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The Region of the Shoulder

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THE REGION OF THE SHOULDER.

THE UPPER EXTREMITY.

The region of the shoulder is formed by the clavicle, the scapula, and the upper part of the humerus (Plate 28), together with the structures surrounding them, by which the upper extremity is attached to the thorax. The skin over this region is comparatively thin, and although there may be a considerable amount of fat in the subcutaneous tissue in certain localities, which softens and subdues the surface markings, yet the prominences of the bony framework can always be detected by the sense of touch. The clavicle, the acromion process, and the spine of the scapula are readily felt through the skin. In order to determine with accuracy these landmarks it is advisable to refer to the corresponding points of the opposite shoulder, and to take advantage of the extreme mobility of the parts, for by rotation, abduction, and adduction many factors otherwise obscure will be explained. The clavicle and the scapula are the framework of the shoulder proper, and with those of the opposite side form the shoulder girdle. This girdle is incomplete posteriorly, owing to the gap between the two scapulae, which are connected with the thorax solely by muscles, while in front the two clavicles are supported upon and connected with the top of the sternum. The shoulder girdle is remarkable for its lightness and great mobility.

The clavicle, or collar bone, is the long irregular bone which extends from the sternum outward over the first rib to the summit of the shoulder, which it forms with the acromion process of the scapula (Plate 28). In the upright position the clavicle usually inclines a little upward at its outer end, and in the recumbent position this is increased in consequence of the weight of the limb being removed. It is subject to variable physical proportions, much depending upon the amount of strain and effort required of the muscles which are attached to it. In the female it is usually smoother and more slender than in the male. The right clavicle is often shorter than the left. The bone presents a peculiar sigmoid curvature, so that the anterior border begins by curving forward at the sternal end, and at
the middle gradually curves backward to the acromial end, where it juts outward. The posterior border is exactly the reverse. The degree of curvature of the inner portion of the clavicle is very variable, especially in men, the freedom and much of the grace of movement of the upper extremity depending upon it. The sternal end is a prominent, rough, thick, triangular-shaped process covered with a dense fibrous tissue. It is provided with an irregular facet, which at its lower part rests upon the shallow facet on the upper border of the sternum, and with the interposition of a disk of fibro-cartilage establishes the important sterno-clavicular joint. This joint is provided with two pouches of synovial membrane, one above and the other below the interarticular cartilage, enclosed within a capsular ligament, of which there are two strong bands of fibres, one stretching in front of and the other behind the surfaces of the contiguous bones. They are called respectively the anterior and posterior sterno-clavicular ligaments. These bands are reinforced by the interclavicular ligament, which is in reality a differentiation of the deep cervical fascia extending between the ends of the two clavicles across the top of the sternum, and the costo-clavicular or rhomboid ligament, which ascends inward from the cartilage of the first rib to the costal tuberosity of the clavicle. This is now regarded as a differentiation of the sheath of the subclavius muscle. It is remarkably strong, and limits the elevation of the clavicle. Although the sterno-clavicular joint is the only direct connection between the upper extremity and the thorax, it is very rarely dislocated. It has been demonstrated that the peculiar sloping arrangement of the articular facets of this joint allows the sternum to advance slightly upon the end of the clavicle in inspiration (Morris). The acromial end is rough, broad, and flattened, and presents upon its under surface an obliquely-directed oval facet for articulation with the acromial process of the scapula, forming the claviculo-acromial joint. This joint is provided with superior and inferior ligaments, the superior being much the stronger, and a reflected synovial membrane. There is sometimes a rudimentary fibro-cartilage within. It is capable of very slight gliding motion, but, slight as this motion is, it is essential to the perfect freedom and harmonious movement of the upper extremity. This joint is liable to rheu-
matic inflammation, and the resulting rigidity will cause weakness in certain movements of the limb. Very often the outer end of the clavicle appears to be tilted above the acromion process, instead of occupying the same level. This is probably due to partial separation of the connecting ligaments from some severe strain. It is not attended with any impairment of function. The inner two-thirds of the shaft of the clavicle are rounded, and its posterior concave surface arches over the subclavian vein and artery and the cords of the brachial plexus of nerves (Plates 30 and 31).

The upper surface of the bone is smooth and subcutaneous, being readily recognizable through the skin, which is always thin and loosely attached over it. The anterior and posterior borders of the upper surface are roughened to a variable extent toward each end. The anterior border gives attachment to the pectoralis major muscle at its inner half, and to the deltoid muscle at its outer. The posterior border receives the insertion of the clavicular portion of the sternomastoid muscle (page 197) inwardly, and of the trapezius muscle outwardly (Plate 16). The under surface presents at the sternal end a small facet for the reception of the first rib, which is in reality a portion of the sternal articular surface. Close to the outer side of this is the rough costal tuberosity for the attachment of the rhomboid ligament, beyond which along the middle of the shaft is the subclavian impression for the subclavius muscle. The costo-coracoid membrane (page 255) is attached to the ridge in front of this impression and a reflection of the deep cervical fascia from the omohyoid muscle to a ridge behind it. Sometimes there is a rough line in the middle of the impression, in which case it affords insertion to a fibrous septum in the subclavius muscle.

Upon the under surface of the shaft, where it spreads out to form the acromion, there is at its posterior border an eminence called the conoid tubercle, from which an oblique line extends to the outer end of the anterior border. The conoid tubercle is directly over the coracoid process of the scapula, to which it is connected by the conoid ligament. The oblique line gives attachment to the trapezoid ligament, which arises from the coracoid process, the two ligaments being practically portions of one, the
PLATE 45.

Figure 1.
Dissection of the right axillary space and inner side of the arm to show the relation of the vessels and nerves.

1. The anterior ulnar vein.
2. The posterior ulnar vein and branches of the internal cutaneous nerve.
3. The median basilic vein.
4. The basilic vein.
5. The lesser internal cutaneous nerve.
6. The greater internal cutaneous nerve.
7. The triceps muscle.
8. The ulnar nerve.
9. The brachial vein.
10. The superior profunda artery and veins.
11. The intercosto-humeral nerve.
12. The latissimus dorsi muscle.
13. The dorsalis scapulae artery.
14. The sub-capular artery and veins.
15. The second sub-capular nerve.
16. The third sub-capular nerve.

17. The axillary glands embedded in adipose tissue.
18. The long thoracic artery.
19. The serratus magnus muscle.
20. The posterior humeral nerve, or external respiratory nerve of Bell.
21. The median vein.
22. The median cephalic vein.
23. The cephalic vein.
24. The biceps muscle.
25. The median nerve.
26. The brachial artery.
27. The coraco-brachialis muscle.
28. The deltoid muscle.
29. The cephalic vein.
30. The sternal portion of the pectoralis major muscle.
31. The right clavicle.
32. The severed trapezius muscle.

Figure 2.
Deep dissection of the right axilla and inner side of the arm. The deltoid and pectoralis major and minor muscles are detached and reflected to show the intricate relations of the brachial plexus of nerves to the artery and veins.

1. The fascia of the forearm and branches of the internal cutaneous nerves.
2. The median basilic vein.
3. The median nerve covering the brachial artery.
4. The anastomotic magna artery.
5. The lesser internal cutaneous nerve.
6. The greater internal cutaneous nerve.
7. The ulnar nerve.
8. The superior profunda artery.
9. The inferior profunda artery.
10. The triceps muscle.
11. The ulnar nerve, passing beneath the basilic vein.
12. The latissimus dorsi muscle.
13. Connecting venous link between the basilic and brachial veins.
14. The basilic vein before it empties into the axillary vein.
15. The axillary glands.
16. The intercosto-humeral nerve.
17. The sub-capular artery and veins.
18. The sub-capular nerves.
19. The blending of the veins of the forearm over the tendon of the biceps muscle.
20. The cephalic vein.
21. The biceps muscle.
22. The basilic vein.
23. The brachial artery.
24. The biceps muscle.
25. The median nerve.
26. The coracoid attachment of the biceps muscle.
27. The musculo-cutaneous nerve.
28. The thoracico-humeral artery.
29. The coraco-brachialis muscle.
30. The coracoid attachment of the severed pectoralis major muscle.
31. The inner cord of the brachial plexus of nerves.
32. The axillary artery.
33. The main brachial vein before its entrance into the axillary vein.
34. The brachial plexus of nerves.
35. The acromio-thoracic artery.
36. The severed pectorals major muscle, reflected.
37. The serratus magnus muscle.
38. The posterior thoracic nerve.
39. The short thoracic artery.
40. The great axillary vein.
41. The right clavicle.
42. The trapezius muscle.
coraco-clavicular ligament. They severally serve to restrain the movements of the shoulder. The curved formation of the clavicle renders it sufficiently elastic to compensate for its otherwise weak construction, so that it is capable of moderating the effects of ordinary concussions received through the shoulder. Its outer surfaces consist of compact tissue, which is much thicker at the middle of the bone, and the interior consists of large-meshed spaces of cancellous tissue containing reddish-colored marrow usually at the sternal end.

The clavicle is peculiar not only in that it is the first bone of the skeleton to ossify, but also in that ossification begins in its primary fibrous substance before the deposition of cartilage. At birth the entire shaft is bony, although the ends are cartilaginous. The sternal end is the sole epiphysis to the clavicle, and it is joined to the shaft about the twenty-fifth year. It is rarely separated from the shaft by accident, owing to the close ligamentous attachments of the sterno-clavicular joint, but the powerful pectoralis major muscle might produce displacement in a young person. This bone is frequently the seat of green-stick fracture, owing to the exceedingly thick and loose periosteum which surrounds it in childhood, as well as to its more early ossification. Fractures of the clavicle occur frequently at all ages, in consequence of the manner of its construction and its exposed position, and they are generally occasioned by indirect violence. The commonest form of fracture occurs at the outer end of the middle third of the bone, the resistance against concussion being weakened by the junction of the two curves of the bone at this point. The direction of the fracture is oblique, and whatever degree of displacement may occur is chiefly through the agency of the weight of the upper extremity upon the outer fragment, the inner fragment rarely changing its position. The outer fragment may also be drawn inward and somewhat rotated, so that it projects in advance of the inner, by the contraction of the muscles attached to the upper portion of the humerus and the coracoid process of the scapula. The great obstacle to the complete reduction of such a fracture is the inability to maintain the scapula in position, owing to the gliding movements which are caused by its suspension in a sling of muscles at the side of the thorax. All the ingenuity which has been
expended in devising apparatus to restrain the scapula has thus far failed, and consequently has been unsuccessful in overcoming the shortening of the bone in the process of repair. Union, however, usually occurs with marvellous rapidity (in from twelve to fourteen days), even when no dressing has been used, and with little impairment of function.

The scapula, or shoulder-blade, is a flattish, triangular bone, situated at the back of the upper part of the thorax, and, in the properly articulated skeleton, extending between the second and seventh ribs. It consists mainly of a broad thin plate, the body, with raised and roughened borders. Its dorsal surface is smooth and slightly convex, and is divided near its upper third by a prominent projection of bone, the spine, into two hollows, called the superior and inferior spinous fossae. The supra-spinous fossa lodges the supra-spinatus muscle, the fibres of which arise from its inner portion and from the dense fascia with which it is invested and converge to a strong tendon, which glides over the outer part of the fossa and across the capsular ligament of the shoulder-joint to be inserted into the superior facet on the greater tuberosity of the humerus. The infra-spinous fossa presents several faint ridges toward the vertebral border, from which and their interspaces the fibres of the infra-spinatus muscle arise, and blend to form a tendon which passes over the upper part of the axillary border, from which it is sometimes separated by a bursa, and across the capsular ligament of the shoulder-joint, to be inserted into the middle facet on the greater tuberosity of the humerus. This muscle is also firmly bound down by an enveloping fascia. The teres minor muscle arises from the upper two-thirds of the axillary border by fibres which pass obliquely upward and form a narrow elongated mass, which mostly terminates in a tendon to be inserted into the inferior facet on the greater tuberosity of the humerus, and by a few muscular fibres into the humerus immediately below. The tendon of this muscle also passes across the capsular ligament of the shoulder-joint. The teres minor muscle is separated from the contiguous muscles by fibrous laminae, which also give origin to some of its component fibres. About the centre of the attachment of the teres minor there is a groove in the axillary border, which accommodates the dorsalis scapulae vessels. The teres major muscle arises by fibres attached to the lower part of the axillary
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border, being separated by an oblique line from the preceding muscle, and by fibres extending over the inferior angle of the scapula. They form a broad mass which ascends outwardly, and, deviating from the teres minor, from which it is separated by the middle portion of the triceps muscle, is inserted by a flat tendon, about five centimetres, or two inches, in length, into the internal ridge of the bicipital groove of the humerus. The lower border of this tendon blends with the lower border of the latissimus dorsi muscle, forming the posterior boundary of the axillary space (page 338), and is inserted conjointly with it. The upper portion, however, is inserted independently, having a synovial bursa interposed between it and the proper attachment of the latissimus dorsi, which is at the bottom of the upper part of the bicipital groove. The latter muscle as it passes from its origin in the back (Vol. II.) crosses over the inferior angle of the scapula, to which it is usually attached by a fibrous expansion, so that it serves to retain this portion of the scapula in place. Occasionally there is no connection between the latissimus dorsi muscles and the two scapulae, they being separated by synovial bursæ. In such a condition the scapulae are apt to jut out like wings beneath the skin of the back.

The vertebral border between the inferior angle and the root of the spine receives the attachment of the rhomboideus muscle. This muscle is sometimes divided by a septum into two portions. The upper portion is then called the rhomboideus minor, in distinction from the lower portion, or rhomboideus major. The fibres of the latter are inserted chiefly into a tendinous arch extending from the inferior angle half-way up the vertebral border. The rhomboideus muscle consists of a flat mass of strongly-developed fibres which arise from the spinous processes of the vertebra prominens and the five upper dorsal vertebrae. Its action is to antagonize the serratus magnus muscle, by drawing the scapula upward and backward. It receives a branch from the fifth cervical nerve, which also supplies the muscle immediately above, the levator anguli scapulae, which arises from the neck (page 208) and is attached to the scapula between the superior angle and the root of the spine. The smooth triangular surface over the root of the spine has in the recent state a mucous bursa, or a layer of loose connective tissue, over which the trapezius muscle plays

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as it passes to its insertion along the upper margin of the spine, as previously described (page 208). The spine gradually projects from the dorsal surface, arising out of the smooth triangle at the vertebral border until it ends in the flattened, rough, quadrilateral acromion process, which is twisted so that it overhangs the shoulder-joint.

The superior border of the scapula extends outwardly from the superior angle and ends in the curiously crooked projection called the coracoid process, at the root of which there is usually a notch, the supra-scapular, for the passage of the supra-scapular nerve, the companion vessels passing immediately over it. This notch is often a distinct foramen, or is converted into one, like similar notches elsewhere, by the presence of a transverse ligament. To this ligament, or to the inner border of the supra-scapular notch, is attached the scapular end of the omo-hyoid muscle.

The coracoid process is very much like the little finger half bent, and extends forward over the shoulder-joint, where it can be felt during life below the clavicle. The inner border receives the attachment of the pectoralis minor muscle (page 255), and from its point the coraco-brachialis and short head of the biceps muscles arise by a common tendon. The coracoid and acromion processes have a strong fibrous band extending between them, called the coraco-acromial ligament, which forms an arch over the shoulder-joint and prevents the head of the humerus from being dislocated upward.

The anterior or thoracic surface of the body of the scapula is concave, presenting a broad sub-scapular fossa, or venter, with three or four slight ridges at the vertebral border, which give origin to the intersections between the bundles of fibres of the sub-scapularis muscle, which completely occupies the fossa. Toward the root of the coracoid process this surface of the bone is smooth and the tendon of the sub-scapularis muscle passes over it, there being a large bursa interposed across the capsule of the shoulder-joint to be inserted into the lesser tuberosity on the anterior part of the top of the humerus. The fibres from the axillary border of the fossa are inserted into the neck of the humerus two and a half centimetres, or about an inch, below the tuberosity. The chief action of this muscle is to rotate the head of the humerus inward. The whole of the anterior
surface of the vertebral border of the scapula receives the insertion of the *serratus magnus muscle*. This flat muscle forms the inner wall of the axilla (Plate 44, Fig. 1, and Plate 45, Fig. 2). It arises by nine digitations from the upper eight ribs (there being two attached to the *second* rib), which are arranged according to the direction of the fibres into superior, middle, and inferior portions. The *superior* is formed by the junction of the slip from the first rib with the anterior slip from the second rib by a small tendinous arch, and is inserted into the border of the superior angle of the scapula. The *middle* is made up of the posterior slip from the second rib with slips from the third and fourth ribs, and is inserted into the vertebral border and the neighboring fibrous arch. The *inferior* is the strongest part, consisting of slips from the fifth, sixth, seventh, and eighth ribs, and is inserted into the anterior surface of the inferior angle of the scapula. This muscle is covered by the contents of the axilla (Plate 45) and the skin over the side of the chest, and is supplied by the posterior thoracic nerve (page 345). Its function is to draw forward the scapula round the chest wall, but when the scapula is fixed its action is reversed, so that it becomes a powerful *inspiratory* muscle. At the external margin of the spine on the dorsal surface beneath the acromion process there is a notch by which the *supra-spinatus* and *infra-spinatus* fossæ communicate: this is called the *great scapular notch*. Through this notch the *supra-scapular* artery passes and establishes the important anastomosis with the *dorsalis scapulæ* and *posterior scapular* arteries (page 342).

The anterior angle is the thickest part of the bone, and is called the *head*, while the constricted portion posterior to it is the *neck*. The head presents an oval shallow fossa, the *glenoid cavity*, which is narrower above than it is below, and is directed vertically outward, forward, and a little upward, for the reception of the head of the humerus. At the upper edge is the *supra-glenoid tubercle*, for the attachment of the long tendon of the biceps muscle, and at the lower edge is the rough *infra-glenoid tubercle*, for the origin of the middle or long head of the triceps muscle. This fossa is deepened in the recent state by the *glenoid ligament*, which consists of a prismatic fibro-cartilaginous band continuous with the expansion of the
fibres of attachment of the above-mentioned muscles round the margins. The central portion of the body of the scapula is extremely light, sometimes being deficient in ossific matter, and the periosteum surrounding the bone is strong and laminated, and especially developed upon the various processes and borders.

**The upper end of the humerus** consists of a smooth *hemispherical head*, directed upward, inward, and backward, to be received against the glenoid cavity of the scapula. The constriction about the head is known as the *anatomical neck*. From this the *greater tuberosity* extends outward. It is a rough prominence, presenting three facets, an upper, a middle, and a lower, for the attachments of the supra-spinatus, infra-spinatus, and teres minor muscles, as already described. From the anterior part of the anatomical neck the *lesser tuberosity* projects directly forward, the tendon of the sub-scapularis muscle being inserted into it. Between these tuberosities there is a deep vertical furrow, the *bicipital groove*, for the accommodation of the long tendon of the biceps muscle (Plate 44, Fig. 2). Below the tuberosities, as far as the middle of the shaft, the bone is cylindrical, and is known as the *surgical neck*, in consequence of the frequency with which it is fractured.

**The shoulder-joint** consists of the adaptation of the smooth surface of the head of the humerus upon the glenoid cavity of the scapula, thereby constituting an *enarthrodial* or *ball-and-socket joint*. These bony surfaces are each covered with articular cartilage in such a manner that it is thickest at the margins of the glenoid cavity and thinnest at the centre, while upon the head of the humerus the reverse is the case, the cartilage being thicker at the centre and thinner toward the anatomical neck. The *capsular ligament* is attached above to the circumference of the glenoid cavity and below to the anatomical neck, except at its inner and lower part, where it extends some little distance below. It is in itself a quite weak structure, being composed of a very loose layer of fibrous tissue. It is thickest at its upper part, where it is strengthened by the *V*-shaped *coraco-humeral ligament*, and serves mainly as an outer layer for the synovial membrane, offering very little security to the joint, which in reality depends upon the great strength and number of the tendons of
the muscles with which it is intimately associated. When these tendons are completely severed, the head of the humerus will fall away from the glenoid cavity to the extent of two and a half centimetres, or an inch, or even more, so loose is the capsular ligament; and likewise the arm appears to be lengthened when the muscles which ordinarily support it are paralyzed. In fact, the capsule is large enough to accommodate the head of the femur, which is nearly twice the size of the head of the humerus. A knowledge of the arrangement of the tendons about the joint is therefore of great importance, not only in realizing the wide range of motion of which the joint is capable, but also in understanding how to readjust it in case of its dislocation.

The tendons of the supra-spinatus, infra-spinatus, and teres minor muscles, as they pass over the capsule to their respective insertions upon the greater tuberosity, strengthen the upper and posterior part; the broad tendon of the sub-scapularis muscle protects it on the inner part, where it comes forward to be inserted into the lesser tuberosity; and below it receives support from the long head of the triceps muscle. Furthermore, the long tendon of the biceps muscle, which is lodged within the deep groove between the tuberosities, pierces the capsular ligament and passes over the head of the humerus to the top of the glenoid cavity, strengthens the upper anterior part of the joint, and prevents the head of the humerus from being brought against the acromion process in the upward movements of the arm. In fact, it is mainly by the normal position of this tendon, assisted somewhat by the atmospheric pressure, that the head of the humerus is retained in its natural position. Occasionally the biceps tendon is dislocated out of its groove onto the inner ridge, and abduction is limited by the great tuberosity thus coming almost immediately in contact with the acromion process. From a careful consideration of the disposition of the tendons it will be seen that they surround the capsule, except toward the axilla, where the head of the humerus can be readily felt. When the arm is raised and extended, the head of the humerus rests upon the weak part of the capsule; and it is therefore through this part, between the tendons of the sub-scapularis and the long head of the triceps, that most of the dislocations at this
joint occur. If the capsule is opened, it presents upon its interior several folds, which have been specialized as gleno-humeral folds. The synovial membrane is reflected upon the inner surface of the capsule and forms fringes at the borders of these folds, and is invaginated about the biceps tendon, which it follows as a tubular sheath down the groove to the extent of five centimetres, or two inches. There is a constant small opening at the upper and inner side of the capsule, which admits the tendon of the sub-scapularis muscle, and by which the synovial membrane communicates directly with the bursa under the tendon. There is also often an opening from the capsule leading into the bursa beneath the tendon of the infraspinatus muscle. In chronic disease of the joint sinuses are readily established in the sites of the bursal connections. There is no anatomical communication between the capsule and the bursa under the deltoid muscle, which is interesting because the sub-deltoid bursa is peculiarly liable to independent disease. It is contained within an expansion of loose connective tissue beneath the deltoid and overlying the tendons of the spinati muscles. The shoulder-joint is practically a universal joint, and, as it depends upon the arrangement and power of the surrounding tendons, rather than upon the mechanical adjustment of the opposing bony surfaces, the grouping of the muscles in effecting the various movements should be understood. Extension is effected by the teres major, latissimus dorsi, and the posterior portion of the deltoid. These are assisted in raising the arm by the teres minor and infra-spinatus muscles. Flexion is produced by the coraco-brachialis and the anterior portion of the deltoid, aided by the pectoralis major; abduction, by the deltoid and supra-spinatus; adduction, by the pectoralis major, teres major, latissimus dorsi, and coraco-brachialis.

The shoulder is rotated outward by the infra-spinatus and teres minor, and inward by the sub-scapularis, latissimus dorsi, and teres major. The shoulder-joint is supplied by the circumflex nerve and circumflex artery, which are described on page 342. The deep structures of the shoulder-joint are protected by the great deltoid muscle, which forms a complete shoulder-cap. It arises from the lower border of the outer third of the clavicle, from the acromion process, and from nearly the whole of the spine
of the scapula (Plate 16). This extensive origin corresponds to that of the trapezius muscle above (page 208). The muscular fibres composing the deltoid are very coarse, and are disposed in bundles or fascicles which are separated by inward expansions of the strong layer of the deep fascia enveloping the muscle upon its outer surface. The bundles thus formed by the fibres arising from the clavicle and from the spine of the scapula generally converge from their origins to their insertions upon the lateral ridges of the deltoid tuberosity, but those of the outer or acromial portion are peculiarly arranged. Here there are additional fibres which originate from the sides of the intramuscular tendinous septa in a bipenniform manner and pass parallel to one another to be inserted by fleshy slips into the middle ridge of the deltoid tuberosity on the outer surface of the shaft of the humerus. The deltoid tuberosity consists, therefore, of three converging ridges. The tendon of insertion can be understood only by detaching the muscle from its origin and reflecting it. When this is done, it will be seen that the insertion is about three and three-quarter centimetres, or an inch and a half, in length, extending upward upon the middle of the shaft from the deltoid ridges, whence fibrous septa are projected into the substance of the muscle between the fibres originating from the aponeurotic expansions between the fasciculi. In this manner the several fasciculi reinforce one another, and the increased number of their fibres compensates for their length, thus greatly augmenting the functional power of the muscle as a whole. Looked at from in front, the insertion of the deltoid resembles the letter V. It is embraced by the fleshy origins of the brachialis anticus muscle, and thus occasions a characteristic depression of the overlying integument. The three parts of the muscle can act separately in raising the arm in different directions, and they each act to better advantage when the humerus is rotated outwardly. The power of the deltoid depends greatly upon the scapula being steadied by the serratus magnus, the long head of the triceps, and the middle fibres of the trapezius muscles. When the whole muscle contracts, it raises the arm to the horizontal position (at an angle of ninety degrees): beyond this it cannot act, further elevation being effected by the serratus magnus and trapezius, which then raise the shoulder. The deltoid muscle receives its
blood from the circumflex arteries (page 342), and is supplied by the circumflex nerve (page 346).

When the head of the humerus is dislocated into the axilla, the rotundity of the shoulder is lost, the deltoid becomes flattened, and the acromion process is rendered very prominent. In such a condition there is beneath the latter process a marked depression, into which one or two fingers can be inserted, constituting one of the diagnostic features of dislocation at the shoulder-joint. Dislocation at this joint is very common. Primarily the displacement is always downward into the axilla, because it is caused by direct violence received upon the point of the shoulder or by indirect violence while the upper extremity is abducted and the joint consequently placed at a disadvantage, the head of the humerus readily slipping through the lowest and weakest part of the capsule (page 332). Sometimes the head of the bone is retained in this position, when it is called a sub-glenoid dislocation. After leaving the capsule, however, the pectoralis major and other muscles having free play, it is most frequently drawn forward and inward, and assumes the character of a sub-coracoid dislocation. Rarely the head of the humerus is driven backward under the acromion upon the dorsum of the scapula (sub-spinous dislocation). In every form of dislocation there will be flattening of the deltoid and more or less stretching of that muscle, and consequently abduction of the arm, with proportionate rigidity. The chief diagnostic symptoms are as follows: the elbow stands away from the side of the body, and the hand of the affected limb cannot be placed in the small of the back nor upon the top of the opposite shoulder. There have been many observations regarding the special anatomy of the various forms of dislocation at the shoulder, but they are of no practical use, beyond the inference that the head of the humerus, in order to be returned to its proper place, must be first restored to the sub-glenoid position, and then, by circumduction or other means, its reduction may be accomplished. The proximity of the important structures within the axilla renders them liable to injury from pressure of the head of the humerus when it is driven against them, and that they escape with so little damage is probably due to the relaxation of the soft parts which follows upon the shortening of the limb.
Fractures involving the anatomical neck of the humerus are extremely rare, and can only be suspected, unless an opportunity is given to explore the joint. The prolongation of the internal and lower fibres of the capsular ligament would connect the fragments unless they were also ruptured. The superior epiphyseal line is below the tuberosities, just where the shaft is widest. It does not become obliterated before the twenty-second year. The upper epiphysis may become detached prior to this period, and simulates the condition of a fracture in the upper part of the surgical neck of the humerus without overlapping.

In amputation at the shoulder-joint it is essential that the incisions should be made so as to leave the division of the axillary vessels to the last moment. Whatever method is employed, the long tendon of the biceps muscle should be sought for, and by using its bony furrow as a grooved director the capsule can be slit up and the joint expeditiously opened. In the oval flap method, which the author has found to possess many advantages, the relations of the severed vessels and nerves as they present themselves in the flaps after amputation at the left shoulder are as follows (Plate 50, Fig. 2). The anterior flap is formed by the pectoralis major (No. 3), the heads of the biceps, coraco-brachialis, latissimus dorsi, teres major, and rotator muscles. The axillary vessels (Nos. 1 and 2), the cords of the brachial plexus of nerves (No. 11), and the inferior scapular artery and veins (No. 12) will be found in the axillary border of this flap; while the long tendon of the biceps (No. 5), a branch of the anterior circumflex artery (No. 7), and the cephalic vein and the descending branch of the acromio-thoracic artery (No. 8) occupy the acromial border of the flap in relation to the severed clavicular portion of the deltoid muscle. The posterior flap is formed mainly by the scapular portions of the deltoid muscle (No. 15), with branches of the posterior circumflex vessels and nerves (No. 14).

THE REGION OF THE AXILLA.

The region of the axilla, or armpit (Plates 44 and 45), varies in depth with the position of the arm. It is a pyramidal space, bounded internally by the side of the thorax, externally by the arm, and in front