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SYNDESMOLOGIA;

OR,

A DESCRIPTION

OF

THE LIGAMENTS

OF

THE HUMAN BODY.

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TRANSLATED.

CONTENTS.

SYNDESMOLOGIA.

OF THE LIGAMENTS IN GENERAL.

THE term Ligament, in common language and in a literal sense, implies a substance uniting any two or more bodies in so intimate a manner, that they appear as one.

The human body is composed of various heterogeneous parts, each of which may be considered as a perfect individual, enjoying a mode of life peculiar to itself; these separate parts, however, cannot form one perfect machine, unless collected together and united by inseparable ties; to these bonds of union we give the name of ligaments, which are obviously and indispensably necessary. As ligaments are peculiar and distinct organs, differing from those bodies to which they are connected, they require a particular and distinct description.

Ligament is of a pearl colour, and composed of fibres which are flexible and elastic, and which are usually collected into parallel fasciculi, these form a compact tough substance, capable of resisting great extending

force, and well calculated for retaining two, or more, separate bodies in their proper relative situation. Ligament differs from every other animal substance; its elasticity and flexibility distinguish it from bone; its fibrous texture from cartilage; its colour from muscle; its density and homogeneous structure from tendon; its origin, state of tension, and use, from nerve; and its solidity from the sanguineous tubes and other vessels.

The older anatomists have been at much trouble to define the "Nature" of ligament, and have described it as a substance formed of similar particles, cold and dry, a structure intermediate between nerve and cartilage, forced, as it were, by heat out of the crassamentum, or the "lenta portione seminis:" but such vague explanations are only calculated to excite useless discussion, on questions which have been already agitated in the schools of Aristotle and of Galen, and without conferring any benefit on science, or adding to it any really useful knowledge. Vesalius, more prudently abstaining from such disputes, has by experiment established one difference at least to exist between ligament and tendon, namely, that the latter when immersed in boiling water becomes swoln, and changed into a gelatinous mass much sooner than the former, which, when similarly treated, has the power of retaining for a long time its tenacity and fibrous appearance, and even if submitted to a stronger heat, will yield no further product, unless that by decomposition it becomes resolved into the elements of animal matter.

We rank under the head of ligaments; 1st, That apparatus which connects the articulating ends of 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 of the numerous motions that are required. 2nd, The ligamentous processes by which those cartilages, which do not appear in the figure of the skeleton, are preserved in their proper situations; such as the cartilages of the ribs, and the several interarticular cartilages of the joints. 3rd, Those annular ligaments which confine certain tendons in their situation, such as those around the tarsus, and carpus, and those along the fingers and toes; to this last division we give the name of false ligaments. To these we might add, 4th, Those folds of membrane and such vessels as have been converted into ligaments, and which preserve in their proper situation different soft parts, and several viscera, for example, the ears, lips, tongue, epiglottis, larynx, stomach, intestines, liver, bladder, penis; this last division is now however very properly excluded from the description of the ligaments. Although it was my intention to describe those ligaments only which are properly so called, yet I find it will be necessary to introduce some of those which are considered as false, particularly such as so nearly resemble true ligaments, that they cannot with equal propriety be arranged under any other system, and which although they do not contribute much to the strength or mutual attachment of the bones, yet give great advantage to the muscles by affording them an extensive surface and advantageous situation for attachment, as well as by determining their necessary line of action with precision.

Ligaments of joints are of two kinds; 1st, Those which are connected to the sides only of the opposite bones. 2nd, Those which surround the entire articulation; the former are generally named "lateral," the latter "capsular ligaments," these cover the whole

joint, and contain the synovial secretion : they are perforated by several vessels in their course to and from the synovial glands; these perforations however are not visible, being closed by adipose and cellular membrane. (Our author does not clearly distinguish between capsular ligaments and synovial membranes, all joints possess the latter, but the orbicular or arthrodial articulations only are furnished with true capsular ligaments; synovial membranes are allied by structure and function to the serous, capsular ligaments belong to the fibrous; the synovial fluid is secreted by the vessels of the membrane, and not by distinct synovial glands.—*Tr.*)

Ligaments differ very much from each other in figure and extent, in consequence of the various forms of the articulating ends of bones, as well as of the different mechanism and degree of motion in the individual joints; accordingly we find them, in some situations, like strong, round cords; in others the fasciculi are loosely connected, so that the fibrous structure is very evident, and sometimes they are even expanded in the form of membranes; this diversity of figure requires a diversity of name, hence we read of Funiculi, Chordæ, Fasciculi, Lacerti, Loramenta, Membranæ, Retinacula, Vaginæ, Annuli, &c.; some ligaments are also named from their comparative size or extent, as Greater or Lesser; others from their apparent density, as Thick or Thin ; some again from their form, as Long, Broad, Triangular, Rhomboid, Round, Square, Circular, Conical, Pyramidal, Trapezoid, Annular; others again from their situation or from the course of their fibers, as Straight, Transverse, Oblique, Horizontal, Perpendicular, Right or Left, Anterior and Posterior ; and some are also named from their attachments, as Interclavicular, Interosseous, &c.

LIGAMENTS OF THE SUPERIOR EXTREMITIES.

I SHALL describe the ligaments which connect the bones of the shoulder, arm, forearm, wrist, and hand, in the following order: 1st, The ligaments of the clavicle; 2nd, Those of the scapula; 3rd, Those between the scapula and humerus; 4th, Those between the humerus and the bones of the forearm; 5th, Those of the bones of the forearm; 6th, Those of the bones of the hand; and 7th, Those of the tendons of the hand.

I. LIGAMENTS OF THE CLAVICLE.

THE Clavicles are firmly connected to each other, and to the adjacent surfaces of the sternum and first rib, by the following ligaments :—

1. *Interclavicular Ligament.* This ligament has been noticed by Riolanus. (*Enchiridion Anatomicum, Lib.* vi. c. xiii.) I have already treated of it (*4th vol. of the Com. of the Petropolitan Academy.*) It is a very distinct ligament, extending in a transverse direction from one clavicle to the other, above the sternum, from the upper or concave edge of which it *arises ;* its fibres thence ascend towards either side, behind the sterno-clavicular articulation, and are *inserted* into the posterior angle of each clavicle ; a few fibres extend along this bone as far as the origin of the sterno-mastoid muscle. This ligament presents a different appearance in different subjects, in some being thin and weak, in others dense and strong ; in some it is a single band,

in others it is divided into two or more fasciculi, and although generally attached to the internal surface of the sternum only, it is sometimes found connected to the external also; in general it adheres intimately to the sternum and its periosteum, but in some instances it is only slightly connected to the latter by cellular membrane. *Use.* To connect the clavicles to each other, also to attach these bones to the sternum, this latter use is effected by those fibres which adhere to the sterno clavicular ligament, as will appear very evident if we endeavour to separate the clavicle from the sternum, after all other connecting media between these bones have been divided.—The interclavicular ligament may also assist in resisting excessive expansion of the chest, in case of very full or forced inspiration.

2. *Sterno-clavicular Ligament, arises* near the edge of the triangular or sternal end of the clavicle; thence the fibres extend over the articulation, and are *inserted* into the anterior and posterior surfaces of the sternum; a few fibres are also inserted into the first rib. This ligament resembles a tendinous expansion, the fasciculi of which are separated occasionally for the passage of blood-vessels; it encloses the entire articulation, except a small portion inferiorly, where the clavicle rests on the cartilage of the first rib; if examined on its internal or synovial surface, its fibres appear short, or divided by the interarticular cartilage, to the circumference of which they adhere. (This ligament forms an imperfect capsule, imperfect above and below; it is therefore commonly divided into two ligaments, which are named the *anterior* and *posterior sterno-clavicular ligaments.*—Tr.)

3. *Interarticular Cartilage.* This is of a pale red colour, and of a consistence more like ligament than

cartilage ; it is thin in the centre and inferiorly, where it is *inserted* by a narrow dense ligament, into the cartilage of the first rib near the sternum ; its circumference is thick, particularly above, where it adheres to the edge of the clavicle by a soft fibrous substance like the intervertebral ; the sterno-clavicular ligament is connected to it before and behind. *Use.* To connect the clavicle to the first rib and sternum, also to adapt the slanting and irregular surface of one bone to that of the other. The interarticular cartilage in old persons is often found hard and dry.

4. *Costa-clavicular Ligament,* is of a rhomboid figure, *arises* from a slight roughness on the inferior surface of the clavicle near its sternal end, descends obliquely inwards, and is *inserted* into the upper and anterior part of the cartilage of the first rib, some fibres also join the insertion of the interarticular cartilage. *Use.* To close the chasm between the clavicle and the first rib, and to prevent these bones being separated by the action of the sterno-mastoid muscle, while at the same time, when the clavicle has been elevated, as, in the case of laborious respiration, the first rib which is thus closely attached to it, serves as a fixed point towards which the intercostal muscles act, and thus by elevating the inferior ribs, towards the first, these muscles assist in expanding the thorax.

The clavicle and acromion scapulæ meet by very small articulating surfaces; these however are connected by a mechanism, which is admirable for the great security it affords, as well as for the free mobility it permits. Vesalius and others have described the ligaments between the clavicle and scapula as among the most powerful in the body.

B

1. *The Acromio-clavicular Ligaments, arise* from the superior and inferior rough surfaces of the clavicle, along which bone their fibres extend a considerable length, and are *inserted* into the corresponding surfaces of the acromion scapulæ; these ligaments consist of strong fasciculi of fibres, which are closely connected to each other, except for the occasional passage of blood-vessels : the superficial fibres are long and ligamentous, the deeper ones are short and almost cartilaginous. The synovial membrane, which covers the opposed surfaces of the two bones, is so delicate as to be difficult of demonstration.

2. *Interarticular cartilage*, does not exist in all subjects; it is thick superiorly, where it is connected to the clavicle and acromion by circular bands, which are gradually lost on these bones; as it descends it becomes thin; inferiorly the bones are in contact.

(Although our author describes the two following ligaments, which connect the clavicle to the coracoid process of the scapula, as common ligaments of the scapula, and accordingly arranges them under the head of the ligaments of that bone; yet as they are equally entitled to be considered ligaments of the clavicle, I prefer inserting their description in this place in conformity with the arrangement, which is generally adopted by modern writers and lecturers on anatomy.—*Tr.*)

3. *Conoid Ligament, arises* from the tuberosity at the root of the coracoid process, some fibres also proceed from the posterior proper ligament of the scapula; it ascends, increases in breadth, and is *inserted* into the posterior margin of the clavicle.

4. *Trapezoid Ligament, arises* from the superior convex surface of the coracoid process; its fibres, which are thick and strong, ascend obliquely outwards, and

are *inserted* into the rough inferior surface of the acromial end of the clavicle : the anterior fibres are the longest, as the apex of the coracoid is bent downwards. *Use*, the conoid and trapezoid ligaments, by their great strength and resistance, afford the scapula a fixed point of suspension, beneath which it can move with freedom and with safety ; if any violent force be applied to depress the scapula, or to separate it from the side, the clavicle will break before these ligaments yield.

II. LIGAMENTS OF THE SCAPULA.

THESE are divided into proper and common, the former are attached to the scapula alone, the latter connect it to the humerus. The proper ligaments of the scapula are two.

1. *Anterior proper Ligament,* is triangular, *arises* narrow from the internal edge of the extremity of the acromion process, passes inwards, becomes broad, and is *inserted* into the whole length of the external margin of the coracoid process. In some this ligament is very strong and perfect, in others it is composed of only two ligamentous bands, one at the anterior, the other at the posterior edge, and the interval between these filled with cellular membrane ; hence it is that Eustachius has represented this ligament as double. *Use*, it has long been considered as a protection to the shoulder joint, as preventing dislocation of the humerus, upwards, or rather upwards and inwards ; hence Vesalius and others arrange it among the ligaments which connect the scapula to the humerus. To me its chief use appears to be to connect and strengthen the coracoid and acromion processes, and prevent them being

separated by the strong action of the pectoralis minor, the short head of the biceps and the coraco-brachialis muscles on one hand, the trapezius and the deltoid on the other, or by the pressure of the clavicle against the acromion itself; it also binds down the supraspinatus muscle, and thus regulates its action and increases its force.

2. *Posterior proper Ligament, arises* from a sharp process about the middle of the superior costa, behind the semicircular notch, near the origin of the coraco-hyoid muscle; it ascends obliquely forwards, passes like a cord above the notch, so as to convert the latter into a foramen, and is then *inserted* into the protuberance at the root of the coracoid process: this ligament is thin and smooth, broad behind, round and narrow before; in some cases it is so broad as nearly to close the foramen, in others it is double. *Use*, to complete the foramen for the free passage of vessels or nerves; it may also serve to close the supraspinatus fossa; it is rather weak to afford any strength to the coracoid process.

III. LIGAMENTS BETWEEN THE SCAPULA AND HUMERUS.

1. *Capsular Ligament* is a large, strong, oblong sac, *arises* around the neck of the scapula, receives some additional fibres from the ligamentous edge of the glenoid cavity, encloses the head of the humerus, and then contracting around the articular cartilage of this bone, it is *inserted* into its cervix. Near the origin of the long tendon of the biceps a well defined oval opening in this capsule is sometimes seen, and another inferiorly, where this tendon is leaving the articulation;

a strong band extends transversely in front of this opening, across the commencement of the bicipital groove in the humerus. This ligament is thin externally where the infraspinatus and teres minor adhere to it, internally beneath the subscapular muscle it is more dense; beneath the deltoid muscle it is strengthened by an aponeurotic expansion, which proceeds from the edge of the triangular ligament, and is lost on the capsule and its investing tendons : it is also strengthened superiorly by the following ligament.

2. *Accessory Ligament, arises* from the external side of the coracoid process, and expands over the upper and anterior part of the joint. Vesalius has described this as three distinct ligaments, but there is no such natural division. The capsule however receives additional strength from an aponeurosis, which is extended over the muscles in this region ; this fascia and some adipose substance fill up the depression between the acromion and coracoid processes, and smooth off other irregularities between the clavicle, and the neck and spine of the scapula; it also covers the several vessels, conducts the suprascapular through the notch in the superior costa, and is thence reflected towards the coracoid process and the clavicle ; beneath the latter, it involves the subclavian vessels and brachial nerves, and is thence continued to the subclavian muscle, which it in part encloses in a sheath, so firm and so dense, as to appear in some subjects like a distinct ligament, between the coracoid process, the clavicle, and the first rib. (This aponeurosis so correctly noticed by our author, has been described by others as a distinct ligament, "bicorne" attached by one extremity to the cartilage of the first rib, and by the other to the coracoid process, while its convexity adheres to the

clavicle and subclavian muscle.—*Tr.*) *Use* of the capsu-
lar ligament, to connect the humerus and scapula, so
loosely, as to allow of the most free motion between
them; it does not bind them closely to each other, nor
does it even retain the opposed surfaces in contact, yet
the head of the humerus we find is always lodged se-
curely in the glenoid cavity; it is not then the capsular
ligament retains it here, but the several muscles whose
tendons adhere to and strengthen it; the infraspina-
tus and teres minor, by their united tendons, cover it
externally, the supraspinatus superiorly, and internally
the subscapularis; this last muscle is inserted in a
two-fold manner, the inferior portion, which is fleshy,
adheres closely to the capsule, and is inserted into the
upper part of the humerus, below the tubercles; the
superior part forms a tendon, which perforates the
capsule near the opening before alluded to, at the ori-
gin of the tendon of the biceps, passes between the
fibrous and the synovial membrane, and is inserted
into the lesser tuberosity of the humerus, close to the
bicipital groove: in addition to these muscles, the del-
toid, the coraco-brachialis and biceps, all co-operate
in strengthening the connexion between these bones.

IV. LIGAMENTS BETWEEN THE HUMERUS AND BONES OF THE FOREARM.

THE ligaments of the elbow joint adhere so closely to
muscles, that in removing the latter, great care must
be taken not to injure the former; the brachialis in
front, the triceps behind, the flexors internally, and
the supinators externally.

1. *Capsular Membrane.* This encloses the entire arti-

culation, it ascends on the posterior surface of the humerus, and is attached to the margin of the great sigmoid notch, which receives the ulna; around this attachment we find much adipose and cellular substance; thence it passes obliquely downwards on each side, beneath the condyles, round to the forepart of the bone, on which it ascends above its articulating surfaces; from the humerus, this membrane descends to the ulna, and is inserted into the olecranon process, into the margin of the sigmoid cavity, and into the edges of the coronoid process, also into the orbicular ligament which connects the radius to the ulna : externally this membrane is rough, and strengthened by bands which run in irregular directions; internally it is smooth, and contains synovial fluid; in the anterior and posterior depressions of the humerus, it is thick, and covers some mucous or adipose follicles; it is very loose anteriorly and posteriorly, to admit of the free motion of the coronoid and olecranon processes in flexion and extension, but on either side it is tense, and strengthened by strong lateral ligaments, which prevent any lateral motion.

2. *Internal Lateral Ligament, arises* narrow from the anterior prominence of the internal condyle of the humerus, descends obliquely forwards, and is *inserted* into the edge and root of the coronoid process, a few fibres which arise rather from the point or extremity of the condyle, descend a little backwards, and are inserted into the margin of the olecranon.

3. *External Lateral Ligament, arises* from the most prominent point of the external condyle, descends, expands, and is *inserted* into the orbicular ligament, and not into the radius : the rotatory motion of the latter on the humerus, within this orbicular ligament, is thus permitted.

V. LIGAMENTS BETWEEN THE RADIUS AND ULNA.

THESE bones are connected at each extremity and along their shafts; above we find the orbicular and accessary ligaments, between their shafts are the transverse and interosseous, and inferiorly are the interarticular cartilage, and the sacciform or capsular ligament.

1. *Orbicular or Coronary Ligament* is very thick and strong; it is composed of fibres, which run in a circular and parallel direction, and are *attached* to the anterior and posterior edges of the lesser sigmoid cavity of the ulna, which receives the head of the radius; this ligament forms three-fourths of a circle, and together with the depression in the ulna, completely surrounds the radius : to its superior margin the thin capsular membrane is attached, its inferior edge is thin and continued for some distance along the neck of the radius by slender ligamentous fibres, which are inserted into the bone, but which are so loose and long, as not to impede the rotatory motions of the latter; by these fibres only does it adhere to the radius. *Use*, to confine the head of the radius in its proper situation. Its external surface is rough, but its internal is very smooth and polished.

2. *Accessary Ligaments* are one *anterior* and one *posterior* ; the former *arises* from the apex of the coronoid process, descends forwards, and is *inserted* into the coronary ligament; the posterior is situated a little lower down, and *arises* from the lower border of the co-

ronary ligament, and is *inserted* into the lateral smooth surface of the olecranon, covered by the anconæus.

3. *Transverse Ligament*, is a fine, round, single cord, *arising* below the coronoid process, from the outer side of the tuberosity of the ulna, into which the brachiæus muscle is inserted; it crosses the interosseous space obliquely downwards and outwards, between the supinator brevis and the flexor sublimis, and is *inserted* into the radius a little below the tubercle, for the insertion of the biceps. *Use*, to prevent too great supination of the radius.

4. *Interosseous Ligament*, more correctly termed *membrane*, as it consists of several distinct fasciculi; these *arise* from the sharp edge of the radius, descend obliquely inwards, and are *inserted* into the opposite edge of the ulna ; the fibres are parallel, and occasionally separated for the passage of blood-vessels ; some fasciculi can be divided into laminæ, and bands are often found crossing these in an opposite direction; this membrane is deficient superiorly, where the interosseous space is partly filled by vessels, and by the supinator brevis and flexor sublimis, which muscles are here closely united ; inferiorly it descends almost to the articulating ends of the bones. *Use*, principally to afford an extensive surface for the origin of muscles ; it can scarcely serve as a connecting medium between the radius and ulna, as this purpose is effected by the ligaments at either extremity of these bones, nor does it prevent excessive supination or pronation, for in either position it becomes relaxed, while in the ordinary state of supination, it is more tense than in any other condition of the forearm.

5. *Interarticular Cartilage*, is the principal bond of union between the lower ends of the radius and ulna ;

it is triangular, the base *arises* from, and is continuous with the cartilaginous covering of the end of the radius, and together with this bone completes the cavity for receiving the upper end of the carpus; each extremity of its base is also connected to the radius by short strong ligaments, which afterwards expand on the carpus; the apex of this cartilage is *inserted* in a strong manner into the styloid process of the ulna, and by a reddish fibrous substance, into the depression of the ulna, between its head and styloid process. *Use*, to connect the radius to the ulna; by its insertion into the latter, it also serves as a centre of motion for the radius to move on around the ulna, a right line drawn from this insertion to the styloid process of the radius, will represent the semidiameter of that portion of a circle, through which this process of the radius will move in pronation and supination.

6. *Capsular* or *Sacciform Ligament, arises* from the margin of the sigmoid cavity, on the inner side of the radius, and from the margin of the interarticular cartilage, as far as the insertion of the latter into the styloid process of the ulna; it then expands so as to enclose the head of this bone, into the neck of which it is *inserted*: this capsule is very loose and thin, posteriorly however, it is strengthened by the sheath of the extensor carpi ulnaris tendon; when the hand is prone, its anterior portion is relaxed, the posterior part is made tense, and *vice versa* when the hand is supine. *Use*, it forms a loose capsule round that part of the ulna on which the radius rolls.

VI. LIGAMENTS OF THE TENDONS OF THE HAND.

In examining the ligaments of the hand, we cannot avoid noticing the influence which the numerous tendons in this region must exert, in connecting the several bones, as also the different sheaths and fasciæ, by which these tendons are confined; before the proper ligaments are described, we shall therefore notice these tendinous sheaths and processes. Around the carpus we observe a strong aponeurotic investment, connected to, yet distinct from the fascia of the forearm; it may be examined on the back and forepart of the wrist, under the name of the " posterior and anterior common vaginal ligament of the carpus;" the *posterior*, is a broad band of transverse parallel fibres, covering the radio-ulnar articulation, and the superior row of the carpus; broad above, narrow and indented below; smooth on its cutaneous surface, but occasionally perforated by blood-vessels; it is attached externally to the styloid process of the radius, internally to the fourth and fifth metacarpal bones, to the sheath of the extensor carpi ulnaris, and to the fascia covering the abductor minimi digiti muscle, its deep surface is connected to the sheaths of the subjacent extensor tendons, particularly to that of the extensor communis, on either side of which it also adheres to the radius, from which it acquires much additional strength. The fascia of the forearm is continued beyond this ligament, over the metacarpus, and is attached to the muscles of the thumb externally, and to those of the little finger internally; this fascia is thinner here than above, the

oblique direction of its fibres distinguish it from the ligament just described.

2. *Anterior common Vaginal Ligament*, is situated higher than the last, is not so distinct or strong, the fascia of the forearm is connected with it above, and that of the hand below, it has but little connexion to the subjacent tendons or their sheaths.

3. *Proper Annular Ligament of the Carpus*, is exposed by removing the tendon of the palmaris longus, and the origins of the small muscles of the thumb and little finger ; it is composed of very strong and tense fibres, which are *inserted* principally into the unciform bone internally, and the trapezium externally ; near the latter some of the deep-seated fibres are also *inserted* into the scaphoid bone, and assist in completing the sheath for the flexor carpi radialis tendon ; internally some fibres are also attached to the pisiform bone, these serve to retain that bone in its situation ; the fascia of the arm is connected to the upper border of this ligament, and that of the hand to the lower ; its cutaneous surface is rough for the attachment of muscles, but posteriorly it is smooth and polished, and forms, together with the bones of the carpus, an annular passage for the flexor tendons.

4. *Palmar Aponeurosis, arises* from the margin of the annular ligament, and expands over the vessels, nerves and tendons in the palm of the hand ; it extends as far as the heads of the metacarpal bones, and is connected on either side of the muscles of the thumb and little finger ; it is attached also to the integuments, by strong tendinous bands ; near the roots of the fingers it separates into fasciculi, which are lost on the sheaths of the flexor tendons ; in this situation, this fascia is strengthened by the (5.) *Transverse Palmar*

Ligaments, these are scattered fibres, which *arise* from the metacarpal bone of the index, and are *inserted* into that of the little finger; they are also connected to the intervening metacarpal bones, and to the sheaths of the flexor tendons. This expansion is commonly considered as an appendix of the palmaris longus muscle, and therefore described along with the muscular system; I have however preferred arranging it with the ligaments, not only on account of its structure and use, but also from its being constantly present, although the palmaris longus muscle is often wanting. The flexor tendons are secured in their course along the fingers, by " *Circular and Vaginal Ligaments.*"

6. The *circular* are of different strength at the different joints, the strongest are opposite those between the metacarpal bones, and first phalanges; these ligaments adhere on each side of the tendon to the proper ligaments of the joint; that opposite the middle joint of each finger is also connected to the skin by a sort of *cutaneous lateral ligament,* which *arises* from the condyle of the middle phalanx, and is *inserted* into the cutis.

7. *Vaginal Ligaments* of the tendons; the flexor tendons of each finger are enclosed in a strong sheath, which is most perfect along the first phalanx; each sheath is composed of circular fibres, strengthened by oblique and cruciform bands, and are *inserted* on each side into the ridge which separates the anterior concave from the posterior convex surface of each phalanx; all these sheaths are lined by a smooth synovial membrane, which is thrown into folds or duplicatures, *accessory ligaments* long and short, but very variable as to extent and situation, they are most numerous in the sheaths of the common flexors; each of these sheaths contains two tendons, the superficial and deep

flexor, the latter perforates the former, and is inserted into the last phalanx, while the divisions of the first spread out on the surface of the middle phalanx. A large bursa or synovial membrane, is also situated beneath the annular ligament of the carpus, and serves as an accessory ligament, as well as to facilitate the motion of the flexor tendons in front of the carpus. The posterior and lateral parts of each finger, are further covered by an expansion from the tendon of the extensor in the middle, and from those of the interossæi and lumbricales on each side ; this expansion is almost equal to a capsular ligament around the articulation, between the metacarpus and first phalanges; but on the remaining articulations of the phalanges it is not so perfect, and it is stronger on the sides of these, than on their back part; this connexion between these tendons not only adds to the security of the articulations, but also binds down each extensor tendon, and confines it to the mesial line of the finger.

VII. LIGAMENTS OF THE HAND.

THESE may be classed into, 1st, The ligaments between the carpus and the bones of the forearm; 2d, Those between the bones of the carpus ; 3d, Those between the carpus and metacarpus; 4th, Those between the metacarpus and the phalanges ; also, those between the phalanges themselves. The ligaments connecting the carpus to the forearm are :—

1. *Capsular Ligament*, is very strong, *arises* from the margin of the glenoid cavity of the radius, from the interarticular cartilage, and from the styloid process of the ulna, and is *inserted* into the upper row of

the carpal bones; it is very strong anteriorly, where it is continued from the first row of the carpus, over the second, even to the metacarpus.

This ligament is strengthened by fibres from the several adjacent bones, and from the sheaths of the tendons, anteriorly from that of the flexor carpi radialis, and from the small muscles of the thumb, and posteriorly from the sheaths of the extensor tendons.

2. *Internal lateral Ligament, arises* from the styloid process of the ulna, and from the interarticular cartilage, and is *inserted* into the inner side of the carpus; it is of a round " funis " form, like a nerve, and is covered by a smooth membrane, which is derived from the capsular ligament.

3. *External lateral Ligament, arises* from the styloid process of the radius, descends obliquely forwards, and is *inserted* into the first and second bones of the carpus. The synovial membrane of the carpus sends in soft mucous-like productions, between the superior carpal bones; these may serve to connect these bones, as well as to confine the capsule itself.

The bones of the carpus are connected to each other very securely, but in such a manner as to allow of some motion between the first and second row.

1. *Capsular Ligament,* resembles that in the wrist joint; it *arises* from the circumference of the upper row of the carpus, and is *inserted* into that of the lower, it is very strong and tense before, but loose behind; this admits of some flexion, but of little or no extension between the two rows. The bones of the carpus are also closely connected to one another, by numerous ligamentous bands, which pass from one bone to another, without observing any particular arrangement: this connexion is also strengthened by the tendon of

the flexor carpi radialis before, and by the extensor tendons behind. The pisiform bone is articulated to one bone only, the unciform; it is however connected by ligaments to the unciform bone, and to the annular ligament, the tendon of the flexor carpilunaris, the muscles of the little finger, and the palmar fascia, also, all contribute to retain this bone in its situation.

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

1. *Capsular Ligaments* are strong, they surround the base of each metacarpal bone, and are *inserted* into the opposite bones of the carpus; these are seen most distinctly behind; they are secured by accessory bands, which pass in various directions; the capsule between the metacarpal bone of the thumb and the trapezium is very loose, but it derives much strength from the insertion of the small muscles around it, as well as from the lateral accessory bands.

The metacarpal bones are also connected to each other at their bases, by three set of ligamentous bands, *dorsal, palmar*, and *lateral;* the two first extend across the bases of the four metacarpal bones, and are attached to each; the latter extend from the base of one, and are inserted into the side of the adjacent bone. The heads of the metacarpal bones are also connected to each other, but not so closely as their bases, by a strong transverse aponeurosis, which is connected to each bone, as well as to the sheaths of the flexor tendons; this aponeurosis covers the tendons of the lumbricales and interossæi muscles.

The first phalanges of the fingers are connected to the heads of the metacarpal bones, by loose, but strong capsular ligaments, which are strengthened posteriorly

by the extensor tendons, which expand very much while passing over this articulation, laterally by lateral ligaments, and anteriorly by the flexor tendons and their sheaths. The *lateral ligaments arise* from slight depressions on the head of each metacarpal bone, and are *inserted* into the condyles of the first phalanx ;— similar ligaments to these exist at the articulations of the phalanges with each other ; to each of these a sort of *cutaneous ligament* is connected ; this *arises* from the condyles of each phalanx, and is *inserted* into the cutis ; it preserves the skin tense and smooth, and prevents it falling into wrinkles at the sides of the fingers : along the side of the last phalanx of each finger is a *subtended ligament*, attached to the extremities of this bone, which project very far beyond its excavated sides ; along these this ligament is seen to extend, it serves to keep the skin tense, it may also assist in fixing the nail on the last phalanx.

LIGAMENTS OF THE HEAD.

THESE may be divided into two classes ; the first connect the head to the trunk, the second the lower jaw to the temporal bones ; I shall commence with the latter, in order that the description of the former may not be separated from that of the vertebral ligaments in general, with which those of the head are inseparably united.

LIGAMENTS OF THE LOWER JAW.

THE condyles of the lower jaw are attached to the articular surfaces of the temporal bones, by an inter-articular cartilage, a capsular and an accessory ligament.

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1. *Interarticular Cartilage*, forms a sort of moveable cover over each condyle of the jaw ; it is composed of two parts, an anterior thin, and a posterior thick ; these are covered and connected to each other by two fine synovial membranes, so closely, that they appear to form but one oval body, in which mucous-like follicles are contained. The membrane which covers the upper surface ascends to be attached anteriorly and laterally around the zygomatic eminence, and posteriorly to the fissure in the glenoid cavity, the condyle of the lower jaw is thus permitted to move partly on the zygomatic eminence, and partly in the cavity behind it; the membrane covering the lower surface of the cartilage decends, and is attached to the border of the condyle, where its investing cartilage terminates.

2. *Capsular Ligament* consists of dense fibres, which *arise* from the margin of the zygomatic eminence, and from the fissure in the glenoid cavity ; as they descend, they adhere to the circumference of the interarticular cartilage, and are *inserted* into the neck of the lower jaw ; it covers the outer and back part of the joint, but is deficient anteriorly, to allow the external pterygoid muscle to pass into its insertion into the interarticular cartilage, and into the neck and edge of the condyle.

3. *Lateral Ligament*, is a thin aponeurosis, which *arises* from a prominence of bone on the inner side of the glenoid cavity, and is *inserted* into the margin of the dental foramen, in the ramus of the jaw ; it is separated from the neck of this bone, by the dental nerve and vessels, in their course to this foramen. *Use*, this ligament, besides contributing somewhat to the general security of the articulation, appears to be of service in protecting the dental nerve and vessels, as well as

the parotid gland from injury in the motions of the jaw; it may also confine the anterior portion of the gland in its proper situation.

LIGAMENTS OF THE HEAD.

THESE ligaments may be arranged into three classes: 1st, Those connecting the head to the first vertebra; 2nd, Those connecting the head to the second vertebra; 3rd, Those connecting the head to the cervical vertebræ in general. The head is connected to the first vertebra by

1. *The Capsular Ligaments.* These attach the condyles of the occipital bone to the glenoid cavities in the atlas; each *arises* from the sides of each condyle, and from the occipital bone at some distance from this process, both before and behind it, and is *inserted* into the anterior and posterior extremities of the margin of the glenoid cavity of the atlas, but externally at some distance from it; by this difference in the extent of attachment in different directions above and below, a certain extent of motion is permitted.—These ligaments are much stronger externally than in any other situation.

2. *Anterior common Ligament*, is a strong broad ligament, attached superiorly to the anterior edge of the foramen magnum, inferiorly to the anterior part of the ring of the atlas, and laterally, to the capsular ligaments of the condyles; in the centre it is very strong, and appears composed of a perpendicular band like a distinct ligament; on either side it is thin and weak, and the fibres run obliquely.

3. *Posterior common Ligament,* is weaker and more lax than the former, attached like it above and below, and extending on each side to the capsular ligaments of the condyles; this ligament is perforated by the vertebral artery and sub-occipital nerve. These two ligaments might be considered as united into one by the capsular ligaments, as Winslow has described them, under the name of the " Infundibuliform ligament."

The head is connected to the second and to the remaining cervical vertebræ by the following ligaments, which we can expose by removing the spinous processes of the cervical vertebræ, and the posterior part of the occipital bone, also the dura mater and its contents.

1. *Apparatus Ligamentosus.* This fibrous expansion, which is very strong and thick, *arises* from the anterior edge of the foramen magnum; as it descends it may be divided into three portions, two lateral and one central, the latter closes the space between the occipital bone and the atlas, covers the odontoid process, and is *inserted* into the bodies of the second, third, and fourth cervical vertebræ; the lateral portions are situated more deeply, and fill up the depressions at either side of the odontoid process, and are *inserted* into the second and third vertebræ. This ligamentous expansion is covered posteriorly by the dura mater, anteriorly by the transverse ligament and its appendices; it is thin in the centre, where the convexity of the odontoid process projects towards the spinal canal, but in the depression on each side of this, it is extremely thick; it thus renders the spinal canal smooth and regular at this place. The *use* of this strong ligament, is to secure the head to the vertebral column, and to resist flexion of the neck, a motion which the poste-

rior common ligament is too weak to oppose. As to the manner in which the head is connected to the second vertebra, a very imperfect and contradictory account has been given by the older writers; by Vesalius, Columbo, Winslow, and others.

1. *Lateral Ligaments*, are thick and strong, they *arise* from each side of the odontoid process, through its whole extent, even to its apex; each may be divided into two parts; the inferior, which *arises* from the neck of this process, ascends very much; the superior, which *arises* from the apex, passes almost horizontally; the fibres of both portions are *inserted* into a depression in the internal margin of the foramen magnum: these ligaments are of *use* not only in connecting the head to the second vertebra, but they also regulate the degree of lateral or rotatory motion, between the atlas and the dentatus; they have no influence over flexion or extension. The inferior fibres of each lateral ligament are strengthened by a fine, soft membrane, which ascends from the base of the odontoid process, to the articulation of the condyles of the occipital bone.

2. *Middle perpendicular Ligament.* In my opinion there is no such ligament; there are a few soft fibres, passing from the apex of the odontoid process to the occipital bone; they are however little more than cellular membrane, and are by no means, as Eustachius has represented them, a distinct round ligament.

LIGAMENTS OF THE BONES OF THE TRUNK.

THESE may be divided into three sets; 1st, The ligaments of the Vertebræ; 2nd, Those of the bones of the Thorax; and 3rd, Those of the Pelvis.

Ligaments of the Vertebræ. The spine is constructed of numerous parts, so wonderfully connected to each other, that considerable motion is permitted, without the safety of the medulla spinalis, or the strength of the column being in the least impaired; several ligaments are required to effect these important purposes, these differ from one another in structure and in use; some are common to all the vertebræ, others are confined to two, and others again are peculiar to one particular class. We shall describe these ligaments in the following order: 1st, Those proper to the cervical vertebræ; 2nd, Those common to all the vertebræ; and 3rd, Those between the bodies and processes of every two vertebræ. The ligaments peculiar to the cervical vertebræ, are

1. The *Transverse Ligament,* is situated within the cavity of the atlas; it *arises* from a small tubercle, between the superior and inferior oblique processes, it then passes across the cavity of the atlas, behind the odontoid process, and is *inserted* into a similar tubercle on the opposite side; this ligament is narrow at each extremity, but wide in the centre, here also it is almost like cartilage; this causes the odontoid process to appear more protuberant than it really is; to this ligament two processes or *appendices* are attached, one *superior,* the other *inferior*; the *superior arises* from the upper border of the transverse ligament, is very strong, about two lines broad and six long, it ascends perpendicularly, and is *inserted* into the cuneiform process of the occipital bone, a little anterior to the foramen magnum; this ligament covers the summit of the odontoid process, but does not adhere to it; it also closes the space between the anterior part of the atlas and the occipital bone. It is this appendix to the trans-

verse ligament, that has been by some authors describ-
ed as the perpendicular ligament. The *inferior appen-
dix* to the transverse ligament descends from its lower
margin, covers the root of the odontoid process, and is *in-
serted* into the body of the second vertebra. These
appendices are inseparably connected to the margin of
the transverse ligament, and are only to be distinguished
from it by the direction of their fibres. The transverse
ligament with its appendices, is of a quadrangular
form, it is convex posteriorly, and concave anteriorly.
Use, to bind down and secure in its proper place the
odontoid process, also to steady the first vertebra,
which wanting the body, must otherwise be more lia-
ble to move in different directions; the appendices also
preserve the transverse ligament in its proper position,
and in a constantly expanded state.

Ligament proper to the first Vertebra. This liga-
ment belongs exclusively to the atlas, it *arises* from
the anterior surface of each transverse process, passes
obliquely upwards and inwards, and is lost in the ante-
rior common ligament, which connects the atlas to the
occipital bone; it is a narrow, weak ligament, its ante-
rior surface, which also looks upwards, is covered by
the recti capitis antici minor, and lateralis muscles, its
posterior or inferior surface is covered by the inter-
transverse muscle.

LIGAMENTS COMMON TO ALL THE VERTEBRÆ.

Anterior Longitudinal or Common Ligament. This li-
gamentous fascia, which extends along the anterior con-
vex surface of all the vertebræ, *arises* from the tubercle of
the atlas, passes over the body of the second vertebra,
adheres but slightly to it, and is *inserted* into the third

and the remaining cervical, also into all the dorsal and lumbar vertebræ. This ligament is not of equal strength or size throughout its whole extent ; at its origin it is small and round, as it descends it becomes broad and thin, and again increases in strength where the spine is much curved, or where the vertebræ diminish in size, accordingly, from the first to the eleventh dorsal vertebra, it is stronger and broader than in the cervical or lumbar regions; in the latter, the crura of the diaphragm occupy its place, and answer the same purpose. This ligament is composed of parallel fasciculi, which, however, seldom extend beyond two or three vertebræ, and where one set are firmly inserted another arise; thus this ligament throughout its entire extent receives different or new fibres from almost every vertebra it covers; it is only attached to the anterior convexity of the spinal column, though occasionally it sends off small processes, which are lost upon its sides.

Posterior longitudinal or common Ligament. This covers the posterior or concave surface of the vertebræ ; it *arises* from the body of the third cervical ; it is also inseparably connected to the apparatus ligamentosus, which separates it from the dura mater, it is *inserted* into all the remaining vertebræ, in the same manner as the anterior ; this ligament is but loosely connected to the dura mater, by cellular membrane and vessels ; in the neck, it is very broad, and extends on each side as far as the intervertebral foramina, and the roots of the transverse processes, but in the dorsal and lumbar regions it is very narrow; on the intervertebral substance, which is convex, towards the spinal canal it expands a little, and adheres very closely to it, whereas it is easily detached from the bones themselves, which are concave.

Infundibuliform Ligament. Winslow describes this as *arising* from the foramen magnum, descending through the spinal canal, being of a funnel shape, and closely connected to the dura mater; I am of opinion, however, that no such ligament exists, and that he has either mistaken for this the posterior common ligament, or some cellular membrane, which connects the dura mater to it.

The anterior and posterior ligaments which thus extend parallel to one another along the spine serve to connect the individual bones, as it were, into one piece ; the anterior one also resists too much extension of the spine, and the posterior which presents a smooth surface to the dura mater and spinal marrow, resists too much flexion.

LIGAMENTS BETWEEN THE VERTEBRÆ.

Intervertebral Ligaments. The bodies of all the vertebræ, except those of the first and second, are separated from each other by this peculiar substance ; most authors consider it of a texture between cartilage and ligament, while some have supposed it to be composed of a congeries of ligaments. It is most developed in the lumbar region, where it presents a convex surface, passing from the margin of one vertebra to that of another. It is composed of white and shining fibres, arranged in laminæ of different thickness, but in a very regular order; the most superficial ascend from left to right parallel to one another, when these are removed, a deeper layer is exposed, passing with the same regularity, but in a contrary direction ; deeper than this is a third, and then a fourth, the fibres of

each becoming more and more oblique, so that the internal are almost horizontal; the different laminæ intersect each other constantly, so that the texture appears very intricate. If this substance be divided by a horizontal section, its fibrous structure is very distinctly seen, the laminæ running in very regular concentric circles, each circle however is a little indented or concave posteriorly, corresponding to the form of the bodies of the vertebræ; the different laminæ adhere to one another so closely in some situations, particularly behind, that the laminated structure is occasionally indistinct, and the whole appears a compact mass; towards the circumference of the vertebræ these laminæ frequently assume a cartilaginous appearance, and in very advanced age are sometimes converted into bone. The internal laminæ are more delicate and soft, and are at a greater distance from each other; in the interstices between these a peculiar substance is placed, which is not so firm as cartilage or so fluid as mucilage; this substance increases towards the centre, where the fibrous structure is deficient, and in the very centre nothing is seen but a sort of mucleus of this gelatino-cartilaginous substance. *Uses.* The intervertebral ligaments unite the several vertebræ into one elastic piece; they prevent too much flexion, extension, or lateral motion of the spine; by their elasticity also they restore the column to its proper length, when the weight of the body is removed.

Ligamenta Subflava, close those deficiencies which are observed in the skeleton, at the posterior part of the spine, between the crura of the spinous processes, on either side of the middle line; these ligaments are of a pale yellow colour, and possess great elasticity; they ex-

tend as far forwards as the oblique processes, the articulations of which they strengthen; they are attached superiorly and inferiorly to the opposite margins of the crura of the spinous processes, they converge posteriorly so closely, that nothing separates the ligaments of opposite sides, except a narrow fissure, which contains a little cellular membrane. These ligaments are very weak and imperfect between the first and second vertebræ, but are of considerable strength between all the others, particularly in the lumbar region. *Use;* to complete the spinal canal posteriorly, and to resist too much flexion of the vertebral column.

Interspinous Ligaments, or Membranes, are posterior to the ligamenta subflava; they are *attached* to the upper and lower margins of each spinous process, from its base to its apex; between the lumbar vertebræ they are very thick, but in the neck and back very thin. *Use,* like the interrosseous membranes in the forearm and leg, they present an extensive surface for the attachment of muscles; they also connect the spinous processes to each other, and separate the muscles of opposite sides.

Supra Spinous Ligaments. These connect the summits of the spinous processes of the vertebræ; they consist of strong fasciculi, which pass from one spinous process to another, the deeper fibres are short, and adhere to each process, but the superficial pass without interruption over several processes, and are of considerable length, they receive additions from the tendons of the longissimus dorsi muscle: in some situations these ligaments are very strong, and nearly as hard as cartilage.

Intertransverse Ligaments. These ligaments are seen most distinctly between the transverse processes

of the inferior dorsal vertebræ, they pass from the extremity of one to that of another; there is also between the transverse processes of all the vertebræ a membrane similar to that between the spinous processes, which serves the same purpose, namely, that of giving attachment to muscles.

Ligaments of the Oblique Processes. Each vertebra is articulated with that below and with that above by the oblique processes, the articulations between which are secured by a synovial membrane and a capsular ligament, the latter is composed of strong and short fibres, which are *inserted* into the circumference of each process; these permit but little motion, except between the first and second vertebræ, the oblique articulations between which are very large, and these ligaments are loose, the processes themselves too are more horizontal, hence rotatory motion can occur to a greater extent between the atlas and dentatus than between any other two vertebræ.

Ligaments between the last Lumbar Vetebræ and the Sacrum. The sacrum is connected to the last lumbar vertebra in the same manner as any two vertebræ are to one another, namely, by the anterior and posterior longitudinal, by the intervertebral, the interspinous, and intertransverse ligaments.

LIGAMENTS OF THE THORAX.

UNDER this head I shall place, 1st, The ligaments of the ribs; 2ndly, Those of the sternum; and 3dly, Those of the ensiform cartilage. The ribs are articulated to the bodies and transverse processes of the vertebræ, also to the sternum by their cartilages; these too are connected to one another. The ribs are con-

nected to the bodies of the vertebræ, by the following ligaments.

1st. *Capsular Ligament arises* from the edge of the head of the rib, and as it is divided into two articulating surfaces, so this ligament divides into two fasciculi, which are *inserted* one into the vertebra above, and the other into that below; the fibres extend along these bones for some way, and mix with their anterior common ligament.

2nd. *Interarticular* or *Intervertebral Ligament arises* from the central projecting angle on the head of each rib, and is *inserted* into the intervertebral substance. This ligament is deficient on the first and two last ribs; the capsular ligaments also of these three ribs consist of only one fasciculus of fibres, as each has but one articular surface on its head, and is connected to one vertebra only. The ribs are attached to the transverse processes by three strong ligaments, one is seen externally, the others internally, under the pleura.

1. *External transverse Ligament arises* from the extremity of the transverse process of each vertebra passes nearly outwards, and is *inserted* into the posterior tubercle of each rib close to its articulation with that process; the superior ligaments are shorter than the inferior, the latter also descend a little.

2. *Internal transverse Ligament* is of a rhomboid figure, *arises* from the superior margin of the neck of each rib, midway between its head and tubercle, its strong and parallel fibres ascend obliquely outwards, and are *inserted* into the transverse process immediately above: the external margin of each of these ligaments is connected to the fascia of the intercostal muscles; these ligaments are longer at the lower than at the

upper part of the thorax. Behind each of these we find the following ligament.

3rd. *External Ligament of the Neck of each Rib* (or posterior transverse.—*Tr.*) *arises* from the upper margin of the neck of each rib, behind the last described ligament, ascends obliquely inwards in a contrary direction to it, and is *inserted* into the root of the transverse process of the vertebra immediately above; this ligament is absent from the first rib, and very weak on the two last. *Use.* These five ligaments serve to connect the posterior extremity of the ribs very firmly in their situation, and prevent displacement or too much motion taking place; they particularly resist too much depression of the ribs; they are all relaxed during inspiration.

" *Accessory Ligaments*" These are very irregular, and are only to be seen on the inferior ribs; they consist of fasciculi of fibres, which pass from the transverse processes to the external transverse ligaments; similar fibres also arise from the transverse processes of the first and second lumbar vertebræ, expand in a radiated direction, and are inserted into the last ribs, the quadratus lumborum muscle is connected to these fibres.

The seven superior ribs are joined to the sternum by cartilages; these are connected to the ribs by symphysis and to the sternum by strong ligamentous bands, which cover fine synovial membranes; these bands are short on the upper and lower border of each articulation, and are very long anteriorly and posteriorly; they are much stronger on the lower than on the upper ribs; those on the three or four superior cartilages are transverse, but, as the inferior cartilages form more acute angles with the sternum, so these

fibres became more oblique or radiated, and those of opposite sides decussate. The cartilages of the ribs are joined to one another, not only by the intercostal muscles, but also by a fine membrane, the fibres of which are nearly perpendicular and decussate the oblique fibres of the intercostal muscles. This aponeurosis does not exist in the two first intercostal spaces, it is also deficientin the two or three last.

The upper part of the sternum receives some ligamentous fibres from its articulations with the clavicles, and during its entire length it derives some from the cartilages of the ribs. This bone is found to consist of two and sometimes of more pieces in the early periods of life, which are then easily separated, being only joined by cartilage and ligamentous fibres ; in old persons, however, they are often united into one bone. The sternum is 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, which can be separated into laminæ, the fibres of one decussating those of another; some fasciculi extend beyond the margins of the sternum to be 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 principally take a longitudinal course.

The ensiform cartilage is connected to the sternum by the last described aponeurosis, which is produced over both its surfaces; also by a strong ligament which *arises* from the middle of its anterior surface, ascends and divides into two portions, which diverge, and are *inserted* into the cartilage of the seventh rib

on each side; these ligaments sometimes consist of several distinct fasciculi; they serve to retain the ensiform cartilage in its situation against the efforts of the abdominal muscles, particularly the recti.

LIGAMENTS OF THE BONES OF THE PELVIS.

UNDER this head I shall describe the ligaments of the ossa innominata, of the sacrum and coccyx. These ligaments are usually arranged into two orders. 1st, Those connecting the sacrum and coccyx to the spine and to one another; and 2dly, those connecting the ossa innominata to the sacrum and coccyx, and to one another. I think it, however, more convenient to adopt the following order: 1st, Those which are seen on the external surface of the pelvis; and 2ndly, Those which are found in its cavity.

1. *Long posterior Ligament of the Ossa Ilii,* (or long ilio-sacral ligament.—*Tr.*) This compact and thick fasciculus of fibres *arises* from the superior posterior spinous process of the ilium, descends obliquely inwards, and is *inserted* into the fourth transverse tubercle of the sacrum. *Use,* to strengthen the ilio-sacral symphysis, although it does not adhere to it.

2. *Short posterior Ligament,* is covered by and *arises* in common with the former, it is *inserted* into the third tubercle of the sacrum. *Use,* the same as the last.

3. *Posterior Lateral Ligament.* This narrow ligament *arises* from the internal surface of the same spinous process of the ilium, descends obliquely inwards, and is *inserted* into the lower margin of the first bone of the sacrum; beneath this ligament is a

large opening, through which the tendons of the sacro-lumbalis and spinalis dorsi muscles with some adipose substance and blood-vessels pass. *Use ;* to cover these, rather than to strengthen the articulation.

4. *Great Sacro-sciatic Ligament,* is of a triangular figure, situated at the lower and posterior part of the pelvis; it *arises* broad from the fourth and fifth tubercles of the sacrum, from the margin of the inferior portion of this bone, and from the first piece of the coccyx, the fibres pass forwards and outwards, converge, and are *inserted* narrow into the internal margin of the tuber ischii; connected to the upper edge of this ligament is a broad aponeurosis which ascends, covers, and adheres to the posterior long ligament; and from its lower edge a long falciform process is continued forwards, and is *inserted* into the ramus of the ischium; these processes or additions to the upper and lower margins of this ligament, may be named the " inferior" and " superior appendices :" the inferior appendix is seen most distinctly from the cavity of the pelvis.

The coccyx is connected to the sacrum by a strong aponeurosis, 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 of the coccyx ; there is also a capsular ligament between the extremities of the sacrum and coccyx.

" *Superior Anterior Ligament of the Pelvis,*" (or superior ilio-lumbar.— *Tr.*) On removing the psoas magnus muscle, this ligament is seen; it is of a triangular figure, its apex is attached to the upper edge of the ilium, and its base to the transverse processes of the two last lumbar vertebræ ; it runs transversely from

one point to another, and is longer above than it is below; the quadratus lumborum muscle is attached to it:—it is perforated by several vessels.

"*Inferior Anterior Ligament,*" (or inferior ilio-lumbar.—*Tr.*) is inferior to the former, has nearly the same attachments, and runs the same course.

"*Ilio-sacral symphysis.*" The opposed surfaces of the ilium and sacrum may be each divided into two parts, an anterior, incrusted with cartilage for mutual connexion; and a posterior, rough and irregular, giving attachment to strong ligaments that 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.

"*Internal or lesser Sacro Sciatic Ligament,*" has nearly the same origin as the great sciatic, on the pelvic surface of which it lies; it *arises* from the margin of the sacrum and coccyx; the fibres pass forwards, outwards, and downwards, converge, and are *inserted* into the spinous process of the ischium. The sacro-sciatic ligaments descussate about their centre, and assist in bounding the two openings at the back of the pelvis, which extend from the excavation beneath the posterior inferior spinous process of the ilium to the spine of the ischium; these ligaments also give origin to some fibres of the levator ani and coccygeus muscles.

Symphysis of the Ossa Pubis. The cartilaginous surfaces of these bones are surrounded by a strong ligamentous substance, which in the adult subject forms a considerable projection on the internal surface; inferiorly it is thinner, and presents a concave or arched appearance over the urethra. The ancient writers deny

that these bones can separate in the least from one another in case of laborious parturition. I have, however, presented to the academy in the year 1731, the ossa pubis of a female, shortly after parturition, which could be easily divaricated, and when this encircling ligament was simply divided the bones completely separated.

Membrane of the Thyroid Hole. Is a fine, smooth, but tense membrane, attached to the circumference of this opening, it consists of two laminæ, an external and an internal : the external is *inserted* into the external border of this opening, except at the lower part, where it is attached to its inner border, so as to leave a remarkable depression on the surface; the fibres of this lamina run in all directions, some are continuous with those on the symphisis pubis. The internal lamina is *inserted* into the internal edge of the opening, and is closely connected to the external layer below, but loosely above; the obturator nerve and vessels pass out of the pelvis through the upper part of this opening in a sort of groove or channel which is bounded below by this ligament and above by the pubis on the inside of the acetabulum. *Use.* These membranes cannot strengthen the pelvis, they only serve to give origin to, and to separate from each other, the internal and external obturator muscles.

Ligament of Fallopius, or Poupart. Poupart was the first who described this ligament; it was known, however, to Fallopius; Morgagni and Heister consider it as the tendon of the external oblique muscle. I concur with Winslow in considering it as a distinct ligament, *arising* from the anterior superior spinous process of the ilium, and *inserted* into the superior border of the ossa pubis ; to its upper edge the abdo-

minal muscles are attached, and to its lower the fascia lata of the thigh; it is subtended like an arch across the cavity between the spine of the ilium and the pubis. I consider this as a distinct ligament rather than the tendon of the external oblique muscle, because, 1st, It surpasses the tendon in thickness; 2ndly, The direction of its fibres differs from that of the aponeurosis of the muscle; 3rdly, It remains perfect even after the muscles are removed; and 4thly, It serves as the fixed point or origin for the internal abdominal muscles. *Use.* It answers the same purpose as bone, namely, that of affording the abdominal muscles a fixed attachment in this situation, and protecting the femoral vessels and nerves as they leave the pelvis along with the psoas and iliac muscles.

LIGAMENTS OF THE INFERIOR EXTREMITIES.

THESE may be arranged in the following order: —1st, The ligaments connecting the femur to the acetabulum; 2ndly, Those between the femur and the bones of the leg; 3rdly, Those between the tibia and fibula; 4thly, Those connecting the foot to the tibia and fibula; 5thly, Those between the bones of the tarsus; 6thly, Those of the metatarsus; 7thly, Those of the phalanges of the toes; 8thly, Those of the sesamoid bones; and 9thly, Those of the tendons of the foot.

ARTICULATION OF THE FEMUR AND ACETABULUM.

THIS is one of the strongest articulations in the body, while at the same time it enjoys great freedom of motion, consequently it requires powerful ligaments; it has re-

ceived the name of " Enarthrosis ;" its security depends upon the following ligaments ; the capsular, the round or interarticular ligament, and the ligamentous apparatus, proper to the acetabulum, and which shall be first described.

1. *Internal cartilaginous Ligament of the Acetabulum*, (or glenoid ligament.—*Tr.*) This strong ligamento-cartilaginous substance is attached to the whole circumference of the acetabulum, except at its internal and inferior part, where the bony margin also is deficient ; this ligament in some parts appears attached to the cartilage which lines the cavity, but in others is distinct, and separated from it by a narrow fissure ; it projects to a considerable distance beyond the bone, so as to deepen the acetabulum very much ; it is most strong and dense externally and superiorly.

2. *External Ligament of the Acetabulum.* This strong band of fibres is situated at the lower and internal part of the acetabulum, where the last described ligament is deficient ; it *arises* from the pubis, where this bone forms the sinus over the obturator ligament ; as it descends it becomes narrow, and is *inserted* into the ischium or inferior margin of the notch in the acetabulum ; this ligament is superficial to the former, and in some degree decussates it ; between both an oblique fissure is left for the passage of vessels to and from the cavity of the joint.

3. *Adipose Ligaments,* are ligamentous bands, which confine the adipose and gland-like substance, which fills up the depression in the lower part of the acetabulum : two of these bands are more remarkable than the others, they cross this substance, converge, and are inserted into the superior margin of the depression.

4. *Capsular Ligament.* This ligament, which surrounds the whole articulation, surpasses all similar ligaments in strength, extent, and capacity; it bears some resemblance to the capsular ligament of the shoulder joint, but differs from it in not being perforated by any tendons, and in not having any muscle, except the glutæus minimus, adhering very closely to it; several muscles however pass over it; namely, in front the psoas, iliacus, and rectus; externally, the glutæus minimus; internally, the pectinæus and obturator externus; posteriorly, the obturator internus, quadratus femoris, pyriformis, and gemelli. The pelvic, or superior extremity of this ligament, surrounds the entire border of the acetabulum and its proper ligaments, but is not attached to either; for it *arises* at a considerable distance from the margin of the cavity, particularly in front, where it extends as far as the inferior spinous process of the ilium; but the synovial membrane, which lines this, passes but a little beyond the ligamentous border. The capsule is *inserted* inferiorly into the femur; it embraces the neck of this bone, and descends anteriorly as far as the anterior intertrochanteric line; it is very strong in this situation, except immediately beneath the psoas and iliac muscles; posteriorly it is shorter and weaker; externally and superiorly it is still shorter than in any other situation; the superficial fibres are the longest, and mostly take a longitudinal course. The synovial membrane does not descend so low as the external, but is reflected on all sides up towards the head of the bone; in this course it is bound by folds or retinacula, and immediately behind the head of the femur it is confined by circular bands.

Accessory Ligament is a fasciculus of fibres, which

arises from the anterior inferior spinous process, and the adjacent surface of the ilium, it takes an oblique course over the capsule, towards the lesser trochanter, near which it is *inserted ;* this ligament adds considerable strength to this part of the capsule, which in this situation is still further strengthened by the iliacus muscle, the fascia lata, and that portion of the tendon of the rectus which is concealed by the glutæus minimus.

Round or Interarticular Ligament is perfectly concealed in the cavity of the acetabulum; it is rather of a triangular or prismatic form, one edge of it looks upwards, another downwards, and the third is lost in the adipose substance ; it becomes rounder and more contracted as it approaches the depression in the head of the femur, into which it is *inserted.*

LIGAMENTS OF THE KNEE JOINT.

Internal lateral Ligament, arises narrow from the upper part of the internal condyle of the femur, descends perpendicularly, and is *inserted* broad into the tibia ; the breadth of this ligament is increased by its marginal attachment to the aponeurosis of the vastus internus muscle, which is expanded over the tendons of the sartorius, gracilis, and semitendinosus, beneath which this ligament lies. ·Behind the internal lateral ligament another ligamentous band is seen, reflected round the tendon of the semimembranosus muscle and adhering to the convex edge of the internal semilunar cartilage.

External lateral Ligament, is a thick, round cord, *arising* from a tubercle on the upper part of the external condyle, immediately above the groove which

lodges the tendon of the poplitæus muscle; it is attached to the convexity of the external semilunar cartilage, and is *inserted* into the fibula a little below its head; this extremity is embraced by the tendon of the biceps muscle, which is thus divided into two by this ligament. *Use.* The lateral ligaments connect the femur to the tibia and fibula, prevent any lateral displacement, preserve the bones at an equal distance in flexion and extension, but do not prevent the rotation of the tibia beneath the condyles of the femur.

Short external lateral Ligament, arises from the lowest part of the external condyle of the femur; as it descends it adheres to the external semilunar cartilage, and to the synovial membrane, and is *inserted* into the head of the fibula; it is often indistinct, at least at its origin. *Use;* to confine the external semilunar cartilage in its situation.

Capsular Membrane, is of great extent, it is attached superiorly to the femur, anteriorly to the patella, inferiorly to the tibia, and to the semilunar cartilages. It ascends upon the anterior surface of the femur, above the hollow for receiving the patella; on either side it lines the tendon of the extensor muscles; it is attached to each condyle above their incrusting cartilage; but posteriorly it approaches nearer to the joint than anteriorly, anterior to the femur it expands, adheres to the surface of the patella, and to the surrounding adipose substances; it then contracts, as it descends it adheres to the tendon of the patella, the semilunar cartilages, and to the ligaments within the joint, and is reflected over the articulating surface of the tibia, in the same manner as on that of the femur and patella. It is very loose on either side, but very tense posteriorly, where it adheres inti-

mately to the tendons of the gastrocnemii, plantaris, and poplitœus muscles, also to the posterior crucial ligament; these connexions, as well as those to the lateral ligaments, serve to retain this membrane towards the parietes of the joint, and preserve it when the latter is flexed, from being compressed between the bones.

Accessory Ligaments. The synovial capsule of the knee, which in itself is very fine and weak, receives considerable strength from an aponeurosis, which is derived from the fascia lata, and which receives additional fibres from the tendons of the biceps, vastus internus, and externus; this aponeurosis adheres to the condyles of the femur, and to the edges of the patella, where it is very strong, it also passes over this bone, but is there very thin; beneath this, however, we find that the patella is still covered by an expansion from the rectus, and by some fibres which adhere closely to the bone, and which appear to belong to the ligamentum patellæ. The synovial membrane is also covered by adipose substance in many places, and on each side we find it strengthened by strong fibres, which pass from the condyles of the femur, to the edge of the patella; the gastrocnemii muscles and the sheath of the poplitœus, and the following ligament, also strengthen it posteriorly.

Posterior Ligament of Winslow. This very principal accessory ligament covers the synovial membrane posteriorly; it is about half an inch broad, and from two to three inches long; it *arises* from the tendon of the semimembranosus muscle, extends upwards and outwards, and is *inserted* into the external condyle. *Use.* It can be of but little service in connecting the femur to the tibia, it rather serves to separate the gas-

trocnemii and plantaris muscles, from the synovial membrane, and to support the latter; it is generally perforated by blood-vessels.

Alar Ligaments, are only duplicatures of the capsular membrane, on each side of the patella, converging below towards the adipose substance inferior to this bone, and which these folds serve to compress; the *internal* is the longer, and is named the great alar ligament; the *external* is the lesser.

Mucous Ligament, arises from the lower part of this adipose substance, and is itself composed in part of adeps, enveloped in the fold of the capsular membrane; it passes upwards and backwards, and is *inserted* into the anterior depression, between the two condyles, but very near to the external, and in front of the anterior crucial ligament. Winslow thinks it proceeds from the patella, I have always, however, found it attached to the adipose substance only.

Crucial Ligaments. These strong ligaments extend from the femur to the tibia; they decussate one another, hence their name; the posterior is the larger, and is seen in the poplitœal space; the anterior is exposed by throwing down the patella, and removing the ligamentum mucosum; their insertions into the femur and tibia are very close.

Posterior Crucial Ligament arises from the depression between the two condyles of the femur, but nearer to the internal, and is *inserted* into the groove on the tibia, behind the spine, which separates its two articulating cavities.

Anterior crucial Ligament, arises from the same depression, but close to the external condyle, and is *inserted* into the tibia anterior to its middle spine. *Use.* To regulate the motion of the joint; the anterior prevents too much extension, the posterior too much flexion;

for, in extension the anterior one is made tense, its superior attachment being elevated and carried backwards; while in flexion, the insertion of the posterior is brought forwards, and thus this ligament is put upon the stretch, whereas in this position the femoral attachment of the anterior is depressed so as to cause the relaxation of this ligament.

Ligaments of the Semilunar Cartilages. These two cartilages are connected by their convex edges to the capsular membrane, and to the lateral ligaments; their cornua become ligamentous, and are *inserted* into the tibia.

External Semilunar Cartilage. Its anterior cornu is *inserted* into the tubercle of the tibia, along with the anterior crucial ligament; the posterior cornu is *inserted* broad into the depression behind the spine or tubercle; from the back part of this cartilage also a ligament *arises,* which joins the posterior crucial ligament, and is *inserted* into the femur.

Internal Semilunar Cartilage. Its anterior cornu is *inserted* into the anterior margin of the tibia, the posterior into the depression behind the spine, along with the posterior crucial ligament.

Transverse Ligament, extends across the anterior part of the tibia, its extremities are attached to the convexities of the two semilunar cartilages, its centre to the ligamentum mucosum. *Use.* It confines the adipose substance in its situation, also the cartilages; but it does not impede their slight motion upon the tibia, which favours the general mechanism of the joint.

LIGAMENTS BETWEEN THE TIBIA AND FIBULA.

THESE bones are attached to each other at their extremities, by a sort of cartilaginous symphysis,

which only admits of a little yielding, but of no perfect motion : these bones are still further connected by ligaments at either end, and by the interosseous membrane along the centre.

Ligaments of the Head of the Fibula. The cartilaginous symphysis at the upper end of the bone is covered by a *capsular ligament,* which is continuous with the periosteum, and is strengthened by strong fibres ; these appear anteriorly like a distinct ligament. This articulation is also secured by the external lateral ligament of the knee joint, and by the tendon of the biceps muscle, part of which passes from the fibula to the tibia.

Interosseous Ligament, resembles that between the radius and ulna ; its fasciculi descend obliquely from the tibia to the fibula, and leave between them small openings for blood-vessels ; these fibres are occasionally crossed by bands, which run in a different direction. This ligament cannot be so perfectly divided into two laminæ as that in the forearm ; it is deficient superiorly, where the tibialis anticus in front, and the tibialis posticus, and soleus muscles behind, fill up the angle between the heads of the tibia and fibula. *Use.* To connect the two bones, and to afford a broad surface for the attachment of the extensor muscles in front, and the flexors behind.

Ligaments of the lower end of the Fibula, are an *anterior* and *posterior,* each of which may be divided into a superior and an inferior.

Superior Ligaments, are attached to the fibula and tibia, where these two bones are in contact ; the anterior has a triangular form, the inferior fibres being the shortest.

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, and descend so low as to rest against the astragalus. *Use.* 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 CONNECTING THE FOOT TO THE BONES OF THE LEG.

THE foot is articulated to the leg by means of the astragalus and os calcis; strong ligaments pass from the malleolus to the bones of the tarsus; there is also a capsular membrane for the entire articulation.

Ligaments between the Fibula and Tarsus. These are three in number, a middle, a posterior, and an anterior. The *middle* is a dense fasciculus of fibres, which *descends* perpendicularly from the lowest point of the fibula, and is *inserted* into the side of the os calcis; this ligament is made tense in flexion of the foot, but is relaxed in extension. The anterior ligament passes from the point of the external malleolus forwards and inwards, and is *inserted* into the upper surface of the astragalus, it is broad and strong, its origin is covered by the anterior inferior tibio-fibular ligament; in flexion of the foot it is relaxed, in extension it is made tense. The *posterior* one is concealed by the tendo Achillis, it passes from the external malleolus horizontally inwards, and is *inserted* into the back part of the astragalus above its articulation with the os calcis.

This ligament appears sunk into a depression on the back part of the astragalus, and in some its superior and inferior edges are prolonged over the adjoining articulations.

Ligament between the Tibia, Os Calcis, Astragalus and Naviculare, or the *Deltoid Ligament, arises* from the inferior extremity of the internal malleolus, descends, and increases in breadth; its posterior fibres, which are thick and strong, are *inserted* into a depression on the internal side of the astralagus; the middle, into the os calcis; and the anterior, which are longer than the last, pass forwards, cover the capsular membrane of the ankle joint, and are *inserted* into the convex surface of the os naviculare. These anterior fibres are relaxed in flexion of the foot, while the posterior are then made tense, and *vice versa* in extension.

Capsular Membrane, covers the opposed surfaces of the bones which enter into this articulation, it is very loose, and is covered by much adipose substance anteriorly and posteriorly, and on either side by the internal and external lateral ligaments.

LIGAMENTS OF THE BONES OF THE TARSUS.

THE seven bones of the tarsus have but little motion between one another; 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. These ligaments may be arranged into eight classes, viz.: 1st, Those between the os calcis and astragalus; 2ndly, Those between the astragalus and naviculare; 3rdly, Those between the os calcis and naviculare; 4thly, Those between the os calcis and cuboides; 5thly, Those between the navi-

culare and cuboides ; 6thly, Those between the navi-
cular and cuneiform bones ; 7thly, Those between the
cuboid and internal cuneiform ; 8thly, Those between
the cuneiform bones.

1. *Ligaments between the Os Calcis and Astragalus.*
But little motion takes place between these two bones,
the tibia and fibula keep them in such close apposi-
tion. They are connected to each other by a capsular
membrane and by accessary ligaments.

Capsular Membrane, is connected to the opposed
articulating surfaces of the two bones; anteriorly and
posteriorly, this membrane is lax and covered by adi-
pose substance, but externally and internally it is very
tense, being closely covered by the lateral ligaments of
the ankle joint, and by the sheaths of the tendons.

Accessory Ligaments, are *inserted* into the opposite
sides of the groove which exists between the astra-
galus and os calcis; some of their fibres run perpen-
dicularly from one bone to another, and others
obliquely.

2. *Ligaments between the Astragalus and Os Navi-
culare.* This articulation is a species of enarthrosis,
and enjoys considerable motion, for the convex head
of the astragalus is received into a cavity in the os
naviculare, in which it is secured by a capsular mem-
brane and accessory ligaments.

The *capsular membrane* is more lax superiorly than
in any other situation, it is covered above and below
by strong ligaments, which pass from the astragalus
to the os naviculare, some fibres of these pass to a
great distance, and are continued even to the adjacent
bones ; this articulation also receives some security
from the deltoid ligament.

3. *Ligaments between the Os Calcis and Naviculare.*

Superiorly we find two ligaments connecting these bones; the first is broad and thin, and passes from the upper part of the extremity of the os calcis to the adjacent external side of the os naviculare; when this ligament is removed we observe another, which of course is deeper seated, this is thick and of a prismatic figure; it takes the same oblique course, and is inserted into the os naviculare, some fibres are also inserted into the astragalus : these bones are also connected laterally and inferiorly by the following ligament :— *the Trochlea :* I apply this name to a substance of a cartilaginous structure, which *arises* from the lower and internal edge of the os calcis, and is *inserted* thin and membranous into the margin of the os naviculare ; the trochlea supports the side of the head of the astragalus, and also affords a convenient passage for the tendon of the tibialis posticus muscle, the sheath of which adheres to this trochlea; below this are two ligaments which proceed from the depression on the upper surface of the os calcis to the edge and tubercle of the os naviculare.

4. *Ligaments between the Os Calcis and Cuboides.* These are a capsular membrane and superior and inferior ligaments. The *superior ligaments* are two superficial and one deep ; the *superficial* are two or three lines broad, they pass from one bone to the other, their external fibres are the longest; the *deep ligament* passes in like manner from one bone to the other, and lies beneath the superficial internal fibres. The *capsule* is covered externally by a ligament similar to the superficial one above. The *inferior ligaments* are three in number; the 1st, or the *long ligament,* is the strongest, it is triangular, and *arises* from the inferior surface, and partly from the external border

of the os calcis, it passes forwards, and is *inserted* into the tubercle on the inferior surface of the os cuboides, where some of its fibres join the muscles of the little toe. Internal to this is the second of these ligaments, which may be named the *oblique ligament ;* and beneath both these is the third or *rhomboid ligament,* the transverse fibres of which are very distinct. *Use.* These three ligaments bind the os calcis to the bones of the tarsus so firmly that little or no motion can take place between any of them, except between the astragalus and navicular; the rhomboid ligament also prevents the foot from being twisted too much inwards.

5. *Ligaments between the Navicular and Cuboid Bones.* These bones are in close contact at one point only, where no capsular membrane even intervenes, elsewhere there is a slight interstice between them, which is filled by three strong ligaments. One consists of transverse fibres, which connect the superior surfaces of these bones; the second occupies the space between them, this is a dense ligamentous substance, whose fibres pass irregularly from one bone to another; the *third* is a round, weak, loose ligament, it proceeds from the inferior surface of one bone to that of the other; this ligament can have but little effect in connecting these bones, it rather serves to bind down the adipose substance, and the deep-seated muscles in this situation.

6. *Ligaments between the Navicular and Cuneiform Bones.* These ligaments are seen on the dorsum of the foot, they pass from the convex surface of the navicular to that of the three cuneiform bones ; they are not very distinct from each other. On the internal side of the navicular and internal cuneiform bone there exists a

fasciculus of fibres, which may be named the lateral ligament : the mention of the two last-named bones leads me to digress from the description of the remaining ligaments for the purpose of offering a few remarks on the tendon of the tibialis posticus muscle. This tendon, after passing the cartilaginous trochlea before described, enters into a short canal, which conducts to the angle of the navicular bone, into which the tendon and its sheath are inserted ; from this bone, however, a short fasciculus of each are continued forwards, and are inserted into the internal cuneiform bone; these processes of this tendon serve as strong connecting ligaments between the navicular and the internal cuneiform bones.

7. *Ligaments between the Cuboid and external Cuneiform Bones.* These bones are connected together on the dorsum of the foot by strong ligamentous bands, which pass from the edge of one bone to that of the other ; and in the sole of the foot there are four strong ligamentous fasciculi, which pass from the cuboid bone in different directions to the external cuneiform.

8. *Ligaments between the Cuneiform Bones.* These bones are in such close and exact apposition that there is but little necessity for ligaments ; a capsular membrane covers the articulating surface of each ; and on the dorsum of the foot ligamentous bands pass transversely from one to the other.

Ligaments of the Metatarsus. The metatarsal bones are connected to the cuboid and cuneiform bones, they are also attached to one another at their posterior extremities; that of the great toe is articulated with the internal cuneiform by a capsular membrane, which is covered superiorly by a broad ligament that passes from one of these bones to the other ; a similar

ligament exists inferiorly. The base of the second metatarsal bone is also furnished with a capsular membrane, and superiorly with ligaments which connect it to the three cuneiform bones; inferiorly also it is attached to the internal cuneiform bone by a strong ligament, and by two lateral ligaments to the middle cuneiform bone. The third metatarsal bone is connected in the same manner to the external cuneiform bone. The fourth and fifth are articulated to the cuboid bone by capsular membranes and similar accessory ligaments; the fifth is the most moveable of all the metatarsal bones. The three external metatarsal bones are joined to one another by transverse ligaments on their dorsal and plantar surfaces, also by interosseous ligaments. The dorsal ligaments are three, and pass from the base of one metatarsal bone to that of another. The lateral or interosseous ligaments pass from the base of one metatarsal bone obliquely forwards, and are inserted into the side of the adjoining bone. The plantar ligaments are stronger and thicker than the dorsal, but have similar attachments and courses; they are all covered by one common transverse plantar ligament, which is attached to the bases of the fifth and second metatarsal bones.

The anterior extremities or heads of the metatarsal bones are also joined together by ligaments, which pass from one bone to the other.

Ligaments of the Phalanges of the Toes. The first phalanges are connected to the metatarsal bones by capsular membranes and lateral ligaments. The *capsular membranes* are very thin on the dorsum and sides, but inferiorly they are defended by a firm cartilaginous structure, which favours the passage of the flexor ten-

dons, and renders the foot more firm and resisting. The *lateral ligaments arise* from depressions in the metatarsal bones, their fibres diverge, and are *inserted* into the sides of the first phalanges, and into the firm substance which covers this articulation inferiorly.

Beneath the articulation of the first phalanx and the metatarsal bone of the great toe, there is a solid substance, containing two *sesamoid bones;* these have one surface flat, which rests on the head of the metatarsal bone, and is confined there by the capsular membrane and lateral ligaments; they also adhere to the flexor tendons of the great toe, and they are connected to one another by a dense substance, which forms a sort of trochlea for the flexor tendon. From the anterior surface of these bones, two ligamentous productions proceed, which extend along the first phalanx of the great toe, they converge at first, but afterwards they separate, and are lost on the sides of this bone; they have an intimate connexion with the tendon of the flexor pollicis and its sheath, and serve as ligaments to connect the sesamoid bones to the first phalanx.

The Tendons of the Foot are provided with nearly the same ligaments and sheaths as those in the hand, for the purpose of confining them in their situation, and directing them in their proper course; thus the tendons which pass in front, and at each side of the ankle joint, are firmly secured by tendinous sheaths which are inserted into the adjacent bones and ligaments; anteriorly, the tendons of the tibialis anticus, extensor pollicis, extensor communis, and peronæus tertius, are all bound down by a strong annular sheath, whose fibres take a circular direction, and terminate abruptly below, where the tendons are seen distinctly,

being there only covered by the common fascia or sheath of the limb, which is attached internally to the tibia, externally to the fibula, and is continued round as far as the border of the tendo Achillis. The tendons of the long and short peronæi are confined by strong sheaths behind the external ankle, and the tendons of the tibialis posticus, flexor communis, and flexor pollicis, are secured in a similar manner behind the inner ankle.

Plantar Aponeurosis, is composed of strong and close ligamentous fibres; it extends beneath the skin and fat from the inferior posterior tubercle of the os calcis as far as the first phalanges of the toes; it is narrow posteriorly, near the phalanges it expands and divides into separate parts, which are lost on the adjacent tendinous sheaths; near these divisions the fascia is strengthened by transverse fibres; this aponeurosis receives additions on either side from the fascia covering the muscles of the great and little toe.

The tendons of the flexor perforans pass through those of the perforatus, and are confined each by a strong ligamentous sheath, which extends along the phalanges in the same manner as in the hand; these sheaths also are strengthened by circular or annular bands, and circular fibres at different situations. On the side of each articulation of the phalanges with the metatarsal bones, a fascia is sent off from the extensor tendon; it is composed of strong and glistening fibres, which run towards the sole of the foot, and unite with the remains of the plantar aponeurosis, and with the tendons of the interossæi muscles; these fasciæ are of great service in retaining the extensor tendons in their proper situation.

On opening the sheaths of the flexor tendons,

we perceive that the latter are confined and regulated in their motions by bands or ligaments similar to those on the fingers; the same dense structure exists also in the integuments along the side of the toes, as has been described under the name of cutaneous ligaments of the fingers.

FINIS.