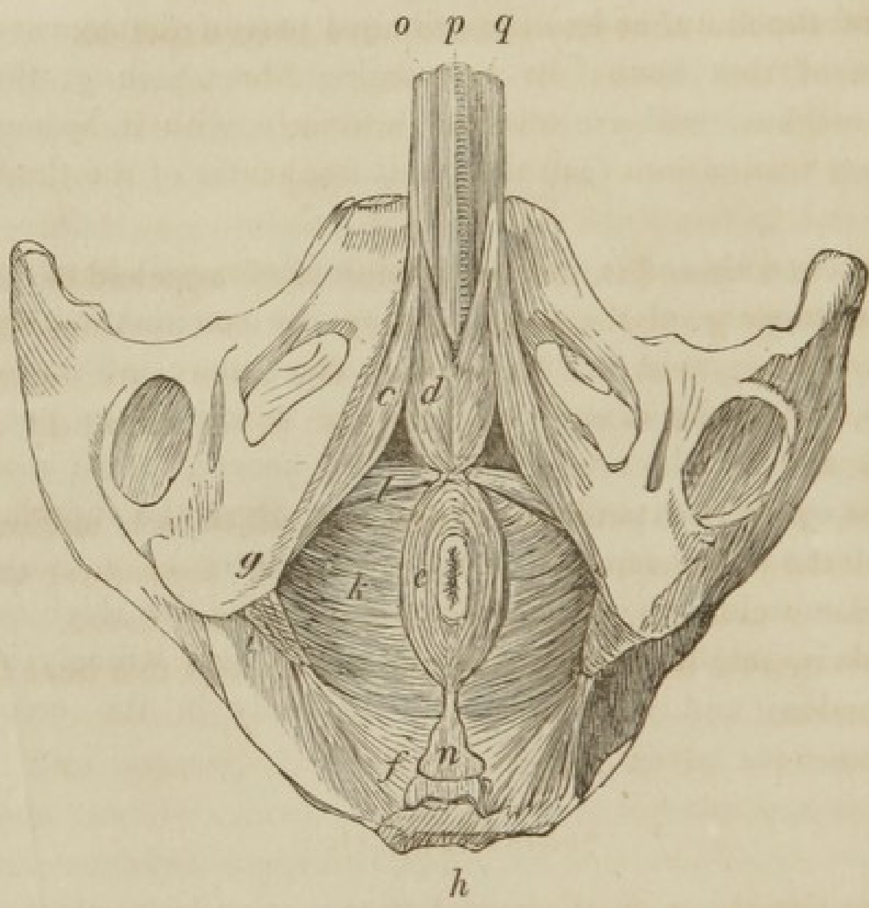
The name of this muscle, *a, a*, is expressive of its figure and situation. It is attached superiorly, at *b*, to the last rib; inferiorly, at *c*, to the posterior part of the crest of the ilium, and to the ilio-lumbar ligament; and on the inner side, by tendons, to the transverse processes of the four first lumbar vertebræ.

This muscle has the power of inclining the body to one side; if both muscles act, they are flexors of the chest upon the hips, and reciprocally the pelvis upon the trunk.

ANAL REGION.

LEVATOR ANI.

Fig. 135.



This muscle, *k*, with its fellow, is a sort of concave floor to the abdominal and pelvic cavity, or it may be compared to a shallow funnel surrounding the extremity of the intestine. It is very thin, and is attached superiorly to the inner part of the pubes, to the superior part of the obturator foramen, and to the spine of the ischium; inferiorly, the middle and anterior fibres unite beneath the rectum enveloping this intestine; the most anterior seem attached to the prostate gland; other fibres spread forwards on the commencement of the urethra, and backwards to *n*, the os coccygis, forming a tendinous line.

The *outer surface* of this muscle is connected by a layer of cellular tissue to the gluteus maximus, the obturator internus, and transversus perinæi. The *inner surface* is connected with the bladder, prostate gland, and lower part of the rectum.

The use of this muscle, as its name implies, is to draw up the rectum after its contents have been expelled.

COCCYGEUS.

This is a thin, flat, triangular muscle, *f*, attached on the one part to *g*, the spinous process of the ischium; its fibres diverge, and are inserted on the other part into *n*, the border of the os coccygis, and into *h*, the extremity of the sacrum.

The *posterior surface* of this muscle, which inclines downwards, is covered by the sacro-sciatic ligaments; the *anterior* is connected to the rectum by cellular tissue.

This muscle moves the coccyx, and secures this bone in its situation.

SPHINCTER ANI.

This muscle, *e*, is of an oval figure, open in its centre; its fibres surrounding the extremity of the rectum or anus are accurately expressed in the figure. It is attached, at *n*, to the os coccygis, by a species of cellular tendon, from whence two fleshy fasciculi proceed, uniting together in front of the anus.

The *upper surface* is connected with the levator ani by a cellular tissue; the *lower surface* is covered by the common integuments.

This muscle closes the anus, and in the male draws down the bulb of the urethra.

GENITAL REGION.

I. IN THE MALE.

CREMASTER.

This muscle consists of a few scattered fibres, sent off by the obliquus internus abdominis, over the spermatic cord, and expanded upon the tunica vaginalis testis. For a view of this muscle we must refer back to Fig. 131, *g*.

This muscle draws up the testis.

ISCHIO-CAVERNOSUS.

This is a small elongated muscle, *c*, placed along the ramus of the ischium, and root of *o*, the corpus cavernosum. It is attached on the one part to the tuber ischii, and on the other part to the fibrous membrane of the corpus cavernosum.

The *outer surface* corresponds with the ramus of the ischium; the *inner* is connected with the transversus perinæi and bulbo-cavernosus.

This muscle draws the root of the penis downwards and backwards.

BULBO-CAVERNOSUS.

This muscle, *d*, is situated beneath the bulb of the urethra, and covering part of *p*, the corpus spongiosum. It is attached to these parts, and its fibres are confounded with the muscles of the anal region; but it is separated from its fellow muscle by a tendinous line.

The *superior surface* covers the bulb and commencement of the spongy portion of the urethra and corpus cavernosum; the *inferior surface* is connected with the preceding muscle and common integuments.

This muscle compresses the posterior part of the urethra, and urges forward any fluid which that canal may contain; hence it has been sometimes denominated accelerator urinæ, vel ejaculator seminis.

TRANSVERSUS PERINEI[a].

This is a flat and thin muscle, *l;* the name indicates its situation. It is attached on its outer part to the ramus and tuberosity of the ischium; on the inner part to the middle line, with its fellow on the opposite side.

The *exterior surface* is covered by the common integuments; its other relations may be seen in the figure.

This muscle is supposed to dilate the urethra; it certainly supports the lower part of the bladder and rectum.

There is frequently another slip of muscular fibres, taking the same course, termed *transversus perinei alter.*

II. IN THE FEMALE.

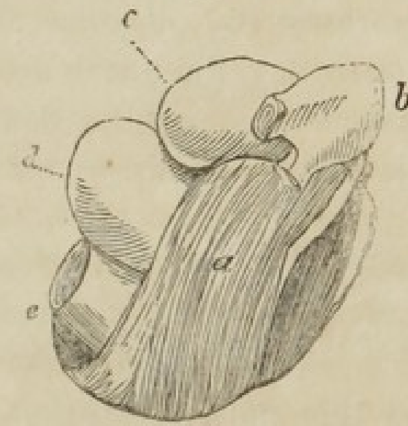
ISCHIO-CAVERNOSUS.

This muscle is similar to that just described in the other sex, but is much smaller. It is attached on the outer side to the tuber ischii; on the inner it terminates by embracing the cavernous body of the clitoris.

[a] The perineum is that space which is between the genitals and anus.

CONSTRICTOR VAGINÆ.

Fig. 136.



This muscle, *a*, consists of a number of muscular fibres, forming a sort of broad fleshy ring surrounding the vagina[b]. This muscle contracts the part which it embraces.

[b] *b*, the pubis, *c*, the bladder, *d*, the uterus, *e*, the rectum.

MUSCLES OF THE POSTERIOR PART OF THE TRUNK.

LUMBO-DORSAL REGION.

TRAPEZIUS.

Fig. 137.

The trapezius is a broad, flat muscle, *a*, *b*, *d*, and Fig. 138, *a*, *e*, *d*, situated at the posterior part of the neck, shoulder, and upper part of the back. It is attached superiorly, at *a*, the superior transverse line of the occipital bone, to the cervical ligament, and to the spinous processes of the seventh cervical vertebræ; inferiorly to the spinous processes of all the dorsal vertebræ; on the outer side to *d*, the spine of the scapula, and the edge of this muscle slides over *e*, a triangular space at the extremity of that bone, to the acromion, and to *c*, the external third of the clavicle. The direction of the fibres is shown by the lines of the engraving.

The *posterior surface* of the trapezius is entirely covered by the common integuments; the *anterior surface* is connected at its upper and inner part with the complexus major; further down with the splenius, levator anguli scapulæ, and serratus posticus superior; at its lower part it covers the supra-spinatus, infra-spinatus, rhomboideus, latissimus dorsi, and sacro-lumbalis muscles.

When all the fibres of this muscle act simultaneously, they draw back the scapula and clavicle; the upper fibres will elevate the tip of the shoulder, the lower will move it backwards and obliquely downwards. If the shoulder is fixed, the trapezius has the power of inclining the head to one side.

LATISSIMUS DORSI.

This is a large, thin, flat muscle, placed on the back and side of the lower part of the trunk. It is attached superiorly, at *f*, to the inner edge of the groove in the os humeri, which receives the long tendon of the biceps; inferiorly, to the posterior half of *g*, the external border of the crest of the ilium, and at *l*, to the back and upper part of the sacrum; on the inner side it is fixed to the spinous processes (from *b* to *l*) of all the lumbar vertebræ, and to those of the six or seven lower dorsal; on the outer side to the four last ribs, at *n*, *n*, *n*, *n*, by as many digitations. The direction of the fibres is expressed in the figure; they are aponeurotic at the internal and inferior part of the muscle, tendinous at its insertion into the humerus, and fleshy in other parts. The superior edge passes over the inferior angle of the scapula at *m*, and sometimes has a slip attached to it, and the margin at *f* forms the fold of the back part of the arm-pit. This muscle is also represented in Fig. 138, at *b*.

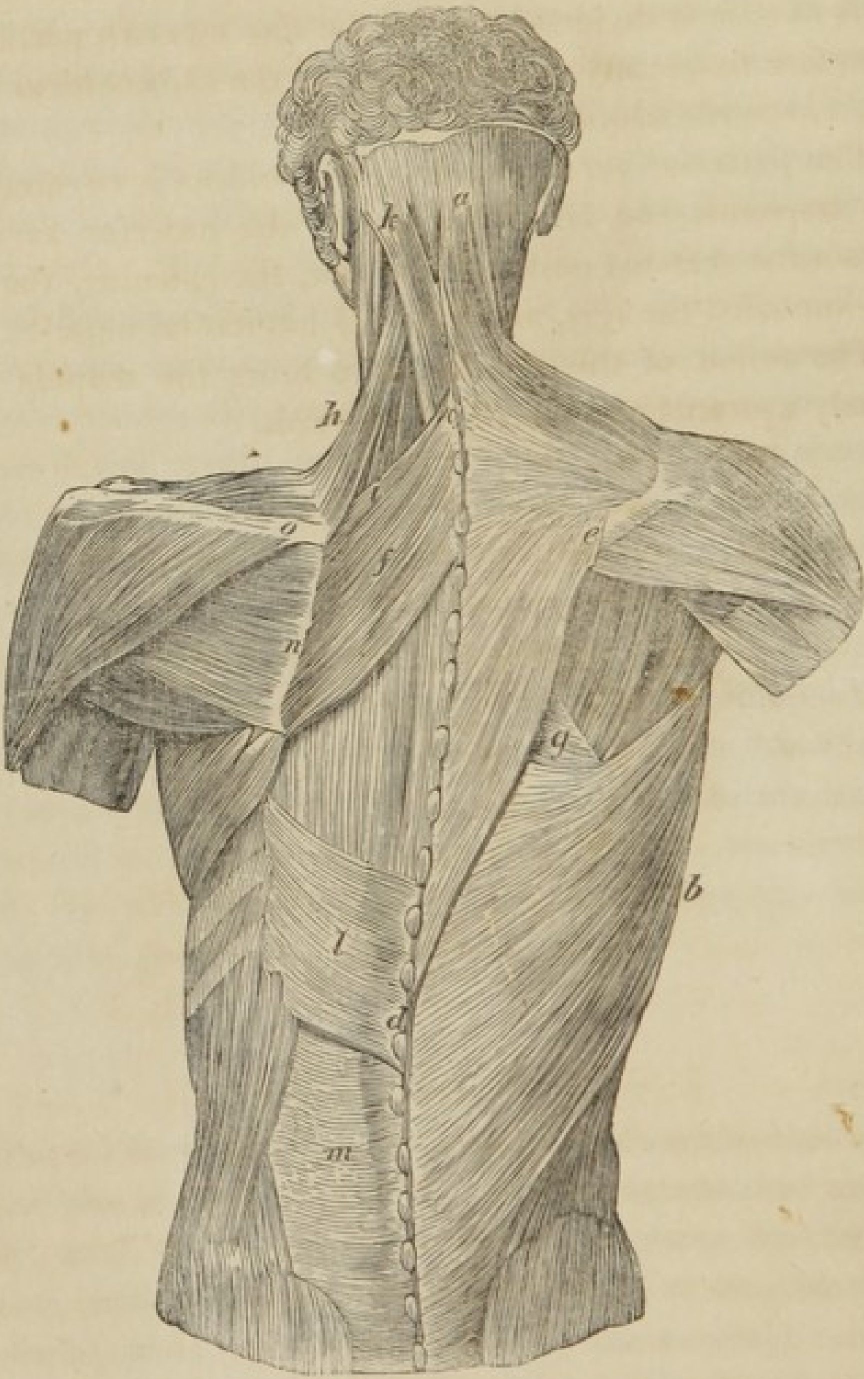
The *posterior surface* of this muscle is covered by the integuments, excepting at its upper and inner part, which is covered by *a*, *d*, *b*, the trapezius. The *anterior surface* is connected with the obliquus abdominis, serratus posticus inferior, sacro-lumbalis, levatores costarum, external intercostal muscles, the serratus magnus, rhomboideus, teres major, infra-spinatus, the lower ribs, and the inferior angle of the scapula.

The office of the latissimus dorsi is to carry the arm backwards and downwards; or, when the hand is fixed, it brings forward the body.

DORSO-CERVICAL REGION.

RHOMBOIDEUS.

Fig. 138.



The situation and form of this muscle, *i*, *f*, is clearly exhibited in the figure. It is attached by its internal margin to the posterior cervical ligament, to the spinous process of the seventh cervical vertebra, and to those of the four or five first dorsal; by its internal margin, at *n*, to all the base of the scapula below *o*, the spine of that bone. This muscle is divided by a cellular line into two portions: therefore frequently denominated, *f*, the *rhomboideus major*, *i*, the *rhomboideus minor*.

The *posterior surface* of the rhomboideus is covered by the trapezius and latissimus dorsi; the *anterior surface* covers the serratus posticus superior, the splenius, the sacro-lumbalis, the ribs, and external intercostal muscles.

The action of this muscle is to bring the scapula obliquely upwards and directly backwards.

LEVATOR SCAPULÆ.

Fig. 139.

This is a long, thick muscle, *a*, placed at the side and back of the neck. It is attached superiorly to the transverse processes of four or five of the superior vertebræ of the neck, by distinct tendons; these unite and form a strong muscle, which is fixed inferiorly into the base of the scapula above *e*, the spine. See also Fig. 138, *h*.

The *outer surface* of this muscle is covered on the upper part by the sterno-cleido-mastoideus, in the middle by the skin, and below by the trapezius. The *inner surface* is connected with the serratus posticus superior, the sacro-lumbalis, and splenius.

This muscle raises the posterior angle of the scapula, and consequently depresses the tip of the shoulder; it has the power also of inclining the neck to one side, or maintaining it in an erect position when it acts in conjunction with its fellow.

SERRATUS POSTICUS SUPERIOR.

This muscle, *g*, is very thin; its situation and form are delineated in the figure. It is attached by its internal border to the posterior cervical ligament, to the spinous process of the last cervical vertebra, and to those of the three upper dorsal; outwardly, by distinct fleshy portions, or digitations, into the second, third, fourth, and sometimes the fifth ribs, a little beyond the angle.

The *posterior surface* is connected with the rhomboideus, the levator anguli scapulæ, serratus magnus, and trapezius; the *anterior surface* with the splenius, longissimus dorsi, transversalis colli, sacro-lumbalis, ribs, and the external intercostals.

The action of this muscle dilates the thorax, by elevating the ribs.

SERRATUS POSTICUS INFERIOR.

For the form of this muscle, the reader is referred back to the preceding engraving, Fig. 138, *l*. It is situated at the inferior part of the back, and, like the serratus superior, is broad and thin. It is attached by its inner border to the spinous processes of the two lower dorsal vertebræ, and to those of the three upper lumbar; at its outer border, by distinct slips into the four inferior ribs.

The *posterior surface* is connected with the latissimus dorsi; the *anterior surface* with the three lower ribs, the corresponding intercostal muscles, and the posterior lamina of the aponeurosis of the transversalis abdominis.

This muscle depresses the ribs, and draws them backwards.

SPLENIUS.

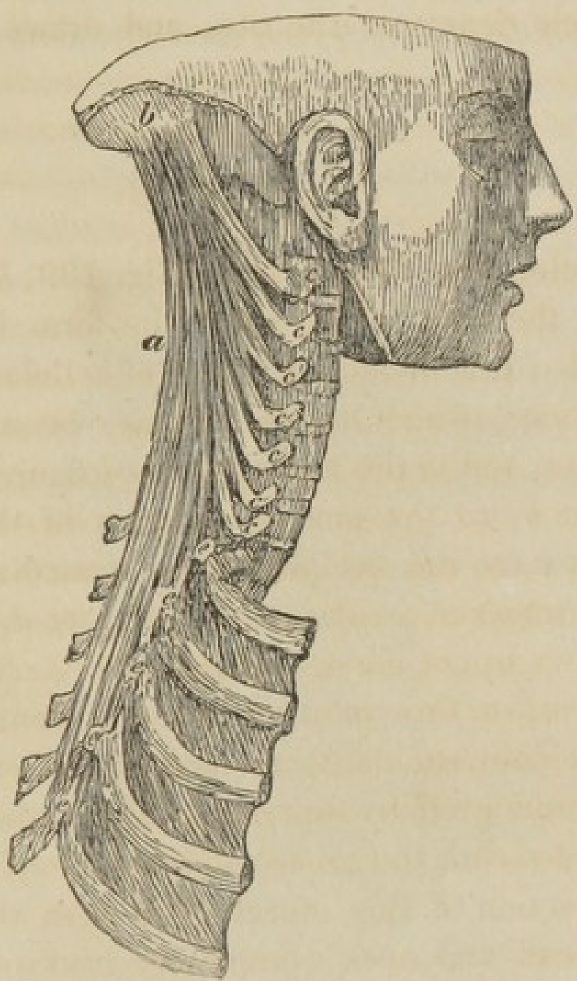
This muscle, Fig. 138, *b*, *c*, *d*, Fig. 139, *k*, is placed obliquely at the back of the neck; its form is elongated and flattened. It is divided by a line of cellular membrane into two portions, which have sometimes been considered as two muscles, and in the last-mentioned figure is attached superiorly, at *b*, to the mastoid process of the temporal bone, and at *c*, to the occipital bone immediately below the superior transverse ridge; inferiorly, at *d*, to the last cervical and six upper dorsal vertebræ.

The *external surface* of the splenius is connected with the sterno-cleido-mastoideus, the trapezius, levator anguli scapulæ, serratus posticus superior, and rhomboideus; the *internal surface* with the great and little complexus.

The contraction of this muscle will turn the head, or incline the head and neck completely backwards; when both muscles act together, they bend the head directly backwards.

COMPLEXUS.

Fig. 140.



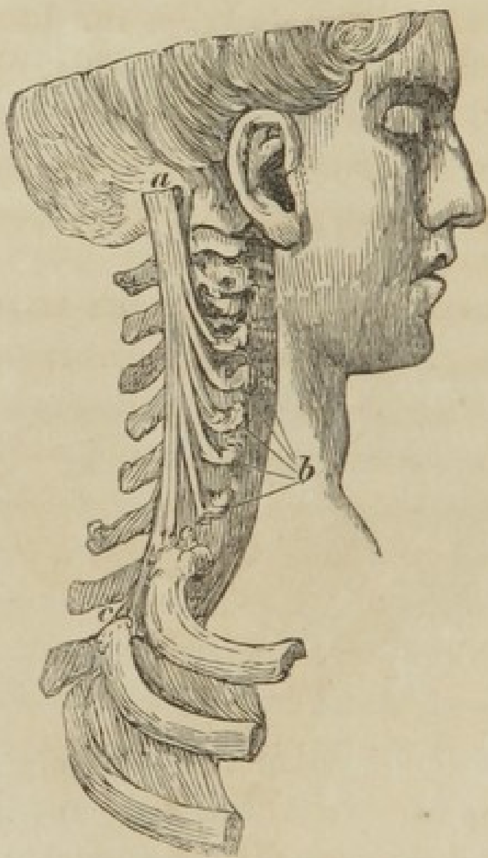
The situation and form of this muscle, *a*, is obvious in the figure before us. It is attached superiorly, at *b*, between the transverse ridges of the occipital bone; inferiorly, by isolated fasciculi of tendinous and fleshy fibres, at *c*, *c*, *c*, *c*, *c*, *c*, to the transverse and articular processes of the last six cervical vertebræ, and at *e*, *e*, *e*, *e*, to the transverse processes of the four or five first dorsal vertebræ. These attachments are frequently confounded with those of the transversus colli.

The *external surface* is connected with the trapezius, splenius, and trachelo-mastoideus; the *internal* with the semi-spinalis colli, the arteria cervicalis profunda, the posterior branches of the cervical nerves, the rectus capitis posticus minor, and the obliquus capitis inferior.

This muscle draws the head backwards and to one side. When the two act together, the face is turned upwards.

TRACHELO[b]-MASTOIDEUS.

Fig. 140.



This muscle is much smaller than the preceding, and is placed on its outer edge. It is attached superiorly at *a*, to the posterior part of the mastoid process of the temporal bone; inferiorly, at *b*, to the transverse processes of the four last cervical vertebræ, and sometimes, at *c*, to the first

b So called from a Greek word for the spine. This and the former muscle are as frequently denominated complexus major et minor, and their resemblance may be seen by comparing the figures before us.

dorsal, by distinct tendinous and fleshy fasciculi. The trachelo-mastoideus is also connected at its inner edge by a fleshy band to the longissimus dorsi. Both this and the preceding muscles are traversed by aponeurotic intersections or bands, varying in direction and position.

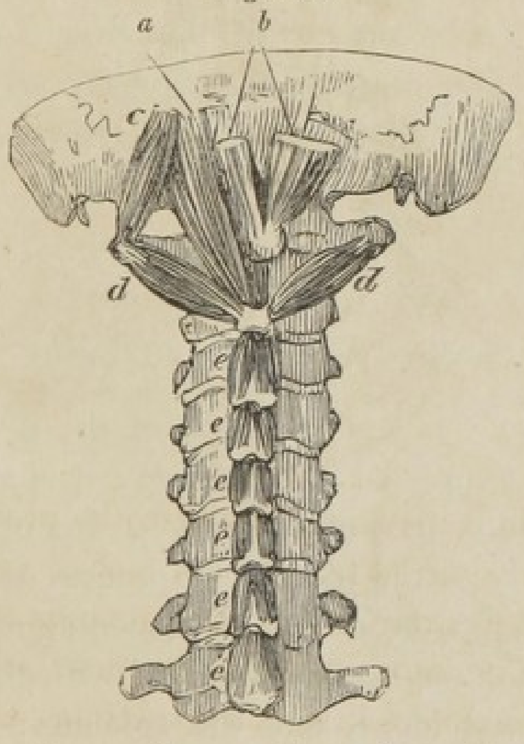
The *outer surface* of this muscle is connected with the splenius and transversalis colli; the *inner* with the complexus and obliquus capitis, the posterior extremity of the digastricus, and the occipital artery.

The action of this muscle keeps the head erect, or inclines it a little backwards or to one side, without rotation.

POSTERIOR OCCIPITO-CERVICAL REGION.

RECTUS CAPITIS POSTICUS MAJOR.

Fig. 142.



This is a small muscle, *a*, situated on the upper part of the back of the neck. It is attached superiorly to the lower transverse ridge of the occipital bone, and to part of the depression above that ridge, between the rectus capitis posticus minor and obliquus capitis superior. Inferiorly it is fixed to the spinous process of the dentata or second cervical vertebra.

The *posterior surface* of this muscle is connected with the complexus and obliquus capitis superior; the *anterior surface* with the occipital bone, the atlas, the rectus capitis posticus minor, and the vertebral artery.

RECTUS CAPITIS POSTICUS MINOR.

This is a very small muscle, *b*, attached superiorly to the occipital bone behind the foramen magnum, and a little to the side of the inferior curved line; inferiorly to the tubercle at the posterior arch of the atlas.

The *posterior surface* of this muscle, which is inclined downwards, is connected with the great complexus and with the preceding muscle; the *anterior surface* with the occipital bone, the alloido-occipital ligament, and the vertebral artery.

OBLIQUUS CAPITIS SUPERIOR.

The relative size and situation of the obliquus capitis superior, *c*, is expressed in the figure; it is attached superiorly to the outer part of the curved line of the occipital bone; inferiorly to the transverse process of the first cervical vertebra, in front of *b*, the preceding muscle.

The *posterior surface* is connected with the complexus, the trachelo-mastoideus, and the splenius; the *anterior* with the occipital bone, the vertebral artery, and the attachment of the rectus capitis posticus major.

OBLIQUUS CAPITIS INFERIOR.

This muscle, *d*, will be found to resemble very much the superior oblique; it is attached superiorly to the transverse process of the atlas, and inferiorly to the spinous process of the dentata.

The *posterior surface* is connected with the complexus and trachelo-mastoideus; the anterior with the second vertebra, and with the posterior ligament uniting the axis and atlas, and with the vertebral artery.

The office of the four muscles just described, according to their several directions and obliquity, is to rotate the head, incline it backwards or to one side, and to maintain the head in the erect position.

INTERSPINALES CERVICIS.

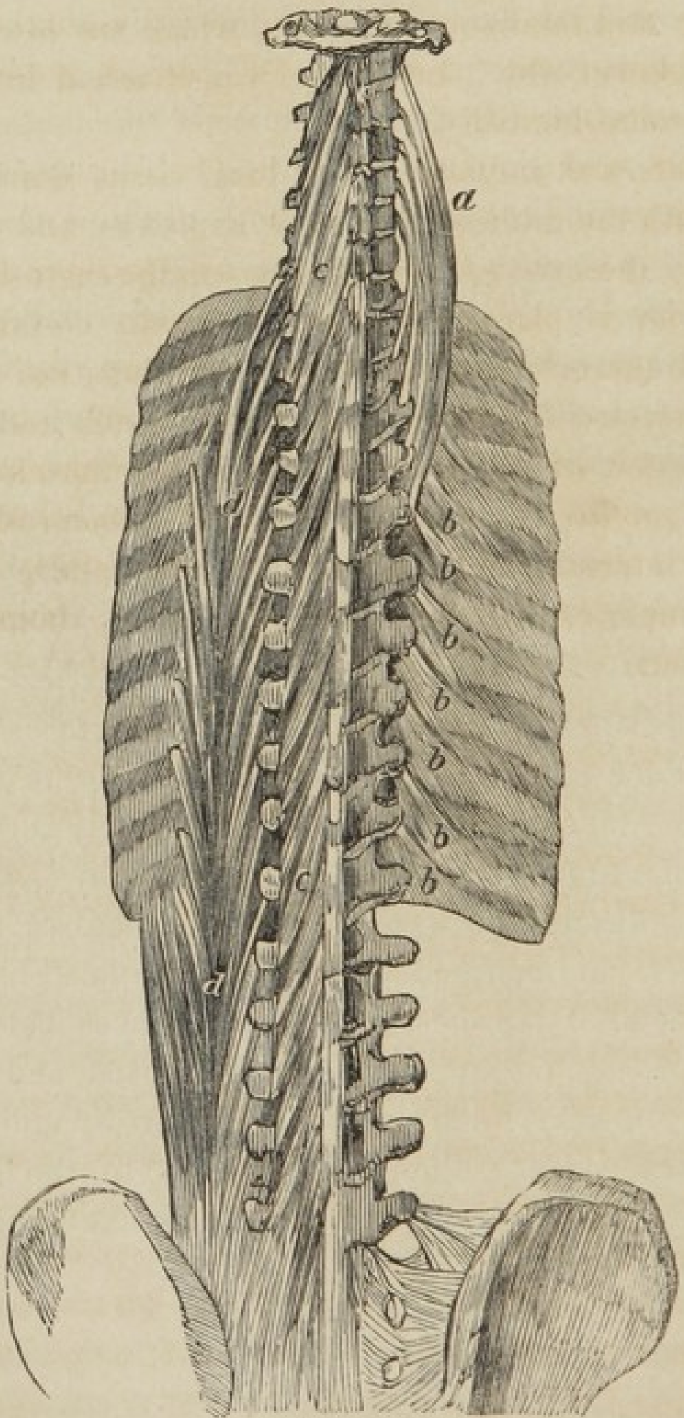
There are six very small muscles, at *e*, *e*, *e*, *e*, *e*, *e*, on either side of the intervals of the spinous processes of the neck. Each of them is attached superiorly to the lower surface of the spinous process, and inferiorly to the upper surface of the next spinous process below it.

These muscles draw the spinous processes nearer to each other, and consequently incline the head backwards. Similar sets of muscles occupy the spaces between the spinous process of the vertebræ of the back and loins; in the neck, however, they are double, corresponding to the bifurcations of the spinous processes. In the back and loins they are indistinct, and are rather like tendons than muscles.

VERTEBRAL REGION.

LONGISSIMUS DORSI.

Fig. 143.



The longissimus dorsi, *d*, *d*, constitutes part of the thick muscular mass which occupies the space between the spinous processes of the vertebræ and the angle of the ribs. On the inner side it is attached by small double tendons to all the transverse processes of the back, and to the last transverse process of the neck; from its outer side it sends off fleshy and tendinous filaments, which are inserted into the eight lower ribs. Inferiorly, it is attached in common with the sacro-lumbalis.

The *internal surface* of the longissimus dorsi is connected with the multifidus spinæ, complexus, and transversalis colli; the *external* is contiguous to the sacro-lumbalis; the *anterior* is placed upon the levatores costarum, the ribs, the transverse processes of the vertebræ, the posterior costo-transverse ligaments, the dorsal vessels and nerves, and a portion of the external intercostal muscles. The *posterior surface* is connected with the aponeurosis of the obliquus internus and transversalis abdominis, serratus posticus superior, latissimus dorsi, trapezius, rhomboideus, and splenius.

SACRO-LUMBALIS.

Fig. 144.

This muscle, *a*, *a*, is situated on the outer side of *b*, the latissimus dorsi, extending from the sacrum to the neck.

On the right side of the figure we see it is attached on the outer part to the lower edge of all the ribs, by as many distinct tendons; on the inner part we find it is attached to the upper border of nine or ten of the lower ribs, by as many tendons. The muscle on the left side is drawn back with the hook, *f*, to show these tendons. There are some portions of this muscle marked *g*, *g*, which are inserted into the transverse processes of five or six of the lower cervical vertebræ by as many distinct tendons. These fasciculi are frequently described under the name of the *cervicalis descendens.* The sacro-lumbalis is inferiorly fleshy within and aponeurotic without; and, as I before observed, forms one inseparable muscle with the longissimus dorsi, which is attached at *e* to the sacrum, the posterior spine of the ilium, all the spinous processes, and near the roots of the transverse processes of the lumbar vertebræ: not separating from *b*, *b*, its companion just mentioned, till it reaches the ribs.

The *anterior surface* of the sacro-lumbalis is connected with the aponeurosis of the transversalis abdominis, the ribs, and external intercostal muscles, the longissimus dorsi, and transversalis colli. The *inner side* with the longissimus dorsi; the *outer side* with the line of union of the posterior laminæ of the aponeurosis of the transversalis abdominis.

The longissimus dorsi and sacro-lumbalis preserve the vertebral column from yielding to the weight placed on it and before it; in a word, they are the most powerful muscles that are employed in keeping the body erect.

TRANSVERSALIS COLLI.

This muscle, Fig. 143, *a*, lies on the inner side of the longissimus dorsi, and is indeed sometimes considered as an appendage to it. It is attached superiorly, by small tendons, to the transverse processes of the second, third, fourth, fifth, and sixth cervical vertebræ; inferiorly it is fixed by tendinous and fleshy slips to the transverse processes of the third, fourth, fifth, sixth, and seventh dorsal vertebræ.

The *posterior edge* of this muscle is blended with the trachelo-mastoideus muscle: in the middle it is connected with the levator anguli scapulæ and the serratus posticus superior, and below with the longissimus dorsi. The *anterior edge* is connected with the transverse processes of the second cervical to the eighth dorsal vertebra. The *outer surface* corresponds with the splenius, levator anguli scapulæ, and sacro-lumbalis; the *inner* with the complexi and part of the multifidus spinæ.

This muscle turns the neck obliquely backwards and to one side.

MULTIFIDUS SPINÆ.

The fasciculi, *c*, *c*, composing this mass of muscles, are placed obliquely from the transverse processes to the spinous processes. They are attached by distinct tendons to all the spinous, transverse, and articular processes of the six last cervical vertebræ, the twelve dorsal, and the five lumbar, and to the posterior surface of the sacrum[c].

The *posterior surface* of these muscles is connected with the trachelo-mastoideus, arteria cervicalis profunda, posterior cervical nerves, and longissimus dorsi; the *anterior surface* with the plates of the vertebræ, their transverse and oblique processes, and the ligamenta subflava; on the *inner side* with the spinous processes of the vertebræ, the interspinalis cervicis, and the dorsal and lumbar interspinous ligaments.

c These have been described by some anatomists as three distinct sets of muscles, viz. *transverso-spinalis colli*, *transverso-spinalis dorsi*, *transverso-spinalis lumborum*.

The office of these muscles is to incline the vertebral column to one side; but when the muscular fibres on each side act, they keep the body erect.

INTER-TRANSVERSALES COLLI.

These are small muscles which fill up the spaces between the transverse processes of the vertebræ of the neck. They are distinguished into anterior, six in number on either side, and into posterior, five in number. The two muscles of each interval are separately attached, and extend from the inferior border of the transverse process of the vertebra above, to the superior border of the transverse process of the vertebra below.

The *anterior set* are connected in front with the rectus capitis anticus major; the *posterior* behind, with the splenius, transversalis colli, and sacro-lumbalis.

These muscles contribute to the lateral motions of the neck.

INTER-TRANSVERSALES LUMBORUM.

Between the transverse processes of the lumbar vertebræ are fleshy fasciculi, similar to those just described. There are five on each side; they are stronger and more distinct than the preceding muscle.

Their *posterior surface* is connected with the sacro-lumbalis; the *anterior* with the quadratus lumborum. Their *lower* and *upper* edges are connected with the corresponding adjacent transverse processes by means of short aponeurotic fibres.

These muscles are supposed to bend the lumbar region of the vertebral column laterally; the short muscles of the spine certainly strengthen the back during muscular exertions.

CHAP. V.

MUSCLES OF THE EXTREMITIES.

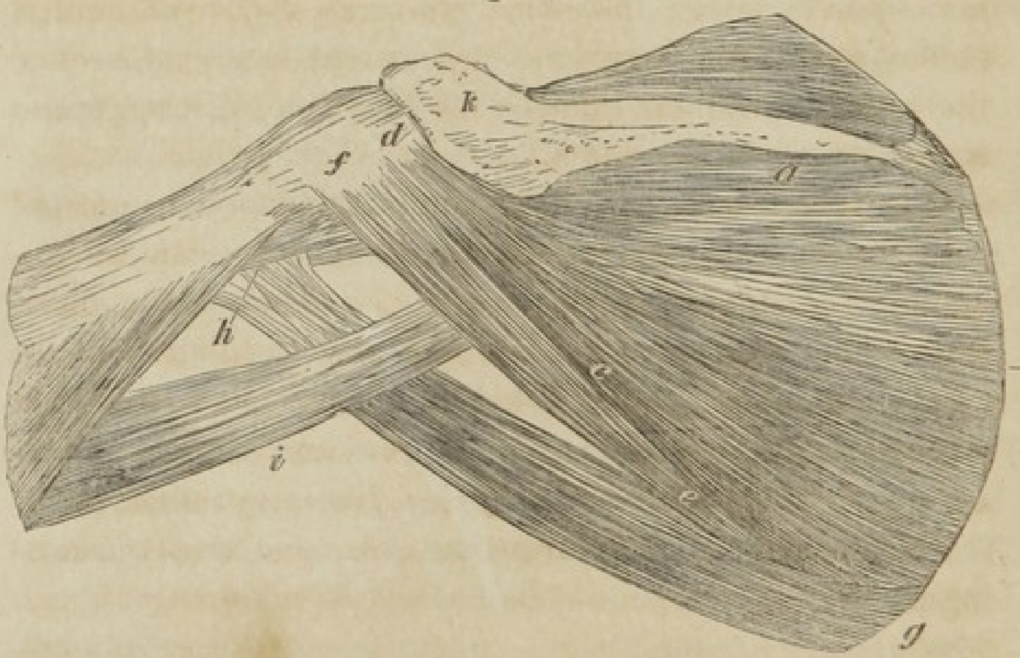
MUSCLES OF THE SUPERIOR EXTREMITY.

MUSCLES OF THE SHOULDER.

POSTERIOR SCAPULAR REGION.

SUPRA-SPINATUS.

Fig. 145.



This muscle, *l*, fills up the cavity above the spine of the scapula. Its attachment on the inner side is fleshy, from the whole concave surface above *k*, the spine of the scapula, from the spine, and from the superior border of that bone, passing under the acromion and adhering to the capsular ligament of the joint; on the outer part it forms a strong tendon, which is inserted into the greater tuberosity of the humerus.

The *posterior surface* of this muscle is connected with the trapezius, deltoides, and coraco-acromial ligament; the *anterior* with the fossa supra-spinata, the superior scapular vessels and nerves, and with the capsule of the shoulder joint.

This muscle raises the arm, and if the arm is fixed it acts upon the shoulder.

INFRA-SPINATUS.

The infra-spinatus, *a*, *b*, *c*, *d*, occupies that space on the back of the scapula which is below the spine. It is attached, on the inner side, to the two internal thirds of the infra-spinata fossa; the fibres converge towards a central tendon which runs over the neck of the bone, adheres to the capsular ligament, and is inserted into *d*, the greater tuberosity of the humerus.

The *posterior surface* of the infra-spinatus is connected with the deltoides, trapezius, latissimus dorsi, and integuments; the *anterior surface* with the infra-spinata fossa, from which it is separated, in its outer third, by cellular tissue, and by the superior scapular nerve and vessels. It is also applied upon the capsule of the shoulder joint. The *lower edge* is confounded with *e*, *f*, the teres minor.

This muscle turns the arm outwards, and assists in raising it.

TERES MINOR.

This muscle, *e*, *f*, is placed along the inferior border of the scapula. A strong aponeurosis covers this and the infra-spinatus; indeed, the two muscles in some subjects are so closely united, as to be with difficulty separated. On the inner part, it is attached to the inferior angle of the scapula, and to the third of the inferior border of that bone; on the outer part it extends to *f*, the lower and back part of the tuberosity of the humerus, where it is fixed by a strong tendon.

The *posterior surface* is connected with the deltoides and integuments; the *anterior* with the external scapular artery, the long portion of the triceps, and the capsule of the articulation of the shoulder. *Superiorly*, it is connected with *c*, *d*, the lower edge of the infra-spinatus muscle; *inferiorly*, with *g*, *h*, the teres major, from which at one part it is separated by *i*, the long portion of the triceps.

The office of the teres minor is similar to that of the preceding muscle.

TERES MAJOR.

This muscle, *g*, *h*, is situated beneath the teres minor. On the inner side it is attached to the quadrilateral surface of the inferior border of the infra-spinata fossa, and to the lower third of the base of the scapula. On the outer side it is inserted by a broad tendon into the inner side of the bicipital groove of the humerus.

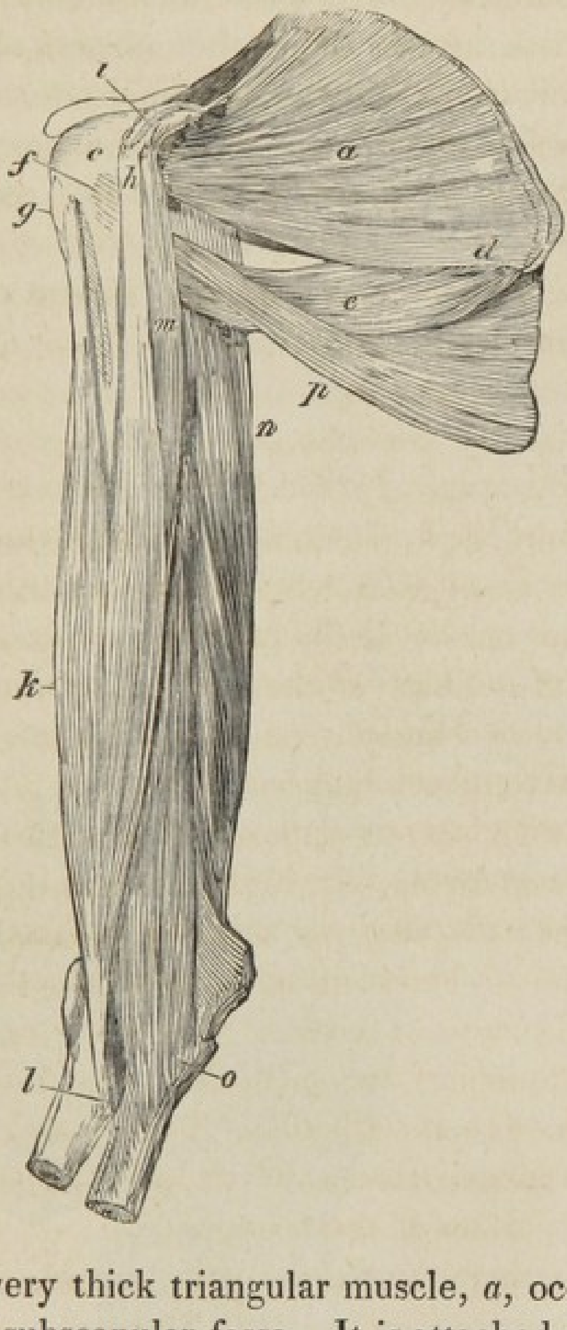
The *posterior surface* is connected with the latissimus dorsi, the integuments, the humerus, and the long portion of the triceps; the *anterior* with the subscapularis, latissimus dorsi, coraco-brachialis and biceps, the axillary vessels and brachial plexus of nerves. The *lower edge* is covered by the integuments, and, with the latissimus dorsi, forms the posterior edge of the axilla. The *upper edge* is united to the teres minor, from which at one part it is separated by the long portion of the triceps.

The teres major turns the arm inwards and draws it backwards.

ANTERIOR SCAPULAR REGION.

SUBSCAPULARIS.

Fig. 146.



This is a very thick triangular muscle, *a*, occupying the whole of the subscapular fossa. It is attached on the inner side to the internal three fourths of the subscapular fossa; the fibres are disposed in fleshy bundles with aponeurotic septa, which converging slide over the inner surface of the neck of the scapula, and pass under *i*, the coracoid process; it then forms a broad and flat tendon which adheres to the capsule of the joint, and is finally fixed at *c*, to the small tuberosity of the humerus.

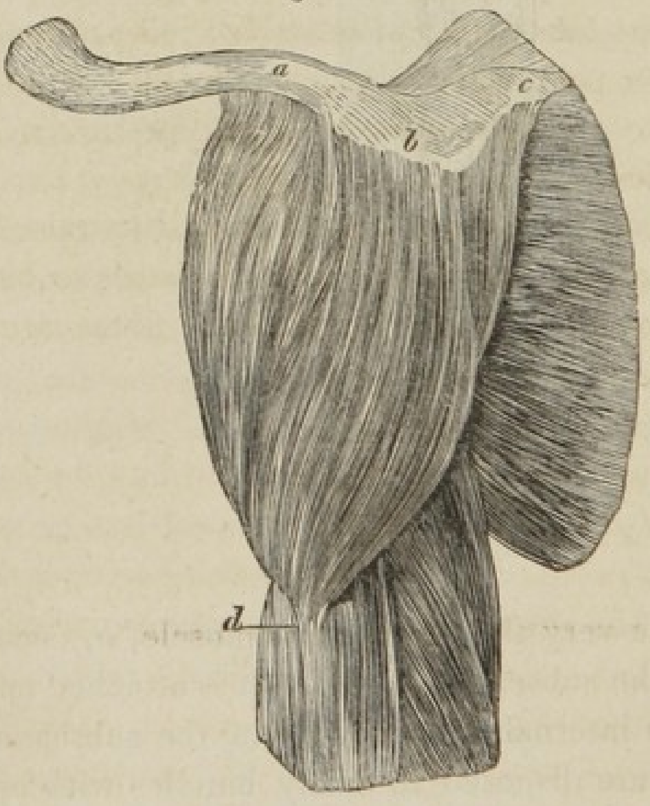
The *anterior surface* of the subscapularis is connected by a thick layer of cellular tissue with the serratus magnus, the brachial plexus of nerves, the axillary artery, and the coraco-brachialis, the biceps and the deltoid muscles; the *posterior surface* with the subscapular fossa, and with the teres major, the long portion of the triceps extensor cubiti, and with the capsule of the articulation of the shoulder.

When the arm is distant from the body it draws it near; or it turns the arm inwards; or when raised it depresses it.

EXTERNAL SCAPULAR REGION.

DELTOIDES[d].

Fig. 132.



d So named from its resemblance to the Greek letter Δ.

The deltoides forms the fleshy part of the shoulder; its shape and the direction of its fibres are exhibited in the figure. Superiorly it is attached by aponeurotic fibres at *a*, to the external third of the clavicle; at *b*, to the acromion process; and at *c*, to the lower margin of the spine of the scapula; inferiorly the fibres concentrate to a tendon which is inserted at *d*, into the deltoid impression in the middle part of the external surface of the humerus. This muscle is composed of large fasciculi of fibres separated by grooves more or less deep. The inner surface is aponeurotic; and where it lies over the greater tuberosity of the os humeri, there is a bursa of considerable size.

The *external surface* of the deltoides is connected with the platysma myoides, the integuments; the *internal* with the infra-spinatus, teres minor, and triceps extensor muscles, the tendon of the supra-spinatus, the acromio-coracoid ligament, the subscapularis, pectoralis minor, biceps and coraco-brachialis muscles, the coracoid process, the capsule of the articulation, the superior third of the external surface of the humerus, and tendon of the pectoralis major. The anterior part, which is parallel to the external border of the biceps, is separated from the pectoralis major by the cephalic vein.

The principal office of this muscle is to raise the arm; but it is also capable of moving it forwards or backwards, according as the anterior or posterior fibres are brought into action.

MUSCLES OF THE ARM.

ANTERIOR BRACHIAL REGION.

CORACO-BRACHIALIS.

Fig. 148.

We see the situation of this muscle, *a*, in the figure; it is long, flat, and narrow. It is attached by a tendon at *a*, to the apex of *b*, the coracoid process of the scapula; it terminates tendinous about *c*, the middle of the humerus, and is inserted into a rough elevated line.

The *anterior surface* is connected with the deltoides, pectoralis major, and biceps; the *posterior* with the subscapularis muscle, the united tendons of the latissimus dorsi and teres major, the axillary artery, the musculo-cutaneous and median nerves, and the brachial artery.

This muscle moves the arm forwards, upwards, and inwards.

The coraco-brachialis is perforated by a nerve called *musculo-cutaneous*. The intermuscular aponeurosis is seen extending from the lower part of this muscle along a ridge to the internal condyle, separating the brachialis internus from the third head of the triceps.

BICEPS FLEXOR CUBITI.

This muscle, Fig. 146, *k*, is situated at the front and inner part of the arm; it is thick at its middle portion, thin at its extremities, the superior of which is divided into two portions. Its short portion is attached at *h*, to the coracoid process of the scapula, along with *m*, the preceding muscle, and by *g*, its long portion, to the superior part of the glenoid cavity; at *k*, the two portions or heads form a hick mass, and about the middle of the arm become inseparably united; it is finally inserted at its inferior extremity to the tubercle at the upper end of the radius, and by a tendinous expansion into the aponeurosis of the fore-arm.

The *anterior surface* of this muscle is connected with the deltoid and great pectoral muscles, the brachial aponeurosis, and the integuments; the *posterior* with the humerus, *a*, *e*, the coraco-brachialis, *h*, the brachialis internus, and the musculo-cutaneous nerve ; on the *inner side* with the coraco-brachialis above, and in the middle and below with the brachial artery.

The biceps flexor cubiti bends the fore-arm on the arm, and the arm on the shoulder.

BRACHIALIS INTERNUS.

This muscle, *d*, *e*, is situated at the anterior and inferior part of the arm. At its upper extremity, *d*, it is attached on each side of the insertion of the deltoides, to the external and internal surface of *c*, the humerus, and to most of the lower and fore part of the bone, as far as the articulation of the elbow joint; it has also an attachment to the external and internal aponeurosis, and inferiorly, by a strong tendon at *e*, to the rough surface immediately below the coronoid process of the ulna. The fibres pass over the joint, and adhere to the capsular ligament.

The *anterior surface* of this muscle is connected with the brachial aponeurosis and the integuments, the supinator radii longus, the biceps, the musculo-cutaneous nerve, the brachial artery, the median nerve, and the pronator teres; the *posterior surface* with the inferior part of the humerus, and the articulation of the elbow.

The brachialis internus bends the fore-arm.

TRICEPS EXTENSOR CUBITI.

The triceps, *f*, *g*, *h*, *i*, occupies all the posterior part of the arm. It is very thick and fleshy, and is divided at the upper part into three portions, from whence it derives its name. Of these, the *first* or middle, which is longer and larger than the others, is attached by a broad tendon, *f*, to the inferior border of the scapula, near its neck; it then forms a large fleshy mass, which covers the back of the os humeri. The *second*, or outer portion, *g*, is attached by a pointed extremity to the outer and back part of the os humeri, below the great tuberosity, and to a ridge which runs from that eminence to the outer condyle, and to the intermuscular aponeurosis, which is common to it and the brachialis internus. The *third* or inner portion, *h*, which is the shortest, commences by an acute form from the inner edge of the os humeri near its middle, and receives an addition of fibres from the intermuscular partition; its fleshy fasciculi descend backwards and outwards. The three portions of this muscle unite about the middle of the humerus, invest the whole back part of the bone, and terminate by a very strong, broad, and thick tendon, which is inserted into the upper part of the olecranon.

The *posterior surface* of the triceps extensor is connected above with the deltoides and teres minor, the brachial aponeurosis and integuments. The *anterior surface* is connected with the subscapularis, teres major, and latissimus dorsi, the capsule of the articulation of the shoulder, and the posterior part of the elbow joint.

The triceps extensor, by extending the fore-arm, acts in opposition to the biceps flexor. The long portion has the power of carrying the arm backwards.

MUSCLES OF THE FORE-ARM.

ANTERIOR REGION OF THE FORE-ARM.

PRONATOR TERES.

This muscle, *a*, is extended obliquely across the upper and anterior part of the fore-arm. See also Fig. 150, *a*, *b*, *c*, and Fig. 153, *a*, *b*. Superiorly it is attached to the anterior part of the inner condyle of the humerus, and to the inner side of the coronoid process of the ulna; between these two parts the median nerve passes. Inferiorly it is fixed to the middle part of the external surface of the radius.

Fig. 149.

The *anterior surface* of this muscle is connected with the aponeurosis of the fore-arm and integuments, the supinator radii longus, the radial vessels and nerves, and the external radial muscles; the *posterior surface* with the brachialis internus, the flexor sublimis, the median nerve, and the ulnar artery; on the *inner side* with the triangular space for the tendon of the biceps, the brachial artery, the median nerve, and the supinator radii brevis.

The pronator teres turns the radius and hand inwards, or it may assist as a flexor of the fore-arm.

FLEXOR CARPI RADIALIS.

This muscle, *b*, is situated on the inner side of the preceding. It has a tendinous attachment to the fore part of the inner condyle of the humerus, fleshy to the fascia and intermuscular aponeurosis, and to the upper end of the ulna. The extent of its muscular fibres is marked in the figure. The tendon of this muscle passes under the annular ligament of the wrist, through a groove in the trapezium, and is fixed to the base of the metacarpal bone which sustains the fore-finger.

The *anterior surface* of the flexor carpi radialis is connected externally with *a*, the supinator longus, and with the aponeurosis of the fore-arm; the *posterior surface* with the flexor digitorum perforatus, the flexor longus pollicis muscles, and the wrist.

This muscle bends the wrist, turning it a little inwards. It also serves as a flexor of the fore-arm.

PALMARIS LONGUS.

This muscle, *c*, *d*, is not always to be found in the arm. It has a slender form, and is attached superiorly by tendinous fibres to the inner condyle of the os humeri; it then forms, at *c*, a thin fleshy mass, which about the middle of the arm sends off a small tendon which is inferiorly adherent to the annular ligament, and is spread out into a very strong tendinous membrane, *d*, named the *palmar aponeurosis*, which is finally fixed to the roots of all the fingers.

The *anterior surface* is connected with the aponeurosis of the fore-arm; the *posterior surface* with the superficial flexor of the fingers.

The palmaris binds down the muscles of the palm of the hand, and its aponeurosis protects the blood-vessels and nerves in their course to the fingers.

FLEXOR CARPI ULNARIS.

The flexor carpi ulnaris, *e*, is situated internally to the preceding muscles of the fore-arm. It is half-penniform, and is attached by means of a common tendon to the inner side of the olecranon, and to the posterior border of the ulna; a number of its fibres are also united to the aponeurosis of the fore-arm. Inferiorly it becomes tendinous, and is inserted into the pisiform bone, and some fibres are detached from it to the annular ligament of the wrist.

The *anterior surface* of this muscle is connected with the aponeurosis of the fore-arm; the *posterior surface* with the deep flexor of the fingers, the ulnar artery and nerve, and the pronator quadratus, and on the outer edge with the flexor sublimis.

This muscle bends the wrist, inclining it a little towards the ulna. When it contracts at the same time with the flexor carpi ulnaris, it draws the hand directly upwards.

FLEXOR DIGITORUM SUBLIMIS VEL PERFORATUS.

This muscle, *d*, *e*, is situated immediately beneath the preceding muscles. It is attached superiorly at *d*, to the inner condyle of the humerus; at *b*, to the coronoid process of the ulna; and at *c*, to the upper part of the anterior border of the radius; these several attachments as they descend form a strong fleshy mass, which sends off four tendons; the tendons are connected by cellular tissue, and pass under the annular ligament of the wrist; from thence diverging as they proceed towards their respective fingers, each tendon, as it were, splits at the extremity of the first phalanx for the passage of the flexor profundus, and is attached to the second phalanx.

Fig. 150.

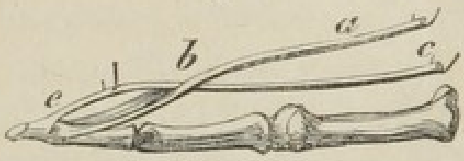
In this figure the fibrous sheaths of the fingers are pinned open; and in the fore finger, at *g*, we observe the splitting of the tendon just mentioned.

The *anterior surface* of this muscle is connected with the pronator teres, the flexor carpi radialis, the palmaris longus, the aponeurosis of the fore-arm, the annular ligament, the palmar aponeurosis, the fibrous sheaths of the fingers, and with the tendons of the deep flexor. The *posterior sur-*

face is connected with the flexor profundus, the flexor longus pollicis, the median nerve, the ulnar artery, the lumbricales muscles, and the phalanges.

This muscle bends the second joint or phalanx upon the first, and the hand upon the fore-arm.

Fig 151.



a. Tendon of the flexor sublimis.
b. The division or slit in the tendon for the passage of
c. The tendon of the flexor profundus, to be attached at *e*, the extremity of the finger.

ANTERIOR DEEP REGION OF THE FORE-ARM.

FLEXOR DIGITORUM PROFUNDUS VEL PERFORANS.

This muscle is situated beneath the preceding; superiorly it is attached, at *a*, to the three superior fourths of the anterior and internal surfaces of the ulna, and at *b*, to the interosseous ligament; the muscular fibres then form a thick mass upon the fore part of the ulna, and divide into four portions, each of which is terminated by a tendon. These tendons pass under the annular ligament of the wrist, and perforate the slits or fissures in the flexor sublimis, as in Fig. 150, and at length are inserted into the anterior part of the third phalanx of the fingers. Fig. 151 best explains the mode in which the tendon of the flexor sublimis, *a*, divides at *b*, to transmit the tendon of the flexor profundus, *c*, *e*.

Fig. 152.

The *anterior surface* of the flexor profundus is connected with the flexor sublimis and flexor carpi ulnaris muscles, the median and ulnar nerves, and the ulnar artery; the *posterior surface* with the fore and inner surfaces of the ulna, the interosseous ligament, the pronator quadratus, the anterior radio-carpal ligaments, the fore part of the metacarpus, the flexor brevis and adductor pollicis, and the two last palmar interosseous muscles.

This muscle bends the third, or extreme joint of the fingers, and assists generally in the flexion of the fingers, hand, and wrist.

FLEXOR LONGUS POLLICIS MANUS.

This muscle, Fig. 150, *f*, *h*, Fig. 152, *c*, lies on the outer side of the flexor profundus ; superiorly it is attached by fleshy fibres to the fore part of the radius and interosseous ligament, and has frequently a tendon from the inner condyle of the humerus. The fibres, *f*, pass obliquely into a tendon on the anterior part of the muscle ; this tendon passes under the annular ligament of the wrist, runs between the two portions of the short flexors of the thumb, and is attached inferiorly at *h*, the last joint.

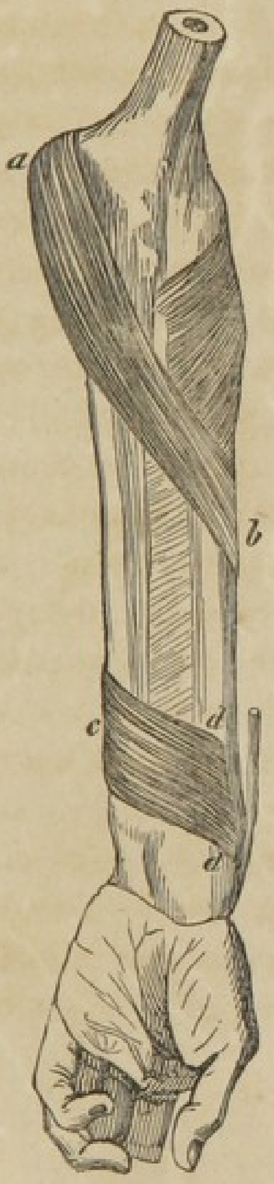
The *anterior surface* of the long flexor of the thumb is connected with the flexor digitorum sublimis, flexor carpi radialis, and supinator longus muscles, the radial artery, and the anterior annular ligament of the wrist ; the *posterior surface* with the radius, part of the interosseous ligament, the pronator quadratus, the fore part of the carpus, and the flexor brevis pollicis. The inner edge lies upon the flexor digitorum profundus.

The action of this muscle bends the last joint of the thumb upon the first, the first upon the corresponding metacarpal bone, and the latter upon the radius ; it likewise assists in the flexion of the fore-arm.

PRONATOR QUADRATUS.

This muscle, *c*, *d*, *d*, as its name implies, is of a quadrilateral form, and lies close to the bone on the lower part of the fore-arm. It is attached broad, by tendinous and fleshy fibres, on the inner side at *c*, to the anterior surface of the ulna, extending from the lower extremity of that bone two inches up its edge. The fibres passing nearly transversely, adhere to the interosseous ligament, and on the outer side, at *d*, *d*, is attached to the anterior surface of the radius.

Fig. 153.



The *anterior surface* of this muscle is connected with the flexor profundus, flexor longus pollicis manus, flexor carpi radialis, flexor carpi ulnaris, and with the radial and ulnar arteries; *posteriorly*, with the two bones of the fore-arm and the lower part of the interosseous ligament.

This muscle turns the radius together with the hand inwards.

POSTERIOR SUPERFICIAL REGION OF THE FORE-ARM.

EXTENSOR DIGITORUM COMMUNIS.

This muscle, *f*, is situated at the posterior part of the arm. It is attached superiorly to the lower part of the outer condyle of the humerus, to the aponeurosis of the fore-arm, and to the aponeurotic septa of the different muscles in that region. From these several attachments it descends vertically, and at the middle of the fore-arm the fleshy mass forms four tendons, which pass under *g*, the annular ligament of the wrist. Below the ligament the tendons diverge, become broader, and proceed to the lower extremities of the metacarpal bones; they sometimes send aponeurotic bands, more or less oblique, to each other, as in the figure before us. These tendons terminate on the back of the fingers by an aponeurotic expansion, reaching to the last phalanx.

Fig. 154.

The *posterior surface* of the common extensor of the fingers is connected with the aponeurosis of the fore-arm; the *anterior surface* with the supinator brevis, extensores pollicis, extensor indicis, the wrist, the metacarpus, the fingers, and the interossei dorsales.

This muscle opens the hand, and bends the hand back upon the fore-arm.

EXTENSOR PROPRIUS MINIMI DIGITI.

This muscle, *h*, which is placed on the inner side of the preceding, is of a very slender form. It is attached superiorly to the external condyle of the humerus, and to the aponeurotic septa which separates it from the extensor communis and flexor ulnaris; and its muscular fibres, at *f*, constitute one mass with these muscles. Within a short distance of the wrist its fibres pass into a tendon, which is transmitted through a distinct ring at *g*, in the annular ligament, and arrives at the posterior surface of the little finger, to which it is attached in the same manner as the tendons of the extensor communis.

The *posterior surface* of this muscle is connected with the aponeurosis of the fore-arm, and at the back of the hand with the integuments. The *anterior surface* with the supinator brevis, extensores pollicis, and extensor indicis. The *outer edge* is united to the extensor digitorum communis; the *inner edge* to the extensor carpi ulnaris.

This muscle extends the little finger, and assists in bending back the hand.

EXTENSOR CARPI ULNARIS.

This muscle, *i*, is situated on the posterior part of the arm; its shape is exhibited in the figure. It is attached superiorly to the lower part of the inner condyle of the humerus, to the intermuscular septa and aponeurosis of the fore-arm, and nearly the middle third of the posterior border of the ulna. It terminates in a strong tendon, which is inserted into the upper part of the metacarpal bone of the little finger.

The *posterior surface* of this muscle is connected with the aponeurosis of the fore-arm, to which it adheres above; the *anterior surface* with the supinator brevis, the extensor ossis metacarpi and extensor secundi internodii pollicis, and extensor proprius indicis muscles, and upon the ulna. Its *outer edge* with the former muscle; the *inner edge* with the anconeus.

This muscle extends the wrist, brings the hand backwards, and inclines it laterally towards the ulna.

ANCONEUS.

This muscle, Fig. 154, *l*, Fig. 155, *a*, which is situated at the outer side of the olecranon, consists of a triangular fleshy mass adhering to the capsular ligament. It is attached superiorly to the external condyle of the humerus by a distinct tendon; inferiorly to the superior third of the external border and surface of the ulna.

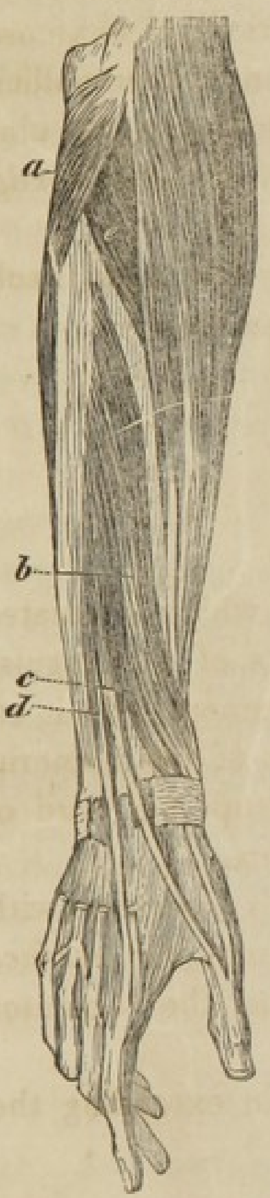
The *posterior surface* of the anconeus is connected with the aponuerosis of the fore-arm; the *anterior surface* with the orbicular ligament of the radius, the supinator radii brevis, and with the ulna.

The office of this muscle is to assist in extending the fore-arm.

POSTERIOR DEEP REGION OF THE FORE-ARM.

EXTENSOR OSSIS METACARPI POLLICIS.

Fig. 154.



This muscle, *b*, is placed obliquely at the back and outer part of the fore-arm. It is attached superiorly, by a pointed extremity to the posterior surface of the ulna, to the interosseous ligament, and to the posterior surface of the radius below the attachment of the supinator radii brevis. The fleshy fibres terminate in a tendon, passing along a groove on the outer edge of the lower extremity of the radius, and is attached inferiorly to the superior part of the metacarpal bone of the thumb.

The *posterior surface* of this muscle is connected with the supinator radii brevis, extensor carpi ulnaris, extensor minimi digiti, extensor digitorum communis, and extensor secundi internodii pollicis; at the lowest part it is in apposition with the aponeurosis o the fore-arm. The *anterior surface* is connected with a portion of the ulna above; crossing the interosseous ligament and the posterior surface of the radius, in the middle, and lying upon the outer surface of the radius, the tendons of the radial extensors, the radial artery, and the wrist below.

This muscle extends the metacarpal bone of the thumb outwardly. It is therefore called by some anatomists *abductor longus pollicis manus.*

EXTENSOR PRIMI INTERNODII POLLICIS MANUS.

This muscle, *c*, is much shorter than the preceding, but of a similar form, and is situated immediately below it. It is attached superiorly by fleshy fibres to the back part of the ulna below its middle, from the interosseous ligament and radius. Its tendon follows the same direction as that of the extensor ossis metacarpi pollicis; inferiorly it is attached to the back of the first bone of the thumb, and its tendon is also continued into the second or extreme joint.

The *posterior surface* of this muscle is connected with the extensor secundi internodii pollicis, extensor minimi digiti, and extensor digitorum communis; at its lowest part with the aponeurosis of the fore fore-arm. The *anterior surface* has the same connections as the preceding muscle, excepting at its inferior extremity, where it is placed upon the first articulation of the thumb.

This muscle extends the first joint of the thumb obliquely outwards.

EXTENSOR SECUNDI INTERNODII POLLICIS MANUS.

This muscle is situated below the two last. It is attached, tendinous and fleshy, to the posterior surface of the ulna, and to the interosseous ligament; its muscular fibres terminate in a tendon which passes in a distinct groove at the back of the radius. It is seen to join the tendon of the extensor primi internodii pollicis, and is inserted into the back part of the last, or extreme joint of the thumb.[e]

The *posterior surface* of this muscle is connected with the extensor carpi ulnaris, the extensor digitorum communis and the extensor indicis, and at its lowest part with the integuments: the *anterior surface* with the extensor ossis metacarpi pollicis and extensor primi internodii pollicis, the bones of the fore-arm, the tendons of the radial extensors, the first metacarpal bone, and the phalanges of the thumb.

This muscle extends the last joint of the thumb, and it may be observed that the extensors just described have also the power of carrying the hand outwards and backwards.

INDICATOR.

This muscle, *d*, is placed nearer to the inner edge of the arm than the extensors of the thumb. It is attached superiorly to the back part of the ulna, and to the interosseous ligament. Its tendon passes through the same sheath of the annular ligament as those of the extensor digitorum communis; and terminates at the back of the fore-finger with the tendon of the common extensor.

The *posterior surface* is connected with the extensor carpi ulnaris, the extensor proprius minimi digiti, and the extensor digitorum communis; the *anterior surface* with the ulna, the interosseous ligament, the extensor secundi internodii pollicis, the inferior extremity of the radius, and the back of the hand.

The office of this muscle is to point the fore-finger, from which it takes its name.

e No letter happens to mark this muscle, although it is distinctly drawn in Fig. 154, and placed between the points of *c*, *d*.

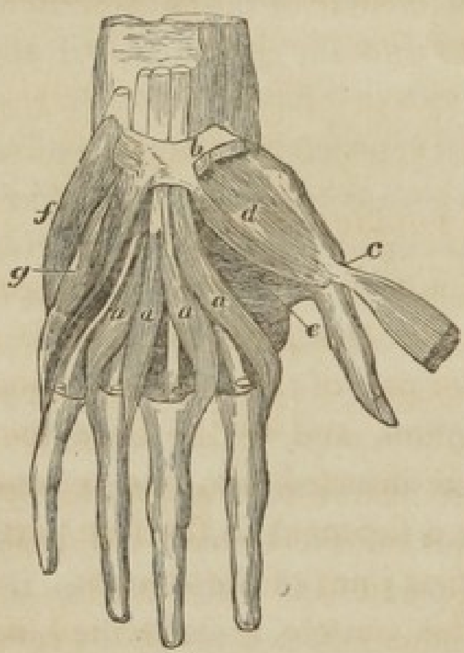
MUSCLES OF THE HAND.

EXTERNAL PALMAR REGION.

ABDUCTOR BREVIS POLLICIS MANUS.

This muscle, *b*, *c*, constitutes the outermost portion of the ball of the thumb. It is attached at *b*, to the anterior surface of the annular ligament of the wrist, and to the os naviculare and os trapezium; from thence it descends a little obliquely outwards. Its fibres converge towards each other, and are attached by a tendon, at *c*, to the outer side of the extremity of the first phalanx of the thumb. In this figure the muscle is divided and turned back[f].

Fig. 155.



The *anterior surface* is connected with the palmar aponeurosis and the integuments; the *posterior surface* with the opponens and flexor brevis pollicus manus.

The office of the abductor pollicis is to carry the thumb from the fingers.

OPPONENS POLLICIS.

This muscle, *d*, lies under the preceding. It is attached superiorly by aponeurotic fibres to the annular ligament of the wrist, to the os naviculare and the os trapezium. Inferiorly to the anterior and lower part of the metacarpal bone of the thumb.

[f] Sometimes this forms two muscles, designated *abductores breves pollicis manus, interior et exterior.*

The *anterior surface* of this muscle is covered by the preceding and by the integuments; the *posterior surface* is connected with the anterior annular ligament of the carpus, the articulation of the trapezium at the first metacarpal bone, with part of the anterior surface of that bone, and the flexor brevis pollicis manus.

The office of this muscle is to bring the thumb inwards, so as to oppose the fingers, from which circumstance it has derived its name.

FLEXOR BREVIS POLLICIS MANUS.

This muscle, Fig. 156, *e*, is of a short, thick, triangular form, and is placed beneath the two preceding. It is attached superiorly to the under part of the annular ligament of the carpus, to the os magnum, and to the third metacarpal bone; inferiorly it is inserted into the sesamoid bone, which is connected by a ligament to the fore part of the upper extremity of the first joint of the thumb.

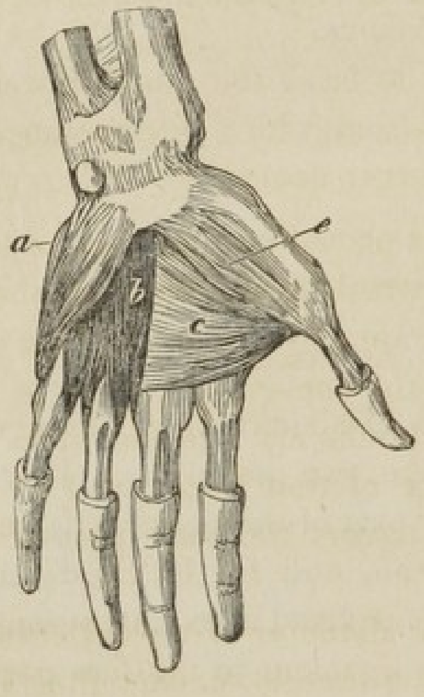
The *anterior surface* of this muscle is connected with the tendon of the flexor brevis pollicis manus, the tendons of the flexor profundus digitorum, the two first lumbricales with an aponeurosis, the integuments, and the adductor minimi digiti; the *posterior surface* with the first metacarpal bone, the two first dorsal and the first palmar interosseous muscles, and the tendon of the flexor carpi radialis.

This muscle bends the first phalanx of the thumb, and the latter towards the wrist.

ADDUCTOR POLLICIS MANUS.

This muscle, *c*, which is broad, thin, and triangular, is still more deeply seated than the flexor brevis. On the inner side it is attached to nearly the whole length of the metacarpal bone of the middle finger, and crossing the metacarpal bone of the fore-finger, its fibres converge, and are outwardly inserted by a tendon with *e*, the preceding muscle, into the inner and upper part of the first bone of the thumb.

Fig. 156.



The *anterior surface* is connected with the tendons of the flexor profundus, the two first lumbricales, and with the integuments; the *posterior* with the interossei and the bones of the metacarpus.

This muscle draws the thumb towards the fingers.

INTERNAL PALMAR REGION.

PALMARIS BREVIS.

The palmaris brevis is not easily demonstrated in every subject, for it consists merely of several small fasciculi of muscular fibres, situated immediately under the skin of the palm of the hand. On the outer side it is attached to the annular ligament of the wrist, and to the palmar aponeurosis; on the inner side to the chorion of the skin which covers the little finger and inner edge of the hand.

The *anterior surface* of this muscle is connected with the integuments; the *posterior surface* with the abductor and flexor muscles of the little finger, the ulnar artery and the nerve.

The office of these fibres is to contract the skin of the palm of the hand.

ABDUCTOR MINIMI DIGITI.

This muscle, Fig. 155, *f*, is placed on the inner edge of the palm of the hand. It is attached superiorly to the os pisiforme, and to the adjacent annular ligament of the carpus; its fibres extend along the metacarpal bone of the little finger, terminating in a tendinous attachment to the inner side of the first phalanx of that finger, and in the aponeurotic expansion which covers the back part of the same finger.

The *anterior surface* of the abductor of the little finger is connected with the preceding muscle, a very thin aponeurosis, and with the integuments; the *posterior surface* with the adductor ossis metacarpi minimi digiti.

The action of this muscle draws the little finger inwards and forwards, and separates it from the other fingers.

FLEXOR PROPRIUS MINIMI DIGITI.

This muscle, Fig. 155, *g*, is situated by the side of the preceding. It extends from the os cuneiforme, and from the annular ligament of the carpus to the upper portion of the first phalanx of the little finger, to which it is attached with the preceding muscle by a round tendon; its connections are the same as the preceding muscle.

This muscle bends the first joint of the little finger, and assists the adductor.

ADDUCTOR OSSIS METACARPI MINIMI DIGITI[g].

This muscle, Fig. 156, *a*, is almost concealed by the two muscles last described. It is attached superiorly, by fleshy fibres, to the os cuneiforme and annular ligament of the carpus; it forms a thick mass, which is attached inferiorly by a tendon to the fore part of the metacarpal bone of the little finger.

The *posterior surface* is connected with the last interosseous muscle, the fourth metacarpal bone, and the tendon of the flexor sublimis, which passes to the little finger.

This muscle carries the metacarpal bone of the little finger outwards, and assists the flexor.

MIDDLE PALMAR REGION.

LUMBRICALES[h].

The lumbricales are four small muscles, Fig. 155, *a*, *a*, *a*, *a*, situated in the palm of the hand. They are attached superiorly to the tendons of the flexor digitorum profundus perforans; each muscle has a tendon, which passes along the side of the finger, and is attached inferiorly to the back part of the first joint.

The *anterior surface* is connected with the tendons of the flexor digitorum profundus, the palmar aponeurosis, and the collateral vessels and nerves of the fingers; the *posterior surface* with the interosseous muscles, the inferior transverse metacarpal ligament, and the phalanges.

These muscles bend the first phalanx: they are small and appear insignificant as flexors, when compared with the powerful muscles already described, but they are in-

g This muscle is frequently designated *opponens minimi digiti*.

h These derive their name from their resemblance to the *lumbricus* or earth-worm.

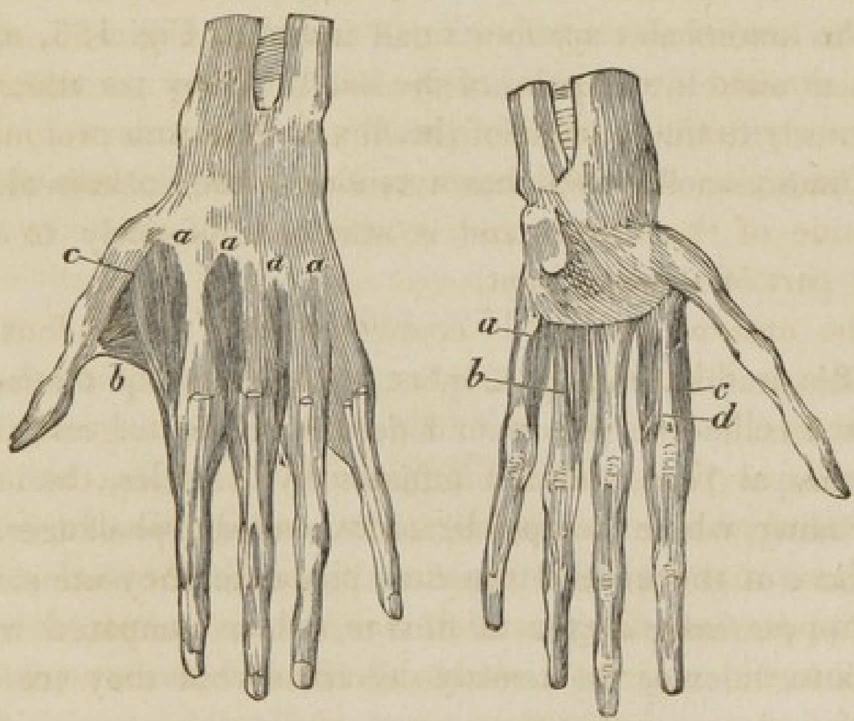
dispensably necessary in the performance of the rapid movements of the fingers, as in playing on musical instruments, etc. Hence Cowper gave them the name of *musculi fidicinales*.

INTEROSSEI.

These are seven little muscles named interossei, situated in the intervals of the metacarpal bones: four, Fig. 157, *a*, *a*, *a*, *a*, on the back of the hand, and three, Fig. 158, *a*, *b*, *d*, in the palm: the latter are not seen till the other muscles of the thumb and fingers are removed; they are designated adductors, and abductors, according to their uses.

I. ABDUCTOR INDICIS.

Fig. 157. Fig. 158.



This muscle, *c*, Figs. 157 and 158, is of a triangular form; it is attached to the outer edge of the metacarpal bone of the fore-finger, and to the upper part of the inner edge of the metacarpal bone of the thumb. The two fasciculi unite into a tendon, which terminates on the outer side of the upper extremity of the first phalanx, and the extensor tendon of the fore-finger.

The *posterior surface* of this muscle is connected with the integuments; the *anterior* with the first lumbricalis, the flexor brevis, *b*, the abductor pollicis, and the integuments.

This muscle approximates the fore-finger to the thumb, and inclines the metacarpal bone inwards.

II. ADDUCTOR INDICIS.

This muscle, Fig. 158, *d*, is placed in the palm of the hand; it is attached superiorly to the inner side of the metacarpal bone of the fore-finger; inferiorly by a tendon in the same manner as the preceding.

The *anterior surface* of the adductor indicis is connected with the flexor brevis and adductor pollicis; the *inner surface* corresponds with the next muscle.

The action of this muscle carries the fore-finger inwards.

III. ABDUCTOR DIGITI MEDII.

This muscle, Fig. 157, is seen at the back of the hand. It is attached to the inner side of the second and third metacarpal bones, and terminates by a tendon, like the preceding, which is attached to the outer side of the first phalanx of the middle finger, and its extensor tendon.

The *posterior surface* of this muscle is connected with the integuments, the tendons of the extensor muscles of the fore-finger, and with an aponeurosis which passes from the second to the third metacarpal bone; the *anterior surface* with the flexor brevis and adductor pollicis.

This muscle draws the middle finger outwards.

IV. ADDUCTOR DIGITI MEDII.

This muscle, Fig. 157, is also situated at the back of the hand. It is attached to the inner side of the third and fourth metacarpal bones, and terminates like the others in a tendon which is inserted into the inner side of the upper extremity of the first phalanx and extensor tendon of the middle finger.

The *posterior surface* of this muscle is connected with the integuments and tendons of the common extensors of the fingers.

This muscle carries the middle finger towards the ring finger.

V. ABDUCTOR DIGITI ANNULARIS.

This muscle, Fig. 158, *b*, is placed in the palm of the hand ; it is attached to the outer side of the fourth metacarpal bone ; and its tendon is inserted into the outer side of the first phalanx and extensor tendon of the ring finger.

The *anterior surface* is connected with the lumbricales muscles and tendons of the flexor profundus.

This muscle draws the ring finger towards the middle finger.

VI. ADDUCTOR DIGITI ANNULARIS.

This muscle, Fig. 157, is situated on the back of the hand. It is attached to the inner side of the fourth metacarpal bone, terminating in a tendon which is inserted into the inner side of the ring finger.

The *posterior surface* of this muscle is connected with an aponeurosis which passes from the fourth to the fifth metacarpal bone, the extensor tendons of the little finger, and the integuments: the *anterior surface* is concealed above by the interosseous muscle of the little finger, but below appears between it and the preceding muscle.

This muscle brings the ring finger towards the little finger.

VII. ABDUCTOR MINIMI DIGITI.

This muscle, Fig. 158, *a*, is seen in the palm of the hand. It is attached to the outer surface of the fifth metacarpal bone; its tendon is inserted into the outside of the first phalanx and the extensor tendon of the little finger.

The *anterior surface* of this muscle is connected with the adductor ossis minimi digiti; the *outer surface* corresponds with the preceding muscle.

The action of this muscle carries the little finger outwards.

THE ENVELOPING APONEUROSIS OF THE UPPER EXTREMITY.

The muscles of the arm are covered by a delicate cellular tissue, very different from aponeurosis, and therefore is usually in dissections taken off with the integuments. But on the fore-arm we find a strong fascia or aponeurosis, investing all the superficial muscles. This external aponeurosis is continued from the intermuscular aponeurosis, which pass down to the condyles of the humerus. It is attached to the condyles and to the olecranon, and on the back part receives a great addition of fibres from the tendon of the triceps. On the fore part of the arm it appears to be a continuation of the aponeurotic insertion of the biceps, and is attached to all the muscles by septa, or fibrous partitions. The sheath descends along the fore-arm, adhering to the whole inner edge of the ulna, and arriving at the wrist, is continued into the annular ligaments. The outer surface is covered by skin, cellular tissue, adipose substance, and by the superficial veins, nerves, and lymphatics of the arm. It appears to form thin sheaths for these different organs; it sends also between them, and especially above them, areolæ and arches, through which the branches of superficial veins and nerves pass. The fibres have no constant direction, but cross each other in all directions, and leave between them small openings, which are traversed by blood-vessels.

CHAP. VI.

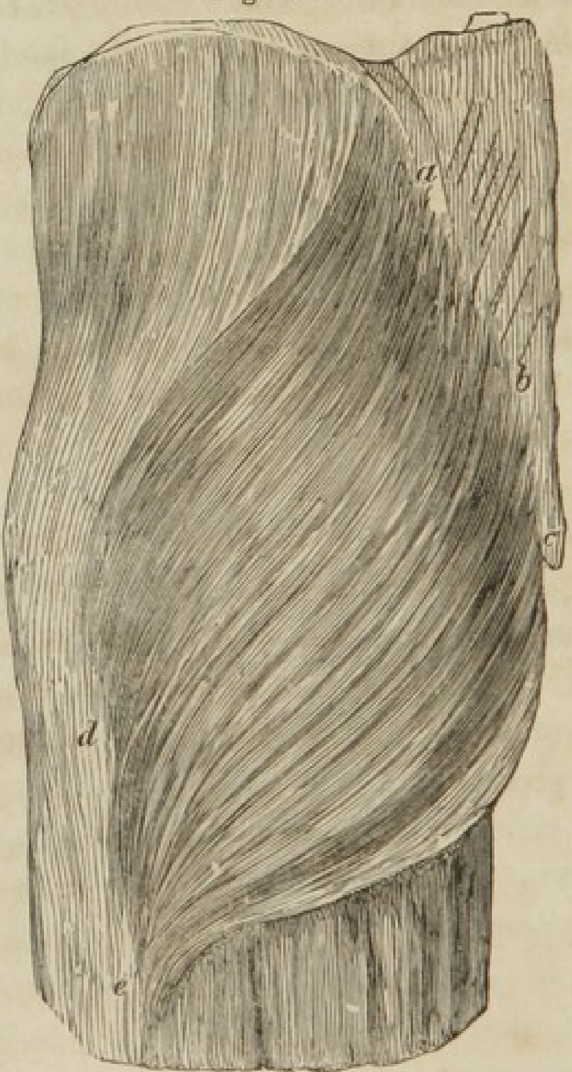
MUSCLES OF THE INFERIOR EXTREMITY.

REGION OF THE HIP.

MUSCLES OF THE HAUNCH AND THIGH.

GLUTEUS MAXIMUS.

Fig. 159.



This muscle is placed at the back part of the hip, covering all the muscles situated on that part. A correct idea of its form may be had from the annexed representation.

It is attached superiorly, at *a*, to the posterior crest of the ilium; at *b*, to the posterior surface of the sacrum; at *c*, to the border of the os coccygis, and to the posterior surface of the sacro-sciatic ligament; the fleshy fibres pass obliquely downwards and forwards, forming a very broad, thick, coarse muscle; its fasciculi gradually converging, terminate in a strong flat tendon, which is attached inferiorly at *d*, *e*, the upper and outer part of the linea aspera of the femur. A great portion of tendinous fibres also unite it to the aponeurosis of the thigh.

The *posterior surface* of this muscle is covered by an extremely thin lamina of the fascia lata, adipose tissue, and skin. The *anterior surface* is applied to the ilium, sacrum, and os coccygis; the attachments of the sacro-spinalis, the gluteus medius, pyriformis, gemelli, obturator internus, and quadratus femoris muscles; to the sciatic nerve, the tuber ischii, the posterior sacro-sciatic ligament, the upper extremity of the biceps, semimembranosus and semitendinosus, the great trochanter, and to the triceps adductor muscles.

The office of the gluteus maximus is to extend the thigh by drawing it backwards and somewhat outwards. It extends likewise the pelvis on the thigh in standing; and assisted by the other glutei in progression, it maintains the equilibrium of the body on the lower extremity, which rests on the ground.

GLUTEUS MEDIUS.

Fig. 160.

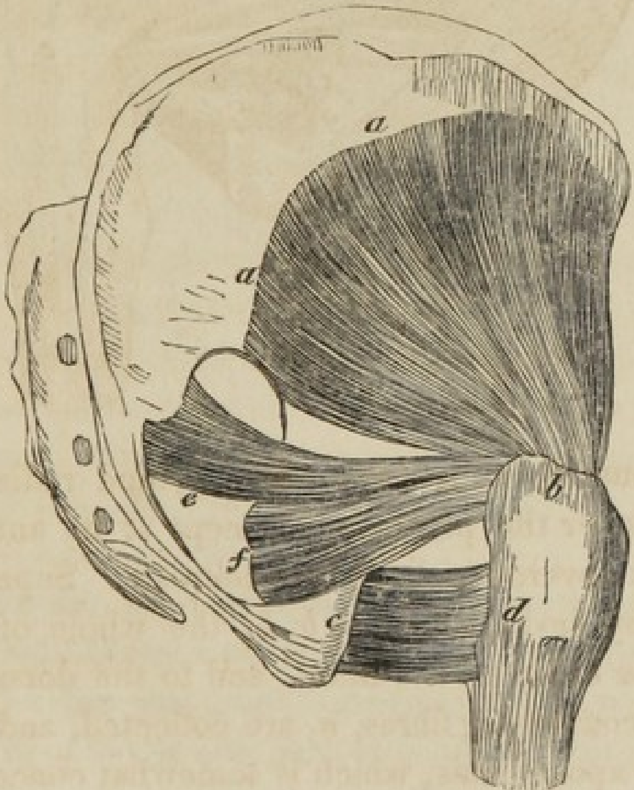
This muscle, *a*, is broad, strong, and radiated; it is situated under the preceding, except at its anterior part, where it is covered only by aponeurosis. Superiorly it is attached by fleshy fibres to *b*, *b*, the whole of the outer edge of the crista of the ilium, and to the dorsum of that bone; its converging fibres, *a*, are collected, and terminate in a broad aponeurosis, which is somewhat concealed in its substance, but is converted into a tendon, and is inferiorly inserted into the upper part of *c*, the great trochanter.

The *outer surface* of this muscle is connected with the posterior half of the gluteus maximus, and its anterior with the fascia lata; the *inner surface* with the iliac bone, the gluteus minimus, pyramidalis, triceps extensor muscles, and the gluteal artery. The *anterior edge* is connected above with the tensor vaginæ femoris, but is separated below by an interval occupied by a great quantity of cellular tissue and branches of the external circumflex artery. The *posterior edge*, at its upper part, is parallel to the pyriformis muscle.

The gluteus medius draws the thigh outwards and a little backwards. It also acts in standing and in progression.

GLUTEUS MINIMUS.

Fig. 161.



This muscle, *a*, *a*, *b*, is smaller than the gluteus medius, and is entirely concealed until that muscle is raised from its connections. A synovial bursa is found between their tendons. The gluteus medius is attached superiorly by fleshy radiating fibres at *a*, *a*, to the semicircular ridge of the ilium, and to the dorsum of that bone below the ridge. Its fasciculi descend and are collected together, terminating inferiorly in a strong tendon, which is attached at *b*, to the anterior and superior part of the trochanter major.

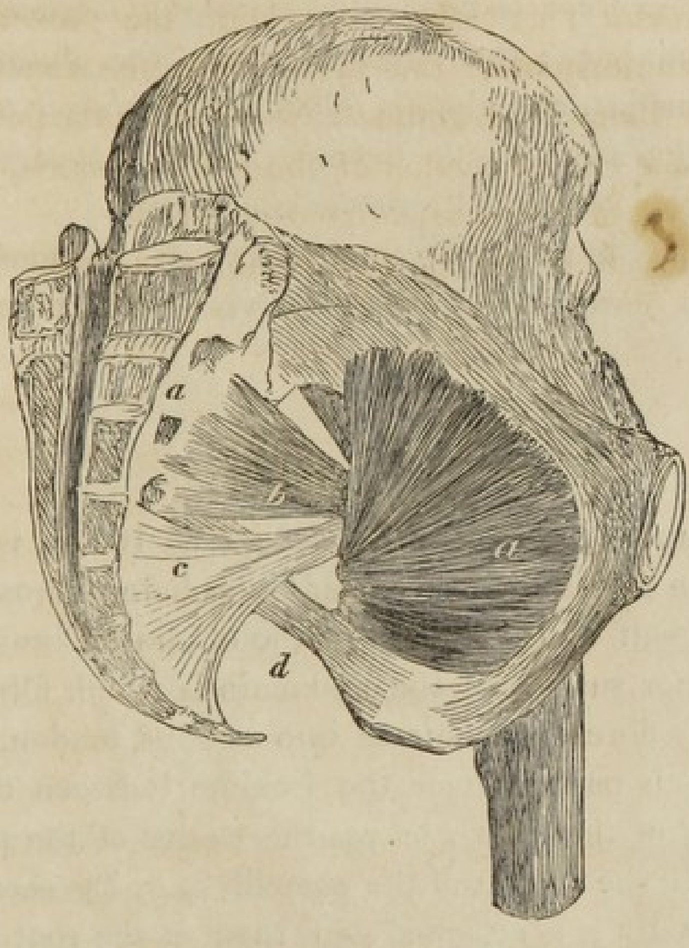
The *outer surface* of the gluteus minimus is connected in the greater part of its extent with the preceding muscle; posteriorly with the pyriformis; the *inner surface* with the ilium, the fibrous capsule of the articulation of the hip, the curved tendon of the rectus femoris, and witn a small part of the triceps extensor cruris.

This muscle assists the two former muscles.

PELVI-TROCHANTERIC REGION.

PYRIFORMIS.

Fig. 162.



This, like the other small muscles of the hip, cannot be demonstrated till the gluteus maximus is removed. It lies behind and below the gluteus medius, but is not at all covered by it. On the one part, it is attached at *a*, by three fleshy portions, to the concave surface of the sacrum, and becoming round and tapering, it passes out of the pelvis below the nitch of the posterior part of the ilium, and above *c*, the superior sacro-sciatic ligament; that part which passes out of the pelvis is seen in Fig. 161, at *e*, terminating in a round tendon, and is inserted into the cavity at the root of *b*, the trochanter major.

In the pelvis, the *anterior surface* is connected with the rectum, the sciatic plexus, and the hypogastric vessels. After leaving that cavity, it is in contact with the ilium, the capsule of the hip joint, and the gluteus minimus. The *posterior surface* is connected with the sacrum and the gluteus maximus; the *upper edge* with the gluteal artery, gluteus medius, and gluteus minimus; the *lower edge* with the anterior sacro-sciatic ligament, and is separated from the superior gemellus by the sciatic nerve.

This muscle turns the thigh outwards: in some degree it has the power of turning the pelvis on the thigh.

OBTURATOR INTERNUS.

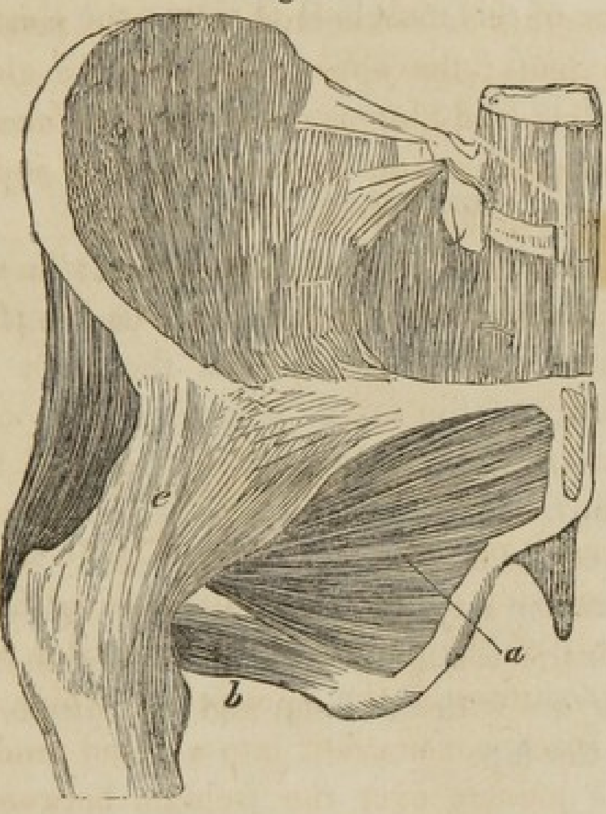
The superior part of this muscle, Fig. 162, *c*, is situated within the pelvis; it is attached by radiated fibres to more than one-half of the margin of the obturator foramen, and to the inner surface of the aponeurosis which fills up that hole. Its fibres concentrate into a round tendon, *f*, Fig. 160, which passing over the ischium between the spine and tuber of that bone, leaves the cavity of the pelvis, is inclosed in the sheath of the gemelli, *e*, *g*, (as seen in Fig. 161;) finally it is attached with them at the root of *c*, the great trochanter. Where the obturator bends there is a *synovial capsule*, lining the cartilaginous layer of the lesser sciatic notch, and reflected over the tendon.

The *outer surface* of the obturator internus is connected with the ilium, pelvis, obturator ligament, sciatic nerve, and gluteus maximus; the *inner surface* with the aponeurosis to which the levator ani is attached, and with the capsule of the articulation of the hip.

The office of this muscle is to rotate the thigh and leg outwards, and to draw it in the same direction.

OBTURATOR EXTERNUS.

Fig. 163.



This muscle covers the external obturator foramen. It is not distinctly seen until all the muscles which run from the pelvis to the upper part of the thigh are removed. Inwardly, it has a fleshy attachment, at *a*, to the circumference of the obturator foramen, and to the external surface of the obturator aponeurosis; its fibres are directed outwards through the notch placed between the inferior margin of the acetabulum and the tuberosity of the ischium, pass round the cervix of the femur, adhering to *e*, the capsular ligament, and terminate in a tendon which is attached outwardly, at the root of the trochanter major, immediately below the gemelli, as seen in Fig. 160, below the letter *g*.

The *anterior surface* of the obturator externus is connected with the pectineus, the adductors, and the quadratus femoris; the *posterior surface* with the ilium, the obturator ligament, and the capsule of the articulation of the hip.

The office of this muscle is to rotate the thigh obliquely outwards.

GEMELLUS SUPERIOR[i].

This muscle, Fig. 160, *e*, is placed below the preceding. It is short, flat, and broad, thicker in the middle than at the extremities. It is attached on the inner side to the external border of the sciatic spine, then proceeds transversely outwards, and embraces the tendon of *f*, the obturator internus, and becomes attached outwardly to the upper part of the inner surface of the great trochanter.

The *posterior surface* of the gemellus superior is connected with the sciatic nerve and gluteus maximus; the *anterior surface* with the ilium and the capsule of the articulation of the hip.

GEMELLUS INFERIOR.

This muscle, Fig. 160, *g*, has the same form, attachments, and connections, as the gemellus superior. The two tendons of the gemelli unite behind that of the obturator internus, so as to form a kind of channel.

These muscles roll the thigh outwards, and draw the one from the other.

[i] This muscle, with the following, are frequently designated under the general name of *musculi gemini*.

QUADRATUS FEMORIS.

This muscle, Fig. 161, is situated below the inferior gemellus. On the inner side, it is attached, at *c*, to the ischium, between its tuberosity and the obturator foramen; on the outer side, its fibres run transversely, and are attached at the back part of the femur to a rough line, which extends from the root of the great to that of *d*, the small trochanter[j].

The *posterior surface* of the quadratus femoris is connected with the sciatic nerve, the gluteus maximus, the semimembranosus, and the adductor magnus muscles; the *anterior surface* with the obturator externus, the extremity of the tendon of the psoas magnus, and the posterior part of the small trochanter.

The office of this muscle is to turn the lower extremity outwards.

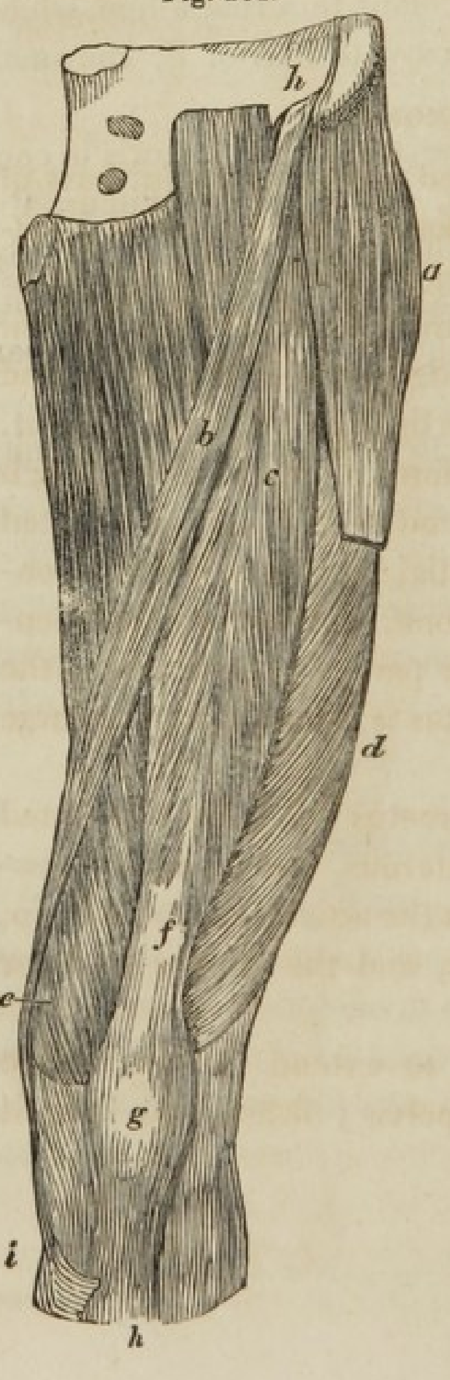
j This muscle is also shewn in Fig. 163, at *b*.

ANTERIOR FEMORAL REGION.

SARTORIUS.

This muscle, *b*, which is the longest of the human body, is situated on the front and inner part of the thigh, before the other muscles. Superiorly it is attached, at *h*, to the anterior superior spinous process of the ilium; crosses the thigh obliquely, passes behind the inner condyle of the femur, at *e*, and is inserted inferiorly by a broad tendon, at *i*, to the inner side of the head of the tibia, near the inferior part of its tubercle.

Fig. 164.



The *anterior surface* of the sartorius is connected with the fascia lata; the *posterior surface* from above downwards with the psoas magnus and iliacus internus, the rectus femoris, triceps extensor cruris, adductor longus, adductor magnus, and gracilis muscles; with the crural artery about the middle of the thigh; and at its lower part with the internal lateral ligament of the articulation of the knee. The *inner edge* of the superior part of this muscle forms with the adductor longus a triangular space, in which the crural artery, vein, and nerve, is situated.

The action of this muscle brings the leg obliquely inwards, as when tailors cross their legs at work; indeed, from this circumstance the muscle obtains its name. Its continued contraction will also bend the thigh on the pelvis.

RECTUS FEMORIS.

The rectus femoris is situated immediately in front of the thigh; its fibres are penniform. Superiorly it is attached by a tendon to the anterior inferior spinous process of the ilium, and by another strong tendon to the dorsum of that bone a little above the edge of the acetabulum, and is also adherent to the capsular ligament of the hip joint. These two tendons unite and form a fleshy mass, which terminates inferiorly in a flat tendon at *f*, and is inserted into the upper part of the patella, *g*, where a thin aponeurosis is continued over that bone, and becomes ligamentous at *h*, connecting the lower part of the patella to the tibia. Thus, virtually the rectus is attached to the large bone of the leg.

The *anterior surface* of the rectus femoris is connected with the fascia lata, iliacus externus, and sartorius muscles; the *posterior surface* with the articulation of the hip, the external circumflex vessels, and the triceps extensor cruris.

The office of this muscle is to extend the leg on the thigh, and the thigh on the pelvis; when standing, it assists in fixing the body.

TRICEPS EXTENSOR CRURIS. { *Vastus externus,* *Vastus internus,* *Cruræus.*

This muscle embraces the femur from the base of the trochanters to the patella. The older writers described it as three distinct muscles; and as its upper part is divided into three fasciculi, the distinction is here retained.

Fig. 165.

1st. The *external fasciculus*, or *vastus externus.* This portion forms the fleshy mass which occupies the outer side of the thigh bone; it is attached superiorly, by tendinous and fleshy fibres, at *a*, to the anterior surface of the great trochanter, to the outer border of the linea aspera, and to the oblique line running to the external condyle. The fleshy fibres pass forwards, and are connected at *b*, to the tendon of the cruræus, and inferiorly, at *c*, to the side of the patella: part of it also ends, at *d*, in an aponeurosis which passes over the side of the knee, is fixed to the head of the tibia, and continued to the leg.

2nd. The *internal fasciculus*, or *vastus internus*, covers the inner part of the femur, in the same manner as the preceding portion does the outer side. It is attached by aponeurotic and fleshy fibres, at *f*, to the fore part of the minor trochanter; its fibres are continued along the inner border of the linea aspera, and the oblique line running to the inner condyle, taking a direction downwards and forwards; they are then connected, at *b*, to the tendon of the cruræus, and inferiorly to the side of the patella, *c*, and to the aponeurosis of the leg.

3rd. The *middle fasciculus*, *b*, is called the *cruræus vel cruralis*, the principal part of which is concealed by the fleshy masses of the vasti, and is connected intimately with them. It is attached superiorly between the trochanters of the femur and the fore part of that bone almost to its inferior extremity. As before stated, the sides are united to the vasti fasciculi. The front is covered by the rectus, the tendon of which, at *g*, joins it near the lower part of the thigh, terminating with it in *c*, the patella[k].

The *anterior surface* of this muscle is connected externally and above with the tendons of the gluteus maximus and minimus, farther down with the fascia lata and its tensor muscles, and at its lowest part with the short portion of the biceps. In the middle it is in connection with the external circumflex vessels; internally, the fascia lata, the crural artery, and the sartorius, are in contact with it. The *posterior surface* is connected with the whole surface of the shaft of the thigh bone, but is separated below from it by a mass of cellular and adipose tissue.

The office of the triceps extensor muscle is to extend the leg on the thigh, and the latter on the former.

k There are frequently found some fasciculi of muscular fibres under the middle portion, and attached to the capsule of the knee joint, which have been considered by some anatomists as a separate muscle, under the name of *subcruræus*.

INTERNAL FEMORAL REGION.

PECTINEUS.

This muscle, *d*, is situated at the superior part of the thigh, and is of a flat, long, and triangular figure. It is attached superiorly by aponeurotic adhesions to the brim of the pelvis; inferiorly by means of a tendon to the linea aspera, immediately below the trochanter minor.

Fig. 166.

The *anterior surface* of the pectineus is connected with the fascia lata and the crural vessels and nerves; the *posterior* with the pubis, the articulation of the hip, the obturator externus, the adductor brevis muscles, and the obturator vessels and nerves. The *inner border* is a little covered by the adductor longus; the *outer* is parallel to the psoas magnus.

The office of this muscle is to bend the thigh, and to rotate it, as when we turn out our toes. It also bends the pelvis upon the thigh, or preserves it in its upright position.

GRACILIS.

The gracilis, which is situated on the inner side of the thigh, is a long, thin, flat muscle. Superiorly it is attached at *a*, by an aponeurosis or flat, thin tendon, to *b*, the ramus of the os pubis, near the symphysis; descending in a direct course by the inside of the thigh, it terminates at *h*, in a tendon, which passes behind the inner condyle of the femur, and is attached inferiorly to the inside of the tibia below the tendon of *i*, the sartorius, and above that of *k*, the semitendinosus.

The *inner surface* is connected with the fascia lata and the sartorius; the *outer* with the adductors, and the semi-membranosus muscles, and the internal lateral ligament of the knee joint.

This muscle, like the sartorius, brings the thigh inwards and forwards; it acts also as a flexor of the leg and thigh.

ADDUCTORS OF THE THIGH.

The adductor muscles of the thigh consist of three distinct muscles, though they are frequently described as one under the name of *triceps adductor femoris*.

ADDUCTOR LONGUS.

This muscle, Fig. 167, is placed between the pectineus and gracilis. It is attached superiorly, by a short and strong tendon at *b*, to the upper and inner part of the os pubis, near its symphysis; the fibres, *a*, descend obliquely, and are inferiorly attached by an aponeurosis at *c*, to the middle of the linea aspera, occupying rather more than one-third of its length.

The *anterior surface* of the adductor longus is connected with the fascia lata, the sartorius, and the femoral artery; the *posterior surface* with the two other adductor muscles, and is almost inseparably united to them below. The *outer border* is parallel to the pectineus muscle; the *inner* is concealed by the gracilis.

ADDUCTOR BREVIS.

This muscle is situated behind the preceding; it is of a triangular, flat figure, and is attached superiorly, by tendinous and fleshy fibres, to the pubes between the symphysis and obturator foramen; inferiorly, to the upper third of the linea aspera, where its insertion is blended with the adductor longus, the adductor magnus, and the pectineus.

The *anterior surface* of the adductor brevis is connected with the preceding muscle and the pectineus; the *posterior* with the adductor magnus. Inferiorly it is united to the gracilis; and externally to the tendon of the psoas magnus, the iliacus internus, and to the obturator externus.

ADDUCTOR MAGNUS.

Fig. 167.

The adductor magnus occupies nearly the whole inner part of the thigh; it is situated behind and below the other two adductors, and separates the anterior and posterior parts of the thigh. It is attached superiorly, at *e*, to the inferior part of the anterior surface of the ramus of the pubes; at *b*, to the anterior surface of that of the ischium, and to the external border of its tuberosity; the fibres run inwards and downwards, having various degrees of obliquity, and are attached inferiorly to the whole length of the linea aspera, to the oblique ridge above the internal condyle of the os femoris, and by a long round tendon to the upper part of the condyle, where the tendon is united to the adductor longus. There is a perforation in the tendon of this muscle at *i*, near the bone through which the femoral artery passes in its course towards the ham.

The *anterior surface* of this muscle is connected with the two preceding, the sartorius, and the femoral artery; the *posterior surface* with the semitendinosus, semimembranosus, biceps, gluteus maximus, and the sciatic nerve. The *inner border* is much thicker above than below, and is connected with the fascia lata and gracilis.

The office of the adductors is—1st, to move the thigh and leg inwards; 2nd, to roll it outwards; 3rd, to bend the thigh on the pelvis; and lastly, to keep the pelvis firm in the erect position of the trunk. The action of the fibres vary according to the obliquity of their attachments.

POSTERIOR FEMORAL REGION.

BICEPS FEMORIS.

Fig. 168.

The biceps femoris is situated at the back part of the thigh, and forms the outer hamstring. It is divided into two portions, one long and the other short. The long portion is attached superiorly at *a*, by a tendon, to the outer part of the tuberosity of the ischium, and descending, forms a thick, fleshy mass; its short portion, *b*, is fixed by tendinous and fleshy fibres to the linea aspera immediately below the gluteus maximus, and to the oblique ridge passing from the condyle, where it is connected with the fibres of the vastus externus. The two heads are united at an acute angle a little above the external condyle of the femur, and terminate in a strong tendon, *c*, which is attached at *d*, to the outside of the head of the fibula.

The *posterior surface* of this muscle is connected with the gluteus maximus and the fascia lata; the *anterior surface* with the semitendinosus, triceps, and adductor magnus muscles, the sciatic nerve, the femur, and the external lateral ligament of the knee. The long portion is placed over the short portion, which is connected with the external superior articular artery and the external head of the gastrocnemius. The *inner border* unites with the preceding muscle to form the ham.

The biceps is a powerful flexor of the leg upon the thigh, or the latter upon the leg; its long portion is capable of extending the thigh upon the pelvis, or of keeping the pelvis erect. It also assists in turning the leg outwards.

SEMITENDINOSUS.

This muscle, *e*, is placed between the biceps femoris and gracilis; we may also see it in Fig. 166, *c, k;* it is attached superiorly, in common with the biceps, by aponeurotic fibres to the tuberosity of the ischium; it has also some fleshy fibres fixed to that projection more outwardly, and is connected for several inches, at *f*, with the commencement of the biceps. The fleshy mass runs down the back of the thigh, forms a long round tendon, *g*, which passing round the inner side of the knee, becomes flattened, and is reflected forward to be inserted into the inner side of the ridge of the tibia, a little below the tubercle, and is connected with the under edge of the tendon of the gracilis, marked in this figure *h*.

The *posterior surface* of the semitendinosus is connected with the fascia lata, and a little at its upper part with the gluteus maximus; the *anterior surface* with the semimembranosus and adductor magnus.

The office of this muscle is to bend the leg backwards and a little inwards, and to assist in keeping the pelvis erect.

SEMIMEMBRANOSUS.

This muscle, *i*, is situated behind the preceding muscle, and with it properly forms the inner hamstring. The tendons of the sartorius and gracilis are sometimes enumerated as part of the inner hamstring, but they lie more anteriorly. The upper portion is best displayed in Fig. 166, and is superiorly attached, at *d*, to the outer part of the tuberosity of the ischium. It forms a fleshy mass in the middle and back part of the thigh; and inferiorly terminates obliquely in a flat tendon, Fig. 168, *i*, which passing behind the inner condyle, is spread out at *k*, in an aponeurotic expansion, which covers and strengthens the capsule of the knee joint, and is attached, at *l*, to the inner and back part of the head of the tibia.

The offices of this muscle are the same as those of the preceding muscle.

The *posterior surface* of the semimembranosus is connected with the biceps, semitendinosus, and fascia lata; the *anterior surface* with the quadratus femoris, adductor magnus, and internal head of the gastrocnemius, popliteal artery, and the knee joint. Its *outer border* is connected with the sciatic nerve, and concurs with the biceps to form the cavity of the ham; the *inner border* is covered by the gracilis and the cavity of the fascia lata.

TENSOR VAGINÆ FEMORIS.

This muscle, Fig. 164, *a*, is situated at the upper and outer part of the thigh; it is attached externally to the anterior and superior iliac spine, between the sartorius and gluteus medius, by a very short tendon; the fleshy fibres descend nearly vertically, diverging as they proceed, and about three inches above the great trochanter terminate in the laminæ of the femoral aponeurosis.

The *outer surface* is connected to a thin lamina of the aponeurosis of the thigh ; the *inner* to another aponeurotic plate, which separates the rectus femoris from the triceps extensor cruris. It also covers a portion of the gluteus medius and gluteus minimus muscles.

The principal action of this muscle is to stretch the aponeurosis which envelopes the muscles of the thigh. It also carries the limb outwards, separating it from the other.

APONEUROSIS OF THE THIGH.

The inferior extremities, like the superior, are enveloped by a strong tendinous web. In the thigh it is frequently termed the *fascia lata femoris ;* and is composed of strong tendinous and ligamentous fibres, which cover all the muscles, and indeed sends septa or partitions between them. On the outer part, it is very strong and tendinous; but in front, and on the inner part, it is thin, and composed of a mere condensed cellular membrane.

Superiorly and anteriorly the aponeurosis of the thigh is continuous with the fibres of the crural arch, and is fixed posteriorly to the sacrum and os coccygis; on the outer side, it is inserted into the crest of the ilium; on the inner side, it is continuous with the ligaments of the pubis. Inferiorly, this aponeurosis is blended round the knee with that of the leg.

There is a considerable opening beneath the crural arch, through which the crural vein passes. This opening is formed in the following manner. The aponeurosis being composed of two portions, the *iliac* and *pubic,* the former is folded in the shape of a sickle at that part where it ceases to be united to the crural arch. The concavity of this fold looks downwards and inwards, and is termed the *falciform process;* the latter, or pubic portion, coming from the pubes, passes over the pectineus and adductors, and unites with the iliac portion beneath the point where the saphena vein joins the femoral.

MUSCLES OF THE LEG.

ANTERIOR REGION OF THE LEG.

TIBIALIS ANTICUS.

Fig. 169.

This muscle, Fig. 169, *a*, *b*, is situated quite superficially on the fibular side of the tibia. It is attached superiorly to the external tuberosity and outer surface of that bone, and to nearly half of the interosseous ligament, *g;* from these surfaces it continues to adhere down two-thirds of the length of the leg. Its fibres also are attached to the inner surface of the aponeurosis of the leg, and to the intermuscular septa. The fleshy mass descends obliquely, and forming a strong tendon, crosses from the outside to the fore part of the tibia, and passing through a distinct ring of *(b)* the annular ligament, near the inner ankle, and running over the astragalus and os naviculare, it is inferiorly inserted, at *c*, into the os cuneiforme internum, and the posterior extremity of the metatarsal bone of the great toe.

The *anterior surface* of this muscle, at its superior part, firmly adheres to the aponeurosis of the tibia; it is also connected with the annular ligament of the tarsus, and the dorsal aponeurosis of the foot; on the *inner side* with the tibia; on the *outer* with the extensor communis digitorum pedis, extensor proprius pollicis pedis, the anterior tibial vessels and nerves. The *posterior border* is placed upon the interosseous ligament, the tibia, the articulation of the ankle, and the upper and inner part of the tarsus.

The office of the tibialis anticus is to bend the foot upwards and inwards. It is also a flexor of the leg on the foot, and it prevents the limb from falling backwards in the standing posture.

PERONEUS TERTIUS.

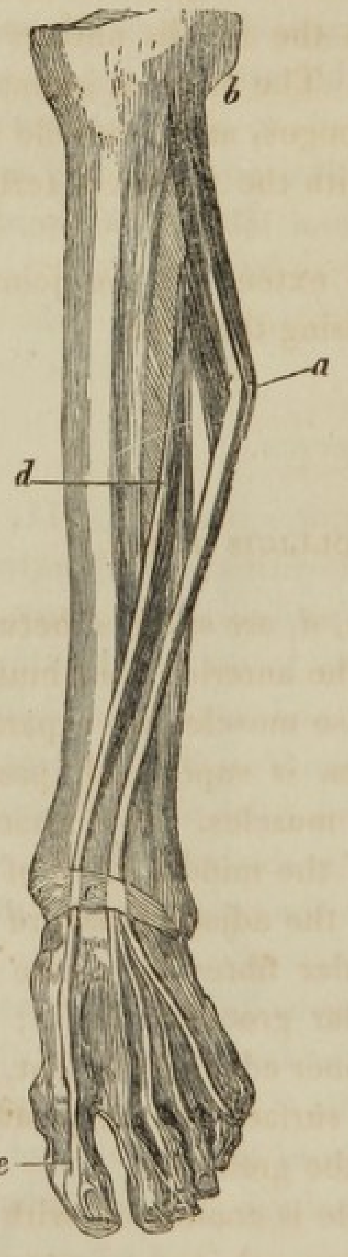
The fleshy fibres of this muscle, *d*, *e*, and Fig. 171, *e*, *f*, are almost inseparably connected with the long extensor of the toes, and indeed it may be said to be the outer portion of it. It is attached superiorly to the inferior third of the anterior border of the fibula, and to the neighbouring part of the internal surface. It sends its fleshy fibres forwards to a tendon which passes under the annular ligament of the tarsus in the same groove as those of *d*, Fig. 171, and is attached inferiorly, at *e*, to the posterior part of the metatarsal bone of the little toe.

The *outer surface* of the peroneus tertius is connected with the aponeurosis of the leg; the *inner surface* with the extensor communis digitorum pedis. In the foot it passes over the extensor brevis digitorum pedis and the first metatarsal bone: its posterior border is placed upon the fibula and interosseous ligament.

The office of this muscle is to bend the foot upon the leg, raising its outer edge; it also bends the leg on the foot.

EXTENSOR LONGUS DIGITORUM PEDIS.

Fig. 170.



This muscle, *a*, is placed entirely superficial between *a*, the tibialis anticus, Fig. 169, and *d*, *e*, the peroneus tertius, being firmly connected to them by the intermuscular membranes. In the figure before us it is represented drawn aside by a hook at *a;* superiorly it is attached by aponeurotic and fleshy fibres, at *b*, to the external tuberosity of the tibia; to the head, and to almost the whole anterior part of the internal surface of the fibula, to the interosseous ligament, and to the aponeurosis of the leg, and the intermuscular septa. The fleshy fibres proceeding from these different directions, pass obliquely into a tendon marked *d*, Fig. 171, which below the middle of the leg is divided into four continuous portions, and pass under *c*, Fig. 170, the annular ligament, then over the upper part of the foot, and are distributed to the posterior extremity of the first phalanx of the four small toes, by flat tendons, which afterwards expand upon the upper surface of the toes.

The *anterior border* of this long extensor of the toes is connected with the aponeurosis of the tibia, the annular ligament of the tarsus, and the integuments; the *posterior border* with the fibula, the interosseous ligament, the tibia, the ankle joint, and the extensor brevis digitorum and the toes. The *inner* corresponds to the tibialis anticus and extensor proprius pollicis pedis. The *outer* is intimately united above with the peroneus longus, at the middle with the peroneus brevis, and below with the peroneus tertius: see Fig. 171.

The office of this muscle is to extend all the joints of the small toes, and to assist in raising the foot.

EXTENSOR PROPRIUS POLLICIS PEDIS.

The fleshy fibres of this muscle, *d*, are situated between the long extensor of the toes and the anterior tibial muscle, and cannot be exhibited until those muscles are separated from each other; but the tendon is superficial, passing between the tendons of those two muscles. It is attached superiorly to the anterior part of the middle third of the inner surface of the fibula, and to the adjacent part of the interosseous ligament; the muscular fibres terminate in a tendon which passes in a particular groove under *c;* the annular ligament runs along the inner edge of the foot, and is inserted, at *e*, into the upper surface of the posterior extremity of the last phalanx of the great toe.

The *inner surface* of this muscle is connected with the tibialis anticus, and anterior tibial vessels and nerves; the *outer surface* with the extensor communis digitorum; the *anterior border* is concealed above between the tibialis anticus and extensor digitorum, and is covered by the aponeurosis of the tibia and the integuments. The *posterior border* is placed on the fibula, the interosseous ligament, the tibia, the anterior tibial artery, the articulation of the tibia and tarsus, and upon the back of the foot and great toe.

The office of this muscle is to extend the great toe; it also bends the leg on the foot and the foot on the leg.

PERONEAL REGION.

PERONEUS LONGUS.

Fig. 171.

This muscle, *g*, and Fig. 174, *d*, is situated at the external part of the leg. Its fleshy fibres are quite superficial. It is attached superiorly to the outer side of the upper extremity of the fibula at *g*, and to one-third of its length downwards, to the crural aponeurosis and to the aponeurotic septa placed between the soleus and flexor longus pollicis pedis on one side, and the extensor longus pollicis pedis on the other side; the fibres run obliquely outwards into a tendon, which passes behind the outer ankle through a groove which is common to it with the peroneus tertius: thus, at the lower end of the fibula, these tendons are bound down by a tendinous bridle. The tendon of the peroneus longus is then conducted through a channel in the os calcis and os cuboides, extends obliquely across the sole of the foot, and is attached to the posterior extremity of the metatarsal bone of the great toe, and to the os cuneiforme internum[1].

The *outer surface* of the peroneus longus is connected with the aponeurosis of the tibia; the *inner surface* with the fibula, extensor digitorum communis, and peroneus brevis; the *posterior surface* corresponds to the soleus above and below the flexor longus pollicis. The several connections of the tendon have already been noticed.

The office of this muscle is to turn the foot outward, and to assist in extending it.

PERONEUS BREVIS.

This muscle is situated between the extensor longus digitorum and peroneus longus; its muscular fibres are concealed by those of the latter muscle. It is attached superiorly to the inferior half of the outer surface of the fibula, and to the intermuscular aponeurosis, and to the aponeurosis of the leg. The fibres run obliquely towards a tendon which passes in a groove of the fibula at the outer ankle, where it is inclosed in the same tendinous ring with the peroneus longus. It is continued through a channel on the outside of the os calcis, and is attached to the superior part of the posterior extremity of the metatarsal bone of the little toe: see Fig. 174, *g*.

The *outer surface* of the peroneus brevis is connected with the aponeurosis of the tibia and peroneus longus: the *inner surface* with the fibula, the extensor digitorum communis, and the peroneus tertius above, and with the flexor longus pollicis below.

The office of this muscle is to turn the foot outwards, and somewhat to extend it.

1 This insertion is distinctly seen in Fig. 174.

POSTERIOR REGION OF THE LEG.

GASTROCNEMIUS EXTERNUS ET INTERNUS.

Fig. 172.

These muscles are extremely large and strong, and principally form the calf of the leg. They are separated above into two flat fleshy masses, but are united below, where they present the strongest tendon of the whole body. The internal muscle is attached superiorly, at *a*, to the back part of the inner condyle of the femur; the external muscle is attached in the same manner, at *b*, to the external condyle. Each of these muscles forms a large fleshy mass, which is united below the ham in a central fibrous line near the middle of the leg: at *c*, they become a broad aponeurosis, which, as it approaches the heel, forms with the two tendons of the subsequent muscles a strong round chord, at *d*, termed the TENDO-ACHILLIS, which is fixed at *e*, the posterior extremity of the os calcis.

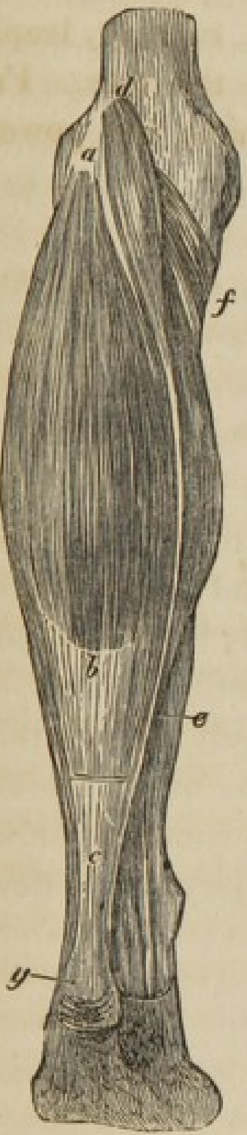
The *anterior surface* of the gastrocnemii is connected with the condyles of the femur, and the synovial membrane of the articulation of the knee; the outer muscle with the popliteus; the inner with the semimembranosus, the popliteal artery, the plantaris and soleus muscles; in the remainder of its extent it is in apposition with the soleus. The *posterior surface* is connected with the integuments.

The separation of the two muscles, at *b*, *a*, contributes to form the ham.

The office of these muscles is to extend the foot. They are seen very strongly acting in dancing, running, leaping, and when we are raising ourselves on the toes. From their origin on the femur, they also have the power of bending the leg on the thigh.

SOLEUS.

Fig. 173.



This muscle is placed under the preceding, but part of it appears on each side of those muscles. Superiorly it is attached, by the external portion at *a*, to the posterior part of the head of the fibula, and to the superior third of the oblique line on the posterior surface of the tibia, and to a portion of the internal border of that bone below *f*, the popliteus, the fleshy fibres terminating, at *b*, in a broad aponeurosis ; inferiorly, this aponeurosis is inseparably united with that of *c*, the gastrocnemii, forming the tendo-Achillis, which is inserted, at *g*, into the os calcis.[m]

The *posterior surface* of the soleus is connected with the gastrocnemii and plantaris, and with the aponeurosis of the leg ; the *anterior surface* with the peroneus longus, popliteus, flexor longus digitorum, flexor longus pollicis, and tibialis posticus muscles, a portion of the back of the fibula, the popliteal, posterior tibial, and fibular vessels.

This muscle assists the gastrocnemii in extending the foot and in raising the heel in progression.

m From the circumstance of the three muscles being united into one tendon, H. Cloquet has described them as a single muscle, under the name of *triceps extensor pedis*.

PLANTARIS.

This muscle, which is long, and extremely thin and narrow, is situated under the outer portion of the gastrocnemius. It is attached superiorly, at *d*, to the posterior part of the external condyle of the femur, and adheres to the capsule of the knee joint, and to the tendon of the gastrocnemius externus. It forms behind the joint a small fleshy fasciculus, which passes over the popliteus, *f*, and sends a very long and slender tendon, *e*, obliquely inwards, which accompanies *c*, the tendo-Achillis, to be attached with it, at *g*, to the os calcis.

The *posterior surface* of the plantaris is connected with the gastrocnemii and integuments; the *anterior surface* with the ligaments at the posterior part of the knee joint, the popliteal vessels, and the popliteus and soleus muscles.

The particular use of this muscle has been a question with physiologists; although it is generally classed with the extensors of the foot, it is so extremely slender that it can have but little power in the motions of the limb. I am of opinion, that its office is solely to contract the foldings of the capsule, so as to prevent injury in the flexion of the knee joint.

POPLITEUS.

This is a small muscle, Fig. 174, *a*, Fig. 173, *f*, of a triangular figure, situated across the back part of the knee joint. It is attached superiorly within the capsule of the knee joint, by a round tendon, to the depression of the external condyle of the femur; it adheres to the posterior and outer surface of the semilunar cartilage; and at the back part of the condyle it perforates the capsular ligament, and forms a fleshy mass, which, passing obliquely inwards, is attached inferiorly, broad, thin, and fleshy, to the superior triangular surface at the back part of the tibia.

The *posterior surface* of the popliteus is connected with the gastrocnemii and plantaris muscles, the popliteal vessels, and the posterior tibial nerve; the *anterior surface* with the articulation of the tibia and fibula, the tibialis posticus muscle, and the tibia. The *outer margin* is united above by a thin membrane with the upper part of the fibula and soleus.

The office of this muscle is to bend the thigh and the leg; but chiefly, like the preceding, it prevents the capsule from being compressed in the motions of the knee joint.

FLEXOR LONGUS DIGITORUM PEDIS.

Fig. 174.

This muscle, *b*, is situated beneath the soleus; it is attached superiorly to the posterior surface of the tibia, and to the superior oblique line, until it arrives within three inches of the ankle. The fleshy fibres pass obliquely into a tendon at the posterior edge of the muscle; this tendon runs behind the inner ankle in a groove of the tibia, and is secured in this situation by a strong ligament, which is extended from the ankle to the os calcis, and having received a tendinous slip from the flexor longus pollicis, divides about the middle of the sole of the foot into four tendons, which pass through slits in the tendons of the flexor digitorum brevis, and are finally attached to the posterior part of the inferior surface of the last phalanx of the four small toes.

The *posterior surface* of this muscle is connected with the soleus muscle, the tibial aponeurosis, and the posterior tibial artery; the *anterior surface* with the tibia and the tibialis posticus muscle. The outer border is united with that muscle, and with the flexor proprius pollicis pedis. In the foot, the upper surface is connected with the deep-seated muscles of the sole, and the lower surface of its tendons with the adductor pollicis, flexor brevis digitorum, adductor minimi digiti muscles, and the plantar nerve.

The office of this muscle is to bend the last joint of the toes, to extend the foot; and it is of great use in walking and standing.

FLEXOR LONGUS POLLICIS PEDIS.

This muscle, *c*, *e*, is placed on the outer side of the preceding, between that muscle and the peroneus longus. It is attached superiorly by fleshy fibres to the middle part of the back of the fibula, to the interosseous ligament, and the aponeurotic septa; the muscular fibres, *c*, terminate in a tendon at *e*, which passes behind the inner ankle; (it is found further back, that is, nearer the os calcis, than the flexor longus digitorum pedis); and in the sole of the foot it crosses the tendon of that muscle to be ultimately attached at *f*, the last joint of the great toe.

The *posterior surface* of this muscle is connected with the soleus and aponeurosis of the tibia; the *anterior surface* with the fibula, the tibialis posticus, and the flexor longus communis muscles, the tibia, and the interosseous ligament. Its tendon is enveloped by synovial membranes behind the ankle joint, and under the great toe, and by the flexor brevis pollicis under the sole of the foot.

This muscle bends the great toe, and assists in extending the foot on the leg.

TIBIALIS POSTICUS.

Fig. 175.

The flexor longus digitorum pedis, and the flexor longus pollicis pedis, are here removed to show the situation of the tibialis posticus; the muscles which cover the tendon in the sole of the foot also are separated to exhibit its inferior attachment. Superiorly, the tibilis posticus is attached to the posterior surface of the tibia at *c*, to the fibula at *f*, to the surface of the interosseous ligament, and to the aponeurotic septa; the fibres pass obliquely, at *b*, towards a central tendon, which passes behind the inner ankle in a channel of the tibia, and is inferiorly inserted into the internal and inferior part of the os naviculare, sending tendinous filaments to the adjacent bones.

The *anterior surface* of the tibialis posticus is connected with the tibia and fibula, a large extent of the interosseous ligament, and the inferior part of the os calcis and scaphoides. The *posterior surface* is covered by the soleus, the flexor longus digitorum, and the flexor proprius pollicis muscles, and by the fibrous sheath of the inner malleolus.

This muscle is an extensor of the foot, and it draws it inwards.

MUSCLES OF THE FOOT.

DORSAL REGION.

EXTENSOR BREVIS DIGITORUM PEDIS.

Fig. 176.

This is a broad flat muscle, situated on the upper part of the foot; the tendons of the long extensor pass over it, but in this figure they are cut off near the toes. Posteriorly, the extensor brevis, *a*, is attached, at *c*, to the upper surface of the os calcis, the os cuboides, and the astragalus; its fleshy fibres divide at *b*, *b*, *b*, *b*, into four portions, each of which sends off a slender tendon; one of them is inserted anteriorly into the first phalanx of the great toe, the others into all the small toes except the little one, and uniting with the tendons of the extensor longus, they invest the upper surface of the phalanges of the toes.

The *upper surface* of the short extensor of the toes is connected with a very thin aponeurotic lamina extended over the back of the foot, and with the tendons of the long extensor of the toes; the *inferior surface* with the tarsus, the metatarsus, the interossei dorsales muscles, and the phalanges.

The office of this muscle is to assist in extending the first four toes, and it directs them a little outwards.

INTEROSSEI EXTERNI.

These small muscles are similar in form and arrangement to those of the hand. They are seen on the back of the foot at *b*, *b*, *b*, *b*; being attached posteriorly between the metatarsal bones of all the toes; anteriorly, to the first joint of the smaller toes. They are divided into adductors and abductors of the toes.

The office of these muscles is to separate the toes.

PLANTAR REGION.

FLEXOR BREVIS DIGITORUM PEDIS.

Fig. 177.

This muscle, *a*, is situated in the middle part of the sole of the foot. Posteriorly it is attached to the inferior surface of *d*, the os calcis, to the inner surface of the plantar aponeurosis, and to the tendinous septa interposed between this muscle and the abductors of the toes. It forms a thick fleshy mass, and divides into four tendons, which, having advanced beyond the tarsus, are split for the passage of the long flexor tendons, and are ultimately attached to the inferior surface of the second phalanx of the four lesser toes. The tendon to the little toe, however, is not always found.

The *inferior surface* of the short flexor of the toes is connected with the plantar aponeurosis; the *superior surface* with the lumbricales and accessory muscle of the flexor longus, with the plantar vessels and nerves, and with the tendons of the long flexor. The inner border is united to the adductor pollicis posteriorly, but is separated from it anteriorly by the tendon of the flexor longus and a portion of the flexor brevis of the great toe; the *outer border* is contiguous anteriorly to the flexor brevis minimi digiti; posteriorly it is annexed to the abductor minimi digiti.

This muscle bends the second joint of the toes.

ABDUCTOR POLLICIS PEDIS.

This muscle, *c*, is placed at the inner edge of the foot. It is attached posteriorly to the lower and inner part of *d*, the os calcis, and plantar aponeurosis; anteriorly to the inner sesamoid bone, and base of the first bone of the great toe.

The *inferior surface* of the adductor of the great toe is connected with the flexor communis digitorum pedis, the flexor accessorius, the lumbricales muscles, and the plantar aponeurosis; on the *inner border* with the flexor brevis pollicis pedis, the tendon of the peroneus longus, and the outer side of the metatarsal bone; on the *outer border* with the interosseous muscles and external plantar artery.

The office of this muscle is to carry the great toe from the others.

ABDUCTOR MINIMI DIGITI PEDIS.

This muscle, *b*, is situated at the outer edge of the sole of the foot. Posteriorly, it is attached to the outer side of *d*, the os calcis, to a ligament which passes from that bone to the metatarsal bone of the little toe, and to the plantar aponeurosis; anteriorly, to the outside of the first bone of the little toe.

This muscle carries the little toe outwards and downwards.

FLEXOR DIGITORUM ACCESSORIUS[n].

Fig. 178.

This muscle, *a*, is situated at the posterior part of the sole of the foot. It is attached on the one part by aponeurotic fibres to the inferior and internal surface of *c*, the os calcis, from which it proceeds in a horizontal direction; on the other part it is inserted into the external border of *b*, the tendon of the flexor longus digitorum pedis.

The *inferior surface* is connected with the adductor pollicis pedis, flexor brevis digitorum pedis, adductor minimi digiti pedis, and the plantar vessels and nerves; the *superior surface* with the os calcis, the superficial inferior ligament of the os calcis and os cuboides, and with the abductor minimi digiti pedis.

The office of this muscle is to assist the flexor longus digitorum pedis.

LUMBRICALES PEDIS.

These muscles, Fig. 178, *c*, *c*, *c*, *c*, are similar in form and number to the lumbricales of the hand; they are an

[n] Or *massa carnea Jacobi Sylvii.*

apparatus of moving powers to assist the flexors of the toes. The lumbricales pedis are situated at the anterior part of the foot, and extend from the tendons of the flexor longus digitorum pedis, to the first phalanx of the four lesser toes.

The *inferior surfaces* of the lumbricales are connected with the plantar aponeurosis; their *superior surfaces* with the abductor pollicis pedis, the transversus pedis, and with the plantar interosseous muscles.

The office of the lumbricales is to bend the toes, and to draw them a little inwards.

FLEXOR BREVIS POLLICIS PEDIS.

Fig. 179.

The fleshy part of this muscle, *a*, is connected almost inseparably to the adductor aud abductor pollicis. It is attached posteriorly to the fore part of the os calcis, and to the two cuneiform bones; extending anteriorly to the inferior and lateral part of the first phalanx of the great toe, and to the sesamoid bones of the articulation.

The *inferior surface* of the short flexor of the great toe is connected with the plantar aponeurosis, flexor proprius, and adductor pollicis pedis; the *superior surface* with the tendon of the peroneus longus, and with the first metatarsal bone: the *outer edge* is united to the abductor pollicis.

The office of this muscle is to bend the first joint of the great toe.

ADDUCTOR POLLICIS PEDIS.

This muscle, *b*, is placed at the internal part of the sole of the foot. Posteriorly, it is attached by aponeurotic and fleshy fibres, at *a*, *b*, in two portions, to a strong ligament, which extends from the os calcis to the os cuboides, and to the plantar aponeurosis; from these different attachments it advances to be inserted into the outer sesamoid bone, and the base of the first phalanx of the great toe.

The *inferior surface* of this muscle is connected with the plantar aponeurosis; the *superior surface* with the flexor accessorius, the flexor brevis pollicis, the tendons of the flexor longus digitorum pedis, the tibialis anticus and posticus, and with the plantar vessels and nerves.

This muscle carries the great toe outwards, and bends it a little.

FLEXOR BREVIS MINIMI DIGITI PEDIS.

This muscle, *d*, is situated at the outer edge of the sole of the foot. It is attached posteriorly to the metatarsal bone of the little toe, and to the ligamentous sheath of the tendon of the peroneus longus; anteriorly, it is inserted into the first joint of the little toe.

The *inferior surface* is connected with the plantar aponeurosis and abductor minimi digiti pedis; the *superior surface* with the fourth metatarsal bone and last plantar interosseous muscle.

The office of this muscle is to assist in the flexion of the little toe.

TRANSVERSUS PEDIS.

This muscle, *e*, is situated at the anterior part of the sole of the foot. It is attached on the outer side to the ligaments of the four last articulations of the phalanges of the toes with the metatarsus; on the inner side, to the external border of the first joint of the great toe.

The *inferior surface* of the transversus pedis is connected with the tendons of the long and short flexors of the toes, the lumbricales, and the collateral vessels and nerves of the toes; the *superior surface* with the interosseous muscles.

This muscle carries the great toe outwards, and brings the metatarsal bones nearer to each other.

INTEROSSEI INTERNI.

These muscles, *c*, are three in number, and are situated in the sole of the foot. They are attached posteriorly between the metatarsal bones of the four lesser toes; anteriorly by tendons to the inside of the first joints of the three smaller toes.

The office of these muscles is to move the three smaller toes towards the greater toe.

APONEUROSIS OF THE LEG.

This is continuous superiorly with the femoral aponeurosis; it adheres strongly to every projecting point of bone, as to the head and spine of the tibia, and to the fibula. At the inferior part of the leg it has very strong adhesions to the outer and inner ankle: it is continuous also with the annular ligament of the instep, and is fixed on the outer side to the sheath of the tendons of the peroneal muscles, aad on the inner side to the internal annular ligament.

ANNULAR LIGAMENT OF THE INSTEP.

This is a transverse band of fibres which binds down the tendons of the extensors of the foot and toes: the anterior part of the annular ligament is attached on the one side to the external part of the os calcis; on the other side to the anterior part of the inner malleolus. It embraces the tendons of the extensor longus pollicis pedis, the extensor longus digitorum pedis, the peroneus tertius, and the tibialis anticus. The internal annular ligament is broader, extending from the internal malleolus to the os calcis; it forms with that bone a species of canal, which contains the sheaths of the tendons of the tibialis posticus, the flexor longus digitorum pedis, the flexor longus pollicis pedis, and the plantar vessels and nerves. See Fig. 170, and 171°.

° The plantar aponeurosis so much partakes of the nature of a ligament, that I have thought proper to arrange and describe it with the ligaments. See p. 133.

OBSERVATIONS ON THE MUSCLES.

In describing the offices of muscles I have confined my observations to their simple motions; but there are very few simple motions in the animal economy: almost every kind of contraction is the effect of a combined effort of several of the muscles. One action produces another: for this reason, the two points by which a muscle is attached have an equal tendency to move; if not prevented by the action of other muscles, both extremes would come into motion when the muscle contracted: thus, by the contraction of the extensors of the leg, the limb would be bent on the foot equally with the foot on the leg, if the foot was not fixed; but it can only be so fixed by means of muscles acting in a reverse, or opposition to the extensors; therefore, whenever two points of attachment are moveable, the simple motion of the one extreme supposes the contraction of a muscular power to fix the other. No muscles are enabled to move singly without the aid of other muscles, except those which are inserted by one of their extremities into a fixed, and by the other into a moveable point, as those of the eye, and the greatest part of the moving powers of the face. We may remark, however, that there is always an immoveable line or point from which every ordinary motion originates, and one extremity is always more moveable than the other; thus, although the two attachments of the gastrocnemii are moveable, yet these muscles act more effectually upon the foot than upon the femur.

To ascertain the office of a muscle, we must examine its direction from the more fixed, up to the more moveable point—the reverse of that direction is the line of action. The tibialis anticus directed downwards and inwards raises the foot and brings it outwards; the rectus femoris directed from the pelvis towards the patella raises the leg without the least deviation. Every other muscle, whatever may be its attachments, has the same disposition: they always act in the reverse of the line of their direction; the coraco brachialis, which is directed downwards and outwards from the shoulder towards the arm, moves the latter upwards and inwards. By this rule, when we see a muscle we may decide for what uses it was intended.

The whole effort of the contraction in long muscles is usually concentrated on a single point of the tendon: in the greatest part of wide muscles, on the contrary, the insertions being on the sides, and by a number of points, all the fibres have not an uniform action. The different parts of the same muscle may be intended for very different, and even for opposite uses; thus, the anterior fibres of the deltoides advance the arm, the posterior draw it backward, and the lower part of the serratus major does not act like the upper; frequently, even different portions of the same muscle do not contract simultaneously: the upper portion of the trapezius may act independently of the lower; the same may be observed of the muscles of deglutition. In the long muscles, however, every fasciculus concurs to produce the same effect at the same moment.

If a wide muscle is concentrated in one common point, as the temporal and deltoid, which is attached to a multiplicity of points on the one part, and on the other is attached by a single tendon, then the average direction of all its fibres is to be taken to ascertain its office. If a muscle is attached by many points at each extremity, the line of direction of its fasciculi must be examined to judge of its action. It is in this way we understand the action of the rhomboideus, serratus magnus, etc. In those muscles which are reflected, as the obliquus superior of the eye, the circumflexus palati, the peronei, etc., the action of the muscle must be calculated from the point of reflexion only. The orbicular muscles, as those situated round the lips, the eyes, etc., have in general no fixed point: they are intended merely to contract the aperture round which they are situated.

Let it again be observed, that with very few exceptions, the actions of muscles are associated. A number of muscles are required, even to nod the head, to maintain the body erect, to put it in motion, or to continue it in progression; and in very great bodily efforts, all the voluntary muscles appear to be in action.

In early life, the muscular system appears to be penetrated with less blood than at a later period, the muscles of the infant being of a much paler colour than those of the adult; as age advances they gradually assume a deeper colour, they receive a greater supply of blood-vessels, and consequently are more abundantly nourished than many other organs. During the period of infancy and youth, the conformation of the male and female muscles is analogous. In the former, after growth in stature is completed, the muscles increase in bulk; to the slender and rounded form of adolescence, alternate projections and depressions mark the outline of the more manly form; and we may remark at this period the muscular system appears (if the organs are well exercised) through the integuments, the fleshy masses of muscular fibre forming prominences separated by distinct grooves. Painters and sculptors pay great attention to the development of the muscles, making them characteristic of the figures they represent under different circumstances and modes of life; as we may observe in the statues of the Farnese Hercules and Pancratiastæ, contrasted with those of the Antinous and Apollo Belvidere.

As the muscles increase in thickness they acquire more density. A remarkable difference may be observed in the firmness of the muscles, especially in a state of contraction, in the adult and in the infant, and between persons who are accustomed to take a great deal of robust exercise and those who are less accustomed to exertion; thus, while the sedentary and indolent are remarkable for the flaccidity of their muscles, the active have them firmly developed. The gymnastic exercises are very much calculated to produce this effect, and to strengthen the moving powers; but such exercises should be taken gradually, and youth should not be urged to exertions beyond those which they can accomplish without subsequent painful sensations.

In the prime of life, the colour of the muscles is of a deep red; in the subsequent stages of life they gradually fade; but there are other causes besides advanced age which destroy the brilliancy of their hue, such as ill health, and excesses of any kind, which have a depressing influence on the vital powers.

As age advances, the muscles undergo other changes: the fibres become tough and resistant, and their excess of density seems to prevent their contraction; at least, they can no longer perform with such rapidity as formerly, nor can movements be continued so long, for weariness sooner follows. But though in persons advanced in life the fibres are dense, the general feeling of the muscles is loose and flaccid, and the calves of the legs quiver in walking, as if less capable of action. Old age is a period at which motion causes a tremor of the whole muscular system. Why is this? Bichat says, it is because the muscles no longer possess a sufficient degree of contractility, and that they are thus too long for the spaces which they fill. This appears to proceed from the contractility of the tissue being reduced in the last stage of life. We are convinced of this fact by comparing a muscle divided transversely in a young and in an aged person: in the former it contracts much more than in the latter.

By the very great contractility of the muscles of youth, all their fibres are drawn closer together during repose, as well as in action; but in the progress of age this effect is no longer produced: these organs therefore remain lax and flaccid, a phenomenon which indicates the low state of contractile power.

As the blood flows in less quantity to the muscular system of infants, and increases gradually as persons become of an adult age, so the quantity of blood gradually decreases as persons become advanced in years; the vessels in old subjects become partially obliterated, and the parts being deprived of their former supply of the vital fluid, are left in the state before described, possessed of a reduced state of vital contractility and sensibility.

The condition of the muscular system after death depends upon the causes which produced it: in ordinary cases, after a short time the dead body becomes stiff, and retains the form it is placed in until decomposition takes place; but in some particular cases, as in poisoning and suffocation from the fumes of charcoal, and in several other instances, the muscles never become firm: all contractility is extinct, and the body continues soft and flexible.

BURSÆ MUCOSÆ, *or Mucous Bags.*

The structures we are about to describe not only enter into the composition of joints, but are placed between the tendons and bones exposed to much friction, and therefore may be considered as auxiliaries to the moving powers. The bursæ mucosæ are intended for the same purpose as the synovial membranes, viz. to produce or secrete a fluid similar to the synovia, which lubricates contiguous surfaces. Their structure and anatomical arrangement are nearly the same, both being shut sacs. Dr. MONROE discovered and described 140 of them, and since which several other bursæ have been described by Dr. ROSENMULLER of Leipsic; they perform the office of friction-wheels in machinery, and take off too severe pressure or friction from the bone or tendon. Bursæ vary considerably in size, as well as in form, some being oval or circular, others elongated, so as to form sheaths which inclose tendons. Thus, where tendons are retained *in situ* by fibrous sheaths, the contiguous surfaces are invested by a bursal membrane reflected over them, as the different flexor and extensor tendons in both extremities; and also where a muscle has to slide over a bony prominence, as where the gluteus maximus passes over the great trochanter, a bursa is interposed; or where processes of bone play on fibrous structures, as between the acromion and the capsule of the shoulder joint. These instances will suffice to point out the operation of the general principle which determines the formation of synovial or mucous bursæ. The following enumeration is from Mr. BELL, and constitute the principal bursæ of the human body.

In connection with the SHOULDER JOINT:

1st. A very large bursa under the acromion, and betwixt it and the head of the humerus.

2nd. Between the head of the clavicle and the coracoid process of the scapula.

3rd. Upon the capsule of the shoulder-joint and under the tendon of the subscapularis muscle.

4th. Under the deltoid muscle.

5th. Under the tendon of the latissimus dorsi.

The principal bursæ around the ELBOW-JOINT are,

1st. Between the tendon of the biceps flexor cubiti and the radius.

2nd. Over the round head of the radius and the extensor muscles.

3rd. On the olecranon and under the triceps tendon.

About the WRIST,

1st. A large bursa between the flexor tendons and the carpus.

2nd. On the trapezium.

3rd. On the pisiforme.

4th. On the back of the carpus and under the extensor carpi radialis.

5th. Between the ligament of the wrist and the tendon of the extensor carpi ulnaris.

Besides these sacs or proper bursæ, sheaths surround the tendons of almost all the muscles of the wrist-joint.

On the PELVIS,

1st. A large bursa between the gluteus maximus and the vastus externus.

2nd. Between the capsule of the hip-joint and the psoas magnus and iliacus internus.

3rd. Under the pectinalis.

4th. A large one on the surface of the trochanter major, under the gluteus minimus.

5th. On the os ischii and under the origin of the biceps.

6th. Under the tendons of the rotators of the thigh bone.

In the THIGH, and around the KNEE-JOINT,

1st. Under the tendon of the extensors of the leg, and communicating with the knee-joint.

2nd. Under the ligament of the patella.

3rd. Between the insertion of the semimembranosus and the origin of the gastrocnemius.

4th. Over the internal lateral ligament of the knee-joint.

5th. Under the popliteus.

Several irregular bursæ are found around those tendons which are inserted into the tibia and fibula.

Around the ANKLE-JOINT.

All the principal tendons which cross the ankle-joint have bursæ under or around them, as the tendon of the tibialis anticus, the extensor proprius, the extensor digitorum, the peroneus longus and brevis. There is also a proper bursa between the tendo-Achillis and the os calcis; another under the flexor longus pollicis, and also under the flexor longus digitorum and the tibialis posticus.

It is necessary for the surgeon to know these bursæ; because, after sprain and injuries, effusion takes place in them, and they present a puffy swelling over the joint not easily understood without the recollection of the natural anatomical structure.

ART. V.

VASCULAR SYSTEM.

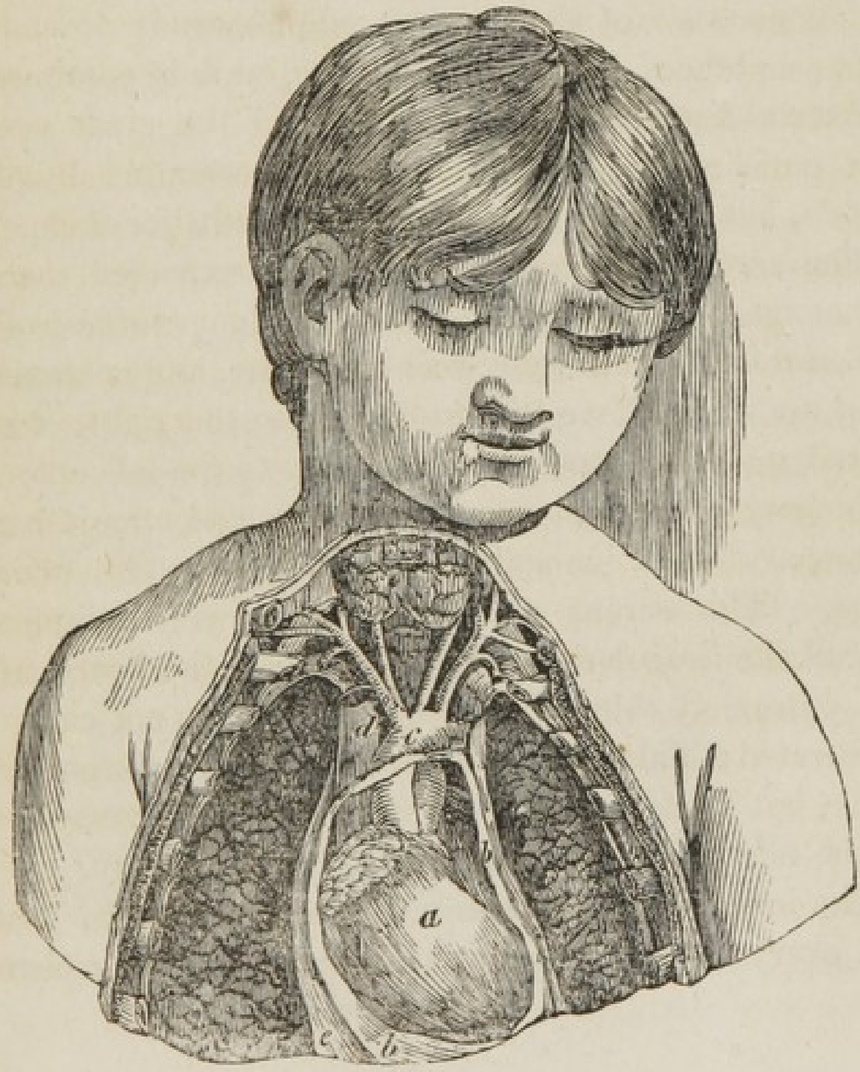
CHAP. I.

ORGANS OF CIRCULATION.

THE HEART AND ITS ENVELOPES.

THE PERICARDIUM.

Fig. 180.



The heart is the central organ of circulation; and the *pericardium, b, b,* is a membranous bag which incloses the heart, *a,* and the roots of the arterial and venous trunks which issue from it. It is situated in the lower part of the anterior mediastium, above the aponeurotic centre of the diaphragm. It is connected anteriorly with the pleura, the thymus gland, the sternum, and the cartilages of the sixth and seventh ribs of the left side; posteriorly with the bronchial tubes, the esophagus, and the descending aorta; laterally with the pleura, *e,* the phrenic nerves, and the inner surface of the lungs.

The pericardium is composed of two membranes, an outer fibrous and an inner serous.

The *fibrous membrane* is intimately united below with the aponeurosis of the diaphragm; it ascends around the heart, embraces it as far as the base, and is continued to a certain distance upon the trunks of the great vessels. The pericardium, therefore, is not perforated by these vessels, but its fibrous lamina forms sheaths for them.

The *serous membrane* is much more extended than the fibrous membrane; for after lining the inner surface of the pericardium, it entirely covers the heart, and is continued upon the aorta above its first curve; to the right, it is reflected upon the superior vena cava, to the left upon the pulmonary artery before its bifurcation, and upon the right pulmonary veins immediately after their issuing from the lungs. This serous membrane of the pericardium dips into all the irregularities of the surface of the heart, where it is extremely thin and transparent, and is not easily demonstrated; it also adheres intimately to the fibrous membrane, but it has very little attachment to the vessels, and can be raised from their surface without difficulty.

The inner surface of this membrane is smooth, glistening, everywhere in contact with itself, and is moistened with a serous fluid, to prevent ill effects from the heart's motion.

The arteries of the pericardium are very small, and are derived from larger arteries in the immediate vicinity. The veins correspond to the arteries, and partly terminate in the vena azygos. There have not yet been any nervous filaments traced into its lamina.

THE BLOOD.

I shall premise a few remarks on the blood, before I proceed to describe the organs which circulate it.

The general appearance of human blood is too well known to render it necessary for me to describe it. The blood circulates in the heart, arteries, and veins; the estimated quantity is about twenty-eight pounds in an adult. In the veins it is of so deep a colour, that it is generally termed *black blood;* in the arteries it is of a *bright vermillion colour.*

In order to render the difference between venous and arterial blood more distinct, MAJENDIE has given the following table of them.

	Venous Blood.		Arterial Blood.
Colour	Black red	..	Vermillion red.
Odour	Weak	..	Strong.
Temperature . . .	101·75° F.	..	Near 104° F.
Capacity for caloric .	852[p]	..	839.
Specific gravity . .	1051[q]	..	1049.
Coagulation . . .	Less rapid	..	More rapid.
Serum	More abundant	.	Less abundant.

p Water being one thousand. Dr. J. Davy's Philosophical Transactions, 1815.

q Water being one thousand.

The blood is the most important fluid of the body, and most essential to the support of its functions. Many able anatomists and physiologists have considered it as a living fluid; and the arguments of those who maintain its vitality are very strong: I consider, stronger than those who take an opposite view of the question. While hot and in motion in its vessels, the blood remains constantly fluid; when it cools and is at rest, it coagulates and becomes a gelatinous mass, which gradually separates into two parts: the one, the *crassamentum* or the more solid part, the other, the *serum* or fluid.

The respective relations in the quantity of serum to the crassamentum, and those of the colouring matter to the fibrin, are variable, according to the circumstances of age and the state of the health.

The crassamentum forms more than half of the blood; it is plastic, thick, and in consistence like a strong glutinous jelly, which soon putrifies in the air; but dried by a gentle heat, becomes a dark brittle mass. The surface of the coagulum, after being exposed in a vessel to atmospheric air, becomes of a florid red colour; but the lower surface contiguous to the vessel is of a deep black; the change of colour on the surface is supposed to be owing to the oxygen of the atmosphere uniting with the blood. The crassamentum is composed of—1st, *red globules;* 2nd, *fibrin.* The red globules are obtained by agitating the crassamentum of the blood in the serum; when the globules, on examination with a powerful microscope, will be found floating in that fluid. According to the observations of Captain KATER and Dr. YOUNG, who measured the red globules of the blood with a micrometer, and thus agree that the size of them is between $\frac{1}{4000}$ and $\frac{1}{6000}$ of an inch in diameter, or, taking the medium, $\frac{1}{5000}$ of an inch[r].

[r] See also Sir E. Home's paper, Philosophical Transactions, 1819.

The red matter of the blood is soluble in water; when dried and calcined, it yields a charcoal, which furnishes during its combustion ammonial gas, and gives the hundredth part of its weight of ashes, composed of

Oxide of iron	55.0
Phosphate of lime, with phosphate of magnesia	8.5
Pure lime	17.5
Carbonic acid	19.0

The *fibrin*, separated from the colouring matter, is whitish, insipid, and inodorous; elastic when moist, but brittle when dry. In distillation it gives out a great quantity of carbonate of ammonia and carbon, the ashes of which contain phosphate of lime, a little phosphate of magnesia, carbonate of lime, and carbonate of soda. A hundred parts of fibrin are composed of

Carbon	53.360
Oxygen	19.685
Hydrogen	7.021
Azote	19.934

The serum is a transparent liquid, slightly yellow; its odour and taste resemble the odour and taste of the blood. According to Mr. Brand, the serum is almost pure albumen, united to soda, which holds it in a liquid state. At a temperature of 158° F. it becomes a solid mass, like the white of an egg, and forms on coagulating numerous small cells, which contain a matter very analogous to mucus.

According to Dr. MARCET, one thousand grains of the serum of human blood contain[s],

Water	900.00
Albumen	86.8
Muco-extractive matter	4.0
Muriate of Soda, with some muriate of Potash	6.6
Subcarbonate of Soda	1.65
Sulphate of Potash	0.35
Phosphates of Lime, Iron, and Magnesia	0.60
	1000.00

From different analyses of blood, and as the processes of investigation are perfected, we discover in the blood all the principles, all the elements of the various organs of the body. We are able with confidence to point out its fibrin as the same matter with the muscular fibre; the albumen, that which forms cartilage, and so great a number of membranes and tissues; the adipose matter, when combined with osmazome and albumen, constitutes the nervous mass; the phosphates of lime and magnesia, which constitute a great portion of the bones; the elements of the most remarkable excrementitious substances, as urea and the yellow matter of the bile, the urine, and that which by absorption extends itself into the cellular tissues around contusions[t].

The blood, therefore, is the common source from which every tissue of the body borrows and chooses its materials according to its degree of sensibility, and appropriates them to itself, and subsequently retains or rejects them. The body derives its nourishment from the blood, which supplies the waste that is continually going on in the animal frame; and the reproduction of any part which may have been destroyed, equally depends upon it. The blood, im-

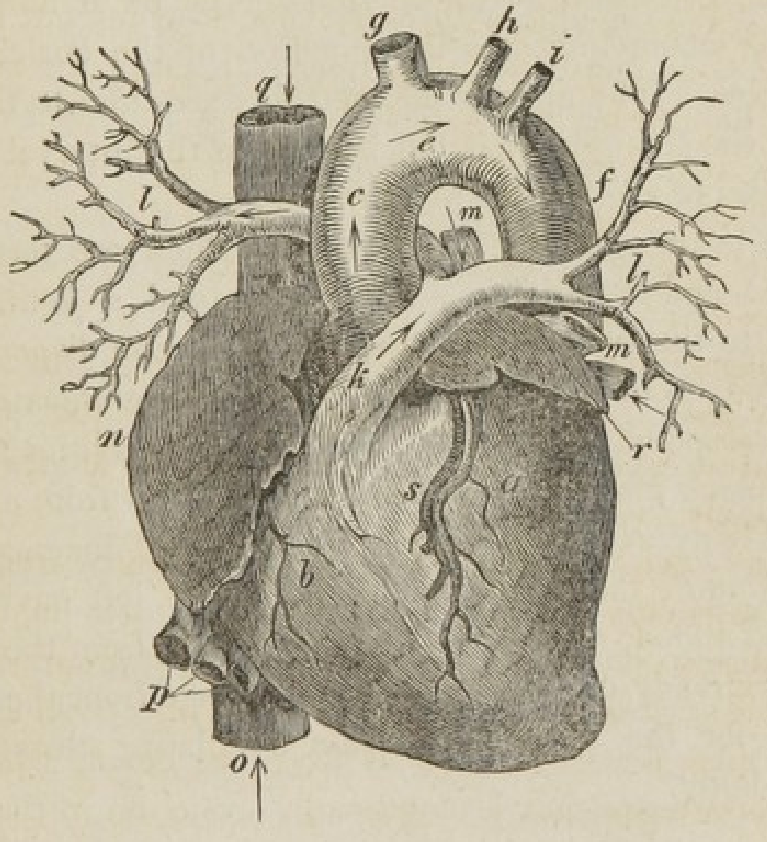
s Philosophical Transactions for 1819. These results very nearly coincide with an analysis of BERZELIUS.

t See Majendie's Compendium of Physiology, Art. Blood.

pelled by the heart, is transmitted by the arteries to the most minute part of the body, building up the several structures, and keeping them in a state of repair. The superabundant quantity is returned to the heart by the several veins; but as a large portion of it is expended in preserving the healthy state of the body, it is necessary that a constant supply should be provided, and this is formed in abundance from both animal and vegetable food.

THE HEART.

Fig. 181.



The heart is a hollow muscular organ: its form is annexed. It is inclined forwards, downwards, and outwards, and from right to left; its general connections have been pointed out in describing the pericardium. The position of the heart somewhat changes as it follows the motions of the diaphragm in breathing, and its weight draws it in different directions according to the inclination of the body.

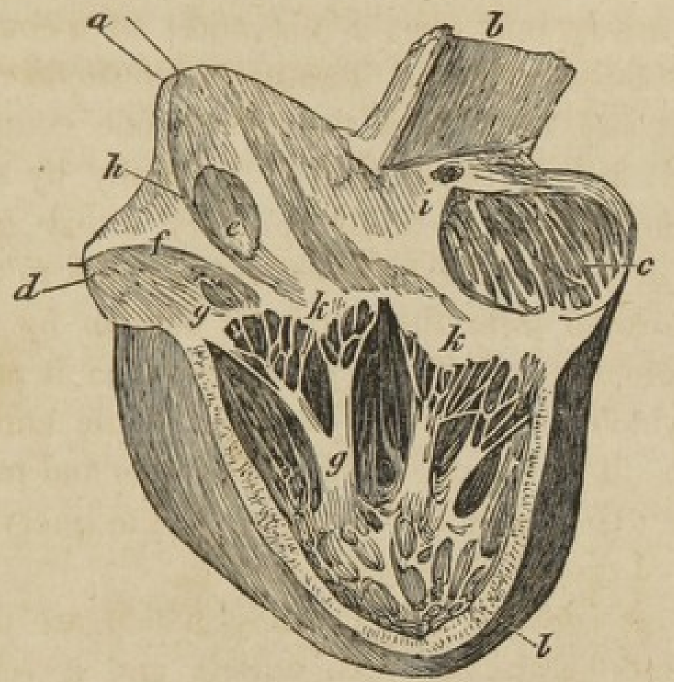
The *anterior surface* is turned a little upwards, and presents in its middle a groove passing from left to right obliquely downwards, and in which is lodged the anterior coronary artery and vein in the midst of a considerable quantity of adipose tissue. The *posterior surface* is nearly horizontal, and rests upon the aponeurotic centre of the diaphragm: it is traversed almost vertically by a channel which receives the posterior coronary artery and vein. The *base* of the heart is situated behind and to the right, and is separated from the vertebral column by the aorta and the esophagus. There is observed on it an oblique groove, which indicates the junction of the auricles and ventricles. The apex is inclined forwards and to the left, and in the living body is felt beating in the interval of the cartilages of the fifth and sixth ribs.

The heart contains four cavities, which are termed its auricles and ventricles. An auricle and a ventricle is placed to the right, and to the left the same disposition is observed. On each side the auricle communicates with the corresponding ventricle. In the right cavities there is found black blood, which has been received from all parts of the body, and which must be submitted incessantly to the action of the air in the lungs; in the left cavities we find red blood, which has been received from the lungs, having already undergone a certain change from the atmosphere, for the purpose of again circulating through the whole body.

RIGHT SIDE OF THE HEART.

THE RIGHT AURICLE.

Fig. 182.



The right auricle is also called the anterior auricle; its situation is obvious in the figure before us[u]. On the right side it has a loose appendage with denticulated borders, which bearing some resemblance to a dog's ear, the whole cavity has obtained the name of *auricle.* The parietes of this cavity, Fig. 181, *n*, are so thin as to be semitransparent; but in the inner surface at *c*, Fig. 182, its muscular fasciculi are disposed somewhat like the teeth of a comb, therefore have been named *musculi pectinati.* Its posterior part, *b*, presents the *orifice of the superior vena cava,* inclining forwards and downwards; this is separated from *a*, *d*, the *orifice of the inferior vena cava,* by a projection formed by a thickening of the muscular coat, the *tuber-*

u The venæ cavæ, the auricle, and its opening into the ventricle, is here laid open.

culum Loweri. The septum of the auricle is seen separating the right from the left; it is thin, and presents, at *e*, an oval depression named *fossa ovalis*, at the circumference of which the fibres are thicker, forming an elevated ring, called the *annulus ovalis*. The space occupied in the adult by the fossa ovalis, is, in the fœtus, an aperture named the foramen ovale, which sometimes remains open through life, the use of which, before the period of birth, is to transmit the blood of the inferior vena cava directly into the left auricle. The orifice of the inferior vena cava is furnished with a duplicature of the inner membrane, which advances into the cavity of the auricle, and is named the *Eustachian valve*, marked *h*, *f*; its dimensions are more considerable in children, and it becomes gradually obliterated with age.

The auricle is a reservoir in which the blood is collected during the contraction of the ventricle.

THE RIGHT VENTRICLE.

The ventricles are the most essential part of the heart; they constitute the forcing machine of the blood, and therefore merit the most particular notice.

The right ventricle has a triangular pyramidical form, the base of which is turned upwards and backwards, being insensibly lost in the corresponding auricle. *Anteriorly* and outwardly, the muscular parietes, marked *l*, are thin and concave; the posterior and inner is formed by a partition, which equally belongs to the left ventricle. The thickness of the parietes of the right ventricle is unequal in the different parts of their extent: the inner surface presenting a great number of muscular fasciculi, as *g*, commonly designated by the name of *carneæ columnæ*, which vary very much in size, length, and direction. Their disposition is irregular, some taking a vertical course from the apex to the base, while the others cross them in all sorts of directions, and form with them a confused network.

Some of these fleshy columns are much larger than the others, and their number also varies from three or four to eight or nine. These are attached to some points of the parietes of the ventricle, and extending from the apex to the base, they terminate abruptly, each by several small white tendinous strings, called *cordæ tendineæ,* which are fixed into the points of *k*, *k*, the tricuspid valve; in one part diverging from, at another part uniting with, each other. There are other muscular fasciculi attached to the parietes in the manner of pilasters; they follow every variety of direction, and are interlaced with each other, so as to represent network, leaving between them depressions of different dimensions.

The entrance from the right auricle to the right ventricle is termed the *auriculo-ventricular orifice*, which is furnished with membranous folds, *k*, *k*, termed the *tricuspid valve*, on account of its being divided into three triangular portions, the form of two of which we see in the figure. One of the surfaces of the valve is turned towards the parietes of the ventricle, the other towards the cavity of the auricle. One of its borders is attached to the circumference of the orifice, the other is divided into three floating portions, which are held *in situ* by the cordæ tendineæ, or tendons of the carneæ columnæ. This valve is thin and transparent in its whole extent, but becomes thicker at its free edge, for the attachment of the small tendons which I have before described.

There is another aperture of a smaller size than the preceding, and leads to the pulmonary artery.

COMMENCEMENT OF THE PULMONARY ARTERY.

Fig. 183.

The office of this artery is to carry the blood into the lungs, to be submitted to the action of the air in respiration. The pulmonary artery arises from the left part of the right ventricle; its orifice is surrounded by a callous ring, which indicates the limits of the muscular fibres of the heart; this orifice is moreover furnished internally with three membranous folds, *c*, *c*, *c*, which are named *sigmoid* or *semilunar valves:* their semicircular form is seen in this figure. They are adherent to the artery by their convex and inferior border, and present in the middle of the loose margin a small tubercle of a fibro-cartilaginous texture, termed the *corpus Arantii*[v]. These are thin and transparent; they are in contact at their extremities, and when let down they completely close the artery, and thus prevent the blood which it contains from again entering the ventricle.

The pulmonary artery passes obliquely upwards and to

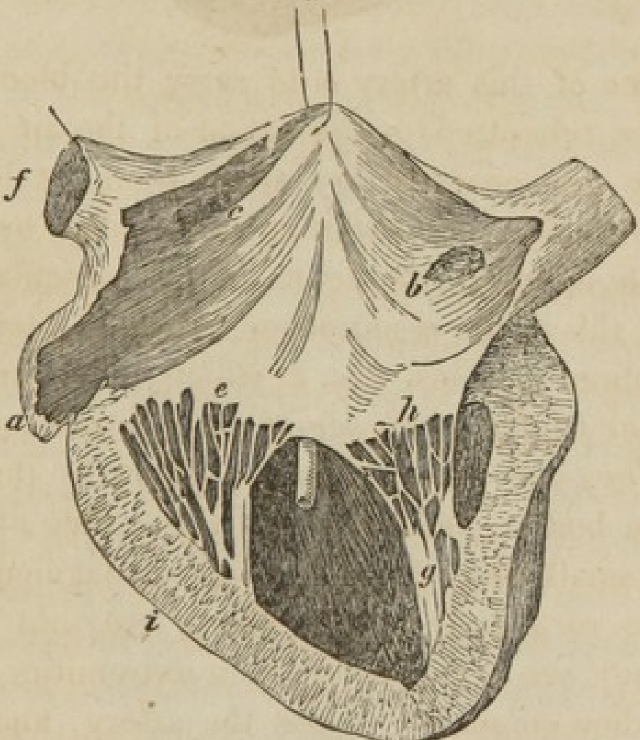
[v] So named from Arantius, who first described them.

the left side, crossing the course of the aorta, beneath which it passes, and to which it is united by cellular and adipose tissue. After a course of about two inches, it divides near the second dorsal vertebra into two branches, one for each lung. Between these branches we observe a round ligament passing from the pulmonary artery to the arch of the aorta: this apparent ligament is the remains of a tube which is named the *ductus arteriosus*, and which, in the fœtus, as the lungs were impervious, transmitted the blood to the right ventricle[w].

THE LEFT SIDE OF THE HEART.

THE LEFT AURICLE.

Fig. 184.



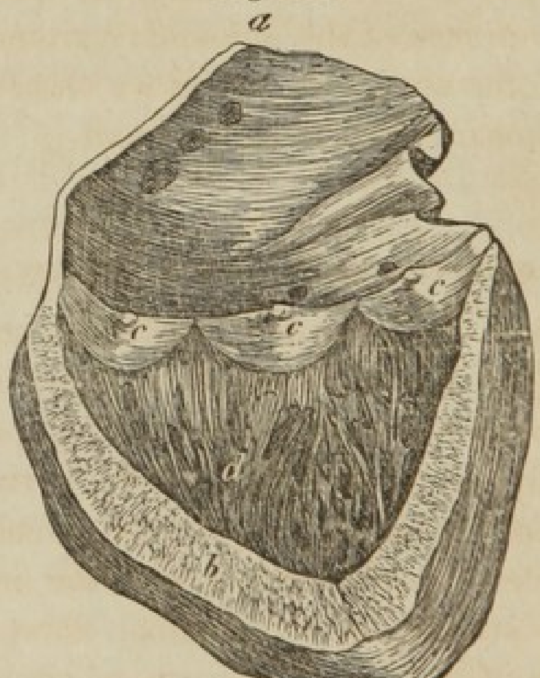
This figure represents a section of the left auricle and ventricle. The left auricle is situated at the posterior and left side of the heart; its extent is narrower and longer

w The distribution of the pulmonary artery will be noticed in a subsequent section.

than the right. It presents at its superior and inner part, at *a*, an auricular appendage, similar to that of the right auricle, but smaller. The *interior surface*, or the cavity of this auricular appendix, contains much fewer musculi pectinati than that of the right appendage. Below is the left *auriculo-ventricular orifice*, leading to the left ventricle. The *right side* is smooth, and formed by the auricular septum. We may observe that the *fossa ovalis* is here less distinct than on the right side. The *left side* is perforated at *b*, *d*, by two corresponding pulmonary veins; the orifices are very near each other. Like the right pulmonary at *f*, *e*, they are destitute of valves.

THE LEFT VENTRICLE.

Fig. 185.



This ventricle is placed at the posterior part of the left side of the heart. Observe at *b*, and at *i*, Fig. 184, the great thickness of the muscular parietes. The interior is furnished with a great number of fleshy columns, termed *carneæ columnæ*, similar to those of the right ventricle, though less numerous, and more irregularly disposed. There are several larger than others, as at *g*, directed from the apex of the heart to the base, fixed by one of their extremities to the sides of the ventricle, and terminating in a multitude of very slender diverging tendons, which frequently cross each other, and are attached to the loose edge of *e*, *h*, the mitral valve.

At the base of the left ventricle the opening into the auricle is marked by a whitish zone, to which is connected a fold of membrane, *e*, *h*, called the *mitral valve*, from its shape being compared to a bishop's mitre. It is divided into two portions, to which the tendons of the carneæ columnæ are attached. There is another opening on the right side which leads into the aorta, Fig. 185, *a*, which is furnished at *c*, *c*, *c*, with three semilunar valves, similar to those at the entrance of the pulmonary artery. Above the loose edge of the semilunar valves we observe the orifices of the two coronary arteries of the heart.

ORGANIZATION OF THE HEART.

The tissue of the heart is formed of muscular fibres in close apposition with each other, taking somewhat of an irregular spiral course from the base to the apex, and there, as it were, dipping in and forming the carneæ columnæ. The parietes of the auricles are much thinner than those of the ventricles. In the *right auricle* the muscular tissue constitutes a stratum of longitudinal fibres towards the point of union of the two venæ cavæ, where it is separated from the serous lamina of the pericardium by a considerable quantity of fat. In the *left auricle* the muscular stratum is much thicker and more uniform than in the right; the muscular fibres extend from the pulmonary veins to the auricle, where they form a transverse plane; but more deeply they cross each other in a very irregular manner.

The exact arrangement of the muscular fibres of the heart is extremely difficult to determine; they intermingle with each other without any apparent cellular tissue being interposed; COWPER, and subsequently J. CLOQUET, represent them as disposed in a spiral direction; but I have frequently examined their fibres, which seem to commence at all points, and extend in all directions; indeed, MAJENDIE confesses that he found it impossible to unravel them.

The *septum auriculorum* forms a thicker and more uniform layer; the muscular fibres of the right ventricle are interwoven at acute angles with those of the left; with a degree of patience, however, they may be separated, so as to divide the heart into two portions, the one the right, the other the left.

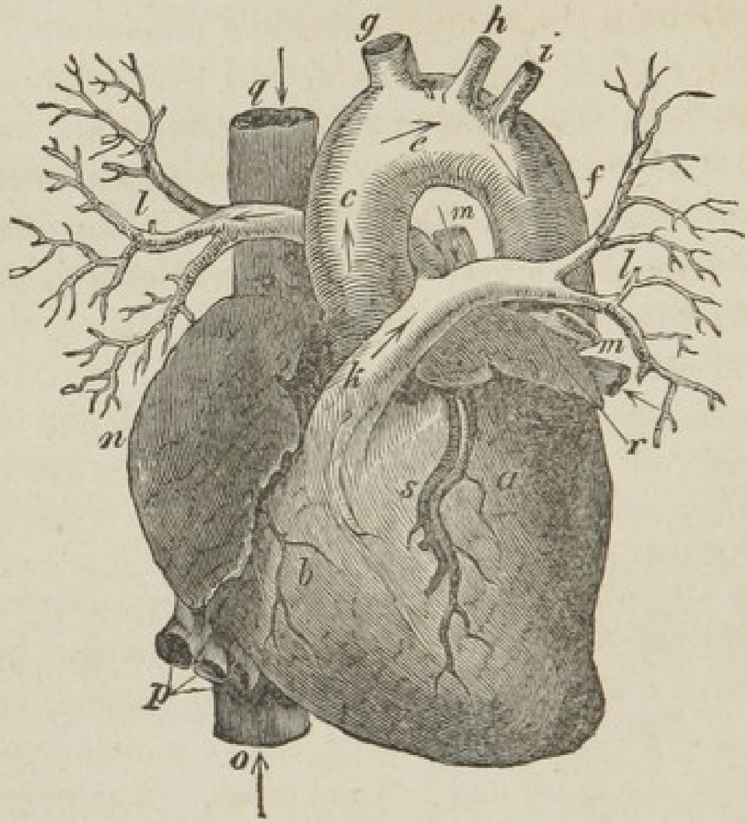
The *membrane of the cavities of the heart* is evidently continuous with the membranes which line the vessels destined for the circulation of the blood. On the right side the inner coat of the venæ cavæ is extended to the auricle, upon the muscular fasciculi, and in their intervals upon the serous tissue which covers the heart. Beneath the inferior vena cava it is folded upon itself, to form the Eustachian valve. Again, at the circumference of the auriculo-ventricular orifice, it is separated from the muscular tissue by a thin layer of fat, which constitutes the white circle we have before mentioned. There also it is folded, as it were, on itself, leaving the parietes of the heart to form the tricuspid valve; after which we may trace it through the whole ventricle and into the pulmonary artery, forming by its folding the three semilunar valves, and continued to the most minute ramifications of that vessel.

The *membrane of the left cavities of the heart* forms part of the inner tunic of the vessels that carry red blood; it extends from the extremities of the pulmonary veins to the whole cavity of the auricle, and penetrates into the ventricle. At the entrance of the latter its thickness increases, and it is so prolonged and doubled on itself, as to form the mitral valve; we may then view this membrane if we examine the aorta forming the semilunar valves, and extending itself into it, and constituting a lining to all the vessels of the arterial system.

THE VESSELS OF THE HEART.

There are *two arteries* which rise immediately from the aorta, and are called *coronary;* these terminate in veins which have the same name, discharging themselves into the right auricle; its *lymphatics* are very numerous, and pass before the aorta and left bronchus. The *nerves* also which come from the cardiac ganglion are very thickly distributed upon the heart. We must consider a portion of the pericardium likewise as contributing to the structure of the heart, for its whole exterior is invested with it.

Fig. 186.



GENERAL OBSERVATIONS ON THE HEART[w].

The office of the heart is to force the blood, through the vessels which are connected with it, to the remotest parts of the body, and the same force returns it to the heart by means of the veins; thus the blood is incessantly flowing from the heart, and again proceeding to it, through the whole period of life, in one circuitous, continual, and interminable stream, hence called the circulation. Having studied the heart, we are now prepared to understand its duplex structure and functions, i.e. there is an auricle and a ventricle on the right side, and similar cavities on the left side: the right performs the *less*, or *pulmonic circulation;* the left, the *great*, or *systematic circulation.* But

w The weight of this organ is about ten ounces in an adult, or, as compared to the body, as 1 to 200.

to give a more detailed account of the process: 1st, the *descending vena cava*, *q*, conveys the blood from the head and upper extremities, the *ascending vena cava*[x], *o*, collects all the blood from the lower part of the body; they meet and form the *right auricle*, *n*. We may term this the first cavity of the heart; its contractions carries the blood into *the right ventricle*, *b*, which is stimulated by the quantity and quality of the blood, contracts, and forces the blood through the lungs by means of the *pulmonary artery*, *k*, which divides into right and left, to convey the blood by the branches *l*, *l*, which are distributed through all the cells of the lungs, to render it fit for the general circulation.

2nd, The veins of the lungs, *m*, *m*, are sometimes three, at other times four, in number: they return the blood, which has been purified in the lungs, to the *left auricle*, *r*; this cavity contracts and fills the *left ventricle*, *a*, and the muscular action of this ventricle at each beat propels all the blood of the body, communicating its vibrations to the extremest vessels. The blood thus distributed by the large trunks, namely, the aorta, *c*, *e*, *f*, the arteria innominata, *g*, the subclavian artery, *h*, and the left carotid artery, *i*, to the smaller branches, is brought back by the veins which are continued from their extremities; this is a fact proved by the veins being filled when a fluid is injected into the arteries. The circulation of the blood also may be seen in the pellucid parts of animals by the aid of a microscope.

x *p*, Veins from the liver, spleen, and bowels.

TABLE OF THE ARTERIES.

I. PULMONARY ARTERY.

II. AORTA.

ARTERIES FURNISHED BY THE AORTA AT ITS ORIGIN.

I. ANTERIOR AND POSTERIOR CORONARY.

II. ARTERIES FURNISHED BY THE ARCH OF THE AORTA.

Primitive carotid.	Divided into external and internal carotids.
External carotid.	Furnishes 1. Superior thyroid. 2. Lingual, which — gives the dorsal and two sublingual. 3. External maxillary, or facial, furnishes — 1. the inferior palatine. 2. submental. 3. coronary arteries of the lips. 4. Occipital, which — gives the posterior mastoid. 5. Posterior auricular, which furnishes — the stylo-mastoid. 6. Inferior pharyngeal. The external carotid terminates in dividing into the temporal and internal maxillary.
7. Temporal artery.	Furnishes, 1. The transverse artery of the face. 2 The anterior auricular. 3. The middle temporal.
8. Internal maxillary artery	Furnishes thirteen branches, 1. Middle meningeal. 2. Inferior dental. 3. Deep posterior temporal. 4. Masseteric. 5. Pterygoidean. 6 Buccal. 7. Anterior deep temporal. 8. Alveolar. 9. Infra-orbital. 10. Vidian. 11. Superior pharyngeal. 12. Superior palatine. 13. Spheno-palatine.

Internal carotid.
- 1. Ophthalmic, which gives (Furnishes,)
  - 1. The lachrymal.
  - 2. Central artery of the retina.
  - 3. Supra-orbital.
  - 4. Posterior ciliary.
  - 5. Long ciliary.
  - 6. Superior and inferior muscular.
  - 7. Posterior and anterior ethmoidal.
  - 8. Superior and inferior palpebral.
  - 9. Nasal.
  - 10. Frontal.
- 2. The communicating artery of Willis.
- 3. Choroid artery.
- 4. Anterior cerebral.
- 5. Middle cerebral.

Subclavian artery.
- Furnishes, 1. The vertebral, which gives
  - 1. The anterior and posterior spinal.
  - 2. Inferior cerebellic.
  - 3. The basilar, divided into
    - 1. The superior cerebellic.
    - 2. The posterior cerebral.
- 2. Inferior thyroid, which gives the ascending cervical.
- 3. Internal mammary, which gives
  - 1. The anterior mediastinal.
  - 2. Superior diaphragmatic.
- 3. Superior intercostal.
- 4. Transverse cervical.
- 5. Superior scapular.
- 6. Deep cervical. Continuing its course, the subclavian takes the name of axillary.

Axillary artery.
Furnishes,
- 1. Acromial.
- 2. Superior thoracic.
- 3. Inferior thoracic, or external mammary.
- 4. Inferior scapular.
- 5. Posterior circumflex.
- 6. Anterior circumflex.
- In continuing it takes the name of brachial.

Brachial artery.
Furnishes,
- 1. Deep humeral or external collateral.
- 2. Internal collateral.
- It divides afterwards into the radial and ulnar.

1. Radial artery.	Furnishes, 1. The radial recurrent. 2. Dorsal artery of the carpus. 3. Dorsal artery of the metacarpus. 4. Dorsal artery of the thumb, and terminates in forming the deep palmar arch.
2. Ulnar artery.	Furnishes, 1. The anterior and posterior ulnar recurrent. 2. The anterior and posterior interosseous, which furnishes the posterior radial recurrent. It terminates in forming the superficial palmar arch, which gives the collateral arteries of the fingers.

ARTERIES FURNISHED BY THE AORTA IN THE THORAX.

1. The right and left bronchial.
2. Esophageal, (four, five, or six in number.)
3. Posterior mediastinal.
4. Inferior intercostals, (eight, nine, or ten in number.)

ARTERIES FURNISHED BY THE AORTA IN THE ABDOMEN.

1. Inferior right and left diaphragmatic arteries.

2. Cœliac artery.	Divided into three branches. 1. Coronary of the stomach.	
	2. The Hepatic, which gives	1. The pyloric. 2. The gastro-epiploica dextra. 3. The cystic.
	3. The Splenic, which gives	1. The gastro-epiploica sinistra. 2. The vasa brevia.
3. Superior mesenteric artery.	Furnishes from its concavity,	1. The superior, middle, and inferior right colic. 2. From fifteen to twenty intestinal branches.
4. Inferior mesenteric artery.	Furnishes, 1. The superior. 2. The middle. 3. The left cholic; and divides into the superior hæmorroidal arteries.	

5. The middle capsular arteries (two on either side).
6. Renal or emulgent.
7. Spermatic.
8. Lumbar (four or five on either side).

ARTERIES RESULTING FROM THE BIFURCATION OF THE AORTA.

The aorta furnishes a little before its bifurcation,	1. The middle sacral, and divides into the primitive iliacs, which are divided into	1. The internal. 2. The external iliac artery.

Internal iliac artery.	Furnishes 1. The ilio-lumbar. 2. Lateral sacral. 3. Gluteal. 4. Umbilical. 5. Vesical. 6. Obturator. 7. Middle hæmorroidal. 8. Uterine. 9. Vaginal. 10. Ischiatic. 11. Internal pudic, which gives	1. Inferior hæmorroidal. 2. Artery of the septum scroti. 3. Transversus perinei. 4. Artery of the corpus cavernosum. 5. Dorsalis penis.

External iliac artery.	Furnishes 1. The epigastric. 2. Circumflexa ilii, and continues downwards under the name of the femoral artery.

Femoral artery.	Furnishes 1. External epigastric. 2. External superficial & deeply seated pudics. 3. Profunda, which gives In continuing its course it takes the name of popliteal.	1. The external and internal circumflex. 2. The superior middle and inferior perforating arteries.

Popliteal artery.	Furnishes 1. The superior middle, external and internal articular arteries. 2. The inferior internal and external arteries. 3. The anterior tibial; its continuation is called the dorsal artery of the foot, which furnishes The popliteal is divided into the peroneal and posterior tibial arteries.	1. Tarsal. 2. Metatarsal. 3. Interosseous. 4. Dorsal arteries of the great toe.

1. Peroneal artery.	Divided into the anterior and posterior fibular.
2. Posterior tibial artery.	Divided into internal and external plantar. It forms, in anastomosing with the continuation of the anterior tibial, the plantar arch, from which the superior, posterior, inferior, and anterior branches are given off.

OF THE ARTERIES IN GENERAL.

The arteries are those tubes by which the blood is distributed to every part of the body. During life they may be distinguished by their pulsation; and if wounded, by the florid colour of the blood, and by its escaping *per saltum*, or by jets; after death they may be distinguished by their thick whitish coats, which are elastic, for if cut through they preserve a circular orifice; and lastly, by their having no valves except at their union with the heart.

We have taken a review of the heart, which represents a root, the arteries forming, as it were, two highly ramified trees, of which the principal trunk is the aorta, commencing at the left ventricle of the heart, branching out through all parts of the system, aud terminating in minute twigs at the circumference of the body, limbs, and internal organs. The other arterial trunk arises from the right ventricle, and is extended through the lungs.

The arteries very frequently communicate with each other, so that the blood can pass from the one to the other; sometimes such communication takes place between trunks of an equal size, as in the vertebral arteries, which unite to form the basilar; more frequently a small twig joins a more voluminous trunk, or a transverse branch unites two separate trunks, as in the anterior cerebral arteries; or lastly, two trunks by their union form an arch, as we observe in the mesenteric arteries[y].

As the arteries are further removed from the heart, their communications are more numerous. In the ultimate branches their union is so exceedingly multiplied as to form an intricate network, ramifying *ad infinitum*, and from which the veins and exhalents seem to originate.

[y] The communication of arteries with each other is termed *inosculation*, or *anastomoses*.

STRUCTURE OF ARTERIES.

The arteries are composed of three membranes or coats, embracing each other; the *inner membrane* is similar and contiguous with that which lines the heart, being very smooth, thin, and transparent, and so fine as to have no traces of fibres. The *outer membrane* is dense and compact, and seems to be continuous with the surrounding cellular tissue, and which is formed of its compressed laminæ; it is called the *cellular coat*. Between these two coats is a *third membrane*, which chiefly forms the artery; it is of a firm, close texture, and strong in proportion to the calibre of the vessel, of a yellowish or grey colour, composed of distinct fibres adherent to each other, and disposed in concentric layers, intimately united to the external or cellular coat, but being very little adherent to the inner membrane. This tissue many anatomists have denominated the *muscular coat*; but it differs very materially from muscular structure. It is of a peculiar nature, very dense, possessing little extensibility, although it is elastic and contractile.

The arteries receive minute arteries, *(vasa vasorum,)* which enter into the coats of the artery, and form very complicated meshes on the surface, and which pass into venules, terminating in the trunks of the neighbouring veins[z]. No lymphatics have been traced into them; but their nerves are very apparent, and are supplied chiefly from the system of the ganglia.

z The blood which flows through the artery is incapable of supplying nourishment to it; these small vessels support its vitality, and are not supplied by the artery which they nourish, but by others in the vicinity.

THE AORTA.

The aorta commences at the left ventricle; it is connected with the heart by a continuation of the lining membrane of that cavity, prolonged into its interior, and there forming three semilunar valves: see Fig. 185.

At its origin, the aorta is concealed by the pulmonary artery, but which at a short distance leaves it, as the aorta immediately is directed upwards and to the right, and crossing before the vertebral column forms a curve called the *arch of the aorta*, see Fig. 180, *c:* opposite the third or fourth vertebra it emerges from the pericardium, and occupies the middle of the vertebral column; it is then directed a little backwards and to the left; from this situation the aorta becomes vertical, and descends in the posterior mediastinum upon the anterior and left part of the dorsal vertebræ; it arrives at the diaphragm, see Fig. 130, *n*, and passes along with the thoracic duct between its two pillars, *f*, *e*, *d*, *c*, and terminates in the abdomen by dividing at the fourth or fifth lumbar vertebra[a]. From its origin to its curve it is termed the *ascending aorta*, and from the arch to its division it is called the *descending aorta*, which is again distinguished into the *thoracic aorta* and the *abdominal aorta*.

The aorta in the pericardium, see Fig. 181, *e*, is embraced by the pulmonary artery, *k*, on the right, and by the vena cava, *q*, on the left; anteriorly, the mediastinum separates it from the sternum. Its arch lies at first on the trachea, a little before the division of the latter, and afterwards on the bodies of the second and third dorsal vertebræ. In the posterior mediastinum it lies on the left of the vertebral column, the esophagus, the thoracic duct, and the vena azygos.

a See Fig. 199.

THE ARTERIES WHICH THE AORTA GIVES OFF AT ITS ORIGIN.

THE RIGHT CORONARY ARTERY.

This artery commences from the aorta immediately above the loose edge of the semilunar valves; and is seen in the groove which separates the right auricle from the corresponding ventricle. It winds round the channel upon the posterior surface of the heart, where it divides into two branches, which are distributed over the heart and extended to the apex.

At its commencement the right coronary artery gives off very small ramifications to the aorta and right auricle; others extend over the venæ cavæ and the interarticular septum; other branches descend upon the right ventricle, and communicate with the left coronary artery.

THE LEFT CORONARY ARTERY.

The left coronary artery is smaller than the right; it arises like it from the commencement of the aorta, to the left of the pulmonary artery. It then directs itself downwards between the pulmonary artery and the left auricle, and enters the groove of the anterior surface of the heart, (see Fig. 181, *s*,) and runs along its whole extent to the apex. It sends branches to the aorta and the pulmonary artery, and to the auricle and ventricle; and dividing into very numerous twigs it communicates with the branches of the preceding artery.

THE ARTERIES OF THE ARCH OF THE AORTA.

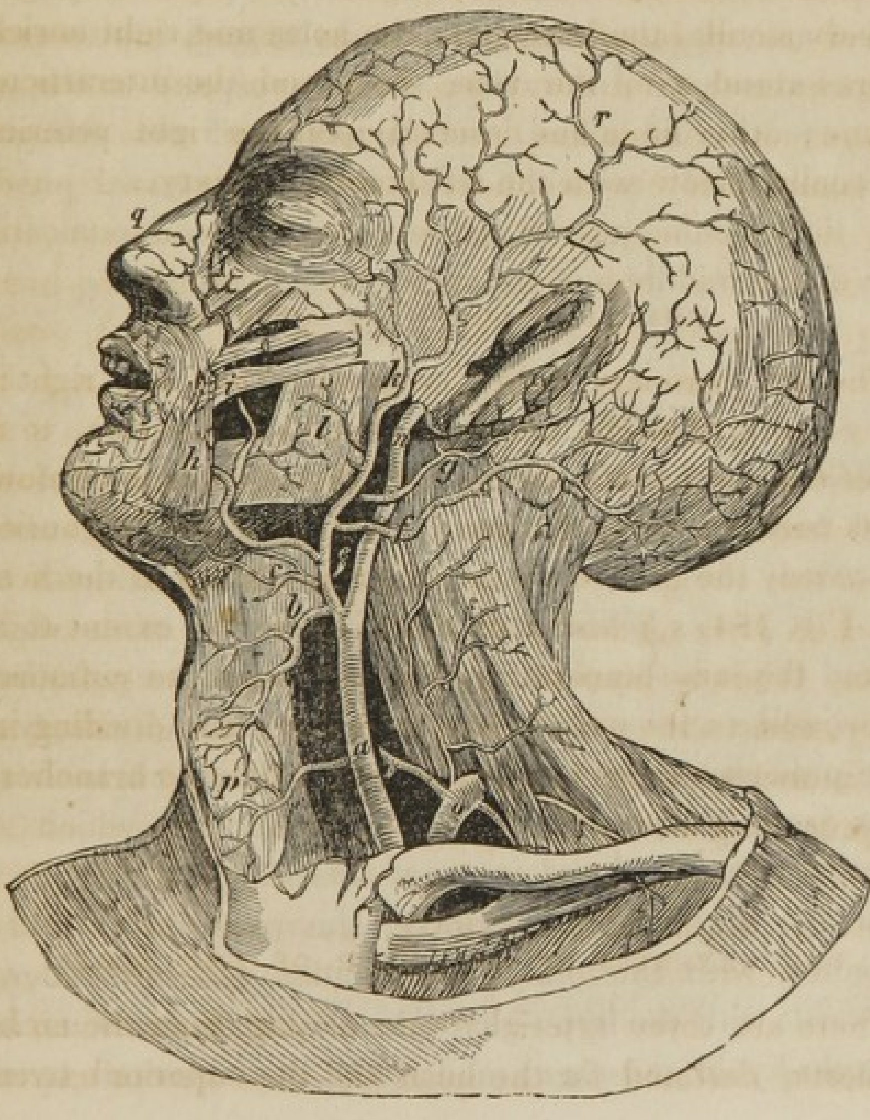
There are three arterial trunks arising from the arch of the aorta, destined for the head and the superior extremities; they are shown in Fig. 186, and designated the *arteria innominata, g,* the left *carotid, h,* and the left *subclavian artery, i.*

ARTERIA INNOMINATA.

This artery ascends obliquely to the right, on the side of the trachea, and after the course of an inch divides into two trunks, of which the one is the right carotid, the other the right subclavian artery.

PRIMITIVE CAROTID ARTERIES.

Fig. 187.



It has been already mentioned, that the right carotid artery arises from the arteria innominata, while the left takes its origin from the aorta. But their volume is precisely the same; they ascend obliquely on each side of the neck, *a*, to the upper part of the larynx, *b*, where they divide into two branches, the *external* and the *internal carotid artery.*

The interval between these two arteries is occupied by the larynx, the trachea, and the esophagus.

Anteriorly, the left carotid is connected with the left subclavian vein, the thymus gland, and the clavicle. Posteriorly, the common carotids are situated upon the vertebral column, and more immediately upon the inferior thyroid arteries, the longi colli, and the recti capitis antici majores muscles. Internally, they correspond to the trachea, the thyroid gland, the larynx, and the pharynx. Externally, they are connected with the internal jugular vein, the pneumo-gastric nerves, and the communicating cords of the middle and superior cervical ganglia.

EXTERNAL CAROTID ARTERY.

This artery, *n*, extends from the upper part of the larynx to the neck of the condyle of the lower jaw, and is particularly destined for the face and the exterior of the skull. It passes behind the posterior portion of the digastric and the stylo-hyoid muscles, where it crosses its direction, winding outwards and backwards, between the zygomatic process of the temporal bone and the angle of the under jaw; then divides into two branches, which are named the *temporal* and *internal maxillary arteries.*

On the outer side, inferiorly, the external carotid is connected with the platysma myoides and integuments, afterwards with the hypo-glossal nerve, the digastricus, and the stylo-hyoid muscles; and lastly, it is covered by the parotid gland. On the inner side, and from below upwards, it is connected with the internal carotid artery, the stylo-pharyngeus, and the stylo-glossus muscles, and the styloid process of the temporal bone.

The branches which this artery furnishes are—1st, anteriorly, the *superior thyroid*, the *external maxillary*, and the *lingual;* 2nd, posteriorly, the *occipital* and *auricular;* 3rd, on the inner side, the *inferior pharyngeal*, and those by which it terminates; the *temporal* and the *internal maxillary* arteries.

ANTERIOR BRANCHES OF THE EXTERNAL CAROTID ARTERY.

I. SUPERIOR THYROID ARTERY.

This artery is situated at the fore and upper part of the neck; it extends from the external carotid, *a*, to the larynx, *b*, and to the thyroid gland, *p*, where it divides into three branches, which are distributed by a great number of divisions in the parenchema of this organ.

On the outer side it is connected with the platysma myoides, the omo-hyoides, and the thyroid cartilage, to which it gives small ramifications, namely, the *laryngeal*, which is directed towards the upper part of the larynx, passing between the os hyoides and the thyroid cartilage into the larynx, to supply the epiglottis, the muscles, and the mucous membrane of that organ. The *crico-thyroid branch* is smaller than the preceding, and descends obliquely over the thyroid cartilage, furnishing ramifications to the adjacent parts.

II. EXTERNAL MAXILLARY ARTERY[b].

This artery commences at the anterior part of the exter-

[b] *Facial* or *labial artery*.

nal carotid above the lingual, *e;* it proceeds transversely inwards and forwards, and after describing several curves, gains the internal part of the angle of the lower jaw; passes between the submaxillary gland and the base of the jaw; then ascends towards the angle of the lips; enters under the union of the levator anguli oris and triangularis muscles, and terminates upon the side of the nose as far as the inner angle of the eye, communicating freely with the nasal twig of the ophthalmic and the infra-orbitar arteries.

BRANCHES OF THE EXTERNAL MAXILLARY ARTERY.

There is beneath the inferior maxilla, 1st, the *inferior palatine*, which, after arising near the origin of the inferior maxillary artery, supplies the superior and lateral part of the pharynx, passes between the pillars of the velum palati, and is distributed to the pharynx, the tonsils, and the Eustachian tube, communicating with the superior palatine. 2nd, the *submental*, which supplies the mylo-hyoideus and the digastricus, and ramifying above the chin, sends branches to the muscles of the superior hyoid region, the submaxillary gland, the internal pterygoid muscle, and the mucous membrane of the mouth. On the face the external maxillary artery furnishes external and internal branches, which are distributed to this region. 3rd, the *coronary arteries of the lips*, which proceed in a serpentine direction on the border of the lips, and communicate with each other at the angles of the mouth. 4th, the *dorsal artery of the nose*, which supplies the muscles, cartilages, and integuments of this part, and is in general the termination of the maxillary artery.

III. THE LINGUAL ARTERY.

This vessel commences at the anterior part of the external carotid between the two preceding arteries, passing inwards and forwards; it is directed a little upwards, and enters between the hyo-glossus and the genio-glossus as far as the root of the tongue, proceeding horizontally along its base under the name of the *ranine artery*. The lingual artery sends branches beneath the hyo-glossus muscle, and to the middle constrictor of the pharynx, the thyro-hyoideus, and the digastricus. From the same point the *dorsal artery of the tongue* arises, ramifying in the back of the tongue, the tonsils, and the velum palati. Several twigs from the lingual artery penetrate the genio-glossus muscle ; and one considerable branch, named the *sublingual artery*, passes forwards above the sublingual gland, furnishing branches to those parts, to the mucous membrane of the mouth, and to the adjacent muscles. Lastly, the *lingual artery* supplies many branches under the tongue, which ramify in the substance of this organ ; at the tip, and above the frenum of the tongue, the two lingual, which have gained the name of the ranine arteries, anastomose with each other.

POSTERIOR BRANCHES OF THE EXTERNAL CAROTID ARTERY.

IV. OCCIPITAL ARTERY.

This artery, *f*, commences at the posterior part of the external carotid under the parotid gland ; passes obliquely backwards, beneath the posterior portion of the digastricus ; ascends between the transverse process of the atlas and the mastoid process of the temporal bone, and finally terminates in a tortuous manner upon the back part of the head. The occipital artery furnishes superior, posterior, and inferior branches, which supply the muscles in that region. One of them, which is larger than the others, is named the *posterior mastoid artery,* from traversing the mastoid foramen, and is subsequently lost on the dura mater; others descend in the substance of the muscles on the lateral part of the neck. The extreme branches are more superficial, and lose themselves in the muscles of the posterior region of the neck.

V. THE POSTERIOR AURICULAR ARTERY.

This is one of the smallest branches of the external carotid; it passes between the auditory canal and the mastoid process, and gaining the inferior part of the external ear, divides into two branches, which are distributed to the posterior auricular and temporal muscles, and the integuments. But before its division, it furnishes the *stylo-mastoid artery,* which enters the foramen of the same name, passes through the aqueduct of Fallopius, and supplies the mucous membrane of the tympanum, the semicircular canals, etc.

VI. INTERNAL BRANCH OF THE EXTERNAL CAROTID ARTERY, OR INFERIOR PHARYNGEAL ARTERY.

This artery passes vertically along the lateral and posterior part of the pharynx, between the external and internal carotids, and divides into two branches, namely, the *pharyngeal,* which is distributed to the constrictor muscles of the pharynx, and the *meningeal branch,* which passes between the internal carotid artery and the internal jugular vein, and entering the foramen lacerum posticus, is distributed to the dura mater.

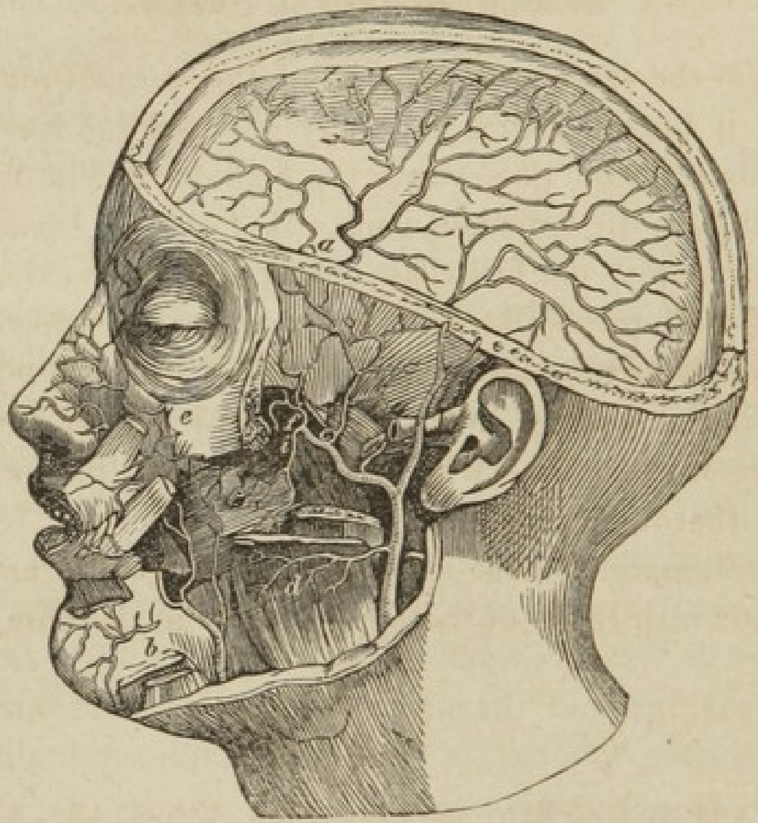
BRANCHES WHICH TERMINATE THE EXTERNAL CAROTID ARTERY.

VII. TEMPORAL ARTERY.

The temporal artery, *k*, separates from the internal maxillary artery opposite the neck of the condyle of the jaw, and passes obliquely upwards beneath the parotid gland; it passes over the zygomatic arch, and glides in a tortuous manner under the anterior and the superior muscles of the ear, and becomes subcutaneous, dividing into three branches, namely, the *transverse artery of the face*, *l*, which ramifies on Steno's duct and the muscles about this region. The *anterior auricular artery*, which supplies the external ear. The *middle temporal*, which pierces the temporal aponeurosis near the zygomatic arch, and is lost in the temporal muscle. Ultimately, the temporal artery divides into the anterior and posterior branches, which diffuse themselves over the occipito-frontalis muscle and the pericranium.

VIII. INTERNAL MAXILLARY ARTERY.

Fig. 188.



This artery is larger than the temporal ; it commences at the external carotid about the same point, and is remarkable for the great number of important branches which it supplies to the deep parts of the face. In this figure the temporal zygoma and the ramus of the jaw is removed, to shew its course between the pterygoid muscles to the floor of the orbit, and spheno-maxillary fossa.

BRANCHES OF THE INTERNAL MAXILLARY ARTERY BEHIND THE NECK OF THE CONDYLE OF THE JAW.

I. MIDDLE MENINGEAL ARTERY.

This is the largest branch, *a*, of the internal maxillary artery; it mounts almost vertically between the two pterygoid muscles, and passes into the cranium by the foramen sphinosum of the sphenoid bone. It furnishes branches to the dura mater, the fifth pair of nerves, and to the aqueduct of Fallopius, and then divides into the anterior and posterior branches; the former is found in a deep groove of the parietal bone, and supplies the exterior surface of the dura mater; the latter is distributed to the posterior part of that membrane.

The ultimate ramifications of the meningeal artery communicate with those of the opposite side of the dura mater.

II. INFERIOR DENTAL, OR INFERIOR MAXILLARY ARTERY.

This vessel descends anteriorly along the inner surface of the ramus of the lower jaw, at the outer side of the pterygoideus internus, enters the inferior dental canal, and emerges by the mental foramen. Before entering the dental canal it supplies the pterygoid muscle; in the canal it furnishes the teeth with branches, which pass through the foramina at their roots. One of its branches passes out of the mental foramen, is distributed to the triangularis and quadratus muscles, at *b*, and communicates with the facial artery; another branch continues its course to the chin, and gives twigs to the canine and incisor teeth.

BRANCHES OF THE INTERNAL MAXILLARY BETWEEN THE PTERYGOID MUSCLES.

I. POSTERIOR DEEP TEMPORAL BRANCH.

This artery, *c*, ascends between the temporal and external pterygoid muscles, and is distributed to the temporal muscle and periosteum in the temporal fossa.

II. MASSETERIC ARTERY.

This branch passes between the temporal muscle and the neck of the condyle of the lower jaw, and ramifies in the masseter muscle, communicating with the transverse artery of the face.

III. PTERYGOID ARTERIES.

These arteries, *d*, are distributed to the pterygoid muscles.

BRANCHES OF THE INTERNAL MAXILLARY ARTERY IN THE ZYGOMATIC FOSSA.

I. BUCCAL ARTERY.

This artery, *i*, descends, then advances between the internal pterygoid muscle and ramus of the inferior maxilla, supplying the buccinator and the zygomaticus major muscles, and the mucous membrane of the mouth.

II. ANTERIOR DEEP TEMPORAL ARTERY.

This artery, *f*, ascends into the anterior part of the temporal fossa, and is lost in the temporal muscle.

III. ALVEOLAR ARTERY.

This artery descends on the maxillary tuberosity, and sends branches into the superior and posterior dental canals, to supply the molar teeth and the membrane of the maxillary sinuses.

IV. INFRA-ORBITAR ARTERY.

This artery, *e*, commences from the maxillary at the anterior superior part of the zygomatic fossa, enters the infra-orbitar canal, and emerging from it, communicates freely with the facial, alveolar, buccal, and ophthalmic arteries.

BRANCHES OF THE INTERNAL MAXILLARY ARTERY IN THE SPHENO-MAXILLARY FOSSA.

I. VIDIAN OR PTERYGOID ARTERY.

This is a very slender artery penetrating the pterygoid canal, and passing out is distributed to the Eustachian tube.

II. SUPERIOR PHARYNGEAL ARTERY.

This artery passes obliquely backwards, and entering the pterygo-palatine canal, terminates at the pharynx.

III. SUPERIOR PALATINE ARTERY.

This artery is larger than the two last mentioned, and proceeds vertically into the pterygo-maxillary fissure, afterwards into the posterior palatine canal, and passing out is reflected forwards to supply the mucous membrane of the palatine arch.

IV. SPHENO-PALATINE ARTERY.

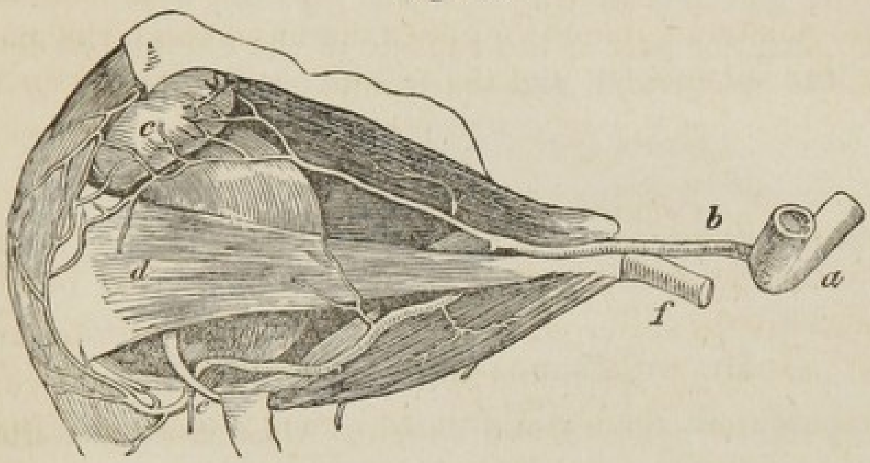
This may be considered as the ultimate distribution of the internal maxillary artery, which, passing into the spheno-palatine foramen, supplies the nasal fossa, the maxillary, the sphenoidal, and the frontal sinuses.

INTERNAL CAROTID ARTERY.

The internal carotid separates from the external behind the digastric muscle, mounts between the anterior and lateral part of the vertebræ of the neck and the pharynx, and then enters the carotid canal. After emerging from this canal it passes upwards and forwards, penetrates the cavernous sinus of the dura mater, and making two inflections, like the curves of a Roman S, arrives beneath the anterior clinoid process; here it ascends obliquely backwards, pierces the dura mater, and terminates in very many branches. While the internal carotid is in the cavernous sinus, it sends two or three twigs to the dura mater, the pituitary body, the membrane of the sphenoidal sinus, and to the nerves of the orbit.

OPHTHALMIC ARTERY.

Fig. 189.



This artery enters the orbit, traversing the optic foramen with the nerve *f*, of the same name, on the outer side of which it is situated ; afterwards it crosses above it, being covered by the rectus superior of the eye, *g*, and proceeds horizontally along the internal wall of the orbit as far as the internal canthus, where it terminates in sending off the following branches :

I. THE LACHRYMAL ARTERY.

This artery arises from the ophthalmic immediately after its entry into the orbit, passes outwards between the external side of this cavity and external rectus muscle, as far as the lachrymal gland, *c*, where it ramifies, and supplies the muscles in this region, as also the muscles of the superior and inferior eyelid.

II. THE CENTRAL ARTERY OF THE RETINA.

This artery is exceedingly slender; it obliquely perforates the coverings of the optic nerve, reaches its centre, and passes into the eye, where it sends a great number of branches to the inner surface of the retina, as far as the corpus ciliare; one of its branches penetrates the vitreous humour, and may be traced, when injected with mercury, to the posterior part of the capsule of the chrystaline lens.

ARTERIES SENT OFF BY THE OPHTHALMIC ABOVE THE OPTIC NERVE.

III. THE SUPRA-ORBITAR ARTERY.

This artery passes forwards along the superior wall of the orbit, and makes its exit by the supra-orbitary foramen, where it divides into an internal and an external branch, the former supplying the muscles in that region, the latter extending to the integuments of the forehead.

IV. THE POSTERIOR CILIARY ARTERIES.

These arteries are very numerous, generally thirty or forty; they communicate with each other round the optic nerve, and traverse the sclerotica. The greater number, however, of these arteries, pass between the sclerotic and choroid coats, and are distributed to the external surface of the latter, forming a very delicate network.

V. THE LONG CILIARY ARTERIES.

These arteries are two in number, one on the inner side, the other on the outer; they penetrate the sclerotica, pass forwards between this coat and the choroid, and arriving at the ciliary circle, form by their anastomoses a network on the great circumference of the iris. From the inner part of this arterial circle other smaller branches proceed, and form a second circle within the former; and these again form a third circle of vessels of greater tenuity, which immediately surrounds the pupil.

VI. THE SUPERIOR AND INFERIOR MUSCULAR ARTERIES.

These arteries are distributed to the superior and inferior muscles of the eye, to the periosteum of the orbit, and to the lachrymal sac.

ARTERIES SENT OFF BY THE OPHTHALMIC IN ITS COURSE ALONG THE INSIDE OF THE OPTIC NERVE.

VII. THE POSTERIOR AND ANTERIOR ETHMOIDAL ARTERIES.

These arteries are directed towards the internal part of the orbit, traverse the posterior internal orbitar canal, and are lost on the dura mater within the cranium.

VIII. THE SUPERIOR AND INFERIOR PALPEBRAL ARTERIES.

These arteries supply the anterior parts of the orbit, the caruncula lachrymalis, the lachrymal sac, and the eyelids, and communicate with the lachrymal artery.

BRANCHES WHICH TERMINATE THE OPHTHALMIC ARTERY.

IX. THE NASAL ARTERY.

This artery issues from the orbit above the tendon of the orbicularis palpebrarum, passes to the root of the nose, and unites with the terminating branches of the external maxillary artery.

X. THE FRONTAL ARTERY.

This artery passes out of the orbit, and ascends on the forehead, where it is entirely distributed. After the internal carotid has given off the ophthalmic artery, it furnishes the following branches:

I. THE COMMUNICATING ARTERY OF WILLIS.

This artery commences from the internal carotid after the ophthalmic, passes backwards and a little inwards on the side of the pituitary body and mammillary eminences, and communicates with the posterior cerebral artery, which is furnished by the basilar.

II. THE ARTERY OF THE CHOROID PLEXUS.

This artery commences above the preceding; it passes outwards and backwards near the crus cerebri, penetrates into the lateral ventricle, and is distributed to the choroid plexus.

III. THE ANTERIOR CEREBRAL ARTERY.

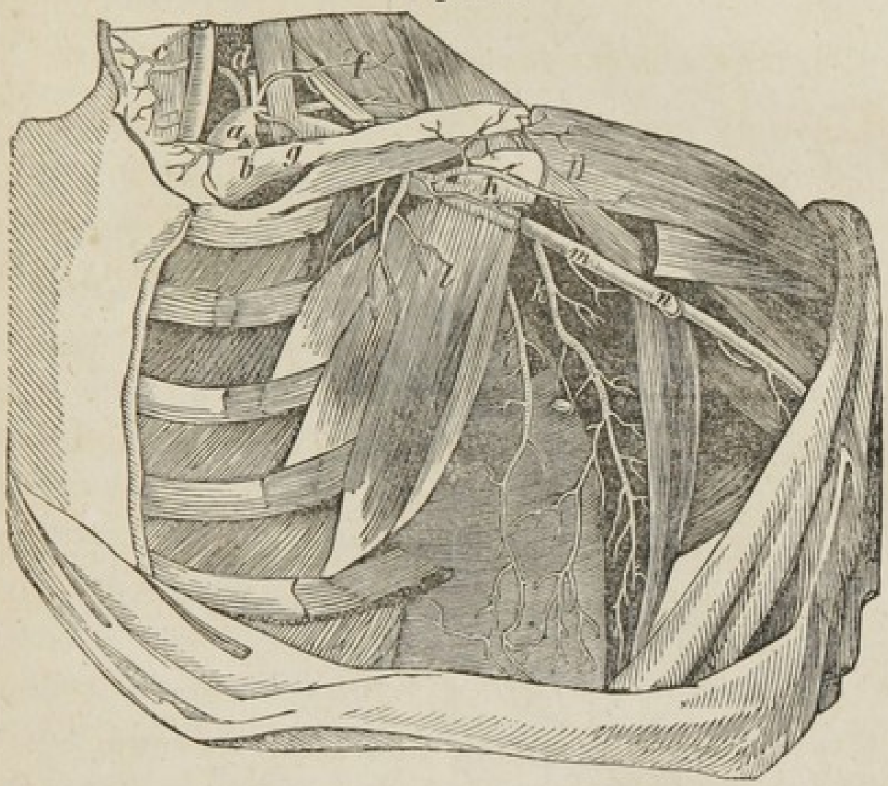
This artery passes under the anterior lobe of the brain, *e*, Fig. 193, where it approaches that of the opposite side, and anastomoses with the communicating artery of Willis. It sends off branches to the fonix, the anterior commisure, and the septum lucidum. Afterwards the cerebral artery is directed forwards, turns round the anterior part of the corpus callosum, and takes the name of that part, terminating on its posterior surface.

IV. MIDDLE CEREBRAL ARTERY.

This artery passes outwards and backwards, and dips into the fissure of the anterior and middle lobes of the brain, where it divides into two branches, one for the anterior, the other for the middle lobe of the brain.

SUBCLAVIAN ARTERY.

Fig. 190.

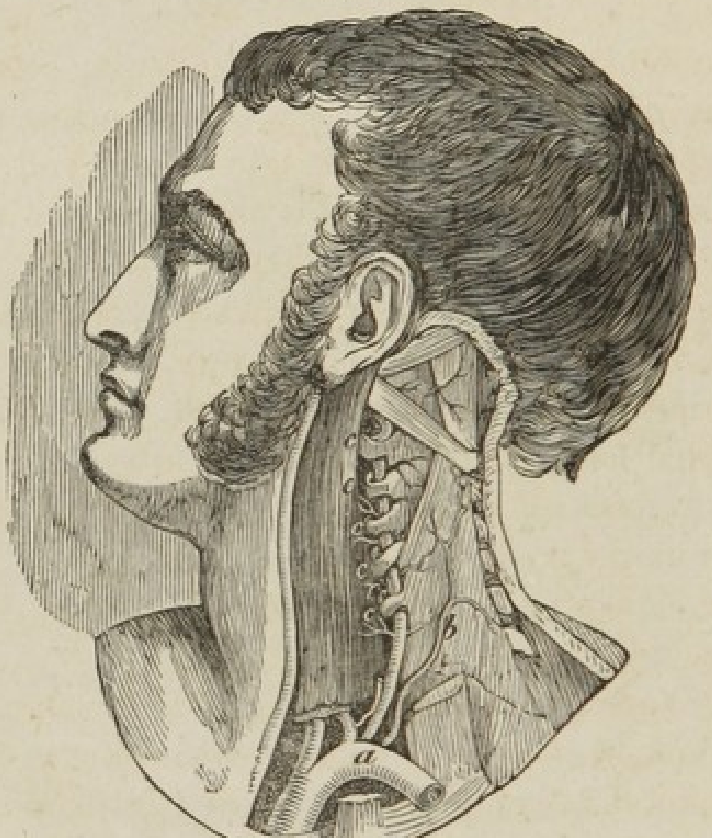


This artery, *a*, is so named from its situation under the clavicle; it is situated at the superior part of the chest, and extending from the arch of the aorta; it proceeds under the clavicle, *b*, *g*, and over the middle of the first rib, passing between the anterior and middle scaleni muscles, then runs under the arch of the pectoralis minor, *l*, and enters the axilla, where it assumes the name of the axillary artery. The right subclavian arises from the arteria innominata, the left separates from the aorta at the termination of its arch. These arteries give branches directly upwards, and directly downwards to the neck, throat, and chest.

BRANCHES OF THE SUBCLAVIAN ARTERY.

I. VERTEBRAL ARTERY.

Fig. 191.



This artery is the largest branch of the subclavian, and extends to the brain. It arises from the upper and back part of the subclavian, *a*, ascends behind the inferior thyroid artery on the vertebral column, enters the foramen at the base of the transverse processes of the sixth cervical vertebra, and takes its course through the canal formed by the union of the foramina of the transverse processes, *c*, *c*, *c*, *c*, *c*, of the other vertebræ of the neck. At the dentata, or second vertebra, it leaves this canal, curving upwards, backwards, and outwards, and perforates the transverse process of the atlas or first vertebra; it then passes between this vertebra and the occiput, forming a second curve; lastly, it enters the skull at the great occipital foramen by the side of the spinal marrow, and, penetrating the dura mater, mounts upwards and forwards between the corpora olivaria and pyramidalia, as seen in Fig. 193, *b*, *b*, uniting with the corresponding vertebral artery to form *c*, the basilar artery.

The vertebral artery sends off the following branches:

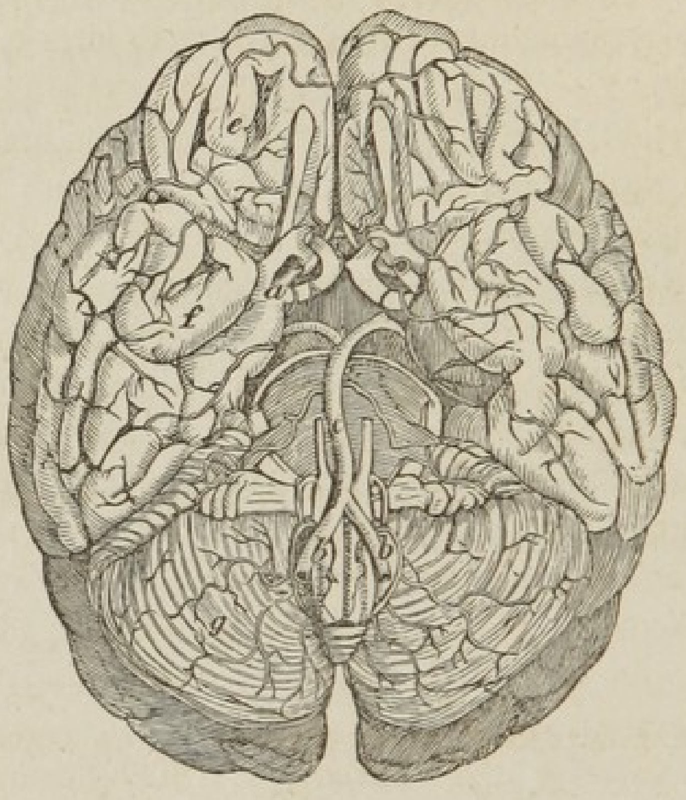
1. The *posterior spinal artery*, which arises near the corpora pyramidalia, proceeds downwards and inwards behind the spinal marrow, and is distributed on its posterior surface as far as the second lumbar vertebra.

2. The *anterior spinal artery*, which commences near the termination of the vertebral artery, and descends on the anterior surface of the spinal marrow. On a level with the occipital foramen it unites with the artery of the opposite side to form a common trunk, which descends as far as the lower extremity of the spinal cord, distributing branches on either side of it, and finally communicating with the middle sacral artery.

3. The *inferior cerebellic artery*, which commences at the termination of the vertebral, or sometimes at the basilar, and proceeds in a serpentine course, distributing numerous branches to the eighth and ninth pair of nerves, to the pia mater, and to the fourth ventricle, and to *g*, the whole inferior surface of the cerebellum.

II. BASILAR ARTERY.

Fig. 193.



The basilar artery, *c*, is formed by the union of the two vertebral arteries, *b*, *b*; it extends along the central groove of the pons varolii, and divides into the following branches:

The *superior cerebellic artery*, which proceeds outwards and backwards, and descends on the upper surface of the cerebellum, where it spreads out into numerous ramifications.

The *posterior cerebral artery*, which proceeds downwards to the posterior part of the lobes of the brain, divides into very many branches to supply the different parts of this region, and receives the communicating branch of Willis, which is given off by the internal carotid artery.

III. INFERIOR THYROID ARTERY.

This vessel, Fig. 187, *d*, commences at the superior part of the subclavian artery, *o:* it extends vertically on the anterior scalenus as far as the fifth vertebra, where it turns inwards towards the thyroid gland, and sends off internal and external branches to the trachea, esophagus, longus colli, and other muscles in this region; a branch called the ascending cervical extends upwards as far as the rectus anticus major, and is distributed to the scalenus anticus, the longus colli, and the splenius muscles; the inferior thyroid artery, at the lower part of the gland, divides into numerous branches, which supply this organ, and anastomose with those of the opposite side, and with those of the superior thyroid artery.

INFERIOR BRANCHES OF THE SUBCLAVIAN ARTERY.

I. INTERNAL MAMMARY ARTERY.

This artery, Fig. 197, *e*, arises from the subclavian, opposite the inferior thyroid, passes inwards and downwards in front of the scalenus anticus muscle, enters the thorax, descends along the sterno-costal cartilages, between these and the pleura costalis, and divides into two branches near the ensiform cartilage. It furnishes several branches to adjacent muscles, and afterwards sends off the following branches:

The *anterior mediastinal artery*, which descends in the superior separation of the anterior mediastinum and divides into branches, which supply the thyroid and thymus glands, the pleura, and the cellular tissue of the mediastinum.

The *superior diaphragmatic artery*, which accompanies the nerve of the same name, supplies the fibrous membrane of the pericardium, the thymus gland, and the mediastinum, and at length is lost in the fleshy fibres of the diaphragm. It also furnishes *external and internal branches:* the external supplying the intercostal muscles, the internal passing through them, and supplying the muscles of the thorax and abdomen.

II. SUPERIOR INTERCOSTAL ARTERY.

This artery, Fig. 196, *g*, commences at the lower and back part of the subclavian, and descends under the pleura in front of the neck of the first and second ribs, where it generally terminates. In front of these ribs it sends off a *posterior* and an *external branch:* the former is distributed to the muscles of the back, the latter to the intercostal muscles, the periosteum of the vertebræ, the esophagus, and the bronchi. In the second intercostal space it furnishes external and internal branches, which follow precisely the same course as the preceding, and are distributed to the muscles or communicate with the first intercostal artery arising from the aorta.

EXTERNAL BRANCHES OF THE SUBCLAVIAN ARTERY.

I. TRANSVERSE CERVICAL OR POSTERIOR SCAPULAR ARTERY.

This artery, *o*, is directed transversely outwards, winding along the scaleni muscles above the nerves which form the brachial plexus; then curving obliquely under the trapezius, the levator anguli scapulæ, and the rhomboideus, it terminates at the posterior border of the scapula, and may be traced to its inferior angle. Near its origin this artery gives off several branches, which ascend, and lose themselves in the muscles at the side of the neck.

II. SUPERIOR SCAPULAR ARTERY.

This artery commences often at the preceding or at the superior thyroid, takes a tortuous course behind and beneath the clavicle, and arrives at the superior border of the scapula; it afterwards passes above the coracoid ligament, sending branches to the trapezius, and ultimately descends into the infra-spinatus fossa, between the bone and the infra-spinatus muscle.

III. POSTERIOR OR DEEP CERVICAL ARTERY.

This artery commences at the posterior part of the subclavian, behind the anterior scalenus; it passes between the transverse processes of the two last vertebræ of the neck, and extends to the great complexus muscle.

AXILLARY ARTERY.

This artery is the direct continuation of the subclavian; it is situated at the superior and lateral part of the thorax; and in the axilla it extends from the first rib, in the interval of the two scaleni muscles, as far as the inferior margin of the tendon of the latissimus dorsi. The axillary artery is seen in Fig. 190, proceeding under the clavicle, *b*, *g*, and under the arch formed by the pectoralis minor, *h*, *l*. In the axilla it is surrounded by branches of nerves of the brachial plexus, which form a sort of sheath for the artery. The corresponding vein is always placed before the artery, and it is further protected by a quantity of cellular tissue and lymphatic glands. When it has passed the anterior edge of the pectoralis major, it assumes the name of the brachial artery.

BRANCHES OF THE AXILLARY ARTERY.

I. ACROMIAL ARTERY.

This artery, *h*, commences at the anterior part of the axillary; it descends obliquely towards the deltoid muscle, and in the narrow space which separates this muscle from the great pectoral; it then divides into a superior and inferior branch: the former ramifies on the shoulder joint, the latter is distributed to the deltoid and the great pectoral muscles.

II. SUPERIOR THORACIC ARTERY.

This artery, *l*, generally arises with the former artery, and descends between the two pectoral muscles, to which it is distributed.

III. LONG THORACIC OR EXTERNAL MAMMARY ARTERY.

This artery, *i*, commences a little lower down than the preceding; it descends from behind forwards, on the upper and lateral part of the chest, along the inferior margin of the pectoralis major, supplying this muscle, the serratus magnus, the intercostals, the lymphatic ganglia of the axilla, the integuments, and the mamma.

IV. INFERIOR SCAPULAR[c].

This artery, *k*, arises from the inferior part of the axillary, opposite the inferior border of the tendon of the subscapularis muscle; it descends along the lower border of this muscle, and gives off an inferior and superior

[c] Frequently termed the *subscapular artery*.

branch ; the former supplies the serratus magnus, the latissimus dorsi, the teres major, and the integuments ; the latter is distributed to the various muscles of the scapula, and to the articulation of the shoulder.

V. POSTERIOR AND ANTERIOR CIRCUMFLEX ARTERIES.

The former of these arteries, *m*, arises from the posterior part of the axillary, passes backwards, turns round the upper part of the humerus, and is lost in the deltoid muscle ; the latter, *n*, is generally furnished by the preceding, and proceeds under the coraco-brachialis and short head of the biceps ; it turns also round the humerus, and is distributed to the deltoid muscle.

BRACHIAL ARTERY.

Fig. 194.

This artery, *a*, is a continuation of the axillary; it is situated at the inner and fore part of the arm, and passes along the inferior edge of the coraco-brachialis. About the middle of the os brachii it crosses over the tendinous attachment of that muscle, being situated between the fleshy mass of the biceps and the upper fibres of the brachialis externus. This artery then proceeds behind the inner edge of the biceps, descending between that muscle and the fibres of the brachialis internus; in approaching the lower extremity of the os brachii, it is inclined forwards towards the bend of the arm, and lies at *i*, beneath the aponeurosis, which is continued from the tendon of the biceps flexor cubiti. The brachial artery sends off numerous branches to the different muscles of the arm, two of which are more considerable than the others, and are termed muscular branches.

I. SUPERIOR MUSCULAR BRANCH, OR DEEP HUMERAL.

This artery, *b*, commences at the inner side of the brachial artery, immediately after it has left the axilla, passes between the triceps and the humerus, accompanied by the muscular spiral nerve, and proceeds between the brachialis externus and the short portion of the triceps, then divides into branches, which supply the triceps near the olecranon and the super-adjacent integuments.

II. THE INFERIOR MUSCULAR ARTERY.

This artery, *c*, is sent off from the brachial about two inches lower than the preceding; it descends among the muscles of the inside of the arm, and is lost about the inner condyle, *k*.

III. THE RAMUS ANASTOMOTICUS MAGNUS.

This artery, *e*, commences about two or three inches above the inner condyle of the os brachii; it is distributed about the elbow, and its principal branches communicate with the recurrent branches of the arteries of the fore-arm.

IV. THE EXTERNAL BRANCHES OF THE BRACHIAL ARTERY.

These arteries, *f*, are small, and supply the coraco-brachialis, the brachialis internus, the biceps, and the integuments.

The *anterior and posterior branches* of the brachial artery are short and slender, their number is very indeterminate, and they penetrate the muscles of the front or back part of the arm.

BRANCHES BY WHICH THE RADIAL ARTERY TERMINATES.

Fig. 195.

The brachial artery, a, divides at k into three branches:

1st, the *radial*, *n*, *o*; 2nd, the *ulnar*, *l*; and 3rd, the *interosseous artery*, *m*; the last two, however, generally arise by one trunk, as at *l*, in this figure[d].

THE RADIAL ARTERY.

This artery is situated at the anterior and front of the fore-arm: it follows the direction of the brachial artery, *a*, and at the bend of the arm, *k*, separates at an acute angle from the ulnar. The radial artery extends from the upper extremity of the radius, *k*, as far as the articulation of the carpus, *o*, here it turns outward, passes between the two first metacarpal bones into the palm of the hand, where it forms the deep palmar arch, *p*. But it is important more particularly to understand its relative connections. Above, it lies between the pronator teres and the supinator longus, and about the middle of the fore-arm passes over the lower attachment of the pronator teres, continuing its course between the supinator longus and the flexor carpi radialis, accompanied by a branch of the musculo-spiral nerve. At the lower extremity of the radius it divides into two branches, which are distributed to the hand.

The branches of the radial artery, in its course along the fore-arm, are as follows:

1. The *radial recurrent*, which passes outwards and upwards near the elbow, and is distributed to the outer condyle, where it anastomoses with branches of the brachial: see Fig. 194.

2. The *internal branches*, which are very numerous, are distributed to the muscles of the anterior and superficial layer of the fore-arm.

d The division of the brachial artery is not always at the same point. I have not unfrequently observed it about the middle of the arm, and sometimes as high as the axilla.

3. The *superficiales volæ*, Fig. 194, *h*, which descends upon the anterior annular ligament of the wrist, distributing a number of twigs to the muscles and integuments of the palmar region.

4. The radial artery at the back of the wrist is only covered by the tendons of the abductor pollicis longus, the extensores pollicis, and the integuments, and ramifying on the back of the hand, is named the *dorsal artery of the wrist.*

5. The *dorsal artery of the metacarpus* passes immediately over the second metacarpal bone, descends on the back of the hand, and is sometimes prolonged to the fore-finger.

6. Small vessels supply the back part of the thumb, termed the *dorsal arteries of the thumb.*

On entering into the palm of the hand, the radial artery divides into two branches:

7. The *artery of the thumb*, which supplies a branch to the outer edge of the fore-finger.

8. The *deep palmar arch*, *p*, which is obvious in the preceding figure, passes transversely from the thumb over the metacarpal bones, and terminates by anastomosing with a branch of the ulnar artery. The deep palmar arch furnishes twigs to the interosseous muscles, and to the deep-seated parts of the palm of the hand.

THE ULNAR ARTERY.

This artery, *l*, is larger than the radial; it is situated at the anterior and inner part of the fore-arm, and extends from the bend of the arm as far as the palm of the hand. It takes its course under the pronator teres, the flexor carpi radialis, the palmaris longus, and the flexor sublimis perforatus, but passes over the flexor profundus perforatus.

It descends between the two last-mentioned muscles, and is found on the ulnar edge of the arm, at the outer edge of the flexor carpi ulnaris; it then proceeds over the annular ligament of the wrist, and under the palmar aponeurosis, until it arrives at the metacarpal bone of the little finger, where it forms the superficial palmar arch, seen in Fig. 194, *g*.

The branches given off by the ulnar artery in its course along the fore-arm and wrist, are the following:

1. The *anterior and posterior recurrent arteries* arise from the ulnar artery, immediately below the elbow. The anterior is distributed to the fore part of the inner condyle, the posterior to the back part of the same process of bone. These arteries communicate with branches of the brachial.

2. The *ulnar artery* furnishes numerous branches to the muscles of the fore-arm.

3. The *anterior and posterior interosseous arteries:* the former, Fig. 194, at *l*, descends in front of the interosseous ligament, between the flexor longus pollicis and flexor profundus perforans, and arriving at the edge of the pronator quadratus, *m*, passes between the radius and ulna to the back part of the arm, and spreads its extreme branches on the wrist and back of the hand. The latter, or posterior interosseous artery, after traversing the interosseous ligament beneath the anconeus, sends off the *interosseous recurrent*, which ramifies on the back part of the elbow joint, and extends between the supinator brevis and abductor longus pollicis manus, and afterwards between the two layers of the posterior muscles of the fore-arm as far as the wrist.

4. The *superficial palmar arch*, Fig. 194, *g*, is a continuation of the ulnar artery, and is situated above the tendons of the flexor sublimis perforatus, immediately beneath the palmar aponeurosis; it commences at the inner side

of the hand, crosses the metacarpus, and terminates at the root of the thumb by branches which unite with the radial artery. The convexity of the arch is turned towards the fingers, and furnishes the collateral branches of the fingers, namely—

1. A branch to the muscles and inner edge of the little finger.

2. The *first digital artery*, which furnishes two branches, one to the outer side of the little finger, the other to the inner side of the ring finger.

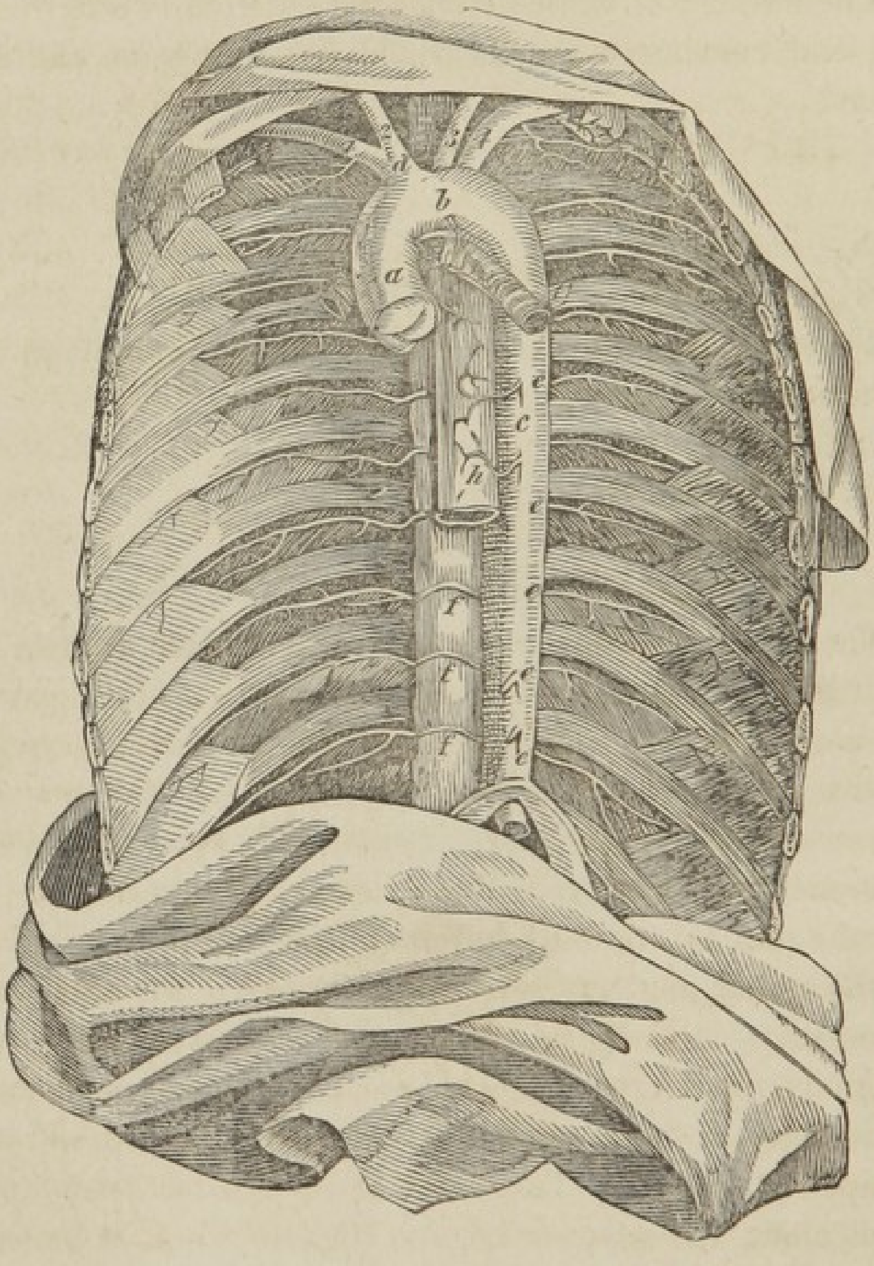
3. The *second digital artery*, which in a similar manner furnishes branches to the outer edge of the ring finger, and to the inner side of the middle finger.

4. The *third digital artery*, which is distributed to the outer edge of the middle finger, and to the inner edge of the fore finger.

5. The *ramus pollicis ulnaris*, or last branch of the ulnar artery, which supplies the muscles of the thumb.

ARTERIES FURNISHED BY THE THORACIC AORTA.

Fig. 196.



BRONCHIAL ARTERIES.

There are generally two bronchial arteries, *a*, *b*, one on the right side, the other on the left; they are distributed to the bronchi, and ramify in the pulmonary tissue.

ŒSOPHAGEAL ARTERIES.

The number of these arteries varies from two to five or six, and curving to the right and left ramify on the esophagus.

POSTERIOR MEDIASTINAL ARTERIES.

These arteries are very numerous, and ramify in the posterior mediastinum and on the aorta.

INFERIOR INTERCOSTAL ARTERIES.

There are nine or ten inferior intercostal arteries on each side; these commence at the posterior lateral part of the aorta; they pass over the bodies of the dorsal vertebræ to the posterior extremity of the ribs, and entering the intercostal spaces each artery divides into two branches, a *dorsal* and an *intercostal;* the former penetrates the vertebral canal by the intervertebral foramen, and ramifying on the spinal marrow, passes out between the transverse processes to the dorsal and lumbar muscles; the latter, which is the largest branch, proceeds in the intercostal space beneath the pleura, and divides into an inferior and a superior branch. The *inferior intercostal artery* proceeds along the superior edge of the rib which is beneath it; the *superior intercostal* passes along a groove in the inferior edge of the rib above it; but towards the sternal end of the rib it is situated in the middle of the intercostal space. The intercostal arteries terminate in front of the thorax by communicating with the internal mammary.

ARTERIES FURNISHED BY THE ABDOMINAL AORTA.

THE RIGHT INFERIOR DIAPHRAGMATIC ARTERY.

This artery generally arises from the aorta by itself, sometimes with the left, and occasionally from the cœliac artery. It ascends on the outer side of the right pillar of the diaphragm, and divides into two branches, which pass between the liver and diaphragm, supplying the right part of the diaphragm, and giving two or three branches to the surrenal capsule.

LEFT INFERIOR DIAPHRAGMATIC ARTERY.

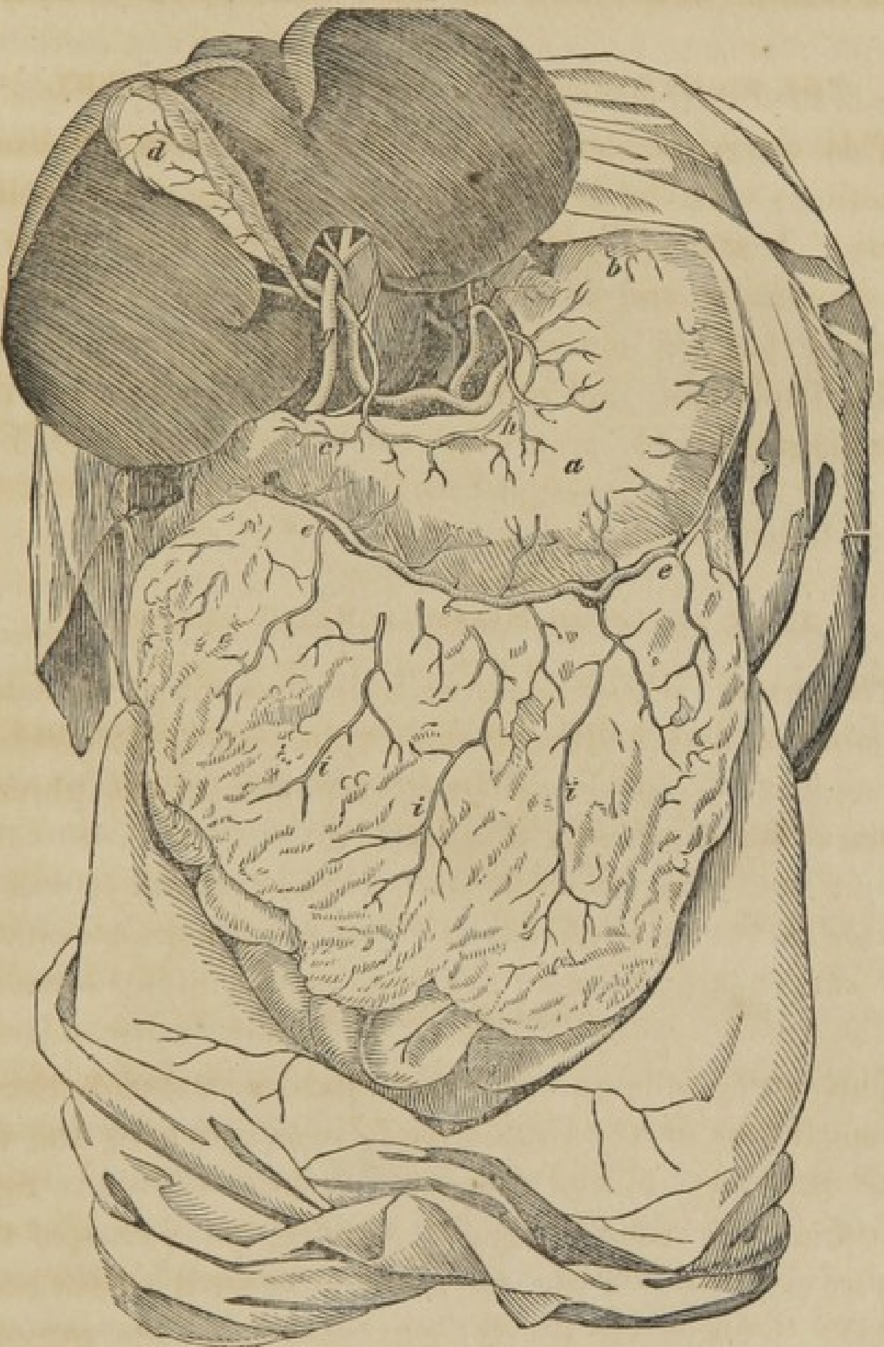
This artery, which arises with the preceding, furnishes branches to the left pillar of the diaphragm, the esophagus, the surrenal capsule, and finally ramifies on the phrenic centre of the diaphragm, Fig. 201, *a*.

CŒLIAC ARTERY.

This artery is large and short, and is situated between the small lobe of the liver *(the lobulus spilegii)* and the small curvature of the stomach; it proceeds at a right angle from the abdominal aorta, between the pillars of the diaphragm; opposite the last dorsal vertebræ it passes horizontally forwards and divides into three branches, namely, the coronary artery of the stomach, the hepatic and the splenic arteries. The cœliac artery is seen in Fig. 201, *e*.

I. CORONARY ARTERY OF THE STOMACH.

Fig. 197.



This artery, *h*, follows the small curvature of the stomach as far as the pylorus, where it communicates with the pyloric artery. It furnishes—

The *Œsophagal branches*, which arise near the cardia, and ascend upon the œsophagus.

The *gastric branches*, *c*, which originate at the small curvature of the stomach, and pass over the surface of *a*, this organ.

Frequently the coronary artery sends a very considerable branch to the liver.

II. HEPATIC ARTERY.

This artery, *l*, is much larger than the preceding, and directs itself transversely to the right and under the lobulus Spilegii as far as the neck of the gall-bladder; it furnishes the following branches:

The *pyloric artery*, which is found on the right side of the pylorus, *c*; passing from right to left along the small curvature of the stomach, communicating with the stomachic coronary branch, and ramifying on the surface of the stomach and pylorus.

The *right gastro-epiploic artery*, *e*, *e*, which arises on the right beneath the pylorus, and descending vertically behind the stomach, it passes from right to left along its greater curvature in the anterior lamina of the great omentum, *i*, *i*, *i*, and unites with the left gastro-epiploic artery: in Fig. 198, it is seen giving branches to the stomach, *i*, the duodenum, *c*, and pancreas, *d*.

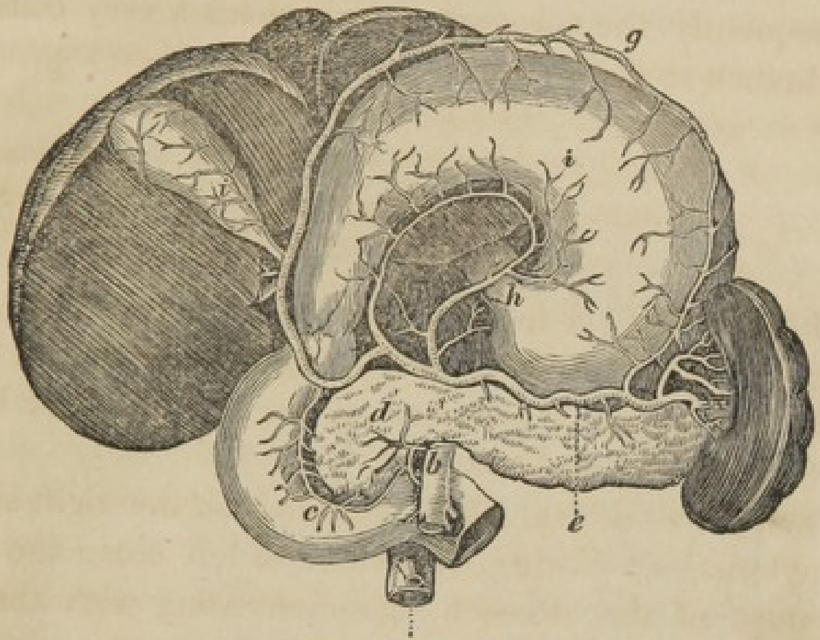
After furnishing these branches, the hepatic artery proceeds towards the right side in front of the vena porta, behind the hepatic duct, to the right side of the lobule of the liver, where it divides into two branches.

The *right branch* furnishes the *cystic artery*, which supplies the parietes of the gall-bladder, *d*, dips into the fissure of the liver, and ramifies in the right lobe.

The *left branch* penetrates by the same fissure of the liver, and is distributed to the left lobe and the lobulus Spilegii, accompanying the divisions of the vena porta.

III. SPLENIC ARTERY.

Fig. 198.



In this figure the stomach and liver is turned up to shew the pancreas and spleen. The splenic artery, *e*, at its commencement proceeds from the right to the left, forming several inflexions along the upper part of the pancreas, *d*, as far as the fissure of the spleen, *f*. In this course it furnishes—

The *pancreatic branches*, which supply the pancreas, *d*.

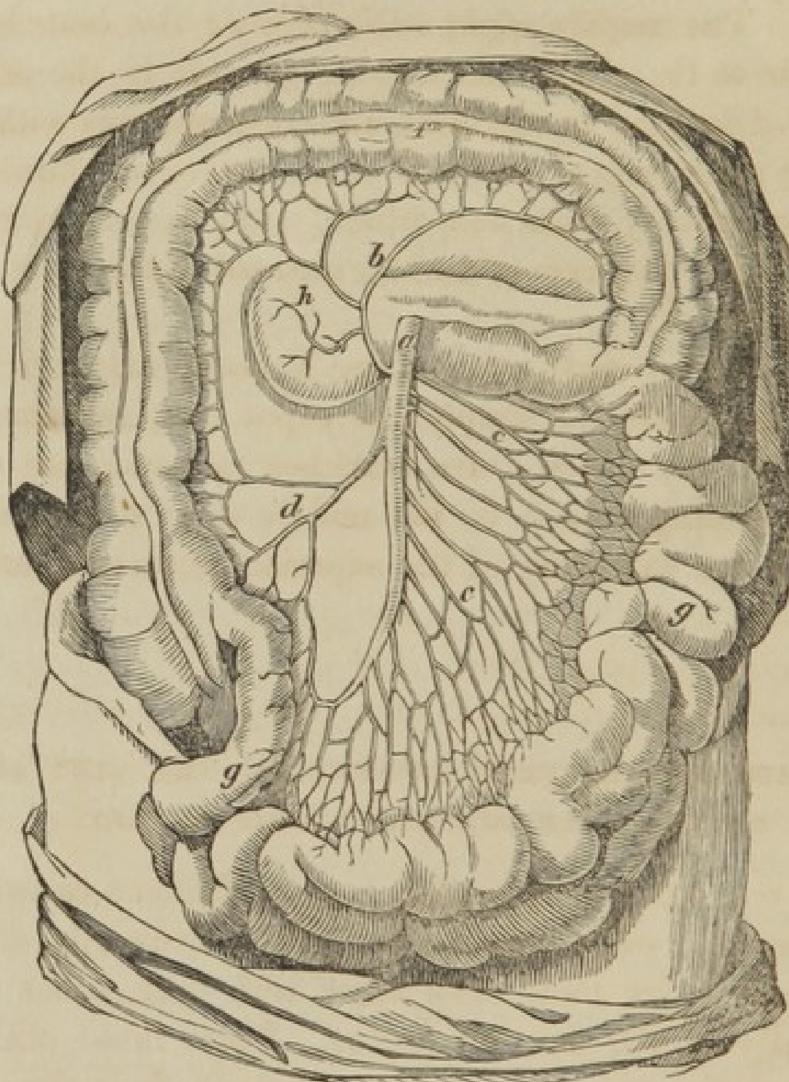
The *left gastro-epiploic branch*, which ascends a little to the left towards the great extremity of the stomach, and then descends along the great curvature, at the middle of which, at *g*, it communicates with the corresponding artery of the right side.

At a little distance from the spleen, *f*, the splenic artery divides into five or six branches, which penetrate this organ after furnishing—

The *vasa brevia*, which are short branches passing from the divisions of the splenic artery, and are distributed to the large extremity of the stomach.

SUPERIOR MESENTERIC ARTERY.

Fig. 199.



This artery, *a*, commences at the anterior right part of the aorta a little below the cœliac, and passing downwards behind the pancreas and before a portion of the duodenum, it gains the upper part of the mesentery, between the two folds of which it enters, and passing from left to right forms a curve, the convexity of which is turned to the left and forwards. It terminates at the end of *g*, the ilium, communicating with *d*, the inferior right colic artery. It furnishes the following branches:

1st. The *superior right colic artery*, *b*, which supplies the arch, and left side of the colon, *f*, where that intestine begins to run over the kidney.

2nd. The *middle right colic artery:* this branch, *h*, proceeds to the right, and a little upwards in the meso-colon divides, and on the right side communicates with the superior right colic artery, and on the lower side furnishes fifteen or twenty branches, which, after frequently communicating in the form of arches, proceed to the right side of the colon.

The *inferior right colic*, *d*, or ilio-colic artery, which passes downwards to supply the caput coli, and the last portion of the ilium. Its branches communicate with the descending branch of the middle right colic artery, and with the extremity of the superior mesenteric artery itself[e].

BRANCHES WHICH ARE FURNISHED ON THE LEFT SIDE OF THE SUPERIOR MESENTERIC ARTERY.

The convexity of this artery sends off fifteen or twenty branches, *c*, *c*, which proceed obliquely downwards, divide into small twigs there, and unite with each other very frequently in the form of arches. From these primary arches smaller twigs commence, which divide in the same manner, and constitute secondary arches by communicating similar to the first. These secondary arches in like manner produce twigs in a third series of arches: from these again a fourth and fifth series of minuter arterial arches

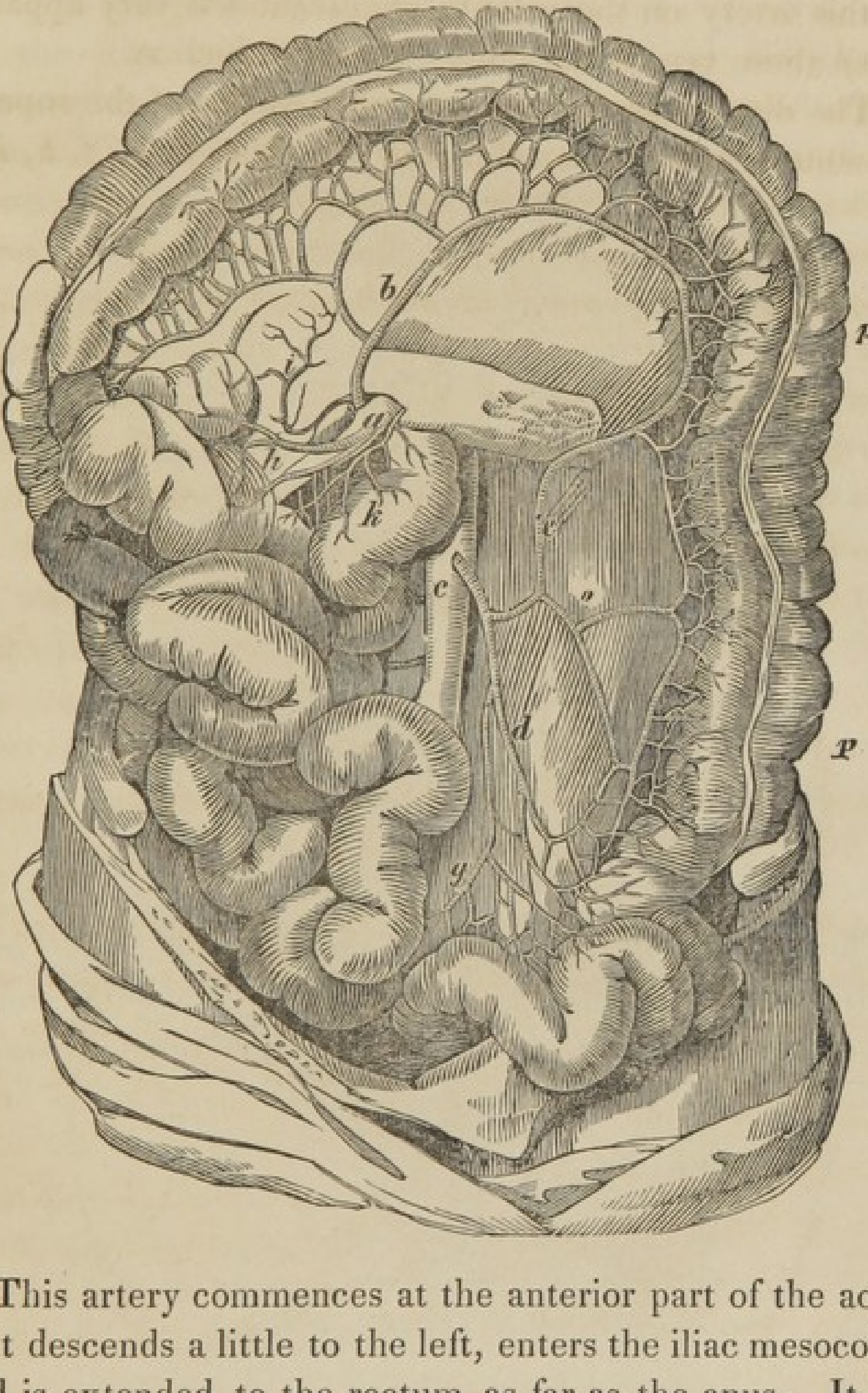
e Although this artery is generally named as a branch immediately issuing from the superior mesenteric, yet it more commonly proceeds from the superior right colic; it is therefore represented as such in this figure.

may be traced to the border of the intestine, where they appear as a network, which finally ramify and subdivide to infinity over the surface of the small intestines, *g*, *g*, and supply the muscular and mucous coats. The distribution of this artery on the valvulæ conniventes is very apparent when these vessels are filled with fine injection.

The distribution of the several branches of the superior mesenteric artery is seen also in Fig. 200, *a*, *b*, *f*, *h*, *i*, *k*.

THE INFERIOR MESENTERIC ARTERY.

Fig. 200.



This artery commences at the anterior part of the aorta, *c*, it descends a little to the left, enters the iliac mesocolon, and is extended to the rectum as far as the anus. It furnishes the following branches:

1st, The *superior left colic artery*, *e*, which extends to the left side of the colon, and communicates with the left branch of the right colic artery, *f*.

2nd, The *middle left colic artery*, *o*, which is generally a branch of the preceding; its distribution to the colon, *p*, *p*, is obvious in the figure.

3rd, The *inferior left colic artery*, which proceeds towards the sigmoid flexure of the colon, and divides into two branches, *d*, *g*.

The left colic arteries are arranged precisely the same as those of the right side; namely, after forming arches and areolæ, they supply the coats of the intestine.

When the inferior mesenteric artery arrives at the posterior part of the rectum, it divides into the *superior hæmorrhoidal arteries*, which descend along the posterior surface of this intestine, and communicate with the middle and inferior hæmorrhoidal arteries.

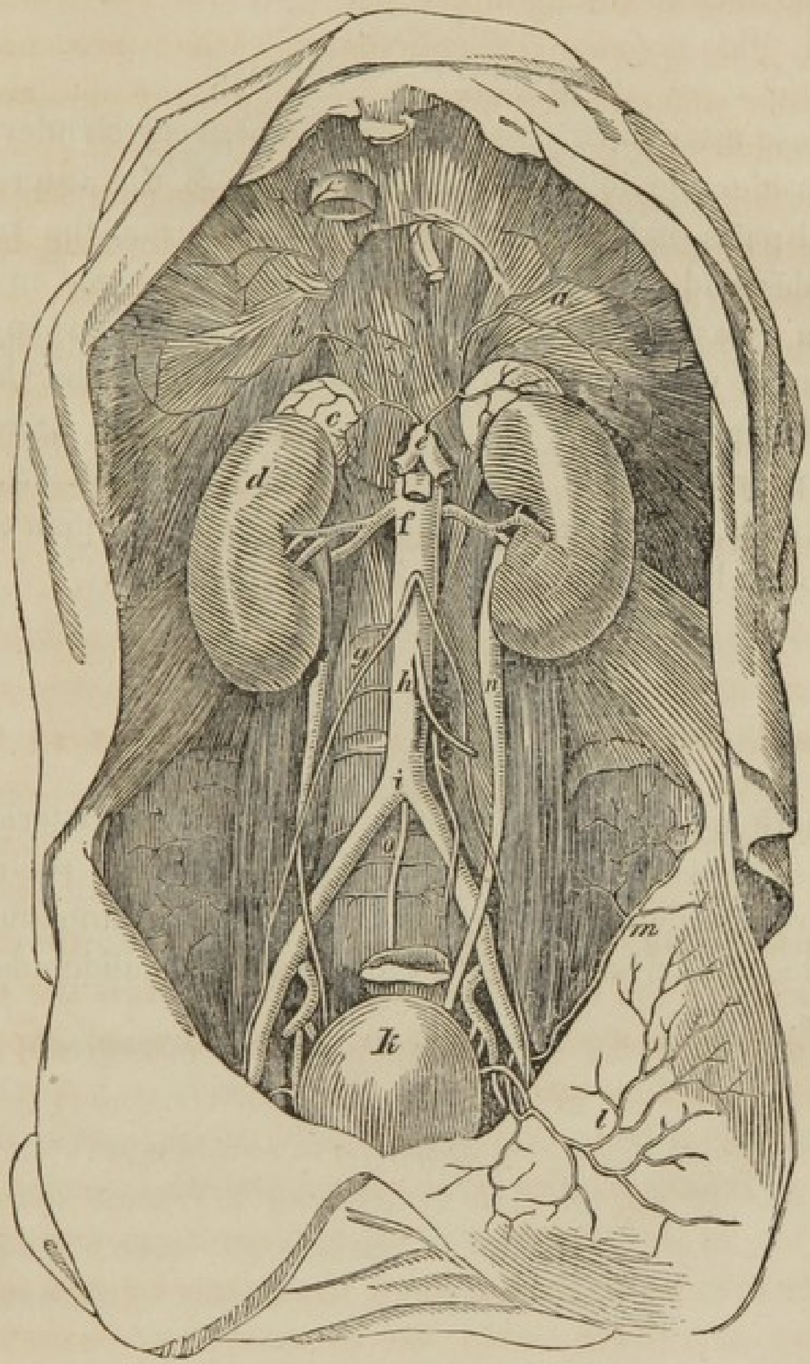
ARTERIES WHICH ARE FURNISHED LATERALLY BY THE ABDOMINAL AORTA.

SURRENAL ARTERIES.

There is one of these arteries on each side; they arise a little above the renal, pass transversely across the vertebral column, and are distributed to the surrenal capsules, marked *c*, in Fig. 201.

RENAL OR EMULGENT ARTERIES.

Fig. 201.



These arteries are of a large size, and very short; there is one on each side; they pass off from the aorta at *f*, transversely across the vertebral column, and arriving at the kidney, *d*, divide into two, three, or four branches, which enter between the pelvis of the ureter and the renal vein.

SPERMATIC ARTERIES.

These arteries, *g*, are two in number, very slender, and of considerable length; they commence at the anterior or lateral parts of the aorta, and sometimes from the renal; they descend on the sides of the vertebral column, in front of the psoas muscles, and ureters, *n*, and accompany the spermatic veins. *In the male*,—they pass out by the inguinal ring, and sending some branches to the spermatic cord, they terminate in the epididymis and the testis. *In the female*,—they pass to the ovary, to the Fallopian tubes, the round ligament, and the sides of the uterus.

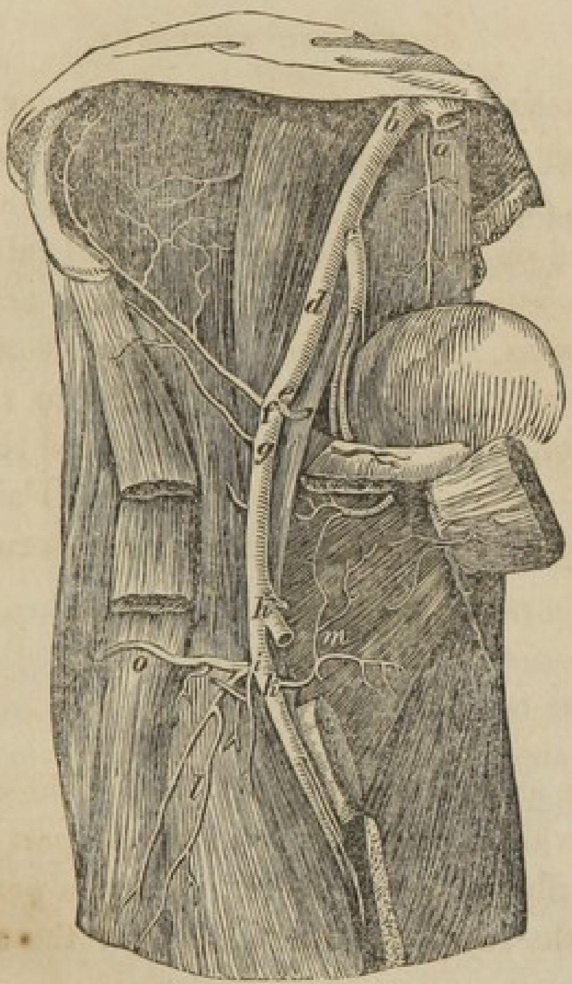
LUMBAR ARTERIES.

There are commonly four or five of these arteries on each side, which commence at the back part of the aorta, and are distributed to the spinal canal, the peritoneum, the muscles of the loins, and to the sides of the abdomen and pelvis.

THE ARTERIES WHICH TERMINATE THE AORTA BELOW.

MIDDLE SACRAL ARTERY.

Fig. 202.



At the fourth lumbar vertebra the aorta divides, Fig. 201, at *i*, into the primitive iliacs; and the middle sacral artery, *o*, commences at the back part of this division, and descends along the anterior surface of the sacrum, and terminates near the summit of the os coccygis: in the annexed figure this vessel is marked *a*.

PRIMITIVE ILIACS.

These vessels, *b*, *c*, *d*, *e*, are formed by the bifurcation of the aorta. Separating from each other at an acute angle, they descend along the edge of the psoas muscle as far as the sacro-iliac articulation, where they divide each into the external and internal iliac arteries. The course of these vessels is very obvious in the figure preceding.

INTERNAL ILIAC OR HYPOGASTRIC ARTERY.

This artery dives almost vertically into the pelvis, in front of the sacro-iliac articulation; and after a short course divides into a great number of branches.

BRANCHES OF THE INTERNAL ILIAC ARTERY.

I. ILIO-LUMBAR ARTERY.

This artery proceeds from the internal iliac, opposite the base of the sacrum; it varies much in size, and ascends outwards and backwards, under the psoas muscle, then divides into an *ascending* and a *transverse branch*, which are distributed to the lumbar muscles.

II. THE LATERAL SACRAL ARTERY.

Sometimes there are two of these arteries on either side; these vessels descend in front of the anterior sacral foramina, as far as the os coccygis. It furnishes *external* and *internal branches:* the former enter the sacral canal, and ramifying on the membrane which lines it, they pass out, and are lost on the muscles at the posterior part of the sacrum; the latter, ramifying in the sacral nerves and ganglia, and in the pyramidalis muscle.

III. GLUTEAL OR POSTERIOR ILIAC ARTERY.

Fig. 203.

This is the largest branch of the internal iliac; it descends outwards and backwards, and passes out of the pelvis through the sacro-sciatic notch, above the pyramidalis muscle; it then proceeds to the posterior part of the pelvis, covered by the gluteus maximus, and divides into two branches: the superficial branch, *c*, is distributed to the gluteus maximus and medius and the sacro-sciatic ligament; the deep-seated branch, *a*, *b*, ascends between the gluteus medius and minimus, and is distributed to the muscles of this region, and to the capsule of the hip-joint.

IV. UMBILICAL ARTERY.

This artery passes obliquely forwards and inwards, as far as the superior lateral part of the bladder, from whence it ascends behind the anterior parietes of the abdomen to the umbilicus. In the adult, this artery is almost obliterated; but in the fœtus, it appears to be a continuation of the internal iliac, and passes out by the umbilicus to form a part of the umbilical cord.

V. VESICAL ARTERIES.

These arteries present many variations in number and origin; they arise from the umbilical, middle hæmorrhoidal, internal pudic, and obturator arteries. The internal iliac furnishes a considerable branch, which supplies the fundus of the bladder, commencement of the urethra, prostate gland, the vesiculæ seminales, and vas deferens; the ultimate ramifications reach to the rectum.

VI. OBTURATOR ARTERY.

This artery generally commences at the internal iliac, or the gluteal, and sometimes from the epigastric; it proceeds to the obturator muscle, and advances as far as the obturator foramen, the superior part of which it traverses; it issues from the pelvis through the space left by the obturator membrane, and divides into *two branches*, which are distributed to the hip-joint, and to the muscles on the inside of the thigh.

VII. MIDDLE HÆMORRHOIDAL ARTERY.

This artery descends obliquely on the anterior part of the rectum; it supplies the tunics of this intestine, and communicates with the superior and inferior hæmorrhoidals.

VIII. UTERINE ARTERY.

The size of this artery is always in relation to the developement of the uterus; arising from the internal iliac, or internal pudic, it passes upon the broad ligament, and is distributed to the lateral and inferior parts of the uterus.

IX. VAGINAL ARTERY.

This vessel is not constant in its origin, for it commences at the internal pudic, the middle hæmorrhoidal, or the umbilical artery; it proceeds to the vagina and external parts of generation.

X. ISCHIATIC ARTERY.

This vessel appears to be a continuation of the internal iliac artery; after supplying the rectum and bladder, it descends in front of the pyramidalis muscle, it proceeds through the great sciatic notch, and at its exit from the pelvis divides into numerous branches, which supply the gluteus maximus, the levator ani, the sciatic nerve, and the muscles of the posterior crural region.

XI. INTERNAL PUDIC ARTERY.

This artery is smaller than the ischiatic, and is frequently furnished by it. It descends before the sciatic plexus and the pyramidalis muscle, and issues from the pelvis by the lower parts of the sciatic notch, between the pyramidalis and posterior border of the levator ani; it afterwards proceeds between the two sacro-sciatic ligaments, to the internal surface of the ischium, as far as the common attachment of the ischio-cavernosus and transversus perinæi, and here divides into two branches, which take a different course in the male and in the female, and of which one is inferior, the other superior.

1st. The *inferior branch, or perineal artery,* proceeds between the integuments and transversus perinæi, as far as the lower part of the scrotum, and is distributed to the muscles of the perinæum; some branches pass towards the rectum, termed the *inferior hæmorrhoidal arteries.* The inferior branch afterwards penetrates the septum scroti, and supplies the integuments of the genitals.

2nd. The *superior branch* ascends above the transversus perinæi, along the ascending branch of the ischium, and the ramus of the pubis to the symphysis of this latter bone, where it divides into two branches, the *dorsal artery of the penis,* and the *artery of the corpus cavernosum.*

3rd. The *transverse artery of the perinæum* is furnished by the superior branch of the internal pudic, near the origin of the latter; it passes above the transversus perinæi muscle, and supplies the bulb of the urethra.

4th. The *artery of the corpus cavernosum* passes into the cavernous body, and divides into a great number of branches to supply its tissue.

5th. The *dorsal artery of the penis,* Fig. 204, *f,* supplies the fibrous membrane of the corpus cavernosum, and terminates in the glans penis.

In the female, the inferior branch of the internal pudic artery terminates in the external labia; the superior is distributed to the clitoris and orifice of the vagina.

EXTERNAL ILIAC ARTERY.

This vessel, *b*, *d*, is formed by the bifurcation of the primitive iliac artery ; it extends to the crural arch, where it takes the name of femoral artery. The external iliac descends obliquely outwards, along the inner and fore part of the psoas muscle, having on its inner side the external iliac vein. It furnishes the following branches :—

I. THE EPIGASTRIC ARTERY.

This artery proceeds from the inner side of the external iliac, at *e*, about an inch before it passes into the thigh ; it extends inwards and a little forwards, behind the spermatic cord, the direction of which it crosses towards the external border of the rectus abdominis muscle. About two inches above the pubis it is situated on the posterior surface of this muscle, and terminates by several twigs at the umbilicus. Its distribution may be seen in Fig. 201, *l*.

II. CIRCUMFLEX ILIAC ARTERY.

This vessel, Fig. 202, *f*, commences at the outer part of the iliac artery, and ascends obliquely outwards along the external border of the iliacus muscle, as far as the anterior superior spinous process of the ilium ; it then passes backwards, and divides into two branches ; its external branch supplies the transversalis and the internal oblique muscles ; its internal branch follows the line of the crista ilii, and terminates in the same muscles. In the subsequent figure it is marked *b*.

FEMORAL ARTERY.

Fig. 204.

Immediately the external iliac artery has emerged from under the crural arch at *c*, it assumes the name of *femoral:* it commences at the middle of the space which separates the anterior superior spine of the ilium from the pubis; it descends on the anterior and internal part of the psoas muscle, and upon the external femoral vein; towards the lower part of the thigh it enters the aponeurotic sheath of the triceps adductor magnus, *m*, on its exit from which it takes the name of *popliteal artery.* To the surgeon, an acquaintance with the femoral artery is of so much importance, that its relative situation claims further notice.

Anteriorly, the femoral artery is connected with the crural aponeurosis, the integuments, and the inguinal lymphatic glands; it is situated in a triangular space, bounded above by the crural arch, on the outer side by the sartorius, and on the inner side by the middle adductor and the vastus internus. Farther down it is covered by the sartorius muscle, which crosses its direction. Posteriorly, it is situated upon the pectineus and the middle adductor muscles.

On the outer side it is connected at first to the crural nerve; then to the tendon of the psoas and the iliac muscles; and lastly, it is placed upon the inner portion of the triceps, which separates it from the shaft of the femur.

On its inner side, it is in contact with the femoral vein and the pectineus muscle, and at the lower part of the thigh it is concealed by the sartorius muscle.

INTERNAL BRANCHES OF THE FEMORAL ARTERY.

I. EXTERNAL PUDIC ARTERY.

These vessels are two in number: one superficial, *c*, which commences near the crural arch, proceeds transversely inwards, and divides into branches, which are lost in the integuments of the inferior part of the abdomen, the penis, *f*, and the labia in the female; the other is a deep-seated branch, distributed under the crural aponeurosis.

EXTERNAL BRANCHES OF THE FEMORAL ARTERY.

II. SUPERFICIAL MUSCULAR ARTERY.

This artery commences nearly on a level with the profunda; it passes transversely outwards between the sartorius and rectus, and divides into ascending and descending branches, which supply the muscles and integuments of the upper part of the thigh. See Fig. 203, *o*.

ANTERIOR BRANCHES OF THE FEMORAL ARTERY.

ABDOMINAL SUBCUTANEOUS OR EXTERNAL EPIGASTRIC ARTERY.

This is a very small artery; it commences immediately above the crural arch, and ascends between the abdominal aponeurosis and the integuments, as far as the level of the umbilicus.

The other anterior branches of the femoral artery are very small, and are distributed to the cellular tissue and integuments.

POSTERIOR BRANCHES OF THE FEMORAL ARTERY.

ARTERIA PROFUNDA FEMORIS, OR DEEP MUSCULAR ARTERY.

This vessel, *h*, is nearly as large as the femoral artery itself; it commences about two inches below the crural arch; it descends backwards between the adductor muscles and internal portion of the triceps, as far as the middle of the thigh. It then diminishes in size, passes through the aponeurosis of the adductor longus to the back part of the limb, and terminates in two branches, which enter into the short portion of the biceps femoris and the semimembranosus. The deep muscular artery, which we have just described, furnishes the following branches:

1. The *external circumflex artery*, *n*, which commences at the outer side, passes outwards behind the sartorius and rectus femoris, and divides into two branches; the one is distributed to the parts about the hip joint, the other descends in the fore part of the thigh between the triceps extensor and the rectus femoris, in which it ramifies.

2. The *internal circumflex artery*, which is larger than the preceding, passes backwards between the pectineus and the tendons of the psoas and the iliac muscles, then divides into two branches, one of which supplies the muscles at the neck of the femur, the other is distributed to the flexors of the leg.

3. The *superior perforating artery*.

4. The *middle perforating artery*.

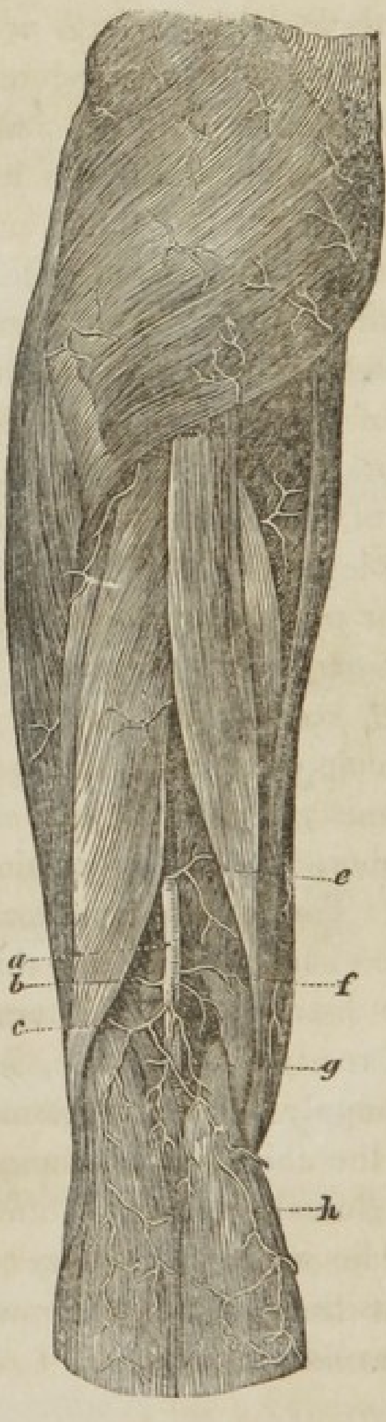
5. The *inferior perforating artery*[f].

These vessels comprehend all the great muscular branches of the profunda; except the two circumflex arteries, they vary in number, and are proportioned in size to the bulk of the limb. These arteries perforate the adductors, and proceed to the back part of the thigh. A particular knowledge of the distribution and branches of the perforating arteries is really unattainable, for they ramify in every direction, supply all the large mass of muscles on the back part of the thigh, and communicate freely with the sciatic, the gluteal, and the obturator arteries. A branch of the middle perforating artery penetrates into the femur by the nutritious canal which we observe on the linea aspera of that bone.

[f] These arteries are irregular in place, size, and number; they are frequently named numerically, as the 1st, 2nd, 3rd, and sometimes branches are termed the 4th and 5th perforating arteries.

POPLITEAL ARTERY.

Fig. 205.



This vessel, *a*, is a direct continuation of the femoral artery, the latter merely changing its name after it has perforated the adductor magnus; it descends into the ham between the condyles of the femur, and extends from the commencement of the inferior third of the thigh to the superior fourth of the leg. On the back part it is connected with the sciatic nerve, the popliteal vein, and the semi-membranosus; afterwards, and more inferiorly, with the gastrocnemius, the soleus, and the plantaris; it is separated above from the femur by a quantity of adipose tissue; farther down it rests upon the back of the knee joint; and below upon the popliteus and the tibialis posticus muscles. The popliteal artery, after giving off a number of small branches to the neighbouring parts, divides into three principal branches to supply the leg.

BRANCHES OF THE POPLITEAL ARTERY.

There are three superior articular arteries arising from the popliteal in the ham.

1. The *internal superior articular arteries*, *e*, *f:* there are generally two or three of these vessels, which vary much; they descend inwards, pass under the tendon of the long adductor, proceed on the internal part of the femur above the condyle, and are distributed into the triceps muscle and the articulation of the knee.

2. The *external superior articular artery*, *b*, passes outwards, turns on the external part of the femur above the condyle, and divides into two branches, the superior of which is lost in the triceps; the inferior descends on the external condyle of the femur.

3. The *middle superior articular artery* proceeds from the anterior part of the popliteal to supply the cellular and adipose tissue posterior to the crucial ligaments of the articulation of the knee.

These and the following branches are given off by the popliteal to the upper part of the leg. The arteries just named are distributed to the posterior surface, and dive into the substance of the gastrocnemii muscles, terminating in the soleus, the popliteus, and plantaris.

There are two *inferior articular arteries*, which arise from the popliteal at the superior part of the leg, namely,

1. The *internal inferior articular artery*, *g*, which descends immediately behind the internal tuberosity of the tibia, to the internal part of the ligamentum patellæ, ramifying on the articulation of the knee and the periosteum of the tibia.

2. The *external inferior articular artery*, *c*, which descends between the popliteus and gastrocnemius, then passes under the tendon of the biceps and external lateral ligament, and is distributed to the articulation of the knee, the ligamentum patellæ, and parts in this region.

The popliteal artery having given off these arteries, descends behind the popliteal muscle, and divides into the anterior tibial, the peroneal, and the posterior tibial arteries.

ANTERIOR TIBIAL ARTERY.

Fig. 206.

The anterior tibial artery, *b*, at its commencement is directed horizontally forwards; it passes from the ham between the inferior edge of the popliteus and the superior fibres of the soleus, then proceeding through the upper extremity of the tibialis posticus and a perforation in the interosseous ligament to arrive at the fore part of the leg; the artery afterwards passes downwards upon the interosseous ligament, between the tibialis anticus and the extensor proprius pollicis, *c;* below the middle of the leg it advances more forward, crosses under the tendon of the extensor proprius pollicis, and is situated between that tendon and the tendon of the extensor longus digitorum, *e;* at the ankle it is extended over the front of the tibia; then having passed under the anterior annular ligament of the instep at *d*, it assumes the name of the dorsal artery of the foot. The posterior tibial artery furnishes the following branches:

1. The *recurrent artery of the knee*, which passes upwards and inwards, supplies the upper extremity of the tibialis anticus, and is lost in the articulation of the knee, *a*, and the integuments.

2. *Numerous small branches* to the muscles on the fore part of the leg.

3. The *internal malleolar artery*, which ramifies over the inner ankle.

4. The *external malleolar artery*, which ramifies over the outer ankle.

DORSAL ARTERY OF THE FOOT.

This artery, *d*, is the direct continuation of the anterior tibial, and extends over the upper surface of the foot to the posterior extremity of the first metatarsal bone, where it descends into the sole of the foot, by passing through the adductor of the second toe. It distributes numerous but very slender *external* and *internal branches*, to supply the adjacent parts of the foot. Two of these branches have been named the *tarsal* and *metatarsal* arteries ; these cross the tarsal and metatarsal bones, and pass obliquely to the outer edge of the foot.

The *interosseal arteries* come off from the tarsal or metatarsal, and supply the interosseous spaces and superior surface of the toes.

A considerable branch proceeds from the dorsal artery of the foot, along the space between the two first metatarsal bones, and divides into,

The *dorsal artery of the great toe*, and an artery which is extended on the inner edge of the toe next to the great toe.

PERONEAL ARTERY.

This artery, *h*, Fig. 207, is smaller than the anterior tibial, and situated at the posterior and deep part of the leg ; it descends upon the inner side of the fibula, giving numerous branches to the peroneal muscles at *i*, and the flexor of the great toe. At the lower part it divides into the *posterior fibular* artery, which, properly speaking, is the termination of the peroneal, descending behind the inferior articulation of the fibula, at *k*, to the posterior part of the foot, and is distributed to the heel and the ankle.

POSTERIOR TIBIAL ARTERY.

Fig. 207.

This vessel, *e*, is the continued trunk of the popliteal, *a*; it descends under the superior attachment of the soleus, between that muscle and the more deeply seated flexors of the toes; it does not lie, however, in immediate contact with the muscular fibres, but like the femoral artery is invested by a strong sheath of condensed cellular membrane. In its course the posterior tibial artery furnishes a number of small branches, which are chiefly distributed to the tibialis posticus and the flexor muscles, the skin, and the periosteum of the tibia; one of these branches, termed the *nutritious artery of the tibia*, descends upon the posterior surface of this bone, and penetrates into the medullary canal. As this artery descends it gradually advances more forwards, follows the course of the flexor tendons, passing behind the inner ankle, *f*, and upon this bone its pulsation may be felt; then sinking under the abductor pollicis, it divides into two branches—

1st. The *internal plantar artery*, which supplies the muscles situated on the inner edge of the sole of the foot, Fig. 208, *b*.

2nd. The *external plantar artery, a,* which crosses

Fig. 208.

obliquely the three middle metatarsal bones, and forms the *plantar arch, c,* the convexity of which furnishes numerous branches to supply the lumbricales muscles; and taking a similar course to the branches of the palmar arch, each anterior branch supplies the corresponding sides of the toes, in the same manner as the collateral arteries are distributed to the fingers.

END OF VOL. I.