This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

AIDS

ANATOMY

BY

GEORGE BROWN MACS LL.D.

BULLIERE & CO.

AIDS

TO

ANATOMY.

BY

GEORGE BROWN, M.R.C.S., L.S.A.

Late Demonstrator of Anatomy at Westminster Hospital Medical School; Gold Medalist, (1873) *Charing Cross Hospital: formerly Prosector of Anatomy at the Royal College of Surgeons of England, &c.*

LONDON:
BAILLIERE, TINDALL & COX., KING WILLIAM ST., STRAND.
DUBLIN:
FANNIN & CO., GRAFTON STREET.
EDINBURGH:
MACLACHLAN & STEWART, SOUTH BRIDGE.
GLASGOW:
A. & W. STENHOUSE, COLLEGE GATE.

1876.

165. q. 34.

LONDON:

REPRINTED FROM THE STUDENTS' JOURNAL, BY
BAILLIERE, TINDALL & COX.

PREFACE.

The anatomical memoranda to be found in the following pages, and which I have designated "Aids to Anatomy" have been reprinted from THE STUDENTS' JOURNAL AND HOSPITAL GAZETTE at the suggestion of many readers of that journal, who were desirous of possessing the "Aids" in a collected and permanent form.

If what is here given be favourably received by Students of anatomy, I shall be encouraged to extend the series at some future time; at present I am content to launch this small and unpretending volume and await the verdict of those for whom it is intended.

GEORGE BROWN.

COLEBBOOKE ROW, LONDON, N.

CONTENTS.

	PAGE.
INTRODUCTORY	1
I. Anterior Triangle of the Neck	3
II. Posterior Triangle of the Neck	7
III. Sub-Occipital Triangle	9
IV. Triangle in front of the Elbow joint	9
V. Scarpa's Triangle	10
VI. Hesselbach's Triangle	10
VII. The Axilla	11
VIII. The Triangular Space at the upper part of the Arm	12
IX. The Popliteal Space	13
X. Structures on the Masseter Muscle	14
XI. Structures on the Mylo-Hyoid Muscle	14
XII. Structures beneath the Mylo-Hyoid Muscle	14
XIII. Structures on the Hyo-Glossus Muscle	15
XIV. Structures beneath the Hyo-Glossus Muscle	15
XV. Structures beneath the Sterno-Cleido-Mastoideus	15
XVI. Structures beneath the Deltoid Muscle	16
XVII. Structures beneath the Gluteus Maximus Muscle	17
XVIII. Structures passing through the superior aperture of the Thorax	18
XIX. The Mediastinum	18
XX. Structures constituting Root of Lung	20
XXI. Structures in concavity of, and behind Arch of Aorta	21
XXII. Structures between the clavicle and First Rib	21
XXIII. The Costo-Coracoid Membrane	22
XXIV. Relations of the Trachea in the Neck	22
XXV. Relations of the Prostate Gland	23
XXVI. Structures passing through Inlet of Pelvis	23
XXVII. Viscera covered or invested by Peritoneum	24
XXVIII. Contents of Spinal Canal	25
XXIX. The Soft Palate	25
XXX. Structure of the Eyelids	26
XXXI. The Inguinal Canal and coverings of Inguinal Hernia	27
XXXII. The Spermatic Cord	28
XXXIII. The Crural Canal and coverings of Femoral Hernia	29
XXXIV. The Parotid Gland	30
XXXV. The Cranial Nerves	31
XXXVI. The Olfactory Nerve	32
XXXVII. The Optic Nerve	33
XXXVIII. The Third Pair of Nerves	34
XXXIX. The Fourth Pair of Nerves	35
XL. The Fifth Pair of Nerves	36
XLI. The Ganglia of the Fifth Pair of Nerves	47
XLII. The Sixth Pair of Nerves	51
XXLIII. The Seventh Pair of Nerves	52
„ (A) The Portio Dura or Facial Nerve	52
„ (B) The Portio Mollis or Auditory Nerve	57
XLIV. The Eight Pair of Nerves	
„ (A) The Glosso-Pharyngeal Nerve	
„ (B) The Pneumogastric Nerve	
„ (C) The Spinal Accessory Nerve	
XLV. The Ninth Pair of Nerves	63

AIDS TO ANATOMY.

There are some students who will ask—and with good reason—"What, in the name of all that is rational, is the use of adding one jot or tittle to our anatomical literature?" "Have we not Quain, Ellis, Gray, Holden, Wilson, Heath, and a host of other works, all of them masterpieces in their way, and any one of them equal to carrying us through any ordinary examination?" I confess that it is difficult to find an answer to these questions, especially since I cannot even pretend to have made a single anatomical discovery, or to have happened on any one anatomical fact, that has not been treated of by one or more of the above observers. But it is quite possible to present these facts to the learner in a different form, and to group the more important in such a manner that the mind may more readily grasp and retain them. This, then, is the object of these papers.

Anatomy is not generally considered to be an interesting subject, or one easy to master, and often the beginner is overwhelmed by the magnitude of the task before him, and despairs of ever becoming familiar with its details. This feeling, though very natural, is scarcely warranted if a proper estimate of the difficulties to be met be formed. For, after all, anatomy is not more

difficult to the medical student than the study of geography to the school-boy. He has to learn all about the various countries of the world, their names, situation, boundaries, and divisions, their mountains and valleys, the rivers running through them, together with their origin, size, branches, communications, and terminations. In the same manner, the student of anatomy has to learn how the body is divided into regions and spaces, their names, situation, boundaries, and contents, the vessels and nerves met with in these spaces, together with their origin, size, branches, communications, and terminations. These particulars respecting the regions and spaces into which the human body is divided are among the things that a student must know *by heart* before presenting himself for an anatomical examination, should he wish to pass with credit. It was to facilitate the acquisition of this knowledge, in my own case, that these "Aids' first obtained a place in my note-book, and, as I found them of assistance, I may hope that they will prove a help to others. And here let me disclaim any intention to palm off the "Aids" as original. Some were copied from anatomical works, others from the slates in the dissecting rooms I have visited, and for many I am indebted to gentlemen connected with the dissecting rooms of other hospitals, whilst a few only can be said to be original. Those who have been subscribers to THE STUDENTS' JOURNAL from the commencement will observe that some of the "Aids" were published in its early issues; but as I am told by the publishers that most of these numbers are out of print, and are often asked for by students preparing for "College" examinations, they are now republished in a permanent form.

It may be as well to caution those who are on the look-out for a "royal road" to anatomical knowledge against imagining that the "Aids" will render dis-

section unnecessary. No greater mistake can be made. In anatomy, nothing can ever take the place of actual dissection, and he who ventures to present himself at the College of Surgeons' "Primary" with nothing more than book knowledge will assuredly pay the penalty.

As before remarked, the human body is divided into a number of regions and spaces, which are of the highest importance, both anatomically and surgically, and it is not surprising that great stress is laid on them at surgical examinations. Among the more important spaces are the triangles of the neck, Scarpa's triangle, the popliteal space, and the axilla, the consideration of which will now occupy our attention.

I.—The Anterior Triangle of the Neck.

The anterior triangle of the neck is the space in front of the anterior border of the sterno-mastoideus muscle, and is limited by the following boundaries:—

In Front.—Median line of the neck from the chin to the top of the sternum.

Behind.—The anterior border of the sterno-mastoideus.

Above.—Body of lower jaw, and a line continued from its angle to the mastoid process of the temporal bone, forming the *base* of the triangle. [The *apex* is at the top of the sternum.]

The Floor.—The floor is formed by the following muscles:—Sterno-thyroideus, sterno-hyoideus thyro-hyoideus, inferior and middle constrictors of the pharynx, the anterior belly of the digastricus, stylo-hyoideus, mylo-hyoideus, and hyo-glossus. The floor is crossed by the anterior belly of the omo-hyoideus and the *posterior* belly of the digastricus, which sub-

divide the anterior triangle into three smaller ones, viz. — (*a*) *Inferior carotid triangle;* (*b*) *Superior carotid triangle;* (*c*) *Sub-maxillary triangle.*

Roof.—The space is covered in by integument, superficial fascia, platysma myoides, and deep fascia. Between the layers forming the roof are the cutaneous branches of the facial and superficial cervical nerves.

The contents will be enumerated in the description of the subdivisions (*a*), (*b*), (*c*).

(*a*).—The Inferior Carotid Triangle.

This triangle is the lowermost subdivision of the anterior triangle of the neck, and has the following boundaries:—

In Front.—Median line of the neck.

Behind.—Anterior border of the sterno-mastoideus.

Above.—Anterior belly of the omo-hyoideus.

The muscles met with on the floor of the space are the sterno-hyoideus and sterno-thyroideus, and it is covered in by integument, superficial fascia, platysma myoides muscle, and deep fascia.

Contents:

As usually dissected, this space contains the following structures:—

Thyroid gland, lower part of larynx and trachea.

Veins.—Internal jugular and inferior thyroid.

Arteries.—Common carotid and inferior thyroid.

Nerves. — Pneumogastric, recurrent laryngeal, descendens noni, communicans noni, and sympathetic.

In order to expose the above structures it is necessary to turn aside the sterno-hyoideus and sterno-thyroideus, and a portion of the sterno-mastodeus. The common carotid artery is occasionally tied in the upper part of this triangle, immediately below the omo-hyoid muscle, but more frequently the ligature is applied above the omo-hyoid in the superior carotid triangle.

(*b.*)—THE SUPERIOR CAROTID TRIANGLE.

This triangle is the middle of the three subdivisions of the anterior triangle of the neck. Its boundaries are :—

Behind.—Anterior border of sterno-mastoideus.

Above.—Posterior belly of the digastricus.

Below.—Anterior belly of the omo-hyoideus.

The muscles forming the floor are the thyro-hyoideus, hyo-glossus, and the inferior and middle constrictors of the pharynx. The roof is formed by the same structures as cover in the inferior carotid triangle.

CONTENTS :

Upper part of larynx and lower part of pharynx.

Veins.—Internal jugular, and those which open into it, viz. :—Lingual, facial, superior thyroid, pharyngeal, and sometimes the occipital.

Arteries.—Termination of common carotid, external carotid, internal carotid, superior thyroid, lingual, facial, ascending pharyn-

geal, and occipital. The five last-named are branches of the external carotid.

Nerves.—Pneumogastric, superior laryngeal, external laryngeal, hypoglossal, descendens noni, spinal accessory, and sympathetic.

(*c*).—THE SUB-MAXILLARY TRIANGLE.

This triangle is the most superior of the three subdivisions of the anterior triangle, and has the following boundaries:—

Behind.—Posterior belly of the digastricus.

Above.—Lower border of the body of the jaw, and line continued from angle of jaw to the mastoid process.

In Front.—Median line of neck from the chin to the hyoid bone.*

The muscles forming the floor are the anterior body of the digastricus, the mylo-hyoideus, and the hyo-glossus, and its roof is formed by the same structures as cover in the superior and inferior carotid triangles.

CONTENTS:

Glands.—Portion of parotid and submaxillary (salivary) glands, submaxillary lymphatic glands and vessels.

Veins.—Internal jugular, commencement of external jugular (formed by the junction of the superficial division of the temporo-maxillary and posterior auricular, and sometimes of the occipital), radicles of anterior jugular, the facial, and those which

* Some anatomists limit this space in front by the anterior belly of the digastricus. It is, however, better to adhere to the boundaries of the original triangle.

open into it below the jaw, viz.: the sub-mental, sub-maxillary, inferior palatine and ranine.

Arteries.—External carotid, internal carotid, facial, sub-mental, mylo-hyoidean, and several smaller branches.

Nerves.—As usually dissected, the superficial nerves met with in this space are the mylo-hyoid (branch of inferior dental), and its branch to the anterior belly of digastric muscle, the infra-maxillary branches of facial nerve, and the ascending branches of the superficial cervical nerve. (The two latter, strictly speaking, are not contents of the triangle, as they ramify in the structures which form its roof.) Deeply situated at the back part of the space are the pneumogastric and glossopharyngeal nerves. That portion of the hypoglossal nerve, which lies on the hyo-glossus muscle, should be included as one of the contents.

The stylo-hyoideus, the stylo-glossus, origin of the stylo-pharyngeus muscles, and stylo-maxillary ligament, may also be given as contents of the space. The stylo-hyoideus is sometimes given as entering into the formation of the posterior boundary.

II.—Posterior Triangle of the Neck.

The posterior triangle of the neck is the space behind the posterior border of the sterno-mastoideus, and has the following boundaries:—

In Front.—Posterior border of sterno-mastoideus.

Behind.—Free border of the trapezius.

Below (*base*).—Upper border of the middle third of the clavicle.

Apex.—Meeting of anterior and posterior boundaries at the occiput.

Floor (*from above downwards*).—Splenius capitis, levator anguli scapulæ, scalenus medius, scalenus posticus and upper digitation of the serratus magnus.

The space is covered in by the superficial and deep fascia, and at its lower part by the platysma myoides.

This triangle is subdivided into two unequal portions by the posterior belly of the omo-hyoideus. The upper portion—the larger—is called *the occipital triangle*, and has the following *contents*:

1. Spinal accessory and superficial plexus of cervical nerves.
2. Transversalis colli artery and vein.
3. Lymphatic vessels and glands (glandulæ concatenatæ).

The lower portion has been named *the subclavian triangle*, and is selected as the best situation for tying the subclavian artery in the third part of its course. This triangle has the following *contents*:—

1. Descending branches of superficial cervical plexus.
2. Brachial plexus of nerves.
3. Subclavian artery (third part of its course).
4. Transversalis colli artery and vein.
5. Transversalis humeri (supra-scapular) artery and vein.
6. External jugular vein and communicating branch with cephalic vein.
7. Lymphatic vessels and glands.

III.—The Sub-Occipital Triangle.

This triangle is situated immediately under the occipital bone, and beneath the upper part of the complexus muscle. Its boundaries are as follows :—

Above.—Obliquus superior.

Below.—Obliquus inferior.

Behind.—Rectus capitis posticus major.

The *roof* is formed by the complexus muscle, and the *floor* by the posterior occipito-atloid ligament and posterior arch of the atlas.

Contents :

Vertebral artery and sub-occipital nerve (posterior branch of first cervical.)

IV.—The Triangle in Front of the Elbow-Joint.

Boundaries :—

Externally.—Supinator longus.

Internally.—Pronator radii teres.

Above (*base*).—A line—imaginary—drawn across the arm two inches above the condyles.

Apex.—Meeting of the supinator longus and pronator radii teres.

The space is covered in by skin, superficial fascia and bicipital fascia, and the *floor* is formed by the lower part of the brachialis anticus and the oblique fibres of the supinator brevis.

Contents (From within outwards) :—

1. Median nerve.
2. Brachial artery and venæ comites. About the centre of the space the artery divides into radial and ulnar.
3. Tendon of biceps.

4. Musculo-spiral nerve. (The supinator longus and brachialis anticus muscles must be slightly separated in order to expose this nerve).

V.—Scarpa's Triangle.

This triangle is situated at the upper part of the anterior surface of the thigh, immediately below the fold of the groin, and has the following boundaries:—

Externally.—Sartorius.

Internally.—Adductor longus.

Above (*base*).—Poupart's ligament.

Apex.—Meeting of the sartorius and adductor longus muscles.

The space is covered in by skin, superficial fascia, fascia lata, and cribriform fascia, and the *floor* is formed from without inwards by the following muscles:—iliacus, psoas, pectineus, and small portion of adductor brevis.

Contents:—

1. Femoral sheath derived from the iliac fascia and fascia transversalis.
2. Femoral artery giving off cutaneous branches and a large deep branch—the profunda femoris.
3. Femoral vein, here joined by the saphena and profunda veins.
4. Anterior crural nerve and its branches.
5. Crural branch of genito-crural nerve.
6. Deep lymphatic glands and vessels and fatty tissue.

VI.—Hesselbach's Triangle.

The space which is known as the triangle of Hesselbach is situated at the lower part of the abdominal wall,

on either side, and is of surgical importance, as being the spot where *direct* inguinal hernia makes its escape from the abdomen. Its boundaries are:—

Externally.—Epigastric artery.

Internally.—Outer margin of rectus abdominis muscle.

Below (*base*).—Poupart's ligament.

The structures entering into the formation of the abdominal wall at this spot are (from without inwards):—

1. Skin.
2. Superficial fascia.
3. Inter-columnar fascia.
4. Conjoined tendon of internal oblique and transversalis muscles.
5. Fascia transversalis.
6. Sub-serous cellular tissue.
7. Peritoneum.

NOTE.—These seven structures form the coverings of direct inguinal hernia.

VII.—THE AXILLA.

The axillary space is of conical form, and is situated between the upper part of the side of the chest, and the inner side of the arm, and has the following boundaries:—

In Front.—Pectoralis major and minor muscles.

Behind.—Subscapularis, teres major, and latissimus dorsi muscles.

Inner side.—Upper four ribs and intercostal muscles, and upper part of serratus magnus muscle.

Outer side.—Upper part of the humerus, the coracobrachialis and biceps muscles.

The *apex* of the cone is directed upwards, and is formed by an interval between the first rib, the clavicle, and the upper border of the scapula; its *base* is formed by the skin and axillary fascia stretched across from the lower border of the pectoralis major to the lower border of the latissimus dorsi.

CONTENTS:

1. Axillary artery and vein, and their branches.
2. Brachial plexus of nerves, and its branches of distribution below the clavicle.
3. A few branches of the intercostal nerves.
4. About ten or twelve lymphatic glands.
5. A quantity of loose fat and areolar tissue.

VIII.—THE TRIANGULAR SPACE AT THE UPPER PART OF THE ARM.

When the muscles attached to the head and neck of the humerus are dissected and cleaned of fat and cellular tissue, a triangular space exists between the neck of the humerus and the axillary border of the scapula, which has the following boundaries, as seen from behind:—

Above.—The teres minor muscle.

Below.—The teres major muscle.

Outer side.—Head and neck of the humerus.

This space is subdivided into two smaller spaces by the scapular head of the triceps brachii, one of which is quadrangular, and the other triangular in form. The quadrangular is superior, and has the following boundaries:—

Above—Teres minor.

Below.—Teres major.

Inner side.—Scapular head of the triceps brachii.

Outer side.—Head and neck of the humerus.

This space transmits the posterior circumflex vessels and the circumflex nerve.

The boundaries of the smaller triangular space are:-

Above.—Teres minor.

Below.—Teres major.

Outer side.—Scapular head of the triceps brachii.

This space transmits the dorsalis scapulæ artery and veins.

IX.—The Popliteal Space.

The popliteal space is situated at the back of the knee-joint, and forms what is called the ham. It is lozenge-shaped, and has the following boundaries:—

Externally.—*Above the joint*, biceps flexor cruris; *below the joint*, outer head of gastrocnemius and plantaris muscles.

Internally.—*Above the joint*, semi-tendinosus, semi-membranosus, gracilis and sartorius muscles; *below the joint*, inner head of gastrocnemius.

The *floor* is formed by the lower part of the back of the femur, the posterior ligament of the knee-joint (ligamentum postici Winslowii), and the popliteus muscle covered by its fascia. The space is covered in by skin, superficial fascia, and fascia lata.

Contents:

1. Popliteal vessels and their branches.
2. Termination of external saphena vein.
3. Internal and external popliteal nerves and their branches.
4. Branch of small sciatic nerve.
5. Articular branch of obturator nerve.
6. Four or five small lymphatic glands.
7. Quantity of fat and loose areolar tissue.

X.—Structures which Lie on the Masseter Muscle.

1. Portion of parotid gland.
2. Glandula socia parotidis.
3. Stenon's duct.
4. Transversalis faciei artery and vein.
5. Facial vein.
6. Branches of facial nerve.

XI.—Structures on the Mylo-Hyoid Muscle.

1. Anterior belly of the digastricus.
2. Superficial portion of sub-maxillary gland.
3. Facial vessels with sub-maxillary and submental branches.
4. Mylo-hyoidean artery (branch of inferior dental from 1st division of the internal maxillary).
5. Mylo-hyoidean nerve (branch of inferior dental from third division of the fifth nerve).

XII.—Structures Beneath the Mylo-Hyoid-Muscle.

1. Sub-lingual gland.
2. Deep part of sub-maxillary gland.
3. Wharton's duct.
4. Sub-lingual artery.
5. Ranine artery.
6. Gustatory nerve (from third division of the fifth nerve).
7. Hypoglossal nerve.
8. Sub-maxillary ganglion.
9. Genio-hyoideus
10. Genio-hyo-glossus
11. Hyo-glossus
12. Stylo-glossus

} muscles.

XIII.—Structures on the Hyo-Glossus Muscle.

1. Deep part of sub-maxillary gland.
2. Wharton's duct.
3. Gustatory nerve.
4. Hypo-glossal nerve.
5. Sub-maxillary ganglion.
6. Digastricus
7. Stylo-hyoideus
8. Stylo-glossus
9. Mylo-hyoideus

} muscles.

XIV.—Structures Beneath the Hyo-Glossus Muscle.

1. Lingual artery and veins with dorsal branches.
2. Glosso-pharyngeal nerve.
3. Stylo-hyoid ligament.
4. Genio-hyo-glossus
5. Superficial lingualis
6. Middle constrictor

} muscles.

Note.—All the structures going to the tongue pass either under or over the hyo-glossus muscle.

XV.—Structures Beneath the Sterno-Cleido-Mastoideus.

1. Deep layer of cervical fascia.
2. Sterno-clavicular articulation with its ligaments.
3. Sternal portion of sterno-thyroideus.
4. „ „ „ sterno-hyoideus.
5. Central portion of omo-hyoideus.
6. Portions of scalene muscles.
7. „ of splenius capitis and splenius colli.
8. Origin of posterior belly of the digastricus.
9. Portion of levator anguli scapulæ.
10. Common carotid artery in its sheath

11. Commencement of external carotid artery with its posterior branches.
12. Commencement of the internal carotid artery.
13. Transversalis colli artery and vein.
14. Transversalis humeri (suprascapular) artery and vein.
15. Internal jugular vein (in carotid sheath).
16. Deep cervical (lymphatic) glands.
17. Portion of parotid gland.
18. Cervical plexus of nerves.
19. Hypoglossal (ninth) nerve.
20. Descendens noni nerve.
21. Pneumogastric nerve (in carotid sheath).
22. Spinal accessory nerve.
23. Phrenic nerve.
24. Facial nerve.
25. Sympathetic nerve.

XVI.—Structures Beneath the Deltoid Muscle.

1. A large bursa.
2. Head and neck of humerus.
3. Coracoid process of scapula.
4. Capsular ligament.
5. Coraco-acromial ligament.
6. Coraco-humeral ligament.
7. Coraco-clavicular ligaments (trapezoid and conoid).
8. Costo-coracoid ligament and membrane (external attachments).
9. Tendon of pectoralis minor.
10. Both heads of biceps.
11. Origin of coraco-brachialis.
12. Tendon of sub-scapularis.
13. „ „ pectoralis major.
14. „ „ supra-spinatus.

15. Tendon of infra-spinatus.
16. „ „ teres minor.
17. „ „ teres major.
18. „ „ latissimus dorsi.
19. Scapular and external heads of triceps.
20. Anterior and posterior circumflex arteries and veins.
21. Acromio-thoracic artery and vein.
22. Branch of superior profunda artery and veins.
23. Circumflex nerve (from posterior cord of brachial plexus).

XVII.—Structures Beneath the Gluteus Maximus Muscle.

1. Part of gluteus medius.
2. Lower border of gluteus minimus (in some subjects).
3. Superficial branch of gluteal artery.
4. Pyriformis muscle.
5. Sciatic vessels.
6. Sciatic nerves (great and small.)
7. Pudic vessels and nerve.
8. Nerve to obturator internus.
9. Gemellus superior.
10. Tendon of obturator internus.
11. Gemellus inferior.
12. Quadratus femoris.
13. Great trochanter of femur.
14. Tuber ischii.
15. Origin of semi-membranosus.
16. „ „ semi-tendinosus.
17. „ „ biceps.
18. Upper part of adductor magnus.
19. Three bursæ, viz., one over trochanter major, one over the tuberosity of the ischium, and one over the vastus externus.

20. Great sacro-ischiatic ligament.

NOTE.—The tendon of the obturator externus cannot be seen until after reflecting the quadratus femoris.

XVIII.—STRUCTURES PASSING THROUGH THE SUPERIOR APERTURE OF THORAX.

1. Right and left sterno-hyoideus
2. „ „ „ sterno-thyroideus } muscles.
3. „ „ „ longus colli
4. Trachea.
5. Œsophagus.
6. Thoracic duct (on left side.)
7. Superficial lymphatic vessels of liver, and lymphatic vessels of right side of chest.
8. Innominate artery (right side.)
9. Left common carotid artery.
10. Left subclavian artery.
11. Right and left internal mammary arteries.
12. „ „ „ superior intercostal arteries.
13. Thyroidea ima artery (if present.)
14. Right and left innominate veins.
15. „ „ „ inferior thyroid veins.
16. „ „ „ phrenic nerves.
17. „ „ „ pneumogastric nerves with cardiac branches.
18. Left recurrent laryngeal nerve.
19. Right and left sympathetic nerves with cardiac branches.
20. Right and left first dorsal nerves.
21. Remains of thymus gland.
22. Apices of lungs and pleuræ.
23. Deep cervical fascia passing on to pericardium.

XIX.—THE MEDIASTINUM.

The mediastinum is the space in the middle line of

the thorax, formed by the approximation of the pleura on either side, and extends from the sternum in front, to the bodies of the vertebræ behind. In no place do the reflected pleuræ come in contact with each other, so that the space between them forms a complete septum, dividing the two pulmonary cavities. The mediastinum is divided into three portions; (*a*), *anterior mediastinum;* (*b*), *middle mediastinum;* (*c*), *posterior mediastinum*, which contain all the viscera of the chest, with the exception of the lungs. The boundaries and contents of the three divisions are as follows:—

(*a.*)—ANTERIOR MEDIASTINUM.

BOUNDARIES:

In Front—The sternum.
Behind—Pericardium.
Laterally—Pleuræ.

CONTENTS:

1. Origin of sterno-hyoideus muscles.
2. „ „ sterno-thyroideus muscles.
3. Triangularis sterni muscle.
4. Left internal mammary artery and venæ comites.
5. Remains of thymus gland.
6. Loose areolar tissue.
7. Lymphatic vessels from convex surface of liver.

NOTE.—The right internal mammary vessels being covered by pleura, is not included among the contents of the space.

(*b.*)—MIDDLE MEDIASTINUM.

BOUNDARIES:

In Front.—Anterior mediastinum.
Behind.—Posterior mediastinum.
Laterally.—Pleuræ.

CONTENTS:

1. The heart enclosed in pericardium.
2. Ascending portion of aorta.
3. Superior vena cava.
4. Bifurcation of trachea.
5. Pulmonary artery and veins.
6. Phrenic nerves (from third, fourth, and fifth cervical.)
7. Arteriæ comites nervi phrenici (from internal mammary.)

(*c.*)—POSTERIOR MEDIASTINUM.

BOUNDARIES:

In Front.—Pericardium and root of lungs.
Behind.—Vertebral column.
Laterally.—Pleuræ.

CONTENTS:

1. Descending aorta.
2. Vena azygos major.
3. Vena azygos minor.
4. Superior intercostal veins.
5. Pneumogastric nerves.
6. Great splanchnic nerves.
7. Œsophagus.
8. Thoracic duct.
9. Lymphatic glands and vessels.

XX.—STRUCTURES CONSTITUTING ROOT OF LUNG.

1. Bronchus.
2. Pulmonary artery.
3. Pulmonary veins.
4. Bronchial vessels.
5. Bronchial glands.
6. Anterior and posterior pulmonary plexuses of nerves.
7. Connective tissue.

The following are the relations of the pulmonary veins, pulmonary artery and bronchus on either side:

Right Side. — From before, backwards; veins, artery, bronchus. From above, downwards; bronchus, artery, veins.

Left Side. — From before, backwards; same as right side. From above, downwards; artery, bronchus, veins.

XXI.—Structures in Concavity of, and Behind, Arch of Aorta.

In Concavity:

1. Bifurcation of pulmonary artery.
2. Remains of ductus arteriosus.
3. Left bronchus.
4. Left auricle.
5. Left recurrent laryngeal nerve.
6. Cardiac plexus of nerves.
7. Numerous lymphatic glands.

Passing Behind:

1. Œsophagus.
2. Thoracic duct.
3. Trachea.
4. Left recurrent laryngeal nerve.
5. Right pulmonary artery.

XXII.—Structures between the Clavicle and First Rib.

1. Rhomboid ligament.
2. Subclavius muscle.
3. Lymphatic vessels.
4. Subclavian artery.
5. Subclavian vein.
6. External cord of brachial plexus of nerves.
7. Internal cord of .. ..

8. Posterior thoracic nerve, or external respiratory of Bell.
9. External anterior thoracic nerve (occasionally).

XXIII.—The Costo-Coracoid Membrane.

The costo-coracoid membrane is a sheath of fascia derived from and continuous with the deep layer of cervical fascia, which encloses the axillary vessels for a short distance at their upper part, and corresponds to the femoral sheath in the lower limb. Externally it is attached to the coracoid process of the scapula, and internally to the lower border of the clavicle, as far as the inner extremity of the first rib. Above, it is continuous with the deep layer of cervical fascia, which forms the sheath of the subclavius muscle. The membrane is pierced by the following structures :—

1. Acromio-thoracic artery.
2. Superior thoracic artery.
3. Cephalic vein.
4. External anterior thoracic nerve.

XXIV.—Relations of the Trachea in the Neck.

Anteriorly :

1. Skin and superficial fascia.
2. Layers of deep fascia.
3. Anterior jugular veins.
4. Inferior thyroid plexus of veins.
5. Left innominate vein.
6. Thyroidea ima artery (in some subjects).
7. Isthmus of thyroid body.

Posteriorly :

1. Œsophagus.
2. Inferior or recurrent laryngeal nerves.
3. Vertebral column.

Laterally:

1. Lobes of thyroid body.
2. Carotid arteries.
3. Inferior thyroid arteries.

XXV.—Relations of the Prostate Gland.

Above. — Bladder, anterior true ligaments of bladder and dorsal vein of penis.

In Front. — Symphysis pubis, triangular ligament and sub-pubic ligament.

Behind.—Rectum (at bend between second and third parts).

Behind and Above.—Recto-vesical pouch of peritoneum.

Behind and Below. — Third part of rectum, vesiculæ seminales and vasa deferentia.

Below.—Central point of perineum and perineal raphé.

Below and in Front.—Triangular ligament, membranous urethra, and bulb of urethra.

Laterally.—Anterior fibres of levator ani muscle, recto-vesical fascia, and prostatic plexus of veins.

XXVI. — Structures Passing Through Inlet of Pelvis.

(*a*).—Viscera and Ducts.

1. Rectum.
2. Small intestines (generally).
3. Ureters.
4. Vasa deferentia (in male subjects), round ligament (in female subjects).
5. Urachus and obliterated hypogastric arteries.
6. Bladder (if distended).
7. Uterus (in female, if pregnant).

(*b*).—VESSELS.

1. Internal iliac.
2. Superior hæmorrhoidal.
3. Branches of vasa intestini tenuis.
4. Sacra media.
5. Ilio-lumbar.
6. Ovarian (in female subjects).
7. Obturator (if from deep epigastric).
8. Pubic branches from external epigastric arteries.
9. Numerous lymphatic vessels.

(*c*.)—NERVES.

1. Lumbo-sacral cord.
2. Obturator.
3. Sympathetic.
4. Branches from hypogastric plexus.

In addition to the above, the peritoneum investing the various viscera and the fasciæ from the abdominal parietes, which become pelvic, should be enumerated among the structures passing through the inlet of the pelvis.

XXVII.—VISCERA COVERED OR INVESTED BY PERITONEUM.

(*a*.)—ALMOST ENTIRELY INVESTED.

Liver	Transverse colon
Stomach	Sigmoid flexure of colon
Spleen	First part of rectum
First part of duodenum	Uterus and ovaries (in female)
Jejunum	
Ileum	

(*b*.)—PARTIALLY INVESTED.

Second and third parts of duodenum	Middle part of rectum
Cæcum	Posterior surface of bladder
Ascending colon	Upper part of posterior wall of vagina (in female)
Descending colon	

(*c*).—COVERED BUT NOT INVESTED.

Kidneys	Pancreas
Supra-renal capsules	

XXVIII.—CONTENTS OF SPINAL CANAL.

The following structures are included in the contents of the spinal canal, about its middle, and are met with in the order given, from without inwards.

1. Venous plexus — *meningeo-rachidian veins*— between the bone and dura mater, and surrounded by loose fat.
2. Dura mater.
3. Arachnoid membrane, parietal and visceral layers, the former merely epithelial. Between the two layers is the *arachnoid space.*
4. Pia mater, with linea splendens in median line, and *ligamentum denticulatum* between the anterior and posterior roots of spinal nerves. Between the arachnoid and pia mater is the *sub-arachnoid space*, and a variable amount of serous fluid.
5. Spinal arteries (one anterior and two posterior) with their accompanying veins ramifying in pia mater.
6. Spinal cord with anterior and posterior roots of nerves.

NOTE.—In addition to the above, the canal contains the spinal accessory nerve in the cervical region, and the *cauda equina* below the first lumbar vertebra.

XXIX.—THE SOFT PALATE.

The soft palate is the name given to the fold of mucous membrane, situate at the posterior part of the mouth and continuous with the *roof* or hard palate. From the middle of its inferior border depends the

uvula, and passing outwards from the uvula, on each side are two curved folds of mucous membrane, the arches, or *pillars of the palate.* The two pillars are closely united above, but below they are separated by a triangular interval which lodges the tonsil. The *anterior pillar* terminates at the side of the base of the tongue, and is formed by the prominence of the palato-glossus muscle. The *posterior pillar* extends downwards and backwards into the pharynx, and is formed by the convexity of the palato-pharyngeus muscle. Between the soft palate and the root of the tongue is the opening from the mouth into the pharynx. This space is known as the *isthmus of the fauces.* Its boundaries are:—

Above.—Soft palate.

Below.—Root of tongue.

Laterally.—Pillars of the palate and tonsils.

In dissecting the soft palate from behind forward the following structures are met with:—

1. Mucous membrane.
2. Submucous tissue, glands, vessels, &c.
3. Palato-pharyngeus muscle, posterior fasciculi.
4. Levator palati and azygos uvulæ muscles.
5. Palato-pharyngeus, anterior fasciculi.
6. Aponeurosis of tensor palati muscle.
7. Palato-glossus muscle.
8. Submucous tissue, glands, vessels, &c.
9. Mucous membrane.

XXX.—Structure of the Eyelids.

The eyelids are composed of the following structures, in the order given from without inwards:—

1. Skin.
2. Orbicularis palpebrarum muscle.
3. Palpebral ligament.
4. Tendon of levator palpebræ (upper lid only)

5. Tarsal cartilage.
6. Meibomian glands,
7. Conjunctiva.

XXXI.—The Inguinal Canal and Coverings of Inguinal Hernia.

The inguinal or spermatic canal commences at the internal abdominal ring, and terminates at the external abdominal ring, its length being about one and a half inches. It serves for passage of the *spermatic cord* in the male, and the *round ligament* with its vessels in the female. Its boundaries are:—

In front.—Tendon of external oblique muscle, lower border of internal oblique and small portion of cremaster muscle.

Behind.—Fascia transversalis; conjoined tendon of internal oblique and transversalis muscles, and the triangular fascia.

Above.—Arched border of transversalis muscle.

Below.—Poupart's ligament.

The inguinal canal is of great surgical importance on account of its being the channel through which inguinal hernia escapes from the abdomen. Inguinal herniæ are of two kinds, *oblique* and *direct*. The former enters the inguinal canal through the internal abdominal ring, passes obliquely along the canal and through the external ring to descend into the scrotum. *Direct* inguinal hernia escapes from the abdomen at Hesselbach's triangle, (vide Aid VI.) and passes through the external ring.

The following are the coverings of each variety of hernia commencing at the surface:—

Oblique.	Direct.
1. Skin.	1. Skin.
2. Superficial fascia.	2. Superficial fascia.
3. Intercolumnar fascia.	3. Intercolumnar fascia.
4. Cremaster muscle.	4. Conjoined tendon of internal oblique and transversalis muscles.
5. Fascia transversalis, or infundibuliform fascia.	5. Fascia transversalis.
6. Sub-serous cellular tissue.	6. Sub-serous cellular tissue.
7. Peritoneal sac.	7. Peritoneal sac.

XXXII.—The Spermatic Cord.

The spermatic cord commences at the internal abdominal ring, passes obliquely along the inguinal canal, escapes at the external abdominal ring, descends into the scrotum and terminates at the posterior border of the testicle. The structures entering into the composition of the cord are:—

1. The investing tunics, or coverings of the cord, viz., (*a*) external spermatic or intercolumnar fascia; (*b*) cremaster muscle; (*c*) internal spermatic fascia or fascia propria.
2. The vas deferens. The vas deferens has three coats (*a*) external or fibrous coat; (*b*) middle or muscular coat; (*c*) internal or mucous coat lined with squamous epithelium.
3. Spermatic artery (from abdominal aorta).
4. Deferential artery (from superior vesical).
5. Cremasteric artery (from epigastric).
6. Vena spermatica (the smaller veins are called *vasa pampiniformia* on account of their peculiar tendril-like arrangement).
7. Lymphatic vessels (numerous and of large size).
8. Spermatic plexus of nerves (from the aortic and renal plexuses of the sympathetic).
9. Genital branch of the genito-crural nerve.
10. Scrotal branch of the ilio-inguinal nerve.

XXXIII. The Crural Canal and Coverings of Femoral Hernia.

The crural or femoral canal is a funnel-shaped interval which exists within the femoral sheath between its inner wall and the femoral vein, and is of great surgical importance as being the space into which the sac of femoral hernia is protruded. It is limited above by the *crural or femoral ring* and is lost below by the adhesion of the sheath to the coats of the vessels. In the normal state the canal is occupied by loose cellular tissue, and numerous lymphatic vessels which perforate the cribriform fascia covering the saphenous opening in the fascia lata and the walls of the sheath to reach a lymphatic gland situated at the crural ring. This gland is retained in its position by a thin layer of sub-serous cellular tissue—*septum crurale*—which, together with the peritoneum, separates the canal from the abdominal cavity. The crural ring is the point where femoral hernia leaves the abdomen and is the most frequent seat of strangulation; its boundaries are:—

In front.—Poupart's ligament.

Behind.—Ilio-pectineal line and body of os pubis.

Externally.—Femoral vein.

Internally.—The sharp margin of Gimbernat's ligament.

The *coverings of femoral hernia* commencing at the surface are:—

1. Skin.
2. Superficial fascia.
3. Cribriform fascia.
4. Femoral sheath or fascia propria.
5. Septum crurale.
6. Peritoneal sac.

XXXIV.—The Parotid Gland.

The parotid—the largest of the salivary glands—is situated in front of and below the external ear, and extends forwards on the masseter muscle on which also lies a small, more or less detached, portion called the socia parotidis. It is bounded above by the zygoma, below by an imaginary line drawn from the angle of the jaw to the sterno-mastoid muscle, and behind by the meatus auditorius externus, the mastoid process of the temporal bone, the sterno-mastoideus and posterior belly of the digastricus. It extends deeply into the neck by means of two processes. One dips behind the styloid process, and projects beneath the mastoid process and the sterno-mastoid muscle. The other process passes in front of the styloid process to the back of the glenoid fossa, behind the articulation of the lower jaw. Embedded in the gland is the external carotid artery, with its posterior auricular, temporal and internal maxillary branches. The transverse facial (a branch of the temporal) emerges from it in front. Superficial to the external carotid artery, the temporal and internal maxillary veins join to form the external jugular, from which a branch passes through the gland forming a communication with the internal jugular vein, which with the internal carotid artery, lies close to its deep surface. It is traversed by the facial nerve and its branches, and by branches of the great auricular nerve, which here communicate with the facial. Its duct (Steno's) commences at the anterior border of the gland by the junction of numerous branches, and, crossing the masseter muscle, is joined by the duct from the socia parotidis. At the anterior border of the muscle, the duct dips inwards, pierces the buccinator muscle and mucous membrane, opening into the mouth opposite the second molar tooth of the upper jaw. The duct con-

sists of two coats, an external or fibrous coat, and an internal or mucous coat lined with columnar epithelium. The gland receives its blood supply from the vessels embedded in it above enumerated, and its nerve supply from the carotid plexus of the sympathetic, the auriculo-temporal, and great auricular nerves.

On cutting into the substance of the parotid gland the structures met with in order from the surface are as follows:—

1. Two or more small absorbent glands.
2. "Pes anserinus," or primary branches of the facial nerve.
3. Branches from the auriculo-temporal nerve which here communicate with the facial nerve.
4. The external jugular vein formed by the junction of the internal maxillary and temporal veins.
5. The external carotid artery which, after giving off several branches in the gland, divides opposite the neck of the jaw into internal maxillary and temporal.

XXXV.—The Cranial Nerves.

According to the arrangement of Willis, which is usually adopted in England, there are nine pairs of cranial nerves, numbered according to the openings in the base of the cranium. He also included the sub-occipital nerve among the cranial nerves forming a tenth pair; this is now reckoned among the spinal nerves, forming the first cervical. On the Continent, the arrangement of Willis is not recognised, that of Soemmering being universally employed. In his system the facial and auditory nerves (7th) are reckoned as

separate pairs, as are also the glosso-pharyngeal, pneumogastric and spinal accessory, which together form the 8th. pair of Willis's. Thus the nine pairs of Willis's equal the twelve pairs of Soemmering's, system as will be seen from the following table:—

Willis.	Soemmering.
1. Olfactory.	1. Olfactory.
2. Optic.	2. Optic,
3. Motores oculorum.	3. Motores oculorum.
4. Pathetici (or trochleares.)	4. Pathetici.
5. Trifacial (or trigemini.)	5. Trifacial.
6. Abducentes.	6. Abducentes.
7. Facial and auditory.	7. Facial (portio dura.)
8. Glosso-pharyngeal, pneumogastric and spinal accessory.	8. Auditory (portio mollis.)
	9. Glosso-pharyngeal.
9. Hypoglossal.	10. Pneumogastric (vagus or par vagum.)
	11. Spinal accessory.
	12. Hypoglossal.

These nerves may be classified according to their physiological functions into three groups as follows :—

Nerves of Special Sense.—Olfactory, (1st.); Optic, (2nd.); and Auditory, (portio mollis of 7th.)

Nerves of Motion. — Motores oculorum, (3rd.); Pathetici, (4th.); Abducentes, (6th.); Facial, (portio dura of 7th.); and Hypoglossal, (9th.)

Compound Nerves: Motor and Sensory.—Trifacial (5th.); Glosso-pharyngeal, Pneumogastric and Spinal accessory, (8th.)

XXXVI.—The Olfactory Nerve.

Origin. — By three roots, an *inner* or *short root*, *middle root*, and *external* or *long root*. The fibres of the inner root arise from the inner and posterior part of the anterior lobe, close to the substantia perforata; the grey fibres of the middle root spring from the

caruncula mamillaris, and the white from the corpus striatum; the fibres of the external root may be traced into the middle lobe of the cerebrum, being continuous with the fibres of the anterior commissure and the exterior white substance of the thalamus opticus.

Course.—The three roots having united, pass forward on the under surface of each anterior lobe of the cerebrum between the pia mater and arachnoid and rest on the cribriform plate of the ethmoid bone. Towards its extremity the nerve increases in size, forming an oblong mass of grey and white matter which is called the *bulbus olfactorius.*

Distribution.—The branches of distribution are given off from the under surface of the *bulbus olfactorius*, and pass through the foramina in the cribriform plate of the ethmoid bone in three groups to supply the mucous membrane of the nares. The nerves forming the inner of the three groups are spread out upon the septum narium, those of the middle group supply the mucous membrane of the roof of the nasal fossæ, and the outer group are distributed on the superior and middle turbinated bones.

XXXVII.—The Optic Nerve.

Origin.—From the corpora geniculata, the thalamus opticus and from the nates.

Course.—From the above origin it winds around the crus cerebri as a flattened band called the *tractus opticus*, and unites with its fellow of the opposite side in front of the tuber cinereum, to form the *optic commissure.* The tractus opticus is united with the crus cerebri, and the tuber cinereum. The commissure is also united with the tuber cinereum from which it receives some fibres. Beyond the commissure, the nerve diverges from

its fellow, becomes rounded in form, and is enclosed in a sheath derived from the arachnoid. It then passes forward through the optic foramen to enter the orbit. At the optic foramen the nerve receives a sheath from the dura mater, which at this point splits into two layers, one of which becomes the periosteum of the orbit; the other, as above stated, encloses the nerve up to the point where it pierces the eyeball, when the sheath becomes continuous with the sclerotic coat. After a short course within the orbit, the optic nerve pierces the sclerotic and choroid coats of the eyeball.

Distribution.—As soon as the nerve has pierced the eyeball it spreads out on its internal surface forming the *retina*.

Note.—Within the commissure the innermost fibres of the optic nerves cross each other to pass to opposite eyes, the outer fibres continue their course uninterrupted to the eye of the corresponding side; some fibres pass in an arched direction, from one nerve to the other behind, and others taking a similar course in front, connect the two retinæ. (Wilson.)

XXXVIII.—The Third Pair of Nerves.

Origin.—The superficial origin of this nerve is from the inner side of the crus cerebri close to the pons Varolii, but its fibres may be traced into the grey substance of the crus, into the longitudinal fibres of the pons (the motor tract), into the corpora quadrigemina and valves of Vieussens, and to a grey nucleus in the floor of the aqueduct of Sylvius.

Course.—From the inner side of the crus cerebri the nerve passes forward between the posterior cerebral and superior cerebellar artery, and pierces the dura

mater immediately in front of the posterior clinoid process. It then descends obliquely into the *external* wall of the cavernous sinus and divides into two branches which enter the orbit through the sphenoidal fissure and between the two heads of origin of the external rectus muscle.

Distribution. — The *superior* of its two branches ascends and supplies the superior rectus and levator palpebræ. The *inferior* divides into three other branches, one of which passes beneath the optic nerve to the internal rectus, another passes to the inferior rectus, and the third, a long branch, supplies the inferior oblique. From this branch a short thick branch is given to the ophthalmic or lenticular ganglion.

NOTE.—The branches of this nerve enter the muscles they supply on their *ocular* surface. In paralysis of this nerve there is dropping of the eyelid (ptosis), external strabismus and dilatation of the pupil.

XXXIX.—THE FOURTH PAIR.

Origin.—The *superficial* origin of this nerve is from the valve of Vieussens close to the testis. Its *deep* origin may be traced in two fasciculi, to a grey nucleus in the floor of the aqueduct of Sylvius in front, and to a similar nucleus in the floor of the fourth ventricle behind. The fibres of origin of the two nerves communicate with each other, forming a kind of commissure.

Course.—The nerve first winds round the crus cerebri to the extremity of the petrous portion of the temporal bone, when it pierces the dura mater below the third nerve, and passes forward in the outer wall

of the cavernous sinus to the sphenoidal fissure through which it passes to the orbit. Having entered the orbit, it crosses the levator palpebræ muscle near its origin to reach the *orbital* surface of the superior oblique muscle.

Distribution.—This nerve is specially distributed to the superior oblique or trochlearis muscle; hence it is often termed the *trochlear* nerve. While in the cavernous sinus, the fourth nerve sends a branch of communication to the ophthalmic nerve, and gives off a recurrent branch, consisting of sympathetic filaments derived from the carotid plexus which is distributed to the lining membrane of the cavernous sinus.

NOTE.—Sometimes the recurrent nerve is a branch of the ophthalmic nerve, and occasionally it arises direct from the carotid plexus.

XL.—THE FIFTH PAIR OF NERVES.

Origin.—Like the spinal nerves, the fifth nerve arises by two roots, a motor and a sensory. The nerve makes its appearance on the surface of the brain—*superficial origin*—at the side of the pons Varolii. Here it consists of two fasciculi, separated by a narrow interspace. The smaller, or anterior, is the motor root; and the larger, or posterior, the sensory. The former consists of about twenty nerve filaments, and the latter of from seventy to a hundred. The fibres of the posterior root can be traced between the transverse layers of the pons Varolii behind the corpus olivare, and between the corpus restiforme and fasciculus innominatus (teres) to its *deep origin* in the grey substance of the floor of the fourth ventricle. The fibres of the

anterior root can be traced to the longitudinal fibres which are prolonged upwards from the corpus pyramidale; but, according to Stilling, the anterior root also has its *deep origin* from the grey substance of the fourth ventricle.

Course.—From the side of the pons Varolii the two roots pass forward and through an oval opening in the tentorium cerebelli, near the apex of the petrous portion of the temporal bone. Here the posterior root spreads out into a large semilunar ganglion, the Gasserian, which is lodged in a depression in the bone. The anterior root is not connected with the ganglion, but passes beneath it and through the foramen ovale, when it unites with the inferior maxillary nerve. From the anterior or convex border of the ganglion are given off three large trunks :—

(*a*) The ophthalmic nerve, which passes forward in the outer wall of the cavernous sinus, and enters the orbit through the sphenoidal fissure. (*b*) The superior maxillary nerve, which passes forward through the foramen rotundum to enter the spheno-maxillary fossa. (*c*) The inferior maxillary nerve, which is given off from the inferior angle of the ganglion, and makes its exit from the cranium almost immediately, through the foramen ovale.

The further course and distribution of the three divisions of the fifth nerve will be considered under their respective headings.

Note.—The Gasserian ganglion receives some filaments from the carotid plexus of the sympathetic, and gives off a few small branches to supply the tentorium cerebelli and the dura mater in the middle fossa of the cranium.

(*a*).—The Ophthalmic Nerve.

The ophthalmic nerve arises from the upper part of the Gasserian ganglion by a short trunk, about three quarters of an inch in length, and passes forward in the outer wall of the cavernous sinus, lying externally to the other nerves. After receiving several filaments from the carotid plexus of the sympathetic, it divides into three branches—*lachrymal*, *frontal*, and *nasal*. Before its division it gives off a small *recurrent* branch, which passes backwards with the recurrent branch of the fourth nerve, between the layers of the tentorium cerebelli, to the lining membrane of the lateral sinus.

The *Lachrymal Nerve* is the smallest of the three branches of the ophthalmic. It enters the orbit through the narrowest part of the sphenoidal fissure, external to the frontal nerve, and passes forward above the upper border of the external rectus muscle, in company with the lachrymal artery, to the lachrymal gland, where it divides into two branches, superior and inferior. The *superior* branch supplies the upper surface of the gland, and is continued forwards through a foramen in the malar bone to communicate with the subcutaneus malæ (br. of sup. maxillary nerve), and a filament of the facial nerve. The *inferior* branch supplies the under surface of the gland, the upper eyelid, and the outer angle of the eye. In the orbit the lachrymal nerve has a connecting filament with the orbital branch of the superior maxillary nerve. Sometimes it receives a branch from the fourth nerve. When this occurs, the lachrymal appears to arise by two roots.

The *Frontal Nerve*, the largest branch of the ophthalmic, enters the orbit immediately to the outer side of the fourth nerve, and passes forward along the middle line of the orbit between the levator palpebræ muscle

and the periosteum. About midway between the apex and base of the orbit it divides into two branches, the supra-orbital and the supra-trochlear. The *supra-orbital* branch is the proper continuation of the nerve. It passes out of the orbit through the supra-orbital notch, in company with the supra-orbital artery, gives off filaments to supply the upper eyelid, the pericranium, and muscles of the forehead, viz.,—corrugator supercilii, occipito-frontalis, and orbicularis palpebrarum, and divides into two cutaneous branches, internal and external, which supply the skin in front of the head as far as the summit, and around the side as far back as the occiput.

The Nasal Nerve enters the orbit between the two heads of the external rectus muscle, and between the two branches of the third nerve. It crosses the optic nerve obliquely, in company with the ophthalmic artery, beneath the levator palpebræ and superior rectus muscle, to reach the inner wall of the orbit where it enters the anterior ethmoidal foramen, passing through which it re-enters the cavity of the cranium. It then traverses a shallow groove on the front of the cribriform plate of the ethmoid bone, passes down through the slit-like opening by the side of the crista galli into the nose, where it divides into two branches, internal and external. The *internal* branch supplies the mucous membrane near the fore part of the septum of the nose; the *external*, after giving off a few filaments to the mucous membrane of the nares, passes outwards between the nasal bone and cartilage to supply the skin of the ala and tip of the nose.

Whilst in the orbit the nasal nerve gives off the following branches:

1.—*Ganglionic*: a slender nerve, half an inch in length, which enters the upper angle of the

ophthalmic ganglion and constitutes its superior or long root.

2.—*Ciliary* (Long ciliary nerves): Two or three long slender filaments which pierce the sclerotic coat near the short ciliary nerves, and passing through the globe of the eye between the sclerotic and choroid coats, are distributed to the ciliary muscle and iris.

3.—*Infra-trochlear*: a small branch which is given off just as the nasal nerve enters the anterior ethmoidal foramen, and passes forward along the upper border of the internal rectus muscle to the inner angle of the eye, where it communicates with the supra-trochlear (br. of frontal) nerve, and is distributed to the lachrymal sac, orbicularis palpebrarum, conjunctiva, skin of the eyelids and side of the nose.

NOTE.—The first division of the 5th nerve is entirely sensory in function. It supplies branches to the eyeball; ophthalmic ganglion; lachrymal gland; mucous membrane of the nose and eyelids; skin of the nose, eyelids, forehead, upper part and sides of the hairy scalp; muscles above the middle of the circumference of the orbit, the pericranium, &c.

(b) THE SUPERIOR MAXILLARY NERVE.

This nerve arises from the middle of the Gasserian ganglion, passes horizontally forward, and makes its exit from the skull through the foramen rotundum in the sphenoid bone. It then crosses the spheno-maxillary fossa and enters the canal in the floor of the orbit, which it traverses, and emerges on the face at the

infra-orbital foramen beneath the levator labii superioris muscle. Here it divides into a number of branches which, together with branches of the facial nerve, form a plexus—the *infra-orbital plexus*.

The branches of distribution of this nerve are divided into three groups: those given off in the spheno-maxillary fossa, those given off in the infra-orbital canal, and those given off on the face (terminal branches), thus :—

Spheno-maxillary fossa	Orbital or temporo-malar.	
	Spheno-palatine.	
	Posterior dental.	
Infra-orbital canal ..	Middle dental.	
	Anterior dental.	
On the face	Palpebral.	or muscular and cutaneous.
	Nasal.	
	Labial.	

The *Orbital* or *temporo-malar branch* enters the orbit through the spheno-maxillary fissure and divides into two branches, temporal and malar. The *temporal branch* ascends along the outer wall of the orbit, receives a branch from the lachrymal nerve, passes through a foramen in the malar bone, and enters the temporal fossa, where it communicates with the deep temporal nerves (brs. of inferior maxillary). It then pierces the temporal muscle and temporal fascia, and supplies the skin of the temple and side of the forehead communicating with the facial and anterior temporal nerves. The *malar branch* passes along the inferior angle of the outer wall of the orbit, emerges on the face through a foramen in the malar bone, and pierces the fibres of the orbicularis palpebrarum muscle, to reach the skin of that region. This nerve is sometimes called subcu-

taneus malæ. It communicates with branches of the infra-orbital, facial and lachrymal nerves.

The *Spheno-palatine* are two branches which pass downwards to the spheno-palatine or Meckel's ganglion.

The *Posterior dental* are two branches which arise from the trunk of the nerve just as it is about to enter the infra-orbital canal, and pass downwards upon the tuberosity of the superior maxillary bone. One of the branches passes forward through the substance of the bone, giving off numerous filaments which supply the molar and bicuspid teeth, the lining membrane of the antrum and corresponding portion of the gums. Opposite the canine fossa this nerve communicates with the anterior dental nerve. The other posterior dental nerve continues its course forward external to the bone, and is distributed to the gums and the buccinator muscle.

The *Middle* and *anterior dental branches* are given off in the infra-orbital canal, and descend to the corresponding teeth and to the gums. The *middle* passes beneath the lining membrane of the antrum, whilst the *anterior* passes through a special canal in the anterior wall of that cavity. Previously to their distribution, the anterior, middle, and posterior dental nerves, form a plexus (the *superior maxillary plexus)* in the outer wall of the superior maxillary bone, immediately above the alveolus, from which filaments are given off to supply the pulps of the teeth, gums, mucous membrane of the floor of the nares and the palate.

The *Palpebral, nasal* and *labial* branches are very numerous, and supply the muscles and skin of the regions indicated by their names. The palpebral also supplies the conjunctiva of the lower eyelid, and communicates with the facial nerve and the malar branch

of the orbital. The nasal branches communicate with the nasal branch of the ophthalmic nerve.

NOTE.—The second division of the 5th nerve is entirely sensory in function. It is the nerve of sensation of teeth, of the upper jaw, the hard and soft palate, gums, tonsils, antrum maxillare, muscles, skin and conjunctiva of the lower eyelid, mucous membrane of the floor of the nares, and the muscles and skin of the cheeks and upper lip.

(c).—THE INFERIOR MAXILLARY NERVE.

This, the largest division of the fifth nerve, consists of two portions, the sensory, which arises from the inferior angle of the Gasserian ganglion, and passes through the foramen ovale in the spheniod bone with the motor portion which, as above stated, passes beneath the ganglion, and unites with the sensory portion just as it makes its exit from the cranium. Immediately beneath the base of the skull, the nerve again divides into two trunks, an anterior and posterior, the former of which receives nearly all the motor fibres. These again subdivide into numerous branches as follows:—

Anterior Division.	*Posterior Division.*
Masseteric.	Auriculo-Temporal.
Deep Temporal (2).	Inferior Dental
Buccal.	Gustatory.
Pterygoid (2).	

The *Masseteric branch* passes outwards above the external pterygoid muscle, behind the tendon of the temporal muscle and in front of the temporo-maxillary articulation crosses the sigmoid notch with the masseteric artery, and enters the masseter muscle. It sends a small branch to the temporal muscle, and a filament to the temporo-maxillary articulation.

The *Deep Temporal branches*, two in number, anterior

and posterior, pass between the upper border of the external pterygoid muscle, and the temporal bone to reach the deep surface of the temporal muscle which they supply. Some filaments from these nerves pierce the temporal fascia and communicate with the larchrymal, subcutaneus malæ, superficial temporal and facial nerves.

The *Buccal Branch* pierces the lower fibres of the external pterygoid muscle, to which it gives a branch, and passes downwards, beneath the inner surface of the coronoid process of the lower jaw, or through the fibres of the temporal muscle to reach the surface of the buccinator muscle which it supplies, as also the skin and mucous membrane of the cheek. It also sends a few filaments to the temporal muscle, and communicates with the facial nerve.

The *Pterygoid branches*, two in number, internal and external, supply the internal and external pterygoid muscles respectively. The *internal* branch is intimately connected with the otic ganglion and also gives filaments to the tensor palati and tensor tympani muscles. The *external* branch may arise separately from the inferior maxillary nerve, but more commonly it is given off from the buccal nerve.

The Auriculo-Temporal Nerve usually arises by two roots between which passes the middle meningeal artery. It then passes backward behind the temporo-maxillary articulation, turns upward between the articulation and the meatus of the ear and escaping from beneath the parotid gland, divides into two temporal branches. While behind the articulation, it forms a kind of plexus and gives off different branches. The branches are :—

Temporo-Maxillary, a small branch to the articulation.

Parotidean; two or three filaments to the parotid gland.

Branches to the Meatus Auditorius, two in number, which enter the canal between the fibro-cartilage and processus auditorius.

Auricular; two in number, superior and inferior; these are distributed to the pinna above and below the meatus. The *inferior* branch communicates with the sympathetic.

Communicating branches, with the otic ganglion and facial nerve.

Temporal Branches (terminal), two in number, anterior and posterior. The *anterior* accompanies the temporal artery to the vertex of the skull, supplies the skin of the temporal region, and communicates with the facial, subcutaneus malæ, supra-orbital and larchrymal nerves. The *posterior* supplies the attrahens aurem muscle, the upper part of the pinna and skin of the posterior part of the temple.

The Inferior Dental Nerve, the largest of the three branches of the posterior division of the fifth nerve, passes downwards accompanied by the inferior dental artery, at first between the two pterygoid muscles, and then between the internal lateral ligament and the ramus of the lower jaw to the dental foramen which it enters. It then runs along the canal in the lower jaw, distributing branches in its course to the molar and bicuspid teeth and to the gums, and at the mental foramen, divides into two terminal branches, the incisive and mental. The *incisive* branch is continued forward within the bone as far as the symphisis, and supplies the canine and incisor teeth. The *mental* branch emerges from the jaw at the mental foramen, beneath the depressor anguli oris muscle, and divides into branches

which supply the depressor anguli oris, the orbicularis oris and quadratus menti muscles, and the mucous membrane and skin of the lower lip. It also communicates with the facial nerve. In addition to the branches above mentioned, the inferior dental gives off an important branch just before it enters the inferior dental foramen, viz:—the *mylo-hyoidean branch.* This nerve having pierced the insertion of the internal lateral ligament, descends in a well-marked groove on the inner surface of the lower jaw, to the mylo-hyoid muscle, which it supplies, a small branch being prolonged forward to supply the anterior belly of the digastricus.

The Gustatory Nerve (sometimes called the *lingual,*) arises from the posterior division of the inferior maxillary nerve, and descends between the internal and external pterygoid muscles a little to the inner side of the inferior dental nerve. Below the border of the external pterygoid, it curves forward between the internal pterygoid and the ramus of the jaw, and crosses obliquely over the superior constrictor of the pharynx and between the stylo-glossus muscle and the sub-maxillary gland, to the side of the tongue, along which it runs, crossing Wharton's duct to reach the tip. This nerve supplies branches to the mucous membrane of the mouth and gums, the sub-lingual glands, and the papillæ and mucous membrane at the sides and tip of the tongue. It also sends branches of communication to the sub-maxillary ganglion, and to the hypoglossal nerve. These latter form a plexus at the anterior margin of the hyo-glossus muscle. While between the pterygoid muscles it receives a branch of communication from the inferior dental nerve, and a little lower down it is joined by the chorda tympani from the facial. After communicating with the gustatory, the chorda tympani

is continued downwards in its sheath to the submaxillary ganglion.

NOTE.—The third division of the fifth nerve has a three-fold function. It is one of the special nerves of the sense of taste; it supplies common sensation to the tongue, the skin of the temple, external ear, lower part of the face, lower lip and other parts to which it is distributed, and it supplies the power of motion to the muscles of mastication (except the buccinator,) the mylo-hyoideus and anterior belly of the digastricus.

XLI.—THE GANGLIA OF THE FIFTH PAIR OF NERVES.

In addition to the Gasserian ganglion (already described) there are in intimate connection with the fifth pair of nerves, four other ganglia, viz:—

(*a*) The ophthalmic or lenticular ganglion.
(*b*) The spheno-palatine or Meckel's ganglion.
(*c*) The otic or Arnold's ganglion.
(*d*) The submaxillary ganglion.

It may be as well to consider these ganglia here, although properly speaking, they belong to the cranial portion of the sympathetic system of nerves.

(*a*) THE OPHTHALMIC GANGLION.

The ophthalmic or lenticular ganglion, is a small quadrangular and flattened ganglion, situated at the back of the orbit on the outer side of the optic nerve and near the ophthalmic artery. It has three roots entering into its formation (*branches of communication*) —sensory, motor and sympathetic.

The *sensory or long root*, the most superior, joins the ganglion at its superior angle, and is derived from the nasal branch of the first division of the fifth nerve.

The *motor or short root*, the most inferior, joins the

ganglion at its inferior angle and is derived from the inferior division of the third nerve.

The *sympathetic root* is a long slender filament which enters the ganglion between the other two roots, and is derived from the carotid plexus of the sympathetic nerve.

Occasionally the ganglion receives a branch of communication from the spheno-palatine ganglion.

The *branches of distribution* are the *short ciliary nerves* which arise from the anterior angles in two groups. The upper group consists of about four filaments, the lower of five or six. They pierce the sclerotic around the optic nerve, to supply the tunics of the eyeball.

(*b*) The Spheno-Palatine Ganglion.

The Spheno-palatine or Meckel's Ganglion is situated in the spheno-maxillary fossa, opposite the spheno-palatine foramen, and a little below the superior maxillary nerve. It has three roots—sensory, motor, and sympathetic.

The *sensory root* is from the superior maxillary nerve, by means of the two spheno-palatine nerves.

The *motor root* is derived through the Vidian nerve from the facial nerve. (*vide* posterior branches.)

The *sympathetic root* is from the carotid plexus of the sympathetic nerve.

The *branches of distribution* of the ganglion are divided into four sets, ascending, descending, internal, and posterior.

The *ascending branches* are three or four small filaments, which are distributed to the periosteum of the orbit. One of these branches sometimes joins the ophthalmic ganglion.

The *descending branches* are the anterior, middle, and posterior palatine nerves. The *anterior* or *great palatine nerve* descends from the ganglion, through the posterior palatine canal, and emerging from the posterior palatine, foramen is distributed to the hard palate. It also communicates with the naso-palatine nerve. While in the posterior palatine canal, the anterior palatine nerve gives off several branches (*inferior nasal*) which are distributed to the middle, and inferior meatus of the nose. The *middle* or *external palatine* nerve passes through the posterior palatine foramen, and is distributed to the tonsil, soft palate and uvula. The *posterior* or *small palatine nerve* emerges from an opening behind the posterior palatine foramen and is distributed to the gums, soft palate and uvula.

The *internal branches* are the superior nasal and naso-palatine. The *superior nasal nerves* are four or five in number, which enter the nasal fossa through the spheno-palatine foramen, and are distributed to the mucous membrane of the superior meatus, and the superior and middle spongy bones. The *naso-palatine* nerve also enters the nasal fossa through the spheno-palatine foramen and crossing the roof of the nares reaches the septum, to which it gives filaments and passes downwards and forwards along the vomer and through the naso-palatine canal to reach the palate to which it is distributed.

The *posterior* branches are the *Vidian* or *pterygoid nerve* and the *pterygo-palatine.*

The *Vidian nerve* passes directly backwards through the pterygoid or Vidian canal to the foramen lacerum basis cranii, where it divides into two branches, *carotid* and *petrosal.* The *carotid branch* or deep petrosal nerve crosses the foramen lacerum and enters the

carotid canal to join the carotid plexus. The petrosal branch or *nervus petrosus superficialis major*, enters the cranium at the foramen lacerum basis cranii, and passes backwards beneath the Gasserian ganglion and dura mater, embedded in a groove on the anterior surface of the petrous portion of the temporal bone, to reach the hiatus Fallopii. Here it receives a branch from Jacobson's nerve, and terminates in the intumescentia gangliformis of the facial nerve. The *pterygo-palatine nerve* is a small branch which passes backwards through the pterygo-palatine canal and is distributed to the mucous membrane of the Eustachian tube and neighbouring part of the pharynx.

(*c*)—The Otic Ganglion.

The Otic, or Arnold's ganglion, is a small oval-shaped ganglion, which may be found near the foramen ovale, lying against the inner surface of the inferior maxillary nerve (third division of 5th). It is closely adherent to the internal pterygoid nerve, and, posteriorly, it is in contact with the middle meningeal artery.

It has three roots—motor, sensory, and sympathetic. The *motor*, or *short root*, is derived from the inferior maxillary nerve; the *sensory*, or *long root*, from the auriculo-temporal nerve, and the *nervus petrosus superficialis minor*, and the *sympathetic* from the nervi molles of the meningeal artery. These are sometimes called *branches of communication*. The *branches of distribution* are, a small filament to the tensor tympani muscle and one or two filaments to the tensor palati.

Note.—The *nervus petrosus superficialis minor*

ascends from the otic ganglion to a small canal situated between the foramen ovale and foramen spinosum, and passes backwards on the petrous bone to the hiatus Fallopii, where it divides into two filaments. One of these filaments enters the hiatus and joins the intumescentia gangliformis of the facial nerve; the other passes to a minute foramen near the base of the petrous bone, and enters the tympanum, where it communicates with a branch of Jacobson's nerve (Wilson.)

(*d*) The Sub-Maxillary Ganglion.

This ganglion is situated on the sub-maxillary gland, a little below the gustatory (br. of 5th) nerve. Its roots, or *branches of communication*, are as follows:—

Motor, the chorda tympani from the facial (7th) nerve;

Sensory, two or three filaments from the gustatory nerve.

Sympathetic; one or two filaments from the plexus on the facial artery, which connect it with the cervical portion of the sympathetic.

The *branches of distribution* are six or eight filaments, which supply the side of the tongue, the submaxillary gland, sublingual gland, and Wharton's duct.

XLII.—The Sixth Pair of Nerves.

Origin. The sixth or abducens nerve arises by several filaments from the upper constricted part of the corpus pyramidale, and by a few filaments from the pons Varolii. This is its *superficial* origin, but according to some anatomists, its *deep* origin may be traced between the fasciculi of the corpora pyramidalie to the posterior

part of the medulla oblongata, and to the grey substance of the fourth ventricle.

Course. From the above origin—superficial—the nerve passes forward parallel with the basilar artery and pierces the dura mater to reach the cavernous sinus. It then runs forward through the sinus below the level of the other nerves, and resting against the internal carotid artery, to the sphenoidal fissure, through which it passes to enter the orbit.

Distribution. This nerve is specially distributed to the external rectus muscle, which it supplies with motor power.

XLIII.—The Seventh Pair of Nerves.

The seventh pair of nerves consists of two distinct nervous cords, which differ from each other, both in structure and in function. These two cords lie side by side on the posterior border of the crus cerebelli. The most internal, which is also smaller and more dense in structure, is called the *portio dura*, or facial nerve. The external is soft and pulpy, and is called the *portio mollis*, or auditory nerve. Connecting the two nerves is a small nerve known as the *portio intermedia* of Wrisberg, which is regarded by some anatomists as the posterior or sensitive root of the facial; that the *intumescentia gangliformis* of the facial nerve is the ganglion of this root; and that it bestows sensory functions on the facial. The origin, course, and distribution of the facial and auditory nerves must be considered separately.

(*A*) The Portio Dura, or Facial Nerve.

Origin. The *superficial* origin of the nerve is the lateral tract of the medulla oblongata at the upper *part of the groove* between the olivary and restiform

bodies. A few fibres arise from the pons Varolii. The *deep* origin is said to be a grey nucleus in the floor of the fourth ventricle.

Course.—From the above origin (superficial) the nerve passes forwards and outwards, resting on the crus cerebelli, and enters the internal auditory meatus with the auditory nerve, lying at first to the inner side of, and then upon, that nerve. At the bottom of the meatus it enters the aqueductus Fallopii, and passes forwards and outwards to the hiatus Fallopii in the anterior wall of the petrous bone, where it receives the petrosal branch of the Vidian nerve, and forms a gangliform swelling, which is known as the *intumescentia gangliformis*, or *ganglion geniculare*. It then curves backwards and descends in the anterior wall of the tympanum to the stylo-mastoid foramen. From the foramen the nerve passes forward, enters the parotid gland, crosses the external carotid artery, and divides opposite the ramus of the jaw into two primary trunks—*temporo-facial* and *cervico-facial*.

In its course from the brain to the ramus of the jaw the facial nerve has several important communications with other nerve structures, which Gray tabulates thus:—

In the internal auditory meatus.	With the auditory nerve.
In the aqueductus Fallopii.	With Meckel's ganglion by the large petrosal nerve. With the otic ganglion by the small petrosal nerve. With the sympathetic on the middle meningeal artery by the external petrosal nerve.

At its exit from the stylo-mastoid foramen. { With the pneumogastric. „ „ glosso-pharyngeal. „ „ carotid plexus. „ „ auricularis magnus. „ „ auriculo-temporal.

In addition to the above communications, it communicates by means of its terminal branches on the face, with the three divisions of the fifth nerve.

Distribution.—The branches of distribution are divided into three sets: (*a*) Branches given off within the aqueductus Fallopii; (*b*) Branches given off at its exit from the stylo-mastoid foramen; (*c*) Branches given off on the face.

(*a*) Branches given off within aqueductus Fallopii.

(i.) *Tympanic*, a small filament to the stapedius and laxator tympani muscles.

(ii.) *Chorda tympani*, a branch given off just before the nerve makes its exit from the stylo-mastoid foramen. It ascends by a distinct canal to the upper part of posterior wall of the tympanum and enters that cavity through an opening between the base of the pyramid and the attachment of the membrana tympani. It then crosses the tympanum between the handle of the malleus and long process of the incus, and makes its exit through an opening in the Glasserian fissure known as the canal of Huguier. Having emerged from the skull, it passes downwards between the two pterygoid muscles, joins the gustatory nerve at an acute angle, and descends to the submaxillary ganglion, of which it forms the motor root [*vide* Aid xli. (*d*)], and finally terminates in the lingualis muscle.

(*b*) Branches given off at its exit from stylo-mastoid *foramen.*

(i.) *Posterior auricular*, a branch given off close to the foramen, which ascends behind the ears and between the meatus and mastoid process, divides into two branches, anterior and posterior. The anterior, or *auricular branch*, communicates with the auricular branch of the pneumogastric nerve and supplies the retrahens aurem and skin of the auricle. The posterior, or *occipital branch*, communicates with the great auricular and small occipital nerves, and is distributed to the occipital portion of the occipito-frontalis and the skin at back of the head.

(ii.) *Stylo-hyoid*, a long, slender branch which communicates with the sympathetic plexus on the external carotid and supplies the stylo-hyoideus.

(iii.) *Digastric*, a branch which supplies the posterior belly of the digastricus and communicates with the glosso-pharyngeal nerve.

(*c*) Branches given off on the face.

On the face, and while still in the parotid gland, the facial nerve divides into two primary divisions—temporo-facial and cervico-facial. Each of these almost immediately subdivides into three sets of branches, constituting the plexus known as the *pes anserinus*. The *temporo-facial* is the larger of the two terminal branches. It communicates with the auriculo-temporal nerve. Its three sets of branches are (i.) Temporal, (ii.) Malar, (iii.) Infra-orbital.

(i.) *Temporal Branches.*—These ascend to the temporal region, supplying the attrahens aurem muscle and skin, frontal portion of occipito-frontalis and orbicularis palpebrarum, and communicates with the supra-orbital nerve and temporal branch of superior maxillary nerve.

(ii.) *Malar Branches.*—These cross the malar bone to reach the outer angle of the eye and supply the orbicularis palpebrarum and corrugator supercilii muscles and skin of the lower eyelid. They also communicate with the supra-orbital nerve, and the subcutaneus malæ.

(iii.) *Infra-orbital Branches.*—These pass horizontally forward in two sets. The superficial set supply the skin and superficial muscles of the face between the lower margin of the orbit and the mouth, the pyramidalis nasi muscle and lower eyelid. The deep set supply the levator labii superioris and levator anguli oris muscles, and beneath these muscles join with the infra-orbital nerve (superior maxillary) to form the infra-orbital plexus. The infra-orbital branches of the facial nerve also communicate with the infra-trochlear and nasal nerves.

The cervico-facial division passes downwards and forwards, and opposite the angle of the lower jaw, divides into its terminal sets of branches. These are: (1) Buccal; (2) Supra-maxillary; (3) Infra-maxillary.

(i.) *Buccal Branches.*—These are distributed to the orbicularis oris and buccinator muscles, and communicate with the temporo-facial division, and with the buccal branch of the inferior maxillary nerve.

(ii.) *Supra-Maxillary Branches.*—These supply the muscles of the lower lip and chin, and communicate with the mental branch of the inferior dental nerve.

(iii.) *Infra-Maxillary Branches.*—These take their course downwards and forwards below the lower jaw, and supply the platysma myoides and communicate with the superficial cervical nerve.

(*B*). The Portio Mollis, or Auditory Nerve.

Origin.—From the lineæ transversæ of the anterior wall or floor of the fourth ventricle. It also receives a few fibres from the restiform body, and is said to be connected with the grey matter of the medulla oblongata.

Course.—From the fourth ventricle the nerve winds around the restiform body to the posterior border of the crus cerebelli. It then passes forward on the crus with the facial nerve and enters with the latter the meatus auditorius internus. At the bottom of the meatus it divides into two branches, *cochlear* and *vestibular*.

Distribution.—The *cochlear* division, the anterior of the two divisions, subdivides into numerous filaments which enter the foramina spiralis in the base of the cochlea, pass upwards in the canals of the modiolus, and then between the layers of the osseous lamina spiralis. Here the nerve filaments form a network from which branches are given off which perforate the bottom of the sulcus spiralis, and are supposed to terminate in the rods of Corti. The central portion of the nerve passes through the tubulus centralis modioli, and supplies the apical portion of the lamina spiralis and adjoining structures. The *vestibular* division subdivides into three branches, superior, middle, and inferior. The *superior* gives off a number of filaments, which pass through the foramina in the posterior part of the superior depression, enter the vestibule, and are distributed to the ventricle and the ampulla of the superior and external semicircular canals. The *middle* sends off numerous filaments, which pass through the foramina in the lower depression, enter the vestibule through the fovea hemispherica, and are distributed to the saccule. The *inferior* passes along the groove and through the foramen at the back part of the meatus, to be distributed to the ampulla of the posterior canal. (Wilson.)

XLIV.—The Eighth Pair of Nerves.

The eighth pair of nerves of Willis consists of three distinct pairs:—*A.* glosso-pharyngeal; *B.* pneumogastric; and *C.* spinal accessory. These are respectively the eighth, ninth, and tenth pairs of Soemmering.

A. The Glosso-Pharyngeal Nerve.

Origin.—(Superficial.) From the groove at the upper part of the medulla oblongata between the olivary and restiform bodies. The *deep origin* has been traced through the fasciculi of the lateral tract to a grey nucleus in the floor of the fourth ventricle.

Course.—From the above superficial origin it passes outwards across the flocculus, and leaves the skull enclosed in a separate sheath of dura mater at the jugular foramen, lying anteriorly to the pneumogastric and spinal accessory nerves, and internally to the jugular vein. It then passes forward between the jugular vein and internal carotid artery to reach the posterior border of the stylo-pharyngeus. It then curves inwards, passing over the stylo-pharyngeus and middle constrictor and behind the hyo-glossus muscle, to be distributed to the tongue, pharynx, and tonsil.

In the jugular fossa the nerve presents two gangliform enlargements, superior and inferior. The *superior* or *ganglion jugulare* is of small size and involves only the posterior fibres of the nerve. The *inferior*, or *ganglion of Andersch*, is larger in size and involves the whole of the nerve. It is lodged in a depression in in the lower border of the petrous portion of the temporal bone, and is hence also known as the *petrous* ganglion. It gives off the following *branches of communication*:—(i.) One to the auricular branch of the *pneumogastric.* (ii.) One to the upper ganglion of

the pneumogastric. (iii) One to the superior ganglion of the sympathetic. Below the ganglion the nerve gives off a branch of communication with the facial.

Distribution.—The branches of distribution are divided into six sets :—(i.) Tympanic ; (ii.) Carotid ; (iii.) Muscular ; (iv.) Pharyngeal ; (v.) Tonsillitic ; (vi.) Lingual.

(i.) The *Tympanic*, or Jacobson's nerve, arises from the ganglion of Andersch, or from the trunk of the nerve above the ganglion, and enters a small bony canal in the petrous portion of the temporal bone to reach the tympanum. It divides into six branches: three *branches of communication* (one to carotid plexus of sympathetic, one to the greater superficial petrosal nerve, and one to the otic ganglion,) and three *branches of distribution*—one to fenestra rotunda, one to fenestra ovalis, and one to lining membrane of the Eustachian tube and tympanum. (ii) *Carotid branches.*—These are several filaments which follow the trunk of the internal carotid artery, and join the nervi molles of the sympathetic. (iii.) *Muscular branches* to stylo-pharyngeus and constrictor muscles. (iv.) *Pharyngeal branches.*—These are three or four in number, and supply the mucous membrane of the pharynx after joining with the pharyngeal branches of the pneumogastric and sympathetic nerve opposite the middle constrictor muscle to form the *pharyngeal plexus.* (v.) *Tonsillitic branches.*—These form a plexus around the base of the tonsil—circulus tonsillaris—from which branches are given off to the fauces and soft palate, and to communicate with the descending palatine nerves. (vi.) *Lingual branches.*—These are two in number, and are distributed to the sides and base of the tongue.

B. The Pneumogastric or Vagus Nerve.

Origin.—(Superficial) By ten or fifteen filaments

from the lateral tract immediately behind the olivary body, below the origin of the glosso-pharyngeal. Its deep origin may be traced through the restiform body to a grey nucleus on the floor of the fourth ventricle.

Course.—From the above origin the nerve passes outwards to the jugular foramen, through which it makes its exit from the skull, enclosed with the spinal accessory nerve in a sheath derived from the dura mater. Whilst in the jugular foramen, the nerve presents a small ganglion, called the *superior* or *jugular* ganglion. It is also known as the *ganglion of the root.* Just below the fossa the nerve presents a larger ganglifform swelling, called the *ganglion of the trunk*, or *inferior* ganglion. To the *superior* ganglion the accessory part of the accessory nerve is attached. After the nerve has emerged from the skull, it takes its course down the side of the neck, enclosed in the same sheath as the internal and external carotid artery lying at first between the internal carotid artery and internal jugular vein. When at the level of the thyriod cartilage, the nerve lies between the common carotid artery and the vein, and continues in relation with these vessels to the root of the neck. Below this point the course of the nerve is different on each side. The *right* nerve enters the chest by passing between the subclavian artery and vein, and descends by the side of the trachea to the back part of the root of the lung, where it forms a network of nerves, the *posterior pulmonary plexus.* From the plexus the nerve proceeds in two cords along the posterior aspect of the œsophagus. At the lower part of the œsophagus the two cords reunite, and are continued on to the posterior surface of the stomach. The *left* nerve enters the chest between the left carotid and subclavian arteries, and behind the left innominate vein, crosses the arch of the aorta, and descends *to the posterior part* of the root of the left lung. It is

then continued downwards along the anterior aspect of the stomach. From the ganglia several branches of communication are given off thus:—From the *superior*, filaments to the spinal accessory, the superior ganglion of the sympathetic and to the inferior ganglion of the glosso-pharyngeal. From the *inferior*, filaments to the hypoglossal, the superior ganglion of the sympathetic, and to the loop between the 1st and 2nd cervical.

Distribution.—The *branches of distribution* are:—(i.) Auricular; (ii.) Pharyngeal; (iii.) Superior laryngeal; (iv.) Cardiac; (v.) Inferior or recurrent laryngeal; (vi.) Anterior Pulmonary; (vii.) Posterior Pulmonary; (viii.) Œsophageal; (ix.) Gastric.

(i.) The *Auricular* branch, or Arnold's nerve, is given off in the jugular fossa, and after receiving a branch of communication from the glosso-pharyngeal, passes outwards to a small opening in the petrous portion of the temporal bone near the stylo-mastoid foramen. It then enters this opening to reach the descending part of the aqueductus Fallopii, where it gives off two branches, one to the facial and one to communicate with the auricular branch of the facial. The continuation of the nerve supplies the skin over the back part of the pinna.

(ii.) The *Pharyngeal branch* arises from the inferior ganglion, and after receiving a filament from the accessory portion of the spinal accessory nerve, passes behind the internal carotid artery to reach the middle constrictor, upon which muscle it joins the pharyngeal plexus.

(iii.) The *Superior Laryngeal* arises from the inferior ganglion, and descends behind the internal carotid artery to the opening in the thyro-hyoidean membrane, which it enters with the superior laryngeal artery to supply the mucous membrane of the interior of the larynx, and the arytenoideus muscle, Whilst behind the artery it gives off the *external laryngeal nerve*, which supplies

the superior constrictor and crico-thyroid muscles, and sends a filament to join the pharyngeal plexus.

(iv.) The *Cardiac* branches are in two sets, *cervical* and *thoracic*. The cervical are two or three branches, which arise from the cervical portion of the nerve. The largest branch of the set is given off just before the pneumogastric enters the chest. On the right side this branch—the *inferior cardiac nerve*—descends by the side of the innominate artery to join the deep cardiac plexus. On the left side it passes in front of the arch of the aorta to join the superficial cardiac plexus. The *thoracic cardiac nerves* on the right side arise from the trunk of the pneumogastric, and on the left they are given off from the recurrent laryngeal nerve. In each instance they join the deep cardiac plexus.

(v.) The *Inferior or Recurrent Laryngeal Nerve* arises on the right side, in front of the subclavian artery, and winds around that vessel from before backwards. It then ascends to the side of the trachea, passing behind the common carotid and inferior thyroid arteries. On the left side the nerve curves around the arch of the aorta and ascends to the trachea. Each nerve ascends in the groove between the trachea and œsophagus, and pierces the inferior constrictor muscle to reach the larynx. It is distributed to all the muscles of the larynx the crico-thyroid excepted.

(vi.) The *Anterior Pulmonary branches* are two or three in number. With branches from the cardiac plexuses they form the anterior pulmonary plexus, and are distributed to the anterior aspect of the root of the lung. The *Posterior Pulmonary branches* join the posterior pulmonary plexus and are distributed to the posterior aspect of the root of the lung.

(vii.) The *Œsophageal branches* are given off above

the root of the lungs. They form a plexus around the œsophagus known as the *plexus gulæ*, and freely communicate with each other,

(viii.) The *Gastric branches* are the terminal filaments of the nerve. The left nerve supplies the anterior aspect of the stomach, and the right the posterior. The right communicates with the solar and splenic plexuses, and the left with the hepatic plexus.

C.—The Spinal Accessory Nerve.

Origin.—By several filaments from the side of the spinal cord, as low down the fifth or sixth cervical nerve. There is a small accessory portion which arises from the lateral tract below the origin of the vagus. The deep origin of this portion may be traced to a grey nucleus in the floor of the fourth ventricle.

Course.—From the above origin the nerve ascends behind the ligamentum dentatum, and between the roots of the spinal nerves to the foramen lacerum posterius. It makes its exit from the skull enclosed in the same sheath of dura mater as the pneumogastric, and then passes downwards and outwards behind the internal jugular vein to to the upper part of the sterno-mastoideus. It pierces this muscle obliquely and crosses the posterior triangle of the neck to terminate in the trapezius. In its course it sends communicating branches to the pneumogastric nerve, the cervical plexus, and the third and fourth cervical nerves.

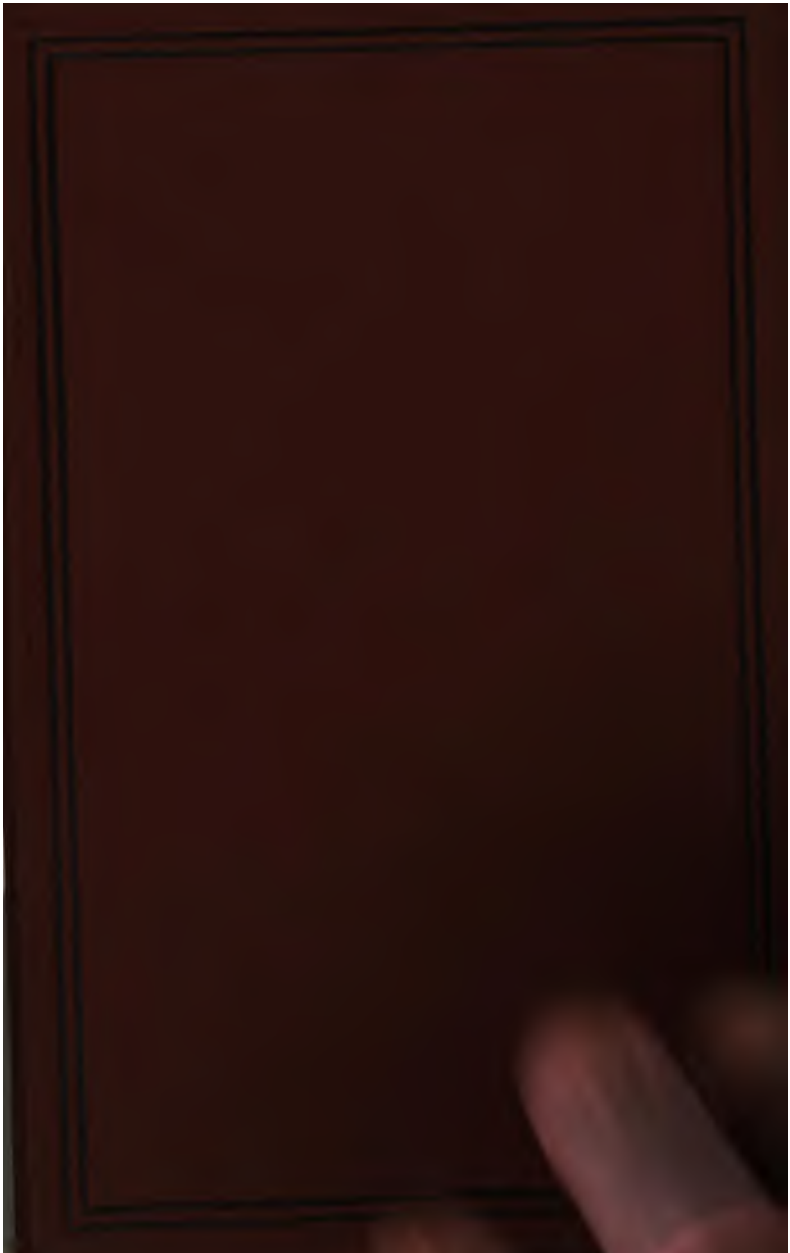
Distribution.—The branches of distribution are nerves of supply to the sterno-mastoideus and trapezius.

XLV.—The Hypoglossal or Ninth Pair of Nerves.

Origin.—The superficial origin of this nerve is by

ten or fifteen filaments from the groove between the olivary and pyramidal bodies. Its deep origin, it is said, may be traced to a grey nucleus in the floor of the fourth ventricle near the nuclei of the glosso-pharyngeal and pneumogastric nerves.

Course.—From the above superficial origin, the nerve passes forward through the anterior condyloid foramen, and then downwards and forwards between the internal carotid artery and internal jugular vein until it becomes parallel with the angle of the lower jaw. It then curves forward around the occipital artery, crosses the external carotid and passes beneath the mylo-hyoideus between it and the hyo-glossus. It is then continued into the genio-hyoglossus and sends filaments onwards as far as the tip of the tongue. In its course it communicates with the pneumogastric, sympathetic, first and second cervical, and gustatory nerves.

Distribution.—The *branches of distribution* are,—(i.) Descendens noni; (ii.) Thyro-hyoidean; (iii.) Muscular.

(i.) *Descendens noni*, a long slender branch, which is given off just as the hypoglossal loops around the occipital artery. It descends on the sheath of the carotid vessels, and just below the middle of the neck it forms a loop with the *communicans noni* nerve from the 2nd and 3rd cervical. From this loop are given off nerves of supply to the sterno-thyroideus and both bellies of the omo-hyoideus. (ii.) The *Thyro-hyoidean* nerve is a small branch which is given off from the hypoglossal, near the posterior border of the hyo-glossus muscle. It supplies the thyro-hyoideus. (iii.) *Muscular.*—These are several branches which are given off beneath the mylo-hyoideus to supply the stylo-glossus, hyo-glossus, genio-hyoid, and genio-hyo-glossus muscles.