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The Region of the Neck

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operations on the organ very difficult, and it is essential in all such that the organ should be first steadied as much as possible.

The trachea is described with the anterior region of the neck (page 236).

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The skeleton of the neck (Plates 1 and 28) is so well covered by the surrounding soft structures (Plates 12 and 14) that its prominences are less conspicuous to external observation than those of any other region of the body. The relations of the component parts of the neck are considerably influenced by the position of the cranium, which is supported, somewhat behind its axis, upon the most flexible portion of the vertebral column. It should be remembered that a line drawn from side to side in front of the mastoid processes will bisect the condyloid processes, and that the upper-jaw teeth are on a line with the foramen magnum at the base of the skull. If a horizontal section of the neck is made about the level of the fifth cervical vertebra (Plate 14, Fig. 1, No. 1), the segment of the body of that vertebra will be found in the anterior part of the section, together with the gullet, windpipe, great vessels, nerves, and glands, while the muscles which hold the head erect upon the spine will occupy principally the posterior part.

The bony landmarks of the neck are very few, but they are very important. They can be ascertained by pressure or manipulation, and by changing the relative positions of the head and trunk.

When the body is upright, with the shoulders squared and the head held so that the face looks straight forward, a line drawn obliquely from the occipital protuberance along the body of the lower jaw to the chin is about parallel with a line drawn from the lower border of the first dorsal vertebra to the top of the sternum; and these two lines may be considered as the upper and lower limits of this region. The atlas vertebra cannot be felt at the back of the neck through the external parts, but by bending the head forward or backward the spinous processes from the second to the seventh cervical vertebra can be readily detected. The seventh vertebra is always so well marked (Plate 1, No. 15) that it has received
A topographical survey of the anterior surface of the body of a well-developed adult male, with especial reference to the clinical study of the relations of the thoracic and abdominal viscera. Also showing the relations of the bones to the surface of the right upper extremity, and the localization of the areas of distribution of the sensory nerves on the anterior surface of the left arm and forearm.

1. The apex of the right lung above the clavicle.  
2. The position of the innominate artery.  
3. The position of the greater tuberosity of the humerus.  
4. The position of the head of the right humerus.  
5. The position of the lesser tuberosity of the humerus.  
6. The approximation of the lungs over the root of the heart, in full inspiration.  
7. The junction of the right third costal cartilage with the sternum, corresponding to the position of the base of the heart.  
8. The position of the aortic semilunar valves.  
9. The position of the right auriculo-ventricular valve.  
10. The right nipple.  
11. The position of the upper surface of the liver in relation to the right arch of the diaphragm.  
12. The position of the lesser curvature of the stomach.  
13. The extent to which the lower lobe of the right lung descends in full inspiration, parallel with the lower border of the cartilage of the sixth rib.  
14. The cartilage of the right seventh rib.  
15. The position of the right lobe of the liver.  
16. The internal condyle of the right humerus.  
17. The position of the fundus of the gall-bladder, in relation to the right eighth costal cartilage.  
18. The position of the head of the radius.  
19. The position of the lower portion of the right kidney.  
20. The position of the lower portion of the inferior vena cava.  
21. The superior anterior spine of the right ilium.  
22. The position of the sacrum and the veriform appendix.  
23. The position of Poupart’s ligament.  
24. The head of the right femur.  
25. The greater trochanter of the femur.  
26. The lesser trochanter of the femur.  
27. The apex of the left lung above the clavicle.  
28. The cutaneous area of the distribution of the external supra-clavicular nerve.  
29. The supra-ternal notch.  
30. The position of the left common carotid artery.  
31. The position of the left subclavian artery.  
32. The ridge between the manubrium and the gladiolus of the sternum.  
33. The position of the pulmonary artery.  
34. The position of the semilunar valves of the pulmonary artery.  
35. The position of the left auriculo-ventricular valve.  
36. The area of the distribution of the lesser cutaneous nerve.  
37. The cutaneous area of the distribution of the circumflex nerve.  
38. The left nipple.  
39. The junction of the left fifth rib with its cartilage.  
40. The normal position of the apex beat of the heart.  
41. The cutaneous area of the distribution of the intercostohumeral nerve.  
42. The tip of the ensiform cartilage.  
43. The extent to which the lower lobe of the left lung descends in full inspiration.  
44. The cartilage of the left seventh rib.  
45. The cutaneous area of the distribution of the internal cutaneous nerve.  
46. The position of the spleen in relation to the left eighth, ninth, and tenth ribs.  
47. The position of the stomach in relation to the anterior wall of the abdomen.  
48. The cartilage of the left ninth rib.  
49. The position of the lower portion of the left kidney.  
50. The position of the abdominal aorta in relation to the body of the second lumbar vertebra.  
51. The umbilicus.  
52. The cutaneous distribution of the musculo-cutaneous nerve on the anterior surface of the forearm.  
53. The lower part of the cutaneous area of the distribution of the musculo-spiral nerve.  
54. The position of the sigmoid flexure of the colon.  
55. The position of the internal abdominal opening.  
56. The lower part of the cutaneous area of the distribution of the musculo-cutaneous nerve.  
57. The position of the external abdominal opening.  
58. The upper part of the cutaneous area of the distribution of the radial nerve.
the special designation of the *vertebra prominens*. Owing to the obliquity of the spinous process of the fifth vertebra, it is on a level with the disk between the bodies of the fifth and sixth. On the sides the transverse process of the atlas vertebra can be felt in front of and below the mastoid process, and by deep pressure in the supra-clavicular fossa the transverse process of the seventh vertebra can be distinguished. About a finger’s breadth above the latter, the head being moved from side to side, the anterior tubercle of the sixth vertebra is perceptible to the touch, which, because of its relation to the overlying carotid artery, is known as the “carotid tubercle.”

In the *front of the neck* the hyoid bone and the external cartilages of the larynx, the thyroid and cricoid, offer reliable indications to the position of the deep vessels and adjoining parts; but, owing to the mobility of these structures, which permits of their accommodation to the efforts of swallowing and of forced respiration, and to the changes of position in consequence of the flexibility of the cervical vertebrae, their relation to the chin above and to the top of the sternum below should be carefully noted. In the *adult*, when the head is in the erect position, the body of the hyoid bone, with its greater cornua, can be felt just below the body of the lower jaw. About two centimetres, or three-quarters of an inch, below it is the top of the thyroid cartilage, the anterior notch of which, or *pomum Adami*, is recognizable,—but always more prominent in the male than in the female. At the lower border of the thyroid cartilage there is a depression corresponding to the crico-thyroid membrane, which intervenes between it and the *hoop of the cricoid cartilage* (page 177). The latter is the most important landmark in the anterior part of the neck, as it is easily detected in fat as well as in lean persons, of both sexes, and at all periods of life. In drawing a comparison between the relative bearing of these parts in the child and in the adult, it should not be overlooked that the larynx is undeveloped before puberty, and that the changes in the jaws as to the size and shape of their rami and the progressive development of the alveolar processes have much to do with the relative position of some of the parts in the vicinity. In bending back the head in the *adult* (Plate 53, Fig. 1, and Plates 23 and 24), the space between the top of
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The sternum and the chin is about double that which it measures when the head is in the natural position, and it is chiefly increased between the chin and the cricoid cartilage. In the child, however, with the head similarly placed the space is increased between the cricoid cartilage and the top of the sternum, because in the child the cricoid cartilage occupies relatively a higher position in the neck, owing to the diminutive size of the larynx. As the larynx becomes developed, the cricoid cartilage is depressed toward the sternum, and the trachea, as well as the other parts of the neck, assumes the adult arrangement. The distance between the cricoid cartilage and the sternum is not more than four centimetres, or an inch and a half, in the ordinary carriage of the head, and when the neck is stretched it is increased very little over twelve millimetres, or half an inch. The upper portion of the trachea can usually be felt just below the cricoid cartilage, but its separate rings are indistinguishable, in consequence of the trachea receding as it descends, so that at the root of the neck it is at a considerable distance from the surface (Plates 24 and 25). When the head is upright the cricoid cartilage is about opposite the spine of the fifth cervical vertebra (Plates 1 and 12); when the head is bent backward, so as fully to extend the neck, the cricoid cartilage is raised opposite the fourth vertebra; and when the head is bent forward until the chin touches the breast the cricoid cartilage is depressed, and corresponds to the sixth vertebra. The general development of the neck varies in different individuals, being commensurate with the stature.

The difference in the length of the neck in the adult is sometimes more apparent than real, frequently resulting from some peculiarity in the conformation of the shoulders. Its breadth is often variable. In children the comparative length of this region is due to the slight development of the face, the larynx being connected with the tongue and the hyoid bone; and it is important to note that in childhood the top of the manubrium sterni is higher in relation to the vertebral column than in the adult.

The skin over the anterior portion of the cervical region is thin, delicate, and very elastic, being so loosely attached by the superficial fascia to the deep fascia enveloping the underlying structures that it is readily raised in folds. The amount of fat in the subcutaneous tissue
varies in different localities, but it is apt to become diffused above the hyoid bone, where it forms the redundancy called "double chin." In marked contrast to the skin in front is that over the nape of the neck, where it is very dense and adherent to the sheaths of the muscles beneath, so that when the head is turned backward the skin is thrown into parallel transverse folds (Plate 53, Fig. 1). The peculiar toughness and low vascularity of the superficial fascia in the latter locality render it liable to become the seat of carbuncle, in consequence of which it is sometimes called the "carbuncular tissue."

In close connection with the skin in front and at the sides of the neck is the thin cutaneous muscle called the *platysma myoides* (Plate 17, No. 7, and Plate 23, Fig. 1, No. 9). This muscle usually arises from the skin over the chin, the body of the jaw, the cheek, and the masseteric fascia, its fibres descending outward and forming a continuous sheet, which is spread over the lateral portion of the neck and is inserted into the subcutaneous tissue over the pectoralis major and deltoid muscles. A few of the fascicles of the upper portion blend with the tissues about the angle of the mouth and radiate backward, being separated from the rest of the muscle, and forming the *musculus risorius* (page 121). Anteriorly the fibres are very sparse and thin and cross those of the opposite platysma; and below the chin they are frequently developed into muscular slips, forming the so-called *sphincter colli*. This muscle serves as a protective covering to the neck. It is supplied with nerves from the cervical plexus and the cervical branch from the facial nerve, over which it lies. Within the meshes of the platysma the external jugular vein appears, when it holds its usual course, in a line from the angle of the jaw to the middle of the clavicle (Plate 17, No. 5). The blue outline of this vein is almost always perceivable in life through the skin, and it is especially pronounced during the acts of speaking, singing, and coughing. Also when the breath is held and any great effort is made, these veins, as well as those of the forehead, become swollen. When the platysma is removed, the deep cervical fascia is seen forming a close investment, having upon it the superficial branches of the cervical plexus of nerves and the external and anterior jugular veins (Plate 23, Fig. 2, No. 34). The *external jugular vein* is
formed by the junction of the temporal and internal maxillary veins in the substance of the parotid gland (page 134), at the lower border of which it receives the transverse facial and posterior auricular veins. It crosses obliquely the sterno-mastoid muscle, and generally takes a perpendicular course to about half an inch above the middle of the clavicle, where it pierces the deep fascia and terminates in the subclavian vein. Sometimes this vein joins the common jugular vein before it empties into the subclavian, in which case the external jugular follows along the posterior border of the sterno-mastoid muscle. The external jugular has two pairs of valves: the lower, near its termination, are imperfect, but the upper, four centimetres, or about an inch and a half, above the clavicle, are more complete. Near the angle of the jaw the submaxillary vein (Plate 18, No. 17) establishes a communication between the external jugular and facial veins.

The occipital vein joins the external jugular about the middle of its course, and in the supra-clavicular fossa there is a confluence of veins which are tributaries to it from the scapular region, and which are of importance because they overlie the subclavian artery in the place where it is usually sought (Plate 17, No. 8). The auricularis magnus nerve turns round the posterior border of the sterno-mastoid muscle where the external jugular vein crosses it, and passes upward to the parotid gland in close proximity to the vein. The superficial cervical nerve passes under the vein at this point, and divides into cutaneous branches which supply the anterior surface of the neck (Plate 18, No. 26, and Plate 23, Fig. 2, No. 31). The anterior jugular vein is usually insignificant, but it bears a compensating supplemental relation to the external jugular, being enlarged when that vein is small or deficient. There are sometimes two anterior jugular veins running side by side along the anterior median raphé of the neck, having short cross links between them above the sternum. The anterior jugular ends either in the external jugular or in the subclavian beneath the sternal end of the sterno-mastoid muscle.

The cutaneous nerves of the neck are the superficial branches of the cervical plexus, which is formed by the intercommunication of the anterior divisions of the four upper cervical nerves under the sterno-mastoid
muscle, and cannot be displayed unless that muscle is turned aside (Plates 20 and 21).

The upper cervical nerves, the most important of which is the great occipital nerve, pertain more especially to the nape of the neck (Plate 22, Fig. 1, Nos. 3 and 12). The nerves which supply the anterior part of the neck appear at the posterior border of the sterno-mastoid muscle, and are arranged in branches which pass upward, forward, and downward, forming what is sometimes called the pes anserinus cervicis. The great auricular and superficial cervical nerves are derived from the second and third cervical nerves, and have been described in connection with the external jugular vein. The small occipital nerve comes from the second cervical nerve, and ascends along the posterior border of the sterno-mastoid muscle to the back of the ear, communicating with the great occipital and posterior auricular nerves (Plate 53, Fig. 1). It also sends a deep branch to the spinal accessory nerve. The descending branches are derived from the third and fourth cervical nerves, and divide into the sternal, clavicular, and acromial nerves, which supply the skin respectively in the neighborhood of the sternum, clavicle, and acromion (Plates 18, 19, and 23). The cervical branch of the facial nerve (Plate 19) pierces the deep fascia at the parotid gland, and, passing near the angle of the jaw, arches over the upper part of the neck, supplying the platysma and the skin, and joins the superficial cervical nerve.

There are a few superficial lymphatic glands in relation to the external and anterior jugular veins which lie external to the deep cervical fascia.

The deep fascia in the cervical region, as elsewhere in the body, constitutes an aponeurotic envelope over all the deeper parts, binding them in position and preserving their relations to one another. From its under surface are reflected over each structure prolongations peculiarly modified to suit their several functions, so that they are encased in appropriate sheaths. In certain localities these prolongations are more strongly developed than in others, and by having special attachments play an important part in the mechanism of this complex region. In others they form dense partitions so arranged that they offer protection against the evil effects of atmospheric pressure. It should be understood that this
is not an uninterrupted membrane, consisting of complete laminae, and that not only is it modified and adapted to the requirements of muscles, vessels, etc., but it is also here and there pierced by vessels and nerves upon which it is reflected, and thus establishes communications between its own recesses and those of the adjacent regions, the thorax and the axillae.

The localities in which the deep fascia is particularly strong and resisting are about the angle of the jaw, in front of the trachea, and in the supra-clavicular fossa. The special attachments of this fascia are of interest, as they often afford an explanation of the course which matter takes when it forms in the neck; but much undue weight has been given to them in this respect, for they do not by any means always set up efficient barriers against or form natural passage-ways for the course of pus as usually described. It is true, however, that here, as elsewhere, inflammatory action may induce plastic thickening in the deep fascia which limits the growth of tumors and modifies the direction of their progress.

The fascia is attached posteriorly to the ligamentum nuchæ and to the spinous processes of the cervical vertebrae, closely adhering to the subjacent muscles at the nape of the neck, and passes forward until it reaches the sterno-mastoid muscle. There it splits into two layers, an external and an internal, which respectively pass over and under the sterno-mastoid muscle, and, uniting at its anterior border, so as to form for it a distinct sheath, split again into lamellæ, which in turn separate into leaflets. The external layer of the deep fascia is attached above to the mastoid process and adjacent part of the occipital bone, to the zygoma, forming in relation to the parotid gland the parotid fascia (page 130), and to the border of the lower jaw. In the middle line of the neck this layer blends with the corresponding layer from the opposite side and becomes closely connected with the body of the hyoid bone. It forms sheaths for the sterno-hyoid and sterno-thyroid muscles, and is attached below to the clavicle and the top of the sternum. Below the thyroid body the external layer of the fascia is divided into two lamelle, which are inserted at the front and back borders of the top of the sternum, including the sternal attachment of the sterno-mastoid muscle on each
side. This corresponds to the supra-ternal notch, and the interval between the layers of fascia in this locality contains a few lymphatic glands embedded in a variable quantity of fat, besides being traversed by the anterior jugular vein. The internal layer of the deep fascia is very complicated, as it separates into many subdivisions, which are in some instances prolonged to join corresponding offsets from the fascia of the opposite side and in others to blend with the deep fascia of adjacent regions. Above it is attached to the base of the skull, and extends from the styloid process to the angle of the jaw, forming the stylo-maxillary ligament. It is prolonged, as the prevertebral fascia, over the longus colli muscles, separating them from the posterior wall of the pharynx, and descends behind the oesophagus into the thorax, where it joins with the anterior common spinous ligament. It is extended across the trachea under the sterno-thyroid muscles, and invests the thyroid body.

The cellular tissue between the prevertebral fascia and the pharyngeal constrictor muscles is loose, and the seat of post-pharyngeal or retro-pharyngeal abscesses, which instead of opening into the pharynx are often guided by the fascia behind the carotid vessels to the outer surface of the neck. A reflection of the prevertebral fascia has an attachment to the transverse processes of the cervical vertebrae which forms sheaths for the scaleni muscles and extends over the cords of the brachial plexus of nerves, to blend with the costo-coracoid membrane in relation to the subclavious muscle. The sympathetic nerve is placed between the prevertebral and post-pharyngeal layers of the fascia.

In relation to the carotid artery, internal jugular vein, and pneumogastric nerve an expansion is given off from the under surface of the sheath of the sterno-mastoid muscle which blends with a leaflet from the prevertebral fascia and becomes considerably condensed, so that it forms a common sheath for these structures, which are also separated from one another by delicate septa. By means of the carotid sheath this layer of the deep cervical fascia becomes continuous with the pericardium, and the heart thus receives support from both sides of the neck.

A reflection of the fascia is looped over the intermediate tendon of the omo-hyoid muscle, which it binds to the first rib, and is prolonged
Front view of a natural (ligamentous) skeleton of a European male aged thirty-eight years, showing the landmarks with their relations to the surface coverings.

1. The right temporal ridge.
2. The right supra-orbital foramen.
3. The squamous suture.
4. The external angular orbital process.
5. The sphenoidal fissure in the back of the right orbit.
6. The infra-orbital foramen.
7. The right malar bone.
8. The incisor teeth.
9. The angle of the lower jaw—the gonion.
10. The mental foramen.
11. The right clavicle.
12. The manubrium sterni.
13. The sternal end of the first rib.
14. The second rib.
15. The junction of the cartilage of the third rib with the sternum (corresponding to the position of the base of the heart).
16. The third rib.
17. The fourth rib. (This line passes over the right nipple.)
18. The right humerus.
19. The right fifth rib.
20. The right sixth rib.
21. The cartilage of the right tenth rib.
22. The right seventh rib.
23. The right twelfth rib.
24. The right eighth rib.
25. The right ninth rib.
26. The cartilage of the right tenth rib.
27. The right radius.
28. The anterior superior spine of the ilium.
29. The anterior inferior spine of the ilium.
30. The great sciatic foramen.
31. The lesser sciatic foramen.
32. The great trochanter of the femur.
33. The ilio-femoral ligament, over the capsular ligament of the hip.
34. The lesser trochanter of the femur.
35. The left frontal eminence.
36. The glabella.
37. The nasion.
38. The sphenoidal fissure in the back of the left orbit.
39. The septum nasi.
40. The infra-orbital foramen.
41. The ramus of the inferior maxillary bone.
42. The mental foramen.
43. The symphysis of the lower jaw.
44. The acromion process of the scapula.
45. The coracoid process of the scapula.
46. The sternal end of the first rib.
47. The venter of the left scapula.
48. The sternal ridge at the junction of the first and second pieces of the sternum.
49. The gladiolus.
50. The fourth rib. (This line passes over the left nipple.)
51. The junction of the left fifth rib with its cartilage (where the apex of the heart beats in life).
52. The left sixth rib.
53. The cartilage of the left seventh rib.
54. The internal condyle of the left humerus.
55. The head of the radius.
56. The left radius.
57. The left ulna.
58. The left Poupart ligament.
59. The styloid process of the radius.
60. The left carpus.

N.B.—In this preparation, owing to the effect of drying, the second, third, and fourth costal cartilages are not in the lines of their ribs, as they are found to be in the recent state. Compare Plate 29.
over the subclavian vessels into the axilla. Back of the sternum there is a continuation of this layer of the deep fascia, which passes along the anterior mediastinum: the pus from a cervical abscess will sometimes travel along this route and point at the side of the xiphoid appendix on the surface of the abdomen. The arrangement of the layers of the deep cervical fascia in relation to the top of the sternum, to the first rib, and to the clavicle is such that the soft parts at the upper opening of the chest are protected against the pressure of the atmosphere during inspiration.

The deep cervical fascia is not normally strong and unyielding, and cannot properly be compared with the fascia lata, but it may become so under the influence of pressure and inflammation; and in many instances where growths or abscesses in this region have been influenced in their course by the denseness of the surrounding fascia, the growth or abscess has itself induced the change. This is especially noticeable where the morbid condition has become chronic.

The sternocleido-mastoid muscle (Plates 16, 18, 19, and 23) is the great muscular landmark at the side of the neck, which serves as a guide to the position of the important vessels with which it is in immediate relation. It arises by a thick, round tendon from the upper and outer surface of the manubrium sterni, internal to the sterno-clavicular joint, and by a flat, fleshy, and tendinous origin from the adjacent portion of the clavicle. Between these origins there is a variable interval, which is filled with a double layer of the cervical fascia. The sternal fibres ascend over the sterno-clavicular joint and join with the clavicular fibres, so that at the middle of the muscle its substance is strong and somewhat contracted, but toward its insertion it flattens out, to be attached to the mastoid process, the temporal bone behind the process, and the contiguous part of the upper curved line on the occipital bone. The fibres composing the external and clavicular portions, if carefully examined, will be found to overlap one another, so that the sternal fibres occupy the outer and more conspicuous position, while the clavicular fibres are deeper and mainly attached to the apex of the mastoid process. These peculiarities of the insertions of the fibres of this muscle explain the different actions of which it is capable. This will be better understood by referring to the landmarks of the articu-
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lated skeleton (Plate 1) than by referring to a detached skull (Plate 2), and it should be remembered that a line drawn from one mastoid process to the other will bisect the condyloid processes, as previously stated, and that the vertical axis of the skull corresponds to a perpendicular line from the vertex to the inter-mastoid line. Ordinarily the united action of the two sterno-mastoid muscles maintains the head in the erect position with the face directed forward, but if the action of the sternal fibres, which are attached to the temporal and occipital bones behind the mastoid process, is greatest, the head will be tilted backward, with the face upward, while if the action of the clavicular fibres, which are inserted into the apex of the mastoid process, predominates, the head will be bowed forward. This action is marked in raising the head from the recumbent position, and both actions may be demonstrated by the application of electrical stimulation (Plate 53, Fig. 1). In considering the action of the sterno-mastoid muscle the expansion of the deep fascia, which connects the upper part of its anterior border with the lower jaw, should not be overlooked, for it probably assists materially the clavicular fibres. The action of one sterno-mastoid muscle draws the head obliquely toward the opposite shoulder, co-operating with the splenius muscle of the other side. The condition known as “wry-neck” is generally due to the spasmodic contraction of one sterno-mastoid muscle. When the head is fixed, the sterno-mastoid muscles elevate the sternum in forced inspiration. Each muscle is supplied principally by the spinal accessory nerve, which enters close to the mastoid process, together with the sterno-mastoid branch of the occipital artery. It also receives nerves from the second and third cervical nerves, and arteries from the superior thyroid and supra-scapular arteries.

The side of the neck may be considered as divided by the oblique direction of the sterno-mastoid muscle into triangular spaces, the anterior and posterior cervical triangles. The anterior triangle is inverted, its base being formed by the body of the lower jaw, and its sides by the middle line and the anterior border of the sterno-mastoid. The posterior triangle has the clavicle for its base, while its sides are defined by the posterior border of the sterno-mastoid and the anterior border of the trapezius muscle (Plate 16). The neck is further subdivided into smaller
triangles by the disposition of the digastric and omo-hyoid muscles beneath the sterno-mastoid. The *digastric muscle* consists of two muscular portions, united by an intermediate tendon, which pierces the tendon of the stylohyoid muscle and is attached to the body of the hyoid bone by a loop of the deep fascia (Plate 25, No. 4). The *posterior* portion arises from the digastric fossa on the temporal bone, back of the mastoid process. The *anterior* portion is attached to the lower jaw near the symphysis. These two portions, with the body of the lower jaw, constitute the submaxillary or *digastric triangle*. When the platysma is removed from this locality the deep fascia presents a dense covering to the contents of this space, the chief of which is the *submaxillary salivary gland* (Plate 18, No. 20, and Plate 13, Fig. 2, No. 6), which has already been described (page 164), as well as the relations of the facial and lingual arteries, for which this triangular space is usually topographically surveyed. The submaxillary vein, which joins the facial vein with the external jugular, is in the superficial fascia, in close proximity to the jaw (Plate 18, No. 17), and there are from six to ten lymphatic glands (Plate 16), some above and some beneath the salivary gland, which receive the lymphatic vessels from the face, the tongue, and the tonsils, already spoken of in the description of these parts. The *stylo-hyoid muscle* is a slender band of fibres, originally separated from the posterior portion of the digastric, with which it is in close relation at its inner side. Its upper attachment is at the outer and back surface of the styloid process, and its lower at the body of the hyoid bone near the lesser cornu, where it is pierced by the middle tendon of the digastric. The nerves which supply the posterior portion of the digastric and the stylohyoid muscles come from the facial nerve, and leave the lower border of the parotid gland immediately above. These muscles overlie the external and internal carotid arteries, the internal jugular vein, and the pneumogastric and hypoglossal nerves (Plate 13, Fig. 2, and Plate 22, Fig. 2). The anterior portion of the digastric muscle is superficial, and rests upon the mylo-hyoid muscle anterior to the submaxillary gland (Plates 23 and 25). The inner margins of the anterior portions of the two digastric muscles are often connected by fleshy fibres, but generally by connective tissue. Their nerves are derived from the mylo-hyoid nerves. The anterior and pos-
terior portions of the digastric muscle always act together, but the effect of their action depends upon which two of the three points of attachment are fixed. If the jaw and skull are both fixed, the muscle raises the hyoid bone, as in swallowing; if the skull and hyoid bone are fixed, the lower jaw is depressed, as in yawning; if the chin is supported so that the jaw and hyoid bone are fixed, the muscle can draw the skull backward. The digastric and stylo-hyoid muscles, with the mylo-hyoid and genio-hyoid muscles, described in relation to the tongue (page 165), are classified as the supra-hyoid muscles.

The omo-hyoid muscle is digastric, consisting of two fleshy portions connected by an intermediate tendon. Its posterior portion arises beneath the trapezius muscle from the superior border of the scapula, usually including the supra-scapular notch and its ligament, and passes forward and upward to the level of the cricoid cartilage, being attached to the clavicle by a fold of deep fascia which loops around its intermediate tendon under the sterno-mastoid muscle. The anterior portion passes vertically upward close to the outer border of the sterno-hyoid muscle, and is attached to the lower border of the hyoid bone. The course of this muscle does not change in contraction, and always maintains an obtuse angle, so that it is a reliable guide to the position of the great carotid vessels, directly over the sheath of which it passes at the point where the anterior and posterior portions of the muscle meet, on a level with the cricoid cartilage, as just stated. The fascial expansion which binds the central tendon to the clavicle is usually reflected to the first rib, and appears to offer resistance to the pressure of the atmosphere upon the internal jugular vein and the apex of the pleura which it covers. Occasionally fleshy fibres are developed in this reflection of the fascia. The contraction of the omo-hyoid muscles takes place only during inspiration, and, owing to their influence upon the fascia enveloping the great venous trunks at the root of the neck, a dilatation of these vessels is coincident with the dilatation of the thorax, so that the flow of the blood toward the heart is facilitated. This also indicates the danger of the entrance of air in wounds involving these veins. The subdivisions of the side of the neck which may be mapped out by the disposition of the omo-hyoid muscle are known as the superior
and inferior carotid triangles anterior to the sterno-mastoid muscle, and the occipital and supra-clavicular triangles posterior to it. The superior carotid triangle has for its three sides the posterior portion of the digastric muscle, the sterno-mastoid muscle, and the anterior portion of the omo-hyoid muscle. The inferior carotid triangle is bounded by the omo-hyoid and sterno-mastoid muscles, above and below, and in front by the middle line of the neck.

These carotid triangles have been so called because they were considered to bear reference to the course of the carotid artery and the internal jugular vein, and to elucidate the topographical study of this very complex region. They are very misleading, and time is often wasted in attempting to acquire or recall their boundaries. The carotid artery is not within the limits of the inferior triangle at all, as the sternal end of the sterno-mastoid muscle completely overlaps the sheath of the great vessels, which is in reality in relation to the interval between the sternal and clavicular origins of that muscle. A needle introduced upon the right side above the clavicle through this interval would pierce the bifurcation of the innominate artery, and on the left side the common carotid artery (Plate 14, Fig. 2, No. 6). The course of the carotid arteries on both sides from this point to their bifurcation is similar, and approximately may be considered as corresponding to the anterior borders of the sterno-mastoid muscles when either of them is brought into relief by turning the head to the opposite side. A line drawn transversely across the neck from the fifth cervical vertebra to the cricoid cartilage will indicate the position where the omo-hyoid muscle crosses the sheath of the great vessels. Above this point the carotid artery is superficial; below it is deeply placed and covered with a quantity of fatty tissue containing many veins, nerves, and lymphatics. It is this point of crossing of the omo-hyoid muscle which should be sought for in any operation upon the carotid artery; and by making an incision opposite the cricoid cartilage along the border of the sterno-mastoid muscle it can be readily reached. The bifurcation of the common carotid into the external and internal carotid arteries usually occurs opposite the top of the thyroid cartilage, which is on a level with the body of the third cervical vertebra, but it may be a little above or
PLATE 29.

The anterior wall of the thorax and upper part of the abdomen removed to show the relations of the heart, lungs, diaphragm, liver, stomach, and spleen to the ribs and their sternal cartilages. The lungs are inflated (as in full inspiration) to indicate the so-called area of the heart's dulness. From a male subject about forty years old, with normal condition of the organs.

1. The supra-sternal notch.
2. The right first rib.
3. The right second rib.
4. The upper lobe of the right lung.
5. The right third rib.
6. The base of the heart.
7. Position of the tricuspid valves.
8. The right fourth rib.
9. The right nipple.
10. The right auricle of the heart.
11. The middle lobe of the right lung.
12. The right fifth rib.
13. The lower lobe of the right lung, resting on the diaphragm and overlapping the liver.
14. The right sixth rib.
15. The costal cartilage.
16. The upper surface of the diaphragm, seen through the space between the sixth and seventh ribs.
17. The cartilage of the right eighth rib.
18. The right seventh rib.
19. The left lobe of the liver.
20. The right eighth rib, in this case a true rib, having an independent sternal cartilage.
21. The cartilage of the right ninth rib, in its relation to the fundus of the gall-bladder.
22. The cartilage of the right tenth rib.
23. The lower margin of the right lobe of the liver.
24. The great omentum.
25. The manubrium.

26. The left first rib.
27. The left second rib.
28. The ridge at the junction of the manubrium and gladiolus of the sternum, where it receives the cartilages of the second ribs.
29. The left third rib.
30. The position of the pulmonary valves.
31. The upper lobe of the left lung.
32. The left fourth rib.
33. The position of the mitral valve.
34. The left nipple.
35. The left fifth rib.
36. The right ventricle of the heart.
37. The position of the apex beat in the adult.
38. The upper surface of the diaphragm, seen between the fifth and sixth ribs.
39. The left sixth rib.
40. The lower border of the left lung.
41. The cartilage of the left eighth rib, independently connected with the sternum.
42. The left seventh rib.
43. The left eighth rib.
44. The fundus of the stomach, in ordinary distention.
45. The cartilage of the left ninth rib.
46. The cartilage of the left tenth rib.
47. The lower border of the spleen, in its relation to the cartilage of the tenth rib.
48. The branches of the gastro-epiploica dextra artery.

N. B.—The subject upon which this dissection was made presented the rare anomaly of a distinct eighth true rib on either side. This is well shown in the plate.
below this point. The bifurcation is often the seat of aneurism or dilatation, in consequence of the resistance here naturally offered to the current of the blood. The external carotid artery, just after its origin, gives off the ascending pharyngeal artery, which runs up between the external and internal carotids to its distribution (page 175), and then in successive order anteriorly the superior thyroid (page 184), lingual (page 166), and facial (page 123) arteries, and terminates in the parotid gland in the internal maxillary and temporal arteries (page 134). Posteriorly the branches from the external carotid are the occipital and posterior auricular arteries (page 8). The relative position which the external and internal carotid arteries hold to each other is worthy of careful notice. At first they are on the same plane, but the external soon crosses in front of the internal to enter the under surface of the upper portion of the parotid gland. The internal ascends close by the side of the pharynx to the base of the skull (Plate 13, Figs. 1 and 3), which it enters by the carotid canal in the apex of the temporal bone. Between the external and internal carotid arteries, just above their bifurcation, there is a long, grayish-colored body, the inter-carotic body, which consists of a vascular net-work of tiny vessels from the external carotid, interwoven with some non-medullated nerves and ganglion cells and connective tissue. It is the remains of one of the fetal visceral clefts. The internal jugular vein receives the blood from the brain by the lateral sinus, and commences at the jugular foramen, where it is joined by the inferior petrosal sinus and presents a slight enlargement, the jugular sinus. The jugular foramen is formed by the apposition of the jugular fossae of the occipital and temporal bones, and is behind the opening of the carotid canal, two and one-half centimetres, or about an inch, from the surface over the mastoid process. The vein descends on the outer side of the internal carotid artery, and, after receiving the temporo-facial vein, becomes ensheathed with the common carotid artery, and pursues its course as the common jugular vein on the outer side of that vessel, until it empties into the subclavian vein at a right angle and forms the innominate or brachiocephalic vein. The internal jugular receives the blood from the pharyngeal, occipital, facial, lingual, superior thyroid, and middle thyroid veins.
The jugular foramen also gives exit from the cranium to the pneumogastric, spinal accessory, and glossopharyngeal nerves.

The pneumogastric nerve (Plate 21, No. 43, Plate 36, No. 61, and Plate 37, No. 32) within the foramen is enclosed in a sheath of the dura mater and arachnoid membrane, with the spinal accessory nerve. There is upon its root a small ganglion (Arnold's) which receives a branch from the accompanying nerve. About twelve millimetres, or half an inch, below the ganglion on the root there is another ganglionic enlargement, the ganglion of the trunk, which involves only a part of the nerve. The pneumogastric is probably at its origin a nerve of sensation only, but as it is joined by filaments from the hypoglossal and from the first and second cervical nerves as well as from the superior cervical sympathetic ganglion, it becomes a compound nerve and resembles a spinal nerve. It descends upon the rectus capitis anticus major and longus colli muscles in front of the cervical vertebrae, and at the upper part of the neck becomes ensheathed with the internal carotid artery and internal jugular vein, holding a position posterior to them. This position of the pneumogastric nerve is maintained with regard to the common carotid artery and internal jugular vein until the root of the neck is reached, where the nerve, as well as the vessels, holds different relations on the two sides, which are specially described on page 317. In the upper part of the neck the pneumogastric nerve furnishes branches to the ear, to the pharynx, and to the larynx. The auricular (Arnold's) branch arises from the lower end of the jugular ganglion, and, passing through a canal in the outer wall of the jugular fossa of the temporal bone, enters the aqueduct of Fallopius and escapes to the outer surface by the auricular fissure, where it communicates with the posterior auricular nerve and supplies the back of the concha (page 63). The pharyngeal branch arises from the upper part of the ganglion of the trunk, and, being joined by filaments from the spinal accessory and sympathetic nerves, passes to the inner side of the internal carotid artery and forms the pharyngeal plexus upon the middle constrictor muscle (page 175). The superior laryngeal branch is derived from the middle of the ganglion of the trunk, and, passing downward behind the internal carotid artery, divides into the internal and external laryngeal
nerves (page 185). In two dissections made within the last year the author has found distinct branches passing from the pneumogastric on the left side to the brachial plexus (one of these is seen in Plate 36).

The *glosso-pharyngeal nerve* leaves the jugular foramen in a separate sheath of the dura mater, in front of the spinal accessory and pneumogastric nerves. This nerve at its exit consists of two cords, which coalesce in the jugular foramen and form a double ganglionic swelling, the upper part of which is the *jugular* (or Ehrenritter's) *ganglion* and the lower is the *petrosal* (or Andersch's) *ganglion*. The trunk of the nerve below the ganglionic enlargement descends between the internal carotid artery and internal jugular vein until it reaches the lower border of the stylo-pharyngeus muscle, whence it is distributed to the tongue (page 167). The *hypoglossal nerve*, after its exit from the skull through the anterior condyloid foramen, is in close connection with the ganglion of the trunk of the pneumogastric beneath the internal carotid artery and internal jugular vein, between which it comes forward and below the posterior portion of the digastric muscle curves round the occipital artery on its way to the tongue (page 167). As it crosses the occipital artery the branch called the *descendens hypoglossi* is given off (Plate 21, No. 41). At first this little nerve enters the sheath of the carotid vessels, but about the level of the hyoid bone it comes through the sheath and runs along on its surface to a point below where the omo-hyoid muscle crosses. This nerve can usually be seen as a white thread on the surface of the carotid sheath, and is generally a reliable indication of its position. The *descendens hypoglossi* forms a loop, the *ansa hypoglossi*, with the communicating branches from the second and third cervical nerves (Plate 21), from which are derived the nerves which supply the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles,—the depressor muscles of the hyoid bone. The descendens hypoglossi appears to consist of fibres mainly derived from a branch from the upper two cervical nerves.

The *spinal accessory nerve* leaves the skull in a common sheath of dura mater with the pneumogastric nerve at the middle of the jugular foramen. The fibres of the original portions of this nerve, the accessory and the
spinal, intermingle at the foramen, but separate into two portions again below the foramen. The accessory portion sends a few filaments to join the ganglion at the root of the pneumogastric nerve, and also filaments to the pharyngeal and superior laryngeal branches as they leave the ganglion of the trunk of that nerve. Below the latter ganglion the remaining accessory fibres are incorporated with the pneumogastric. The spinal portion, after leaving the accessory, curves backward and outward across the internal jugular vein and the transverse process of the atlas vertebra behind the stylo-hyoid and digastric muscles. It pierces the upper portion of the sterno-mastoid muscle in company with the sterno-mastoid branch of the occipital artery. Leaving the sterno-mastoid muscle, the nerve crosses obliquely the occipital division of the posterior triangular space of the neck to the under surface of the trapezius muscle, and is joined by branches of the second, third, and fourth cervical nerves (Plate 20, No. 58, and Plate 21, No. 10).

The occipital triangle is bounded in front, behind, and below respectively by the sterno-mastoid, trapezius, and omohyoid muscles. Within this space (Plate 21) are found the deep cervical plexus of nerves, the spinal accessory nerve as above described, and a chain of lymphatic glands in relation to the posterior border of the sterno-mastoid muscle, extending from the mastoid process to the root of the neck (Plate 16). The transversalis colli artery and vein (Plate 25), and the superficial cervical branch from the transversalis colli artery to the trapezius muscle, pass outwardly in the lower portion of this space.

The deep cervical plexus of nerves (Plates 20 and 21) consists of intercommunicating branches between the anterior divisions of the upper four cervical nerves, which rest upon the levator anguli scapulae and scalenus medius muscles, close to the transverse processes of the upper four cervical vertebrae. Each nerve forming the plexus, with the exception of the first, divides into ascending and descending branches. The superficial nerves of the plexus have been already described (page 193). The deep nerves consist of external and internal branches. The external branches are, besides the communicating nerves to the spinal accessory, muscular nerves to the contiguous muscles,—viz., the sterno-mastoid,
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scalenus medius, levator anguli scapulae, and trapezius. The *internal* branches consist of the *communicantes* (from the second and third nerves), which, looping round the internal jugular vein, join the descendens hypoglossi, muscular branches from the first nerve to the prevertebral muscles,—viz., the recti antici, rectus lateralis, and longus colli,—and branches to the hypoglossal, pneumogastric, and sympathetic nerves, and the *phrenic*, which arises from the third, fourth, and fifth cervical nerves and descends toward the root of the neck over the scalenus anticus muscle.

The *supra-clavicular triangle*, called also the *subclavian triangle*, because it contains the subclavian artery, is bounded below by the clavicle, in front by the clavicular origin of the sterno-mastoid muscle, and above by the posterior portion of the omohyoid muscle. The area of this space is variable, and depends upon the obliquity of the omohyoid muscle and the extent of the clavicular attachments of the sterno-mastoid and trapezius muscles. The contents of the supra-clavicular triangle are described with the other parts at the root of the neck. They, together with the contents of the occipital triangle, rest upon the deep muscles of the neck, the splenius (capitis et colli), the levator anguli scapulae, the scalenus medius and posticus, and part of the serratus magnus.

The *splenius muscle* (Plate 16, No. 7, Plate 19, No. 25, Plate 22, Fig. 1, Nos. 5 and 14) arises by tendinous slips from the spinous processes of the six upper dorsal and seventh cervical vertebrae, from the supra-spinous ligament, and from the lower portion of the ligamentum nuchae. The fleshy fibres are directed upward and outward, and are divided into two portions, an inner and an outer. The *inner* portion is inserted into the mastoid process and into the outer part of the superior curved line of the occipital bone beneath the sterno-mastoid muscle, and is called the *splenius capitis*. The *outer* portion is inserted into the posterior tubercles of the transverse processes of the three upper cervical vertebrae, and is called the *splenius colli*. These muscles are supplied by the external branches of the posterior divisions of the cervical nerves. The action of the splenii muscles aids that of the sterno-mastoid muscles. When the two muscles on both sides contract together, they assist in
holding the head erect. The action of either of them (the two portions working together) is to draw the head and the upper cervical vertebrae toward its own side. When this contraction is permanent it may produce "wry-neck," and may be confounded with the action of the opposite sterno-mastoid muscle, which produces the same effect (page 198).

The *levator anguli scapulae* (Plate 16, No. 8) arises tendinously from the transverse processes of the four upper cervical vertebrae, the two upper slips being the largest. These unite to form a prismatic muscle which descends along the side of the neck and is inserted into the posterior border of the scapula from the superior angle to the root of the spine. It receives branches from the third and fourth cervical nerves of the deep cervical plexus, and a branch from the fifth cervical nerve. When this muscle is brought into action, it raises the posterior angle of the scapula, as in shrugging the shoulders.

The *cervical portion of the trapezius* muscle covers the preceding muscles. It is superficial (Plate 22, Fig. 1, No. 4) at the back of the neck, and constitutes the lateral bulge on each side of the middle depression over the spines of the cervical vertebrae.

The *trapezius* arises from a variable extent of the inner portion of the superior curved line on the occipital bone, from the ligamentum nuchae, from the spinous process of the vertebra prominens, and from the spines of all the dorsal vertebrae and their supra-spinous ligaments. Each trapezius muscle is triangular in shape, but the two together form a trapezoid, and between the sixth cervical and the third dorsal vertebra their origin presents a glistening semi-oval aponeurosis, the *speculum rhomboideum*. The fibres of each muscle converge from their extensive vertical origin toward the shoulder, to be inserted upon the scapula exactly corresponding to the origin of the deltoid muscle (Plate 16, No. 10). The upper fibres pass downward and outward, to be inserted into the upper edge of the clavicle, usually upon its outer third, but often extending forward as far as the posterior border of the clavicular portion of the sterno-mastoid muscle; the middle fibres pass transversely outward to the inner border of the acromion process and upper margin of the spine of the scapula; and the lower fibres pass upward and outward and are inserted by a thin tendon
into the tubercle of the spine of the scapula. There is always a layer of loose connective tissue or a mucous bursa interposed between the tendon and the triangular surface at the back of the scapula. The trapezius is supplied by the spinal accessory nerve, and by the deep branches of the cervical plexus. Its nutrient arteries are derived from the superficialis colli and the dorsal branches of the intercostal arteries (Plate 22, Fig. 1, No. 10). When both trapezius muscles act from below they draw the head backward, or one muscle acting in the same manner will turn the head backward to the corresponding side. The whole of each muscle has the power to retract the scapula, and, by rotating it, to raise the shoulder.

Beneath the trapezius and splenius muscles at the back of the neck is the powerful complexus muscle. This muscle is broad and thick, and arises usually by seven tendons from the tips of the transverse processes of the three upper dorsal vertebrae and the vertebra prominens and from the articular processes of the sixth, fifth, and fourth cervical vertebrae. It is inserted into the depression between the two occipital curved lines near the median ridge. Very often this muscle presents a transverse tendinous intersection, and a separate fasciculus is sometimes specialized at the spinous border, which, because it has a longitudinal tendon in its centre, is called the biventer cervicis. This muscle is separated from its fellow by the ligamentum nuchae, which is practically a continuation upward of the supra-spinous ligament. It consists of fibro-elastic tissue, and extends from the spinous processes of all the cervical vertebrae, except the atlas, to the external occipital protuberance. In a few instances muscular fibres have been found in place of this ligament, but in man it is a rudiment of the strong elastic ligament which enables some of the lower animals to sustain the weight of the head.

At the outer side of the complexus are the trachelo-mastoid and transversalis colli muscles, which are accessory portions of the longissimus dorsi continued to the head and neck.

The trachelo-mastoid muscle arises from the upper five dorsal transverse processes and from the lower four cervical articular processes by tendinous slips which unite to be inserted into the back of the mastoid process beneath the sterno-mastoid and splenius muscles. The transversalis colli
PLATE 30.

The lungs inflated, so as to demonstrate the approximation of their edges over the heart, as in full inspiration.

1. The right common carotid artery.
2. The right internal jugular vein.
3. The right scalenus anticus muscle.
4. A rubber tube introduced into the trachea for the purpose of inflating the lungs.
5. The right transversalis colli artery and vein.
6. The right pneumogastric nerve.
7. The sternal end of the right clavicle.
8. The innominate artery.
9. The right subclavian vein and artery.
10. The sternal end of the right first rib.
11. The right innominate vein.
12. The ascending portion of the aorta.
13. The right second rib.
14. The right third rib.
15. The cleft between the upper and lower principal lobes of the right lung.
16. The right lung.
17. The right fourth rib.
18. The right fifth rib.
19. The cleft in the lower portion of the right lung, indicating its division into the so-called middle and inferior lobes.
20. The right sixth rib.
21. The anterior lower border of the right lung (as in full inspiration).
22. The upper surface of the diaphragm.
23. The right seventh rib.
24. The left common carotid artery.
25. The left brachial plexus of nerves.
26. The left internal jugular vein.
27. The trachea at the root of the neck.
28. The left scalenus anticus muscle.
29. The left pneumogastric nerve.
30. The remains of the left comno-clavicular membrane.
31. The sternal end of the left clavicle.
32. The left subclavian artery.
33. The left subclavian vein.
34. The sternal end of the left first rib.
35. The left innominate vein.
36. The left pneumogastric nerve.
37. The left second rib.
38. The approximation of the edges of the lungs in the median line, covering the root of the heart, as occurs in full inspiration.
39. The left third rib.
40. The upper lobe of the left lung.
41. The left fourth rib.
42. The notch in the anterior edge of the left lung in relation to the apex of the heart.
43. The left fifth rib.
44. The right ventricle of the heart covered with the pericardium.
45. The left sixth rib.
46. The anterior lower border of the left lung (as in full inspiration).
47. The left seventh rib.
48. The left eighth rib.

N. B.—This and the succeeding plates (31, 32, and 33) were taken from a male subject about thirty-two years of age, who died from choking. The lungs were absolutely healthy. The pleura were removed in the dissection.
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muscle arises by delicate tendons from the six upper dorsal transverse processes, and is inserted by as many tendons into the posterior tubercles of the lower six cervical transverse processes. The last two muscles are supplied by external branches from the posterior divisions of the cervical nerves, the complexus receiving internal branches of these nerves, together with branches from the sub-occipital and great occipital nerves. The action of the trachelo-mastoid and transversalis colli muscles assists the overlying muscles in holding the head erect or in turning it backward to one or the other side according as both pairs of the muscles act together or the individual muscles act severally. The occipital artery, after leaving its groove in the temporal bone back of the mastoid process, passes horizontally underneath the sterno-mastoid, splenius, and trachelo-mastoid muscles to the complexus (Plate 22, Fig. 1), upon the outer surface of which it turns upward, and, piercing the attachment of the trapezius, winds tortuously over the occiput, dividing into numerous branches, which supply the tissues of the scalp posteriorly. The point where the occipital artery reaches the scalp (Plate 21, No. 6) is about midway between the external occipital protuberance and the mastoid process, and it also corresponds to the position of the great occipital nerve, with which the vessel is in close relation. The occipital artery furnishes nutrient vessels to the digastric, stylo-hyoid, splenius, trachelo-mastoid, and sterno-mastoid muscles. It also sends a branch to the back of the concha, and one or more meningeal branches which enter by the mastoid foramen or through the jugular foramen to supply the neighboring part of the dura mater; but the most important branch is the princeps cervicis, which passes downward from the occipital between the complexus and splenius muscles and divides into two branches. One of these is superficial, and, penetrating the splenius, supplies the trapezius and anastomoses with the superficial cervical branch of the transversalis colli; the other takes a deep course between the complexus and semispinalis colli muscles and anastomoses with the vertebral and often with the deep cervical branch from the superior intercostal artery. By means of these anastomoses the collateral circulation is mainly established after ligature of the carotid or subclavian artery.

The deeper muscles beneath the complexus are the prolongations of
the erector spinae mass. They are of variable development in different subjects, and are interesting because they assist the more superficial muscles in holding the head in the various positions while the body is upright. The *cervicalis ascendens* is the upward continuation of the accessorius muscle: it arises from the angles of the four or five upper ribs, and is inserted by tendons into the posterior tubercles of the transverse processes of the sixth, fifth, and fourth cervical vertebrae. The *spinalis colli* is often absent, but when it exists it connects the spines of the lower cervical vertebrae, like the *spinalis dorsi*, and is inserted into the spinous process of the axis vertebra. The cervical portion of the *multifidus spinae* consists of a series of muscular slips extending from the articular processes of the lower four cervical vertebrae, each of which passes obliquely to be inserted into the spinous process of the vertebra above and the contiguous portions of the laminae.

Besides the above there are the *inter-spinales* and the *inter-transversales*. The former are more pronounced in the neck than they are in the back, and extend between the spinous processes of the lower six cervical vertebrae, while the latter pass between their transverse processes. The anterior portions of the inter-transversales correspond to the intercostal muscles. There are seven in the neck, where they are also most marked, and they are arranged in pairs between the anterior and posterior tubercles of the contiguous vertebrae. All these deeper muscles are supplied with branches from the internal posterior branches of the cervical nerves.

At the very top of the neck there are upon each side various small muscles which are concerned in the movements of the head upon the atlas and axis vertebrae. They are specialized as follows. The *rectus capitis posticus major* is the largest: it arises from the side of the spinous process of the axis, and is inserted into the outer part of the lower curved line on the occipital bone and the rough surface below it. The *rectus capitis posticus minor* is deeper than, and internal to, the major: it arises by a narrow tendon from the posterior tubercle of the atlas, and is inserted by a fan-shaped expansion between the inner portion of the inferior curved line and the foramen magnum. The action of these muscles is to raise the head. The *obliquus capitis inferior* passes from
the spine of the axis to the under surface of the transverse process of
the atlas. The obliquus capitis superior extends from the upper surface
of the transverse process of the atlas, just above the insertion of the
former, to the interval between the occipital curved lines. The action of
the inferior oblique is to turn the head round to the same side by rotating
the atlas upon the axis vertebra. The great occipital nerve supplies it
with a branch as it turns round its lower border. The action of the
superior oblique is to draw the occiput toward the spine. This muscle
and the two recti postici receive branches from the sub-occipital nerve,
which is in close relation to them. The so-called sub-occipital triangle
is formed by the disposition of the two oblique muscles with the rectus
.capitis posticus major, the obliquus superior being on the outer side, the
rectus capitis posticus major on the inner, and the obliquus inferior on
the lower. This triangle contains the arch of the atlas vertebra, with
the vertebral artery lying in a groove on its upper surface (page 215).
The posterior division of the sub-occipital (first spinal nerve) is placed
between the artery and the bone.

Beneath the multifidus muscles, upon the laminae of the cervical
vertebrae, there is on both sides of the neck a plexus of large veins,
the cervico-dorsal spinal veins, which communicate freely with the
veins of the vertebral canal through the interlaminar ligaments. The
interlaminar ligaments, or ligamenta subflava, are thick masses of elastic
yellow fibrous tissue which fill in the intervals between the arches of the
vertebrae. They pass from the upper edge of each vertebra to a rough
ridge on the anterior surface of the vertebra above. The ligament upon
one side is continuous with its corresponding fellow. In the cervical region
these ligaments are thinner than elsewhere, and are directed outwardly to
the inner margins of the articular processes. The interspinous ligaments
in the neck are not markedly developed, and appear like projections of
the ligamentum nuchae between the spinous processes. There is no inter-
spinous ligament between the axis and atlas vertebrae, and none between
the atlas and the occipital bone. The interlaminar ligament between the
atlas and the axis, the posterior atlanto-axial ligament, and that below
the occipital bone and the atlas, the posterior occipito-atlantic ligament,
are deficient in elastic tissue, being composed chiefly of condensed areolar tissue which is closely connected with the dura mater of the spinal cord in front.

The nerves at the back of the neck are the posterior divisions of the cervical nerves.

The posterior division of the first cervical nerve, or sub-occipital, makes its exit from the spinal canal between the arch of the atlas and the vertebral artery, and thence enters the sub-occipital triangle and sends off muscular branches, as already described. The posterior division of the second cervical nerve, or great occipital, emerges between the arches of the atlas and axis vertebrae. The posterior divisions of the lower six cervical nerves divide into external and internal nerves. Of these the internal are the larger, and those from the second, third, and fourth nerves form the so-called posterior cervical plexus beneath the complexus muscle, which after supplying the muscles terminate in the skin over the trapezius. The lower three cervical nerves also give off cutaneous branches.

There are eight pairs of cervical spinal nerves, and their origins from the spinal cord can be seen only by removing the posterior segments of the cervical vertebrae (Plate 4, Fig. 2). The removal of these segments exposes the theca vertebralis, or cervical portion of the spinal dura mater, through which the spinal nerves pass out, the two roots—anterior (motor) and posterior (sensory)—of each piercing the membrane by separate holes and receiving from it prolongations or sheaths. The anterior roots are the smaller, and have no ganglionic enlargement upon them, while the posterior roots are larger, and have a ganglion upon each, with the exception sometimes of the posterior root of the first cervical nerve. The two roots of each nerve blend with each other beyond the ganglion, and the compound trunk thus formed passes out of the corresponding intervertebral foramen and separates into an anterior division to supply the anterior part of the neck, and a posterior division to supply the posterior part, each nerve being composed of fibres from both roots. The ganglia are of oval form and proportionate in size to the nerve-trunks to which they contribute, and are generally situated in the intervertebral foramina outside of the dura
THE REGION OF THE NECK.

mater (Plate 4, Fig. 2). When the first nerve has a ganglion on its pos-
terior root, it is, however, usually within the dura.

The spinal cord presents an enlargement opposite the fifth cervical
vertebra, where the nerves are given off which form the brachial plexus
on each side. The anatomy of the spinal cord is described with the
region of the back in Vol. II.

The vertebral arteries, after their origins from the subclavian arteries,
ascend for a short distance between the longus colli and scalenus anticus
muscles on each side, and, entering the foramen in the transverse process
of usually the sixth cervical vertebra, mount upward through the vertebral
foramina above until the interval between the axis and the atlas is reached.
Here each artery makes an abrupt curve backward, being accommodated
in grooves on the arch of the atlas vertebra within the sub-occipital
triangle, and enters the foramen magnum after perforating the posterior
occipito-atlantic ligament and the dura mater (Plate 4, Fig. 2, Nos. 9
and 25). Within the skull the two vertebral arteries unite to form the
basilar artery, which occupies the anterior median fissure of the pons
Varolii (page 46). The cervical branches of the vertebral arteries are
small, some going to the deep muscles, and others, the lateral spinal,
supplying the spinal cord and its membranes in relation to the inter-
vertebral foramina and the contiguous surfaces of the bodies of the verte-
brae. The vertebral veins commence by tributaries from the muscles in
the neighborhood of the foramen magnum, and descend in front of the
arteries through the vertebral foramina. They are often brought in relation
with the lateral sinuses by emissary veins through the posterior condyloid
foramen on one or the other side.

The characteristic curvature of the cervical portion of the spine is
mainly due to the shape of the disks of intervertebral fibro-cartilage,
which are here thicker in front than behind. These disks, like all the
others of the spinal column, consist of outer concentric layers of fibro-
cartilage surrounding a pulpy nucleus of elastic tissue. The nucleus is
not quite in the centre of each disk, and contains a small irregular-shaped
cavity. The fibres at the circumference cross one another, taking an oblique
direction from side to side. At the margins of the disks the fibrous layers
PLATE 31.

The relations of the lungs, in moderate distention, to the pericardium, as in ordinary breathing. Also the great vessels and nerves at the root of the neck. The sternum and costal cartilages are removed.

1. The right superior thyroid vessels, and superior laryngeal nerve.
2. The median notch in the thyroid cartilage.
3. The right internal jugular vein.
4. The right common carotid artery.
5. The right scalenus anticus muscle.
6. The median cord of the brachial plexus.
7. The right pneumogastric nerve.
8. The right transversus colli artery and veins.
9. The right phrenic nerve.
10. The brachial plexus of nerves, and subclavian artery and vein, below the clavicle.
11. The innominate artery.
12. The right recurrent laryngeal nerve.
13. The sternal end of the right first rib.
14. The right innominate vein.
15. The sternal end of the right second rib.
16. The aorta, covered with the pericardium.
17. The right third rib.
18. The right lung.
19. The right fourth rib.
20. The right fifth rib.
21. The right sixth rib.
22. The upper surface of the diaphragm.
23. The body of the hyoid bone.
24. The left superior thyroid vessels, and superior laryngeal nerve.
25. The left internal jugular vein.
26. The left common carotid artery.
27. The left brachial plexus of nerves, above the clavicle.
28. The left phrenic nerve.
29. The left scalenus anticus muscle.
30. The left pneumogastric nerve.
31. The left deltoïd muscle.
32. The left brachial plexus, below the clavicle.
33. The sternal end of the left clavicle.
34. The left subclavian artery and vein.
35. The left pectoralis minor muscle.
36. The sternal end of the left first rib.
37. The left innominate vein.
38. The superior vena cava.
39. The position of the pulmonary artery, covered with the pericardium.
40. The left second rib.
41. The upper lobe of the left lung.
42. The left third rib.
43. The position of the right auricle, covered with the pericardium.
44. The left fourth rib.
45. The left fifth rib.
46. The right ventricle of the heart, covered with the pericardium.
47. The left sixth rib.
48. The left seventh rib.
are firmly attached to the contiguous margins of the vertebral bodies above and below. The bodies of the vertebrae and the intervertebral disks are strongly united in front by the anterior common spinal ligament, and by a similar band within the spinal canal, called the posterior common ligament. The anterior ligament consists of several strata, the outer being composed of long fibres extending along several vertebrae, and the inner, of short fibres from one vertebra to another. This ligament is thicker over the bodies of the vertebrae than the intervertebral disks, and is attached above to the axis in connection with the longus colli muscles. Each joint between the articular processes in the cervical vertebrae is provided with a synovial membrane surrounded with a loose capsular ligament, in accordance with the free movement in the neck. For the same reason the joint between the occipital bone and the atlas and axis vertebrae has specialized ligaments. The anterior common ligament is continued upward from the top of the anterior arch of the atlas to the front border of the foramen magnum, as the anterior occipito-atlantic ligament, which is thicker at the centre than at either side. The posterior occipito-atlantic ligament has been already referred to (page 213). If a section is made of the posterior arches of the two upper vertebrae and the occipital bone, the ligamentum latum axiale is exposed. This is a strong fibrous band separated from the posterior common ligament. Beneath the broad axial ligament is the remarkably strong transverse ligament, which is stretched across between the internal tuberosities of the atlas back of the odontoid process, a synovial bursa and a thin layer of fibro-cartilage being interposed between the process and the ligament. Some fibres of this ligament pass upward from its centre to be attached to the basilar process, and some downward to the body of the axis. The occipito-odontoid or check ligaments are placed above the transverse ligament, and extend from the inside of each occipital condyle to the same side of the top of the odontoid process. They are rendered tense by turning the head to one side or the other. A few fibro-cartilaginous fibres pass from the apex of the odontoid process to the front of the foramen magnum, and are called the suspensory ligament of the axis. In addition to the above, the articular surfaces of the occiput and atlas are provided with synovial sacs and capsular ligaments. The
cervical curve of the spine is considered as consequent upon the extension of the neck in development, and extends from the atlas to the intervertebral disk between the second and third dorsal vertebrae. The weakest point, not only in the neck but also in the entire column, is between the second and third cervical vertebrae.

The structures in immediate relation to the front of the cervical portion of the spinal column are the prevertebral muscles and fascia (Plate 11, Fig. 1). The longus colli muscle consists principally of a vertical portion, the fibres of which arise tendinously from the lateral ridges on the bodies of the three upper dorsal and two lower cervical vertebrae external to the common spinous ligament, and are inserted by arching tendons into the bodies of the fourth, third, and second cervical vertebrae, and into the anterior tubercle of the atlas. Besides these there are accessory portions. The inferior oblique portion arises with the vertical tendons from the three upper dorsal vertebrae, and is inserted into the transverse processes of the sixth, fifth, and fourth cervical vertebrae. Those fibres which are inserted into the sixth vertebra cover the vertebral artery at its entrance into the foramen in the transverse process of that vertebra. The superior oblique portion arises from the transverse processes of the fifth, fourth, third, and sometimes second cervical vertebrae, and is inserted with the vertical portion into the bodies of the upper two vertebrae and the anterior arch of the atlas. The longus colli muscle is supplied by branches from the lower cervical nerves, and the action of the united portions is to bend the cervical vertebrae forward.

The rectus capitis anticus major muscle arises from the transverse processes of the fifth, fourth, third, and second cervical vertebrae, and is inserted into the basilar portion of the occipital bone near the pharyngeal spine. Under this muscle there is a much smaller muscle, the rectus capitis anticus minor, which arises from the front of the root of the transverse process of the atlas, and is inserted into the basilar process of the occipital bone behind the former muscle. The two recti antici are supplied with branches of the anterior division of the sub-occipital nerve, and some filaments from the deep cervical plexus, and their action is to assist in bending the head forward. The rectus capitis lateralis muscle extends
from the transverse process of the atlas to the jugular process of the occipital bone, and is in reality the topmost of the series of *intertransversales muscles* in the cervical region, which extend between the successive transverse processes in front of the exits of the spinal nerves and over the vertebral artery. The laterales are capable of bending the head slightly sideways.

The *cervical portion of the sympathetic nerve* on each side consists of a continuous cord, on which there are three ganglia, situated in front of the transverse processes of the cervical vertebrae. The *superior ganglion* is the largest of the three, and is about opposite the second and third cervical vertebrae, over the rectus capitis anticus major muscle, behind the internal carotid artery, and internal to the pneumogastric nerve (Plate 36, No. 49). It is an elongated, reddish-gray body, generally three centimetres, or about an inch and a quarter, in length. It is sometimes marked by constrictions, and receives externally four communicating branches from the four upper cervical nerves. It sends branches to the upper and lower ganglia of the pneumogastric (page 204), also to the ganglion of Andersch, on the glossopharyngeal nerve (page 205), and to the hypoglossal nerve. From the upper portion of the superior ganglion the cord is continued into the carotid canal with the internal carotid artery, to form the carotid sympathetic plexus. Filaments leave the anterior border of the superior ganglion and accompany the branches of the external carotid artery, upon which they form plexuses and are distributed to the territories which they supply. A branch is also sent to the inter-carotic body. The *superior cardiac nerve* arises from the lower part of the superior ganglion, and descends upon the longus colli muscle behind the sheath of the carotid vessels, in close connection with the main sympathetic cord.

The *middle cervical ganglion* is very small and inconstant, and when present is situated opposite the sixth cervical vertebra, near the inferior thyroid artery, and about on a level with the crossing of the omo-hyoid muscle. It receives branches from the adjacent cervical nerves, and gives off thyroid branches and the *middle cardiac nerve*, which descends with the superior cardiac either over or under the subclavian artery to join the cardiac plexus.
The *inferior cervical ganglion* is deeply situated between the transverse process of the vertebra prominens and the neck of the first rib (Plate 36, No. 22). It receives branches from the seventh and eighth cervical nerves, and gives off branches which form the plexuses about the subclavian and vertebral arteries and the *inferior cardiac nerve*, which joins the deep cardiac plexus.

The *scalene muscles* extend from the transverse processes of the cervical vertebrae to the two upper ribs, in the manner of a scalene triangle, on each side, and are comparable to the intercostal muscles both in their attachment and in their function. The *scalenus anticus* arises from the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebrae, and is inserted by a flat tendon at the inner border and upper surface of the first rib (Plates 31, 32, 34, 35, and 36). This muscle is usually described as being inserted into the tubercle (of Lisfranc) on the first rib, and much stress has been laid upon it as an important guide to the adjacent vessels; but, after examining several hundred specimens, the author has the recollection of seeing only four or five upon which any approach to a tubercle was developed. The *scalenus medius* arises from the posterior tubercles of the transverse processes of the lower six cervical vertebrae, and is inserted also upon the first rib behind the scalenus anticus. This is the strongest of the three scalene muscles. The *scalenus posterior* arises from the posterior tubercles of the transverse processes of the three lowest cervical vertebrae, and is inserted upon the second rib external to its angle. These muscles receive their nerves from the lower cervical nerves, which they surround as they leave their grooves on the upper surfaces of the transverse processes. Their combined action is to raise the thorax, as in deep inspiration, or, being fixed below, they can bend the cervical vertebrae, as in rising from the recumbent position. The scalenus anticus is a guide in distinguishing the position of the important structures with which it is in close relation at the root of the neck. The lower attachment of the scalenus anticus is usually overlapped by the clavicular portion of the sterno-mastoid muscle, but by depressing the shoulder and extending the neck the outer border of the former muscle can be readily felt.
The subclavian artery and the subclavian vein are separated by the costal attachment of the scalenus anticus, as they pass in their respective grooves upon the first rib on their way to and from the axilla. The vein is in front and the artery is behind: the latter can sometimes be felt pulsating over the rib by pressing with the thumb in the supra-clavicular fossa, at the outer border of the sterno-mastoid muscle. In this way also compression of the subclavian artery may be sometimes satisfactorily effected, as is required in amputation at the shoulder. In one instance the author found both the artery and the vein in front of the scalenus anticus; and several cases have been recorded in which the relations of the vessels were reversed, the artery being in front of the vein.

In relation to the scalenus anticus muscle it should be remembered that the phrenic nerve (page 207) passes obliquely from the outer to the inner border in front of that muscle, to enter the chest between the subclavian artery and subclavian vein (Plates 25 and 31), and that it is joined on the outer surface of the muscle by a twig from the fifth branch of the cervical plexus as well as by a filament from the sympathetic nerve.

The supra-scapular and transversalis colli arteries (page 233) cross over the lower part of the scalenus anticus, and between it and the scalenius medius and above the subclavian artery are the cords of the brachial plexus of nerves. Its inner border is in close relation with the vertebral artery, which is here covered by the internal jugular vein.

The structures collected at the root of the neck (Plate 14, Fig. 2) present a complex arrangement which varies upon both sides, even in the normal condition, in consequence of the mode of distribution of the great aortic branches. The innominate artery upon the right side leaves the aorta at the commencement of the transverse portion of the arch behind the middle of the manubrium sterni, opposite the fourth dorsal vertebra, and ascends to the sterno-clavicular joint, behind which it subdivides into the right subclavian and right common carotid arteries. The innominate artery is usually four centimetres, or about an inch and a half, in length, in a well-developed adult, but it is often half an inch longer, and in some cases the vessel ascends above the clavicle close to the trachea before it divides. The innominate sometimes gives off a branch, the thyroidea ima.
(Plate 43), which ascends to the lower border of the thyroid body along the front of the trachea and compensates for a deficiency in the inferior thyroid artery. In the child, owing to the greater laxity of the connective tissue and the prolongation of the cervical fascia, the innominate artery may be drawn upward into the supra-sternal notch by extending the head and neck backward, but this cannot be done in the adult if the artery is in its normal position. It has been demonstrated on the dead subject (Burns) that if the innominate artery be tied with a ligature the collateral circulation can be established both in the right side of the head and in the right arm, and the operation has been successfully performed on the living subject (Mott); but it is a desperate undertaking, and should not be attempted except as such. The artery lies above the bifurcation of the trachea, and is enveloped in a strong sheath prolonged from the deep cervical fascia, which continues over it to the pericardium. The two vena innominata, or right and left brachio-cephalic veins, converge in front of the innominate artery to empty into the superior vena cava, the right vein descending on the outer side of the artery and the left vein passing across its origin. These veins thus form a triangular space (Plates 31 and 35), in which the artery appears when the loose fascia which connects it to the coat of the left innominate vein is removed.

The pneumogastric nerve descends into the thorax between the right innominate vein and the innominate artery at its bifurcation into the right subclavian and common carotid arteries, and in this relation gives off the right recurrent laryngeal nerve, which turns upward under the subclavian or innominate artery, as previously described (page 186). It will be noticed that the great innominate veins, with all their tributaries, occupy a plane anterior to that of their respective arteries, which is the converse of the relation of the arteries and veins below the diaphragm (Plate 42), with the single exception of the renal vein. The innominate veins are formed respectively by the confluence of the common jugular and subclavian veins of each side. The right vein commences behind the right sterno-clavicular joint, and descends a little forward to a point opposite the first right intercostal space, where it is joined at an obtuse angle by the left vein, to empty into the superior vena cava. It is about two and a
THE REGION OF THE NECK.

half centimetres, or an inch, in length, and receives the right internal mammary, superior intercostal, and inferior thyroid veins. The left innominate vein is nearly three times the length of the right, being six centimetres, or two and a half inches, as it commences behind the sternal end of the left clavicle and extends across the origins of the left common carotid and innominate arteries. The left vein receives upon its under surface the left internal mammary, thymic, and mediastinal veins, and on its upper surface the left inferior thyroid, vertebral, and deep cervical veins. The tributary veins to both vessels are guarded with single crescentic valves at their orifices. In the young child the left innominate vein is generally above the upper margin of the sternum. Between the innominate vessels and the sternum there is a considerable quantity of adipose and connective tissue, and in the adult the remains of the thymus gland (and in the child, up to the third or fourth year, the gland itself), with numerous veins. These veins form a plexiform net-work, and are associated with the inferior thyroid veins, which occupy the space between the trachea and the top of the sternum and empty into the right and left innominate veins. The presence and proximity of these veins render any operation in this locality extremely hazardous. They are liable to become dilated and engorged from interference with the respiration, as in membranous croup, or under the influence of pressure from a neighboring growth. In a patient from whom the author successfully removed the upper portion of the sternum and adjacent third of the clavicle for osteosarcoma, the venous hemorrhage was appalling, and could be arrested only by sponge pressure.

The right and left common carotid arteries ascend from the root of the neck by the sides of the trachea, diverging outward from the middle line to their bifurcation opposite the top of the thyroid cartilage (page 201). On a level with the top of the sternum, and three centimetres, or about an inch and a quarter, from the surface, the two carotid arteries are separated from each other by two centimetres, or less than an inch, but at their bifurcation, owing to the breadth of the larynx, they are six centimetres, or two and a half inches, apart (Plates 31, 32, 33, and 42). In consequence of the independent thoracic origin of the left common carotid artery from the
### PLATE 32.

The relations of the lungs, partially distended (as in tranquil respiration), to the pericardium. Also the vessels and nerves at the root of the neck.

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The right facial artery.</td>
</tr>
<tr>
<td>2</td>
<td>The right facial vein.</td>
</tr>
<tr>
<td>3</td>
<td>The right lingual artery.</td>
</tr>
<tr>
<td>4</td>
<td>The right thyro-hyoid artery.</td>
</tr>
<tr>
<td>5</td>
<td>The right superior laryngeal nerve.</td>
</tr>
<tr>
<td>6</td>
<td>The right external carotid artery.</td>
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<tr>
<td>7</td>
<td>The thyroid notch.</td>
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<tr>
<td>8</td>
<td>The thyroid cartilage.</td>
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<tr>
<td>9</td>
<td>The right superior thyroid artery.</td>
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<tr>
<td>10</td>
<td>The right internal jugular vein.</td>
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<tr>
<td>11</td>
<td>The right common carotid artery.</td>
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<tr>
<td>12</td>
<td>The right scalenus anticus muscle.</td>
</tr>
<tr>
<td>13</td>
<td>The right trapezius muscle.</td>
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<tr>
<td>14</td>
<td>The right internal jugular vein.</td>
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<tr>
<td>15</td>
<td>The right brachial plexus of nerves.</td>
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<tr>
<td>16</td>
<td>The right pneumogastric nerve.</td>
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<tr>
<td>17</td>
<td>The right phrenic nerve.</td>
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<tr>
<td>18</td>
<td>The suprascapular artery and veins.</td>
</tr>
<tr>
<td>19</td>
<td>The right recurrent laryngeal nerve.</td>
</tr>
<tr>
<td>20</td>
<td>The right deltoide muscle.</td>
</tr>
<tr>
<td>21</td>
<td>The brachial plexus of nerves below the clavicle.</td>
</tr>
<tr>
<td>22</td>
<td>The right axillary artery.</td>
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<tr>
<td>23</td>
<td>The right axillary vein.</td>
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<td>24</td>
<td>The right innominate vein.</td>
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<tr>
<td>25</td>
<td>The sternal end of the right first rib.</td>
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<tr>
<td>26</td>
<td>The superior vena cava.</td>
</tr>
<tr>
<td>27</td>
<td>The right phrenic nerve.</td>
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<tr>
<td>28</td>
<td>The sternal end of the right second rib.</td>
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<tr>
<td>29</td>
<td>The upper lobe of the right lung.</td>
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<tr>
<td>30</td>
<td>The right auricle covered with the pericardium.</td>
</tr>
<tr>
<td>31</td>
<td>The sternal end of the right third rib.</td>
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<tr>
<td>32</td>
<td>The middle lobe of the right lung.</td>
</tr>
<tr>
<td>33</td>
<td>The sternal end of the right fourth rib.</td>
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<tr>
<td>34</td>
<td>The height to which the diaphragm arches on the right side.</td>
</tr>
<tr>
<td>35</td>
<td>The sternal end of the right fifth rib.</td>
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<tr>
<td>36</td>
<td>The lower lobe of the right lung.</td>
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<tr>
<td>37</td>
<td>The sternal end of the right sixth rib.</td>
</tr>
<tr>
<td>38</td>
<td>The branches of the right phrenic nerve on the diaphragm.</td>
</tr>
<tr>
<td>39</td>
<td>The left facial artery.</td>
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<tr>
<td>40</td>
<td>The left facial vein.</td>
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<tr>
<td>41</td>
<td>The left thyro-hyoid artery.</td>
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<tr>
<td>42</td>
<td>The left external carotid artery.</td>
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<tr>
<td>43</td>
<td>The left internal jugular vein.</td>
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<td>44</td>
<td>The left superior thyroid artery.</td>
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<td>45</td>
<td>The left trapezius muscle.</td>
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<tr>
<td>46</td>
<td>The left carotid artery.</td>
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<tr>
<td>47</td>
<td>The clavicular cartilage.</td>
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<tr>
<td>48</td>
<td>The left brachial plexus of nerves.</td>
</tr>
<tr>
<td>49</td>
<td>The left phrenic nerve.</td>
</tr>
<tr>
<td>50</td>
<td>The left scalenus anticus muscle.</td>
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<tr>
<td>51</td>
<td>The left pneumogastric nerve.</td>
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<tr>
<td>52</td>
<td>The left deltoid muscle.</td>
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<tr>
<td>53</td>
<td>The trachea.</td>
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<tr>
<td>54</td>
<td>The left brachial plexus of nerves.</td>
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<tr>
<td>55</td>
<td>The left axillary vein.</td>
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<tr>
<td>56</td>
<td>The innominate artery.</td>
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<tr>
<td>57</td>
<td>The left innominate vein.</td>
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<tr>
<td>58</td>
<td>The sternal end of the left first rib.</td>
</tr>
<tr>
<td>59</td>
<td>The left thoracic artery.</td>
</tr>
<tr>
<td>60</td>
<td>The pectoralis minor muscle.</td>
</tr>
<tr>
<td>61</td>
<td>The left phrenic nerve.</td>
</tr>
<tr>
<td>62</td>
<td>The root of the heart covered with the pericardium.</td>
</tr>
<tr>
<td>63</td>
<td>The sternal end of the left second rib.</td>
</tr>
<tr>
<td>64</td>
<td>The upper lobe of the left lung.</td>
</tr>
<tr>
<td>65</td>
<td>The sternal end of the left third rib.</td>
</tr>
<tr>
<td>66</td>
<td>The sternal end of the left fourth rib.</td>
</tr>
<tr>
<td>67</td>
<td>The right ventricle of the heart covered with the pericardium.</td>
</tr>
<tr>
<td>68</td>
<td>The sternal end of the left fifth rib.</td>
</tr>
<tr>
<td>69</td>
<td>The sternal end of the left sixth rib.</td>
</tr>
<tr>
<td>70</td>
<td>The branches of the left phrenic nerve on the diaphragm.</td>
</tr>
<tr>
<td>71</td>
<td>The sternal end of the left seventh rib.</td>
</tr>
</tbody>
</table>
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arch of the aorta, it is longer than the right, the thoracic portion being equivalent in length to the innominate artery. The thoracic portion of the left common carotid artery is crossed by the left innominate vein, and its under surface is in relation to the trachea, oesophagus, and thoracic duct (Plate 39).

In the neck, between the clavicle and the position of the crossing of the omo-hyoid muscle the relations of the two carotids are almost identical. The right artery is usually a little nearer the surface than the left, and its calibre is larger. The right and left common jugular veins occupy separate compartments of the general sheaths on the outer sides of their companion arteries. As they approach their termination in the innominate veins they overlap the arteries, and on the left side this is more especially so than on the right (Plates 33 and 42), because of the inclination of the large veins from the left to the right side to reach the venous side of the heart. The calibre of the right common jugular usually exceeds that of the left, and they are both provided with double valves about three centimetres, or an inch and a quarter, above their terminations.

The right and left pneumogastric nerves ascend also in separate compartments of the sheath posterior to the septa between the artery and the vein, but somewhat nearer the latter. The position of the carotid vessels, on each side, may be indicated by drawing a line from the top of the sternal end of the clavicle to the parotid gland between the mastoid process and the angle of the lower jaw. As the sterno-mastoid muscle is attached to the anterior surface of the top of the sternum, with its fibres interlacing with those of the sternal portion of its fellow muscle (Plates 23 and 24), it completely covers the line of the carotid vessels, which in reality corresponds to the space between the sternal and clavicular attachments of the sterno-mastoid muscle (page 197). Between the sheath of the vessels and the sterno-mastoid muscles at the root of the neck there are also the sternal attachments of the sterno-hyoid and sterno-thyroid muscles, and between the latter muscles and the sheath are the intricate thyroid veins, and sometimes the external jugular vein passing into the internal jugular to empty conjointly into the subclavian (Plate 21).

The sheath of the carotid vessels is separated posteriorly from the bodies
of the lower cervical vertebrae by the longus colli and rectus capitus anticus muscles. It is in close relation with the sympathetic nerve cord, and separated from the vertebral artery by the inferior thyroid artery, which winds upward and inward from the subclavian to the thyroid body. To the inner side are the trachea, the larynx, and a lobe of the thyroid body. The oesophagus inclines to the left of the middle line at the root of the neck, so that it is in closer relation to the left carotid sheath. The recurrent laryngeal nerve on both sides ascends to the larynx between the trachea and the oesophagus, but is separated from the carotid sheath by considerable cellular tissue (Plate 24, Fig. 2).

In the operation for applying a ligature upon the carotid artery it is essential to avoid as far as possible interfering with the cellular investment of the sheath and its attachment to the reflections of the deep cervical fascia (page 195). In order to reach the artery the head should be turned to the opposite side over a pillow, so as to bring into relief the anterior border of the sterno-mastoid muscle, along which an incision from three to four inches in length should be made through the skin, superficial fascia, and platysma muscle so as to intersect the line of crossing of the omo-hyoid muscle at the level of the cricoid cartilage. The carotid sheath is immediately under the omo-hyoid, and this muscle may be cut through, or the sheath can be opened above or below it as required. A finger pressed upon the vein at the root of the neck will cause it to distend and reveal its precise relation. The sheath should be opened on the tracheal side, and it is well to raise the head and to turn it to the same side before passing the artery needle, so as to relax the tissues and avoid including or injuring any of the adjacent structures. The descendens hypoglossi nerve is usually seen upon the sheath, and the sterno-mastoid branch from the superior thyroid artery crosses it near the omo-hyoid muscle. The thyroid veins are numerous over the sheath at the root of the neck; and if it is necessary to tie the artery in that locality, they must first be secured with a double ligature and severed. Upon the left side the operation low down is attended with so much difficulty that it is well to divide the sternal attachment of the sterno-mastoid muscle, which will render the vessel more accessible.
After ligation of the common carotid artery the collateral circulation is established through the anastomoses of the branches of the external and internal carotid arteries of the opposite side with the branches of the ligatured side, in which the blood-current is reversed, and between the vertebral and posterior communicating, the inferior and superior thyroids, and the profunda and princeps cervicis, of the same side.

The deep cervical lymphatic glands (or glandulae concatenatae) form a chain extending from the base of the skull to the root of the neck embedded in the connective tissue which surrounds the great vessels. Some of these glands are directly over the sheath of the common carotid, and others lie between it and the bodies of the cervical vertebra, so that when they become diseased they are often so adherent to the adjoining structures that their removal is extremely hazardous. These glands are continuous with the thoracic and axillary glands. They are most numerous in the neighborhood of the bifurcation of the common carotid artery by the side of the pharynx, as they receive here the lymphatic vessels from all parts of the head and neck. The cervical lymphatic vessels unite at the inner border of the scalenus anticus muscle on both sides, so as to form the jugular lymphatic trunks. Upon the right side the trunk empties into the right lymphatic duct, which is about twelve millimetres, or half an inch, in length, and terminates at the junction of the common jugular and subclavian veins, and on the left side the trunk generally empties into the thoracic duct (page 318), and sometimes, by a separate orifice, directly into the angle of junction of the left common jugular and subclavian veins (Plate 20).

The subclavian arteries differ not only in their origins but in their relations upon the two sides of the root of the neck (Plates 33, 35, and 39). Each of them pursues an arching course to pass behind the scalenus anticus muscle (page 221), which divides the vessel into three portions,—the first or pectoral portion being between its origin and the inner border of the scalenus anticus, the second or muscular portion that which is behind it, and the third or cervical portion that which is between the outer border of the muscle and the lower border of the first rib, whence the artery continues as the axillary.
The right subclavian artery ordinarily leaves the innominate behind the sterno-clavicular joint, and its first portion is very deeply placed as it passes upward and outward to the inner border of the scalenus anticus. Any change in the position of the bifurcation of the innominate artery will of course affect the point of origin of this artery. Besides the superficial coverings, it has over it the insertions of the presternal muscles (Plate 23) and a layer of deep fascia which is projected from the inner border of the scalenus anticus muscle. Under this fascia it is crossed by the common jugular and vertebral veins (Plate 21), by the pneumogastric and phrenic nerves (Plates 34 and 35), and by the superior cardiac sympathetic nerves. Behind the artery are the recurrent and sympathetic nerves (Plate 36) upon the longus colli muscle and the transverse process of the first dorsal vertebra. It is here, also, in close proximity to the apex of the right lung covered with its pleura (Plate 39). The subclavian vein lies below the artery, under cover of the clavicle. Three branches are given off from the first portion of the subclavian artery,—i.e., from its under surface the internal mammary (page 257), and from its upper surface the vertebral (page 232) and the thyroid axis (page 232).

The left subclavian artery commences within the thorax by an independent origin from the arch of the aorta, and its first portion is consequently longer than that of the right. Its calibre is less, and it is also deeper. Within the thorax the first portion is crowded by the apex of the left lung within its pleura. It is covered by the sternal end of the first rib, by the sterno-clavicular joint, and by the left subclavian vein on its way to join the jugular vein to form the left innominate vein. Between the vein and the artery in this locality the phrenic nerve descends. Behind the artery, and internal to it, are the trachea, the oesophagus, the left recurrent laryngeal nerve, the inferior cervical ganglion of the sympathetic, and the thoracic duct (Plates 36 and 39).

Above the clavicle the first portion of the left subclavian artery corresponds very nearly in its relations to those on the right side, and its branches are similarly disposed. The second portions of both the right and left arteries very closely resemble each other as they pass between the
scalenus anticus and scalenus medius muscles over the first rib, the only difference being in the height to which the artery ascends above the clavicle, which in some cases is as high as four centimetres, or an inch and a half. The right subclavian usually arches higher than the left (Plate 35). The phrenic nerve descends across the scalenus anticus muscle, and at its anterior border passes between the artery and the vein. The superior intercostal artery is the only branch given off from the subclavian behind the scalenus anticus.

The third portions of both subclavian arteries also resemble each other in their relations. Here the vessel is more superficial as it passes downward over the first rib. It occupies the supra-clavicular triangle, formed by the sterno-mastoid and omo-hyoid muscles and the clavicle; but it should be remembered that the dimensions of this triangle may be encroached upon by the approximation of the sterno-mastoid and trapezius muscles (page 207). As this portion of the artery is most readily exposed, and therefore most easily ligatured, it deserves special attention. Besides the superficial coverings in this locality, there is the double layer of deep fascia, consisting of the expansion from the omo-hyoid to the clavicle and the underlying expansion from the scalenus anticus. Within the superficial fascia the supra-clavicular nerves, the lower end of the external jugular vein, and the transverse cervical and supra-scapular veins cross this space (Plates 18 and 19). In the ordinary position of the arm the clavicle and subclavius muscle and the supra-scapular vessels lie directly over this portion of the subclavian artery, but by turning the head and neck to the opposite side and depressing the shoulder the axillary artery may be drawn upward and made to take its place. The artery rests directly in a groove upon the first rib, and the outer border of the subclavian vein is below and on a plane anterior to it, under cover of the clavicle. The cords of the brachial plexus of nerves and the posterior portion of the omo-hyoid muscle are placed obliquely above the artery. The supra-scapular artery usually arises from the third portion of the subclavian, although occasionally it is derived from the thyroid axis at the inner border of the scalenus anticus muscle.
PLATE 33.

The relations of the lungs, when completely collapsed, to the heart. Also the deeper relations of the vessels and nerves at the root of the neck. The pericardium is removed, and the ribs sawn through at their middle to give a better view into the cavity of the thorax. The clavicles are also removed.

1. The right facial artery and vein.
2. The right digastric muscle.
3. The right lingual artery.
4. The right superior laryngeal nerve.
5. The right superior thyroid artery.
6. The right common carotid artery.
7. The right internal jugular vein.
8. The right pneumogastric nerve.
9. The right phrenic nerve.
10. The right brachial plexus of nerves.
11. The right scalenus anticus muscle.
12. The right suprascapular artery and veins.
13. The right subclavian artery.
14. The origin of the subclavian artery from the innominate artery.
15. The right subclavian vein.
16. The innominate artery.
17. The right recurrent laryngeal nerve, winding under the innominate artery.
18. The right innominate vein.
19. The back of the upper part of the thoracic cavity.
20. The superior vena cava.
21. The right phrenic nerve.
22. The ascending portion of the aorta.
23. The upper lobe of the right lung.
24. The right auricle of the heart.
25. The middle lobe of the right lung.
26. The position of the tricuspid valve.
27. The lower lobe of the right lung.
28. The branches of the right phrenic nerve on the upper surface of the diaphragm.
29. The diaphragm.
30. The left facial artery and vein.
31. The left digastric muscle.
32. The body of the hyoid bone.
33. The thyro-hyoid membrane.
34. The thyroid notch.
35. The left superior laryngeal nerve.
36. The left superior thyroid vein and artery.
37. The crico-thyroid membrane, and the crico-thyroid artery.
38. The cricoid cartilage.
39. The left internal jugular vein.
40. The left common carotid artery.
41. The left recurrent laryngeal nerve.
42. The left scalenus anticus muscle.
43. The left brachial plexus of nerves.
44. The left subclavian artery.
45. The left subclavian vein.
46. The left innominate vein.
47. The left pneumogastric nerve giving off its recurrent branch to pass under the aorta.
48. The back of the upper part of the thoracic cavity.
49. The transverse portion of the arch of the aorta.
50. The left phrenic nerve.
51. The pulmonic artery.
52. The upper lobe of the left lung.
53. The right ventricle of the heart.
54. The lower lobe of the left lung.
55. The branches of the left phrenic nerve on the upper surface of the diaphragm.
The subclavian vein, upon either side, does not arch upward like its companion artery, but takes nearly a straight course to join with the common jugular in forming the corresponding innominate vein. It extends from the lower border of the first rib to a point between the insertion of the scalenus anticus and the sterno-clavicular joint. The phrenic and pneumogastric nerves descend between it and the artery upon both sides of the neck, and it receives its blood through the anterior and external jugular veins. Before its junction with the common jugular it is guarded with a pair of valves. It should be noted that throughout its course the subclavian vein is placed on a lower plane than, and in front of, the artery. The sheath over the subclavian vessels is attached to the back of the clavicle, and, as the vein is more firmly enveloped by it than the artery, it follows the movements of that bone. This intimate relation of the vein to the clavicle renders it liable to injury in fractures of that bone. The operation for tying the subclavian artery is a difficult task, even upon the dead subject with the parts in their normal positions. It is naturally more so upon the living, and not only is a practical knowledge of the anatomy requisite, but also a knowledge of the possible deviations which attend the structural changes in consequence of aneurism or other tumor involving this region.

In ligation of the subclavian artery in the third or outer part of its course the patient's head should be turned back, the shoulders raised, and the arm pulled down to the utmost, so as to lower the clavicle. The integument should be drawn downward, and an incision several inches long should be made directly upon the clavicle through the superficial coverings. If the trapezius and sterno-mastoid muscles overlap the supra-clavicular space they must be cut and turned aside. In this incision care must be taken not to wound the external jugular vein, and, as the suprascapular veins are often in the way, they may require a double ligature and section. The deep fascia can be opened by following the external jugular vein as it pierces it. Much time is often lost through mistaking the cellular space above the deep fascia for that below it. In the depths of the latter the artery in question is situated. In more than one instance the lower cord of the brachial plexus has been mistaken for the artery, and on several
occasions tied; but this is not likely to happen if before securing the ligature the arm is raised and rotated, so as to relax the parts, when they can be better recognized. The impression conveyed to the finger by pressing over the first rib should never be relied on. The operator does not usually see the vein. It is out of the way, below the clavicle. In the deeper cellular space there is generally a quantity of fat, with some lymphatic glands, which when enlarged offer additional embarrassment to the operation. The collateral circulation after the artery has been tied in its outer portion is maintained by the occluded branches of the axillary artery drawing the blood from their anastomoses with the superior intercostal, upper aortic, intercostal, and internal mammary arteries, assisted by the communications between the dorsalis scapulæ and the supra-scapular and posterior scapular arteries.

The vertebral artery arises from the upper and posterior surface of the first portion of the subclavian. It ascends behind the common jugular vein, and runs between the scalenus anticus and longus colli muscles until it enters the vertebral foramen in the transverse process of the sixth cervical vertebra. On the way it is crossed by the inferior thyroid artery, and on the left side by the thoracic duct. The sympathetic nerve cord is in close relation to it, and some delicate nerves from the inferior cervical ganglion pass along with it, and others pass across, to blend with the cords of the brachial plexus. After entering the transverse process of the sixth vertebra it continues up through the corresponding foramina in the transverse processes of the vertebrae above until it arrives at the atlas in the sub-occipital triangle (Plate 4, Fig. 2), where, after it rises through the foramen in the transverse process, it turns backward round the condyle of the occipital bone to penetrate the posterior occipito-atlantic ligament and to enter the sub-dural space within the foramen magnum. Within the cranium the vertebral artery passes between the hypoglossal nerve and the anterior root of the first cervical nerve and ascends upon the basilar process to join with its fellow (page 22) and form the basilar artery (Plate 5, Fig. 3).

The thyroid axis is a short trunk arising from the first portion of the subclavian at the inner border of the scalenus anticus muscle. It usually
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divides into three branches, the inferior thyroid, the transversalis colli, and the supra-scapular. The inferior thyroid artery ascends tortuously across the vertebral artery, the recurrent laryngeal nerve, and the longus colli muscle to the corresponding lobe of the thyroid body. The middle cervical ganglion of the sympathetic nerve is very close to it as it passes beneath the sheath of the carotid vessels. The inferior thyroid sends off branches to the pharynx, oesophagus, trachea, and the anterior mediastinal glands, and the little inferior laryngeal artery which accompanies the recurrent laryngeal nerve. Within the thyroid body it breaks up into terminal branches which anastomose freely with those of the other thyroid arteries. The transversalis colli artery usually arises from the axis and passes over the scalene muscles and the brachial plexus to reach the upper angle of the scapula, where it supplies the adjacent muscles. Its veins are in close relation with it and empty their blood into the external jugular. The transversalis colli often gives off the superficial cervical artery, which passes upward along the border of the trapezius muscle (Plate 25) and anastomoses with the descending branch of the occipital artery. It is accompanied by two venæ comites, which join the transverse veins. The supra-scapular artery arises sometimes from the thyroid axis, sometimes independently from the third portion of the subclavian artery (page 229). It passes behind the clavicle, separated from the subclavian artery by the reflection of the deep cervical fascia from the omohyoid muscle, and on reaching the scapula it enters the supraspinous fossa. It then passes over the supra-scapular ligament and eventually terminates in the infra-spinous fossa. In its course it sends branches to the neighboring muscles, to the clavicle, to the acromion and body of the scapula, and to the shoulder-joint. This vessel is accompanied by two veins, which are provided with valves at their termination in the external jugular or subclavian veins.

The thyroid body is the very vascular glandular organ which is situated in the neck over the front and sides of the upper part of the trachea, extending upward on each side of the larynx. It consists of two ovoid lateral lobes, united near their lower borders by a median transverse portion, the isthmus. It is of a reddish-brown color, and weighs in the
adult about two ounces. Each lobe extends from the fifth or sixth ring of the trachea below to the side of the thyroid cartilage above, which is embraced by the narrower end. Each lobe is five centimetres, or about two inches, in length, by three centimetres, or an inch and a quarter, in breadth. The anterior surface is convex, and covered by the infra-hyoid, sterno-hyoid, sterno-thyroid, and omo-hyoid muscles (Plates 23, 24, and 25), and is overlapped at the sides by the anterior borders of the sternomastoid muscles. The posterior surface is adapted to and closely adherent to the parts of the trachea, larynx, and oesophagus over which it lies. The carotid sheath is usually in contact with the external border of the lobe on each side, but very often it is embraced, particularly on the right side, by the glandular structure.

The isthmus is variable in size, shape, and position, and usually crosses over the second and third rings of the trachea, being firmly attached by a band of the deep cervical fascia, besides the general investment which connects the thyroid body to the sides of the trachea and to the cricoid and thyroid cartilages. In consequence of this intimate association the organ rises and falls with the larynx in swallowing, and thus a valuable means is afforded of distinguishing the character of any enlargement of its lobes. Very often there is an accessory pyramidal middle lobe which extends upward from the junction of the isthmus with the left lobe to be attached to the thyro-hyoid membrane by a fascial band. This may sometimes be covered by a separate slip from the sterno-hyoid muscle, called the levator corporis thyroidei.

The thyroid body varies in size in different individuals and at different periods of life. It is relatively larger in the child than in the adult, and in the female than in the male. In children the isthmus is usually very insignificant. The function of the thyroid body is unknown, but it is supposed to be in some way a blood-forming organ and to regulate the production of mucin. Each lobe consists of many irregular lobules, held together by areolar-tissue septa which are inflected from the external glandular investment. In these septa are the branchings of the vessels, surrounded not unfrequently with a colloid substance. The lobules are composed of a great number of closed follicles, the epithelial lining of
which secretes a serous fluid in the child. In the adult the lining wall degenerates and colloid matter takes the place of the earlier limpid fluid. There are fine sympathetic nerve filaments which accompany the vessels throughout the glandular structure; and there are numerous lymphatic vessels which commence in lymph-spaces in the interlobular septa and terminate in the lymphatic ducts upon each side of the neck. There is no proper duct to the thyroid body itself. The arteries which supply the thyroid body are remarkable for their number, size, and free inoscula-

tion. The superior thyroid arteries (page 203) arise from the external carotid arteries just below the greater cornua of the thyroid cartilage, and curve downward beneath the infra-hyoid muscles to the upper and front surface of the thyroid body (Plate 24). The inferior thyroid arteries arise from the thyroid axis of the subclavian arteries (page 233) and ascend tortuously to the under surface of the thyroid body. Occasionally there is a middle thyroid artery, the thyroidea ima, which arises either from the arch of the aorta or from the innominate artery and ascends in front of the trachea to the isthmus. The thyroid veins are also remarkably large, and form a plexus upon the lobes of the thyroid body. The superior and middle thyroid veins upon each side empty into the internal jugular. The inferior thyroid veins communicate freely with each other over the trachea in the anterior part of the root of the neck, and terminate in the innominate veins. The relations of the thyroid body to the great vessels and nerves of the neck explain many of the symptoms produced by the hyper-
trophied condition of any portion of it, known as "bronchocele."

The trachea in the neck is covered anteriorly by the sterno-hyoid and sterno-thyroid muscles (Plate 23, Fig. 2). The sterno-hyoid muscles are thin fleshy bands of parallel fibres beneath the skin, which arise on each side from the posterior surface of the sterno-clavicular joint and the contiguous portions of the clavicle and manubrium sterni. They ascend and converge to be inserted tendinously into the lower border of the body of the hyoid bone. The sterno-thyroid muscles arise from the posterior surface of the manubrium sterni, internal to the sterno-hyoid muscles, and from the cartilage of the first rib on each side, and ascend like two muscular ribbons, diverging a little from each other to be inserted into the oblique
lines of the alæ of the thyroid cartilage. Occasionally these muscles present tendinous intersections. The *thyro-hyoid* muscles are continuations upward of the sternothyroid muscles, and are variable in their degree of separation from them. They are somewhat broader than the sternohyoid, and project laterally beneath the attachments of the omohyoid muscles. These muscles are all brought into action in forced inspiration. The sternohyoid aids the omohyoid in depressing the hyoid bone. The thyrohyoid elevates the thyroid cartilage, while it is depressed by the sternothyroid. These muscles are innervated by the communicating loop from the descendens hypoglossi nerve (Plate 27). In the middle line the fascial sheaths of the sternothyroid and sternohyoid muscles blend and form the *linea alba cervicalis*, which can be readily distinguished after incision through the integument (Plate 23.)

**The trachea** is the cartilaginous and membranous portion of the windpipe which commences at the cricoid cartilage of the larynx opposite the fifth cervical vertebra (page 177) and extends medially downward to about the body of the fourth dorsal vertebra, where it divides into the right and left bronchi (page 268). It is situated partly in the neck, and partly within the superior mediastinum of the thorax (page 260). The length of the trachea in the adult is from ten to eleven and a half centimetres, or from four to four and a half inches, and its diameter is about nineteen millimetres, or three-fourths of an inch, from before backward, and a little more than that from side to side. The dimensions vary with the age and development of the individual, and in the female the trachea is smaller than in the male. In a general way the calibre may be said to correspond to the size of the patient's forefinger. It is a cylindrical tube flattened behind, so that upon section it appears shaped like the letter D (Plate 26, Fig. 2, No. 7). It is composed of a series of incomplete cartilaginous rings, from sixteen to twenty in number, which extend round the anterior two-thirds of its circumference. At the posterior deficiency in the rings, where the trachea is in relation to the oesophagus, the tube is completed by a fibro-muscular membrane, in consequence of which its calibre can be increased or enlarged. The muscular tissue consists of layers of longitudinal and transverse fibres. The spaces between the rings are filled
up with the fibrous membrane, in which there is an additional development
of elastic tissue. The hoops of the rings are generally parallel with one
another across the front of the tube, but their extremities offer great diver-
sity in conformation. Sometimes they fork, alternating upon the two
sides, and sometimes the ends of the adjacent rings are united. The last
ring is peculiar, and usually is modified by being prolonged in front in a
V-shaped piece so as to conform with the first rings of the two bronchi.
The top ring is always broader than the rest, and is strongly connected by
fibrous tissue with the lower border of the cricoid cartilage, with which it is
sometimes blended. The tracheal cartilages rarely ossify, as they are non-
vascular. They are invested with a dense perichondrium which closely
adheres to the entire tube. The mucous lining of this portion of the air-
passage is smooth and of pinkish color, although it is but slightly vascular.
Within the sub-mucous layer are the blood-vessels, lymphatics, and nerves,
together with a number of small racemose mucous glands, the tracheal
glands. These are situated mostly in the posterior membranous wall and
along the borders of the rings, and their ducts convey their secretion to
the inner lining. In bronchitis they are the sources of the abundant
secretion. The tracheal arteries are supplied by the inferior thyroid
arteries (page 233) and run longitudinally downward to terminate in
capillary plexuses. The nerves are derived from the pneumogastrics and
their recurrent branches. The trachea is surrounded by a quantity of
loose connective tissue, especially in children, which allows of its free
mobility. This mobility of the trachea is one of the greatest obstacles to
the satisfactory performance of tracheotomy, as it is essential to fix the
trachea in the middle line, which here, as elsewhere in the body, is
regarded surgically as the line of safety, owing to the feeble anastomosis
of the vessels from side to side.

In the performance of the operation of tracheotomy, the patient’s
head should be extended straight backward, with the shoulders elevated
over a firm pillow, so as to bring the trachea into relief and to steady it
as much as possible. The landmarks, consisting of the thyroid notch,
the hoop of the cricoid cartilage, and the top of the sternum, are clearly
noticeable. The upper rings of the trachea cannot be detected through the
PLATE 34.

Preparation to show the relations of the heart, within the pericardium.

1. The thyro-hyoid membrane.
2. The thyroid notch.
3. The right thyro-hyoid muscle.
4. The right superior thyroid artery.
5. The right superior laryngeal nerve.
6. The right crico-thyroid muscle, and crico-thyroid artery.
7. The right pneumogastric nerve.
8. The right common carotid artery.
9. The right subclavicular artery.
10. The right scalenus anticus muscle.
11. The right phrenic nerve.
12. The right brachial plexus of nerves.
13. The right subclavian artery.
14. The right first rib.
15. The right pneumogastric nerve, passing behind the right innominate vein.
16. The innominate artery.
17. The right innominate vein.
18. The upper lobe of the right lung, drawn aside.
19. The superior vena cava.
20. The right phrenic nerve.
21. The middle lobe of the right lung, drawn aside.
22. The position of the right auricle, covered with the pericardium.
23. The lower lobe of the right lung.
24. The right ventricle of the heart within the pericardium.
25. The left superior thyroid artery.
26. The left thyro-hyoid muscle.
27. The crico-thyroid membrane.
28. The cricoid cartilage.
29. The left internal jugular vein.
30. The left common carotid artery.
31. The left pneumogastric nerve.
32. The left brachial plexus of nerves.
33. The left recurrent laryngeal nerve.
34. The left scalenus anticus muscle.
35. The trachea.
36. The left subclavian artery.
37. The left subclavian vein.
38. The left phrenic nerve.
39. The left innominate vein.
40. The upper lobe of the left lung, drawn aside.
41. The position of the pulmonary artery within the pericardium.
42. The left lung, drawn aside.
43. The left phrenic nerve.
44. The apex of the heart within the pericardium.
45. The lower portion of the lower lobe of the left lung, drawn aside.
46. The position where the pericardium blends with the central tendon of the diaphragm.

N.B.—The ribs are cut away so as to give an unrestricted view.
THE REGION OF THE NECK.

integument, except in very thin subjects. The isthmus of the thyroid body crosses over the second and third tracheal rings, and is usually very closely bound down to them. It should be remembered that the crico-thyroid artery passes over the top of the crico-thyroid membrane (page 184), that occasionally the anterior jugular vein occupies the middle line (page 192), and that the inferior thyroid veins always intercommunicate over the trachea at the root of the neck (page 235). These anatomical facts indicate the isthmus of the thyroid body as the point above which or below which the operation offers special features of interest. In all cases it is well to make the incision through the superficial tissues free; and it should be kept absolutely in the middle line. It should divide the skin over the position of the isthmus of the thyroid body, when the anterior jugular vein, if present, will be recognized, and the white aponeurotic line between the sterno-hyoid and sterno-thyroid muscles will be exposed. The surface of the crico-thyroid membrane should be carefully examined for the presence of any transverse vessel,—the crico-thyroid or superior thyroid,—and traction should be made upon the isthmus to see whether it can be drawn upward or downward. If it cannot be displaced it may be cut through upon a director, and, if necessary, between a double ligature. When the trachea is sufficiently exposed, a tenaculum should be inserted to steady it, and the upper rings cut by plunging into them the point of the knife to the extent of half an inch, so as fully to open the mucous lining. This precaution is necessary when there is a false membrane, so that the canulated metal tube when inserted may not pass between it and the tracheal wall. It is not safe to make the plunge with the knife deeper than half an inch, on account of the danger of wounding the oesophagus. It is noticeable that when air enters the lungs through the tracheal wound the engorgement of the tributary veins subsides in consequence of the relief afforded to the heart, which is thus enabled to pump out the venous blood from its right side. Below the isthmus of the thyroid body the trachea becomes deeper as it descends behind the sternum (page 190), which adds greatly to the difficulty of opening it in this situation. In little children the neck is usually very fat, and at the root of the neck, besides the intricate inferior thyroid veins, the left innominate vein, and
even the innominate artery, may be drawn upward above the margin of the manubrium sterni, in consequence of the comparatively greater laxity of the connective tissue. The upper portion of the thymus gland is also often in the way. In the adult, however, unless there is an unusual origin for the innominate artery, it can hardly be made to mount so high as the supra-sternal notch by stretching the neck, as already stated (page 222). In operating below the isthmus the inferior thyroid veins should never be forgotten, and the knife should be introduced with the back toward the sternum, to avoid the thymus gland and other structures in that situation.

THE REGION OF THE THORAX.

The landmarks of this region are so obscured by the superficial and external structures that they are not easily recognized without particular knowledge of the component parts in their several localities. They are of the greatest importance, on account of their medical application in the physical examination of the chest as relates to diagnosis by auscultation or percussion in affections of the thoracic organs. Attention will therefore be first drawn to the general construction of the thorax, and then to its principal features in detail, before considering its topographical relations.

The skeleton of the thorax (Plate 28) is composed of the dorsal vertebrae, the ribs and costal cartilages, and the sternum, so arranged as to form a conical, movable framework, which gives attachment to the muscles of respiration, and affords protection to the heart and the lungs. The method of the articulation of the ribs with the dorsal vertebrae behind, and with the sternum through their cartilages in front, is one of the most ingenious pieces of mechanism in nature, which not only permits the unceasing momentary alterations in capacity of the thoracic cavity during respiration, but also fulfills the function of support and protection.

The ribs are twelve pairs of flattened, bony hoops, which are attached to the spinal column between the neck and the loins, and so arranged that they project anteriorly and describe a series of arches which increase in length to the seventh and in obliquity to the ninth from above downward. The obliquity of the ribs is so great that the sternal end of any rib is on