

The **A to Z** of The **Brain** & **Cranial Nerves**



Dr A. L. Neill

BSc MSc MBBS PhD FACBS

INTRODUCTION

The Brain and Cranial Nerves are involved in all the 5 senses. Indeed a lot of the body's actions take place in this head and neck region, which means this book ties in well with the *A to Z of Eyes* and the *A to Z of the Digestive Tract*. The Peripheral Nerves form the second part of the Nervous system and they are examined in the *A to Z of Peripheral Nerves* but all the A to Zs are cross-referenced and together are forming a set covering the all structural elements of the human body. Recently pathology as well as anatomy has been tackled by the A to Zs with The *A to Z of Bone Failure* the first book to cover the breakdown of the body's structures in this manner.

The Common terms section has been expanded and is now illustrated and includes some pathological terms which will be expanded in the book the A to Z of the failure of the Brain. Basically however the content is unchanged structures are listed alphabetically where possible with extensive cross referencing.

If there is a structure / subject you want to see in the A to Zs let us know. anatomy.update@gmail.com

We have 2 websites and there maybe others where you can view all images of the A to Zs and any additional material please feel free to examine the new books which may be placed here and to give any suggestions. The order of the new titles is often guided by the feedback received. <http://www.aspenpharma.com.au/atlas/student.htm>
www.amandasatoz.com

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DEDICATION To students.

HOW TO USE THIS BOOK

The structure of the A to Z books has by necessity changed slightly. The principle of listing all the structures in an alphabetical manner and hence making the book its own index for easy retrieval has been maintained, but because of the complexity of this material it is now necessary to consider the whole as well as its component parts, which in this case means the Brain is examined as whole, before listing and illustrating each and every part alphabetically; then the Cranial Nerves their pathways, functions and common pathologies are individually illustrated and listed alphabetically. A separate section on basic neurological examination of the brain and cranial nerves is placed after their anatomical descriptions in response to requests to make these books more clinical.

All entries are cross referenced in the usual manner i.e. **see** for go to and **also see** for additional images listed under that heading.

Thank you

A.L. Neill

BSc MSc MBBS PhD FACBS

medicalamanda@gmail

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Abbreviations

a	= artery	DM	= dura mater
A	= actions /movements of a joint	DX	= diagnosis
aa	= anastomosis (es)	e.g.	= example
A	= anterior	EAM	= external acoustic meatus
ACF	= anterior cranial fossa	EB	= eyeball
aka	= also known as	EC	= extracellular (outside the cell)
alt.	= alternative	EL	= eyelid
AM	= arachnoid mater	Gk.	= Greek
ANS	= autonomic nervous system	GM	= grey matter
ant	= anterior	gn	= ganglion
art	= artery	Hp	= Hippocampus
AS	= Alternative Spelling, generally referring to the diff. b/n British & American spelling	IAM	= internal acoustic meatus
assoc.=	associated with	IC	= intracellular / intercostal
BBB	= blood brain barrier	IC	= intercarpal
bc	= because	IO	= inferior oblique m.
BP	= blood pressure	IR	= inferior rectus m.
BS	= blood supply	jt(s)	= joints = articulations
Bs	= brain stem	L	= lateral
b/n	= between	L	= left / lumbar
C	= cervical / carpal	LL	= lower limb
CC	= cerebral cortex	LMN	= lower motor neuron
c.f.	= compared to	LR	= lateral rectus m.
CF	= cranial fossa(e)	Lt.	= Latin
CH	= cerebral hemispheres	lig	= ligament
CN	= cranial nerve	m	= muscle
CNS	= central nervous system	M	= mater
CO	= cardiac output	MB	= midbrain
Co	= coccygeal	MCF	= middle cranial fossa
CoP	= coccygeal plexus	med	= medial
collat.=	collateral	MN	= myelinated nerve
CP	= choroid plexus	MO	= medulla oblongata (medulla)
Cr	= cranial	MR	= medial rectus m.
CSF	= Cerebrospinal fluid	N	= nerve
CT	= connective tissue	nMN	= non-myelinated nerve
DD	= differential diagnosis	NP	= nerve plexus
DH	= dorsal horn = (post. horn)	NR	= nerve root(s)
diff.	= difference	NS	= nervous system/nerve supply
dist.	= distal	NT	= nervous tissue/ neural tissue
		NTr	= nerve tract / trunk
		P	= plexus
		Pa	= parasympathy

PaNS	=	parasympathetic nervous system
PCF	=	posterior cranial fossa
pl.	=	plural
PM	=	pia mater
PN	=	peripheral nerve
post.	=	posterior
proc.	=	process
prox.	=	proximal
R	=	Resistance
R	=	Right
RC	=	radiocarpal
S	=	sacral
sing.	=	singular
Sc	=	spinal canal
SC	=	spinal cord
SN	=	spinal nerve
SO	=	superior oblique m.
SP	=	spinous process
SR	=	superior rectus m.
SSS	=	superior sagittal sinus
SyNS	=	sympathetic nervous system
T	=	thoracic
TP	=	transverse process
UL	=	upper limb, arm
UMN	=	upper motor neuron
v	=	vein
V	=	vertebra
VB	=	vertebral body
VC	=	vertebral column
VF	=	visual fields
VH	=	ventral horn (ant. horn)
ven	=	ventricle (of the brain)
WM	=	white matter
w/n	=	within
w/o	=	without
&	=	and

Common Terms used in Neurology & Neuroanatomy

Action potential	the generation of a N impulse through stimulation and depolarizing of the N cell membrane
Acusis	hearing
Adiadochokinesia	inability to rapidly perform rapidly alternating movements
Afferent	incoming - as with sensory fibres <i>see Sensory</i>
Agnosia	<i>w/o knowledge</i> inability to recognize sensory stimuli (auditory, tactile, visual)
Agraphia	<i>w/o writing</i> - inability to write coherently – due to a cerebral lesion
Ala cinerea	ashen hued wing - triangular region on the floor of the 4 th Ven – one of the Vagal nuclei
Alexia	<i>w/o words</i> - inability to grasp the meaning of words
Allocortex	the older cerebral cortex = archicortex + paleocortex
Alveus	<i>trough</i> – thin WM layer covering the ventricular surface of the Hp
Amacrine	<i>long</i> - the N cell type with long fibrous processes in the retina
Ammon's horn	Ammonis = Egyptian god with a ram's head used for the Hp which sagittally has a curl like a ram's horn
Amygdala	<i>almond</i> - almond shaped body in the Temporal lobe involved in memory & emotion
Anesthesia	<i>w/o feeling</i> - loss of sensation
Angular gyrus	part of the Temporal lobe involved in language processing, letter shape and word recognition, connects occipital cortex with Wernicke's area
Anhidrosis	absence of sweating
Anopsia	<i>w/o sight</i> - defect of vision
Ansa -	<i>loop</i> - a loop like structure eg Ansa Cervicalis
Ant. Cingulate gyrus	part of the limbic system - assoc. with cognitive processing of pain perception and emotional response (<i>see cingulum</i>)
Antidromic	N impulse running up the axon or down the dendrite <i>in the opposite direction</i>
Aperture	an opening or space b/n bones or w/n a bone.
Aphasia	<i>w/o speech</i> - loss of speech or comprehension of the written and spoken word
Apraxia	<i>w/o being able to do</i> - inability to move purposefully <i>w/o paralysis</i>
Arachnoid	<i>spidery</i> – <i>weblike</i> eg AM

Archeocortex	AS Archiocortex part of the 3 layered Allocortex in the Limbic system – mainly in the Hp and Dentate gyrus
Archicerebellum	AS Archeocerebellum old part of the little brain – to do with balance
Area postrema	caudal area on the floor of the 4 th Ven
Articulation	joint, which is a point of contact b/n 2 bones / relating to a joint. - hence articular branches of a N supply the joint described.
Association fibres	those N fibres which connect cortical areas of the brain ipsilaterally (as opposed to commissural fibres)
Astereognosis	<i>w/o solid shape</i> - inability to recognise basic shapes by feeling them
Astrocytes	<i>star</i> - one of the supportive cell types in the CNS (<i>see Glia</i>)
Asynergy	<i>w/o work</i> - disturbance in the muscle contraction sequence in doing a coordinated act
Ataxia	<i>w/o order</i> inability to contract muscles in order and hence weakness in contraction
Athetosis	<i>w/o position</i> inability to keep fingers or toes in a still position continually writhing of the extremities – due to degeneration in the CC and Corpus Striatum
Autonomic	automatic motor innervation of the viscera
Axial	<i>axis</i> - refers to the head and trunk (vertebrae, ribs and sternum) of the body.
Axolemma	plasma membrane of the axon
Axon	N process carrying material away from the cell body to the target organ, each N has only one axon
Axon collaterals	branches of the axon
Axon hillock	part of the N where the axon rises and has no Nissl bodies
Axoplasm	cytoplasm of the axon
Baroreceptor	<i>weight receiver</i> sensory N fibre which responds to pressure changes as in the carotid canal
Basal ganglia	incorrect term for cluster of Ns buried in the WM of the brain and involved in movement includes: CAUDATE NUCLEUS + PUTAMEN + GLOBUS PALLIDUS + SUBSTANTIA NIGRA (<i>see also nucleus</i>)
Basilar	relating to the base or bottom of structures
Basiocranium	bones of the base of the skull
Basis pedunculi	(<i>see crus cerebri</i>)
Bipolar	neurons with 1 dendrite + 1 axon (<i>see unipolar, multipolar</i>)
Blood brain barrier =	BBB the barrier protecting the brain from certain substances found in the BS
Brachium	<i>arm</i> - large bundle of N fibres joining one region to another

INTRODUCTION

Bradykinesia	abnormally slow movements
Brainstem (BS)	MO + Pons + Midbrain
Broca's area	central region of the L frontal lobe of the CC - involved in the production of speech: - word perception, production, sound and memory
Brodmann's areas	areas of the CC which have been designated by their histology – cytoarchitecture - and later analysed and found to have specific functions (after Korbinian Brodmann 1909)
Bulb	old term for MO / in the corticobulbar tract refers to the that part of the brain stem containing the motor nuclei of the CNS
Calamus Scriptorius	<i>reed / pen</i> - caudal part on the floor of the 4 th Ven which looks like a pen
Calcar	<i>spur</i> as in the Calcarine sulcus of the Occipital lobe
Canal	tunnel / extended foramen as in the carotid canal, at the base of the skull adj canal (canicular - small canal)
Caput	relating to the skull
Carotid	to put to sleep; compression of the common or internal carotid artery causes coma. This refers to bony points related to the carotid vessels
CAT scan =	computerized axial tomography scan – computer mediated Xray image depicting a crosssection of the body AKA <i>CT scan</i>
Cauda equina	<i>horse's tail</i> - lumbar and sacral N roots of the SC resembling a horse's tail
Caudate nucleus	<i>tail</i> nucleus in the Corpus Striatum, having a long tail
Cavity	<i>an open area</i> hence an open area or sinus w/in a bone or formed by 2 or more bones (adj. cavernous), may be used interchangeably with fossa. Cavity tends to be more enclosed fossa a shallower bowl like space (Orbital fossa-Orbital cavity).
Central sulcus	major groove in the coronal plane dividing the frontal and parietal lobes
Cephalic	pertaining to the head
Cerebellum	<i>little brain</i> – the brain situated in the PCF - to do with motor coordination, balance and posture – same structure as the Cerebrum – 2 hemispheres cortex and medulla - only smaller
Cerebrospinal fluid =	CSF fluid - fluid surrounding the brain and SC formed by the ependymal cells from filtered blood. It is part of the BBB, and contains sugar, urea and protein - approx 125mls and flows around the brain and SC at any time.

Cerebral cortex	GM interconnection b/n the 2 sides via the Corpus Callosum
Cerebral hemispheres	= CH L mainly to do with: speech, writing, language & calculation R mainly to do with spatial abilities, face recognition, music perception and production - see <i>Cerebrum</i>
Cerebro-spinal fluid	= CSF, fluid surrounding the Brain + SC providing insulation, nutrition and pressure
Cerebrum	<i>Brain</i> – the major 2 hemispheres of the brain – consisting of an outer cortex of Ns = GREY MATTER GM) + inner medulla of N fibres WHITE MATTER (WM)
Chiasma	(Gk +) used for the crossing of the Optic fibres
Chorea	<i>dance</i> – irregular, involuntary, movements of the limbs and face – due to degen. of the neostriatum
Choroid	AS Choroid <i>delicate membrane</i> – as in the choroid plexus in the brain or the retina
Cinerea	<i>ashes / ashen colour / grey</i> – as in Tuber Cinereum - ventral portion of the Hypothalamus
Cingulate gyrus	part of the Limbic System, directly above the corpus callosum on the medial surface of the CH –to do with emotion and attention
Cingulum	<i>girdle</i> as in a bundle of association fibres in the WM of the Cingulate gyrus of the CH, medial surface
Circulus arterios cerebri	AKA cerebral arterial circle
Clastrum	barrier - thin sheet of GM b/n Lentiform nucleus and the Insula
Cochlea	<i>a snail</i> hence snail-like shape relating to the Organ of Corti in the middle ear (<i>adj. cochlear</i>)
Cognition	to know – a processing of knowledge for use in higher functions as in recognition and recall for use in problem solving etc
Colliculus	<i>small elevation / mound</i> – e.g. superior and inf. colliculi forming the tectum of the MB – Facial colliculus on the floor of the 4 th Ven
Commissural fibres	those N fibres crossing the Median plane in the brain or SC (e.g. anterior commissure)
Commissure	<i>joining together</i> - a decussation or crossing of large groups of fibres from one side of the median plane to the other in the brain or SC
Confabulation	memory disturbance resulting in long winded rambling conversation as the person fills in their memory gaps

INTRODUCTION

Cordotomy	AS Chordotomy –sectioning of spinothalamic tract for intractable pain (<i>also tractotomy</i>)
Contra	<i>opposite</i> (as opposed to ipsi – the same)
Contralateral	on the opposite side (as opposed to ipsilateral on the same side)
Corona	<i>crown</i> – fibres radiating from an inner point outwards - as in the Corona Radiata – fibres from the internal capsule to the CC
Corpus Callosum	<i>hard body</i> – the main neocortical commissure of the CH – connects the 2 CH via large mass of axons crossing from one side to the other
Corpus Striatum	<i>striped body</i> - mass of GM with motor functions at the base of each CH
Cortex	<i>outer rind / bark</i> – outer GM of the cerebrum and cerebellum
Cortical plasticity	ability of connections b/n Ns of the CC to change
Cranial Nerve (CN)	N coming directly from the brain not the SC (\neq PN)
Cranium	the cranium of the skull comprises all of the bones of the skull except for the Mandible.
Crest	prominent sharp thin ridge of bone formed by the attachment of muscles particularly powerful ones e.g. Temporalis/Sagittal crest
Crus	<i>leg</i> – e.g. Crus Cerebri - the ventral part of the Cerebral Peduncle of the MB
CT scan	see CAT scan
Cuneus	wedge – e.g. gyrus on the medial surface of the CH – Fasciculus Cuneatus of the MB & SC
Cutis	<i>skin</i> - hence cutaneous branches refer to the Ns supplying the skin & adnexae
Declarative memory	memory of words which can be recalled
Decussation	X - a crossing of paired N fibres inside the CNS e.g. in the pyramids, medial lemniscus and superior cerebellar peduncles
Dendrite(s)	<i>tree</i> - N process(es) bringing communication to the cell body
Dentate	<i>toothed</i> – e.g. Dentate nucleus in cerebellum – Dentate gyrus in the Temporal lobe
Depolarization	the loss of the potential across the cell membrane of a N due to stimulation and formation of a N impulse (<i>see repolarization</i>)
Dermatome	the cutaneous innervation of a SN

Diencephalon	<i>through the brain</i> = Epithalamus + Thalamus + Subthalamus + Hypothalamus
Diplopia	double vision
Distal	further away from the axial skeleton (<i>opposite of Proximal</i>)
Dura	<i>hard</i> – as in DM – thick external layer of the meninges
Dyskinesia	<i>disordered movement</i> – abnormal motor function with involuntary purposeless movements
Dysmetria	<i>disordered measure</i> – abnormal reach or control of muscle action
Efferent	outgoing as in Motor nerves - <i>see Motor</i>
Emboliform	<i>plug</i> – e.g. emboliform nucleus of the cerebellum
Endocranium	<i>w/n the skull</i> - refers to the interior of the “braincase” adj. endocranial divided into the 3 major fossae anterior (for the Frontal lobes) middle (containing Temporal lobes) and posterior (for the containment of the Cerebellum).
Endoneurium	<i>w/n the N</i> - innermost of the CT coverings of a PN fibre (<i>see neurium, perineurium and epineurium</i>)
Engram	<i>mark</i> – a lasting memory – memory picture from a past experience
Enophthalmos	recession of the eyeball
Entorhinal	<i>w/in the nose</i> – the entorhinal area lies in the ant. of the parahippocampal gyrus – in the lateral olfactory area
Ependyma/ Ependymal cells	line the ventricles and the central canal of the SC (<i>see Glia</i>) form the CSF
Epineurium	upon the N - outermost of the CT coverings of a PN fibre (<i>see neurium, perineurium and endoeurium</i>)
Epithalamus	<i>upon the inner chamber</i> – region of the diencephalons above the thalamus includes the pineal body
Extradural space	space external to the DM but w/n the skull or boney canal of the VC
Extrapyramidal system	all the motor parts of the CNS except the pyramidal system
Extrastriate	visual areas of the CC assoc with higher order visual recognition eg face recognition
Falx	<i>sickle</i> as in falx cerebri, falx cerebelli
Fascis	<i>bundle</i>
Fasciculus	<i>small bundle</i> – used for a bundle of N fibres
Fastigial	<i>gabled roof top</i> – eg the Fastigial nucleus at the top of the cerebellum

INTRODUCTION

Fimbria	<i>fringe</i> – band of N fibres along the edge of Hp continues as the fornix
Forceps	<i>paired tongs</i> – as in the U shaped fibres of the Corpus Callosum - Forceps frontalis and Forceps occipitalis
Foramen	<i>a natural hole</i> in a bone usually for the transmission of BVs &/or nerves.(pl. foramina).
Fornix	<i>an arch</i> – as in the efferent N tract of the Hp which arches over the Thalamus and terminates in the Mammillary body
Fovea	<i>pit</i> – as in the Fovea Centralis at the centre of the retina
Funiculus	<i>little cord</i> – as in the cords of WM in the SC which consist of a number of different fasciculi all running together in the Lateral Funiculus of the SC
Funis	<i>cord</i>
Ganglion	<i>knot</i> - collection of N cell bodies outside the SC (also incorrectly used for isolated islands of N cells w/n in the WM of the brain eg Basal Ganglia of the brain - see <i>Basal Ganglion</i>), <i>pl ganglia</i> an abnormal collection of neural tissue found subcutaneously
Gemmule	<i>small bud</i> – swellings on the ends of some dendrites in the CNS
Genu	<i>knee</i> – anterior end of the Corpus Callosum = the genu of the Corpus Callosum; geniculate ganglion of the Facial N; geniculate nuclei of the Thalamus
Glia / Glial cells	<i>glue</i> associated supporting cells of the CNS connective tissue and immune functions, <i>types: astrocytes, oligodendrocytes, ependymal cells and microglia</i>
Globus pallidus	<i>pale ball</i> – medial part of the Lentiform nucleus of the Corpus Striatum - part of the basal ganglia
Glomerulus	<i>small knot, tangle</i> – synaptic glomeruli of the olfactory bulb
Grey Matter (AS Gray) (GM)	N tissue in the brain and SC which contains mainly N cells, dendrites unmyelinated axons & glial cells (opposite to WM which contains mainly myelinated axons)
Gracilis	<i>slender</i> – Fasciculus Gracilis of the SC; Nucleus Gracilis of the of the Medulla
Groove	<i>long pit or furrow</i>
Gyrus	<i>a circle</i> , hence a coil of brain cortex generally the CC.
Hemiplegia	<i>half stroke</i> – paralysis down one side of the body

Brodmann's areas – summary

Area	Anatomical location	Name	Function	Pathology
41, 42		1 ^o 2 ^o Auditory association Cortex	conscious awareness of sound	
43	b/h Insula and post/precentral gyrus	Subcentral area		
44	pars opercularis	part of Broca's area on L hemisphere	Formation of speech	
45	pars triangularis	3 ^o motor cortex part of Broca's area on L hemisphere		
46		3 ^o motor cortex Dorsolateral prefrontal cortex		
47	Inferior prefrontal gyrus	3 ^o motor cortex	involved in syntactical processing	
48	small part of the medial surface of the temporal lobe	Retrosubicular area		
49				
50				
51				
52	at the junction of the temporal lobe and the insula	Parainsular area		

Notes

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Surface Views – Lobes

Lateral and Superior

CEREBRUM – covered in GM with 4 major lobes, 4 major lobes of the Brain and a covered area of GM - the Insula or 5th lobe

- 1 **FRONTAL LOBE**
- 2 **PARIETAL LOBE**
- 3 **OCCIPITAL LOBE**
- 4 **TEMPORAL LOBE**
- 5 **INSULA**

Separated by major fissures or sulci

- A central sulcus = Rolandic fissure b/n the frontal and parietal lobes
- B parieto-occipital sulcus
- C preoccipital notch
- D lateral sulcus = Sylvian fissure b/n the temporal and the frontal +parietal lobes
- E stem of the lateral sulcus
- L longitudinal sulcus = longitudinal fissure b/n the R and L CH

further subdivided w/n the lobes by minor sulci

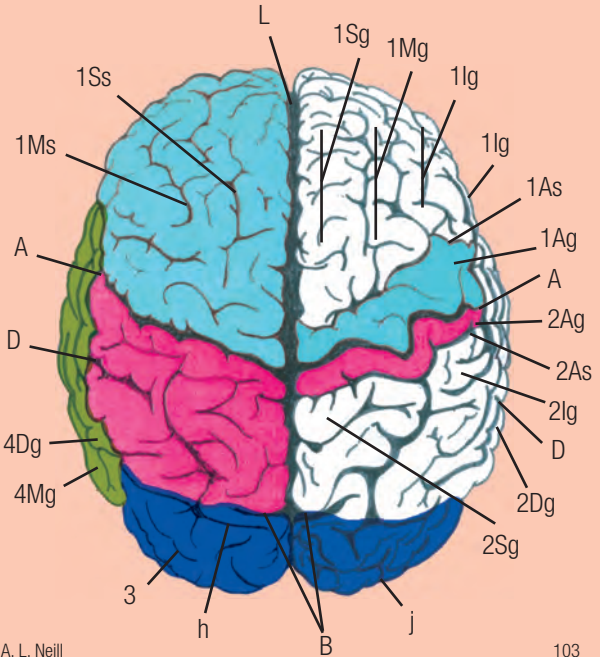
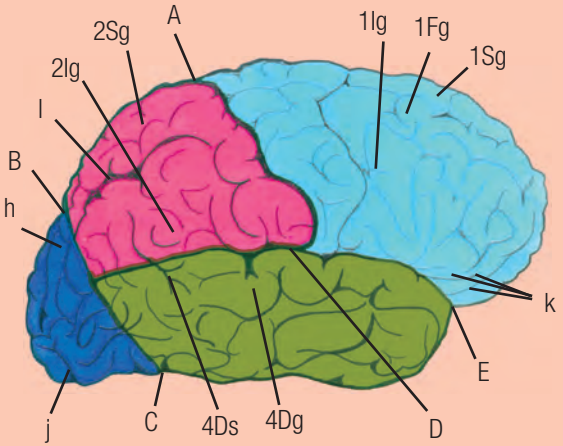
- j **lunate sulcus**
- h **transverse occipital sulcus**
- i **inferior temporal sulcus**
- l **intra parietal sulcus**
- k **associated rami of the lateral sulcus**

GM either side of the lateral fissure = Opercula, overlies the covered GM of the brain = **Insula = Island of Reil**

g = gyrus bulge in the brain

s = sulcus / fissure if large = infolded section b/n the gyri

- 1Ag pre-central gyrus MOTOR
- 2Ag post central gyrus SENSORY
- 2lg inferior parietal gyrus (lobule)
- 2Sg superior parietal gyrus (lobule)
- 1Sg superior frontal gyrus
- 1Fg mid frontal gyrus
- 1lg inferior frontal gyrus
- 4Dg superior temporal gyrus
- 4lg inferior temporal gyrus
- 4Mg mid temporal gyrus



Cerebrum – Insula and Operculum

Lateral

Most of the GM of the cerebrum is superficial and divided into 4 lobes named according to the bones which overlie them - but a “5th” lobe is buried deep to the Lateral fissure - the Insula (island) the GM overlying this Insula GM is the Operculum

- 1 Operculum -(insula lying deep to this GM) – partially in the frontal, parietal and temporal lobes
- 2 Insula (operculum cutaway) showing fibres of the corona radiata going to the GM on the surface

See website for more details on the Cerebrum and Cerebellum.

1



2



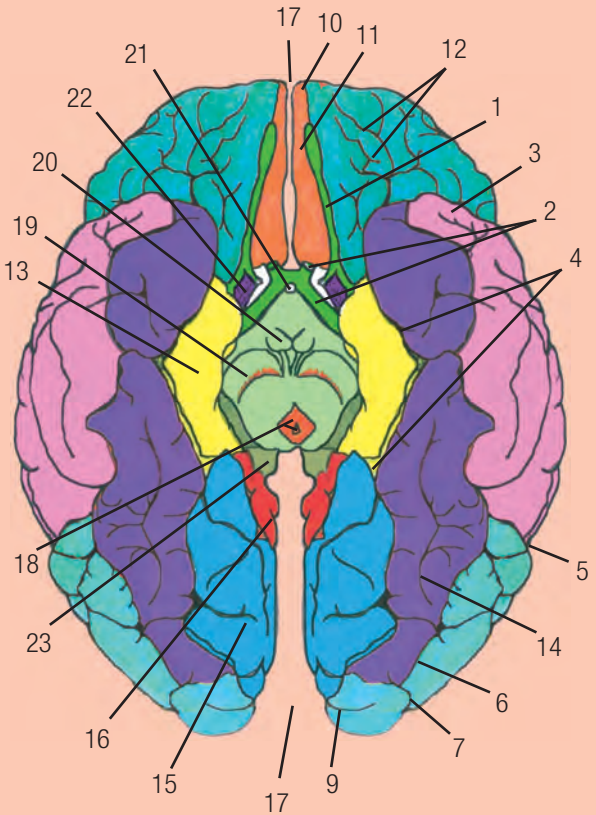
Cerebrum

Inferior view - Cerebellum removed

CEREBRUM – a highly folded cap of neural tissue with the outer N cells (GM), sitting in the anterior and middle cranial fossae. Arranged into 4 major lobes on the surface, the cerebrum is responsible for most of the “executive” decisions of the body and mind.

Many of the CNs can be seen emerging from the brainstem inserted into the undersurface concavity of the cerebrum, and continuing on to become the SC.

- 1 Olfactory bulb and tract – CN I
- 2 Optic nerve, chiasma and tract CN II
- 3 Stem of the lateral sulcus
- 4 Collateral sulci
- 5 Preoccipital notch
- 6 Occipito-temporal sulcus
- 7 Lunate sulcus
- 8 Occipital pole
- 9 Branches of the occipital sulcus
- 10 Frontal pole (of frontal lobe)
- 11 Gyrus rectus = straight gyrus
- 12 Orbital sulci
- 13 Parahippocampus
- 14 Gyrus occipitotemporalis medialis
- 15 Lingual gyrus
- 16 Cingulum
- 17 Longitudinal Sulcus
- 18 Cerebral aqueduct + periductal GM
- 19 Crus cerebri
- 20 Mammillary body
- 21 Infundibulum (of the pituitary)
- 22 Anterior perforating substance
- 23 Uncus



Corpus Callosum

Median view - midsagittal

Superior views - Upper image deep transverse - level of insula

- Lower image supf. transverse - level of central sulcus

This decussation of fibres is the main form of communication b/n the 2 CH and has 3 parts, other fibres linking parts of the CC are associated with this structure.

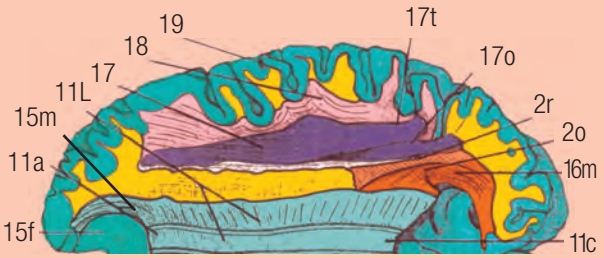
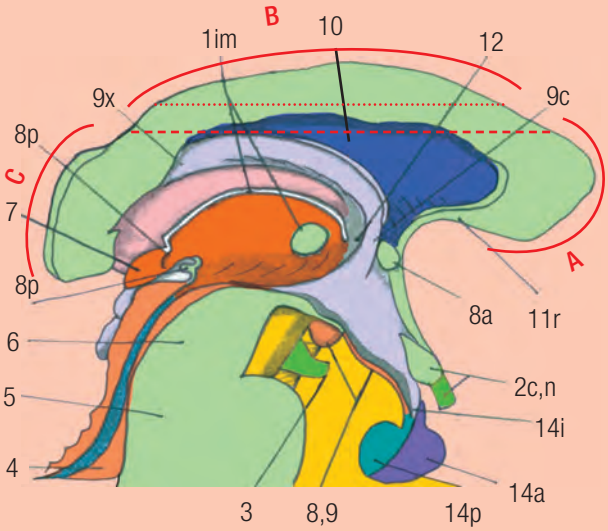
A = genu or knee

B = body or trunk

C = splenium or tail

A + B + C = corpus callosum = 11

- | | | | |
|----|--|----|--|
| 1 | Thalamus i =
intermediate body /
m = medullary striae | 14 | Pituitary i = infundibulum
a = anterior / p = posterior |
| 2 | Optic structures = CN II
c = chiasma / n = nerve
r = radiation | 15 | Cingulum – f = floor of
the cingulum sulcus |
| 3 | CN III | 16 | Forceps M = major /
m = minor |
| 4 | IVth ventricle | 17 | Superior longitudinal
fascicles o = occipital
part / t = temporal part |
| 5 | Pons | 18 | Short association fibres |
| 6 | Midbrain | 19 | Central sulcus |
| 7 | Pineal body | 20 | Tapetum |
| 8 | Commissures a = anterior
p = posterior | 21 | Floor of Calcarine sulcus |
| 9 | Fornix c = column /
X = crus | 22 | Inferior longitudinal
fascicles |
| 10 | Septum pellucidum | 23 | Roof of the inferior horn
of the lateral ventricles |
| 11 | Corpus callosum
L = longitudinal striae /
r = rostrum | 24 | Insula |
| 12 | Interventricular foramen | 25 | Lentiform nucleus |
| 13 | Lamina terminalis | 26 | Corona radiata
b = base of |

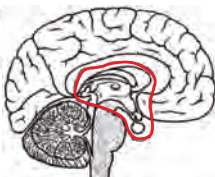


Diencephalon

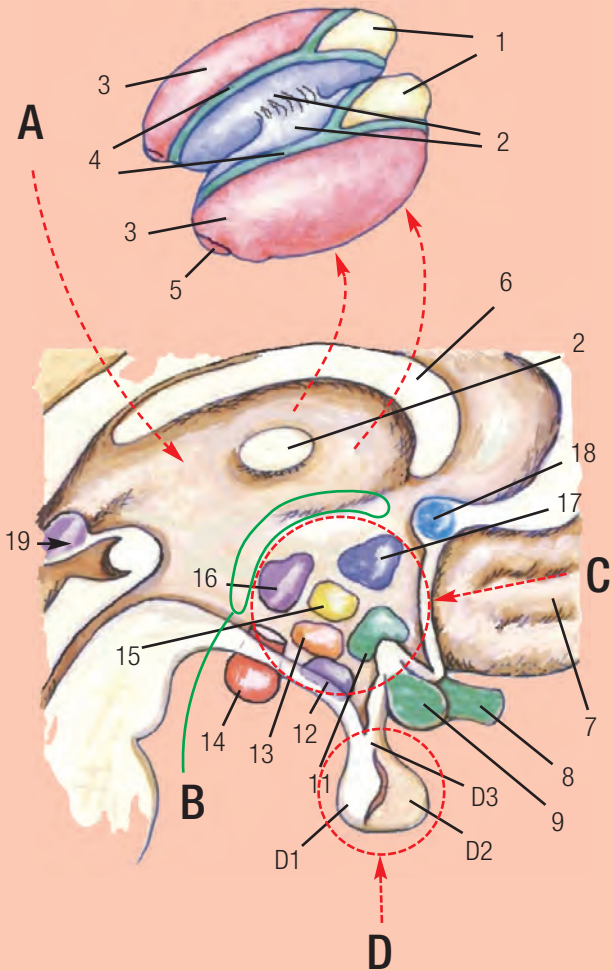
Thalamus + Epithalamus + Hypothalamus = Diencephalon *Superolateral, Mid sagittal*

The Thalamus (A) is a bilobed oval mass of GM ~ 3cm long - the major sensory relay station - coordinating sensory input to the CC. The Hypothalamus (C) is the major control of the ANS. The Epithalamus (B), which includes the pineal gland (19) has a role in the body clock and awareness of location. These 3 structures develop from the Diencephalon in the embryonic brain. The Thalamus lies immediately inferior to the Corpus Callosum (6) and CC (7) in the 3rd ventricle coordinating information. It has a number of nuclei (1-5) which relate to the CC lobes that are immediately adjacent and feeds information to the Hypothalamus (C) where, via the hypothalamic nuclei, (12-18) information has direct effects on the ANS, pituitary gland actions and the sense of smell.

- A Thalamus
- B Epithalamus
- C Hypothalamus
- D Pituitary gland = Hypophysis
 - D1 posterior pituitary = neurohypophysis
 - D2 anterior pituitary = adenohypophysis
 - D3 infundibulum = stalk of pituitary



- | | |
|--|---|
| 1 Ant thalamic nuclei | 10 BS and cerebral canal b/n the 3rd and 4th ventricles |
| 2 Medial thalamic nuclei with Intermediate Mass in b/n | 11 Supraoptic nuclei |
| 3 Lat thalamic nuclei | 12 Arcuate nuclei |
| 4 Internal medullary laminae | 13 Ventromedial nuclei |
| 5 Geniculate bodies – lateral & medial | 14 Mammillary bodies |
| 6 Corpus Callosum | 15 Dorsomedial nuclei |
| 7 Frontal lobe of the CC | 16 Post hypothalamic nuclei |
| 8 Optic N = CN II | 17 Paraventricular nuclei |
| 9 Optic Chaisma | 18 Lat preoptic nuclei |
| | 19 Pineal gland |



Dura Mater – DM = Hard Mother

Outer layer of the Meninges

Fixes the brain and limits movements supports the 2 inner coverings which contain the BS of the Brain.

Continues down the SC to protect the neural tissue in this region as well.

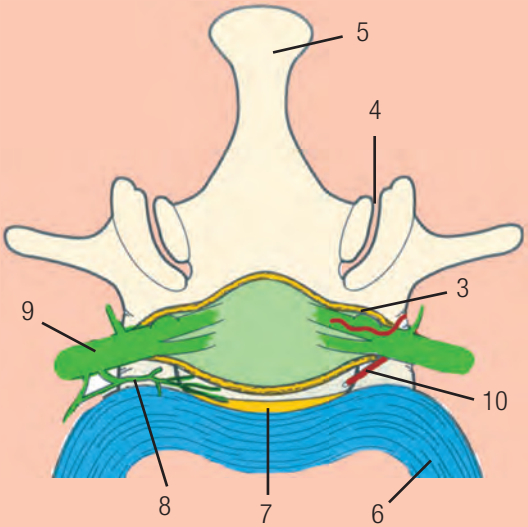
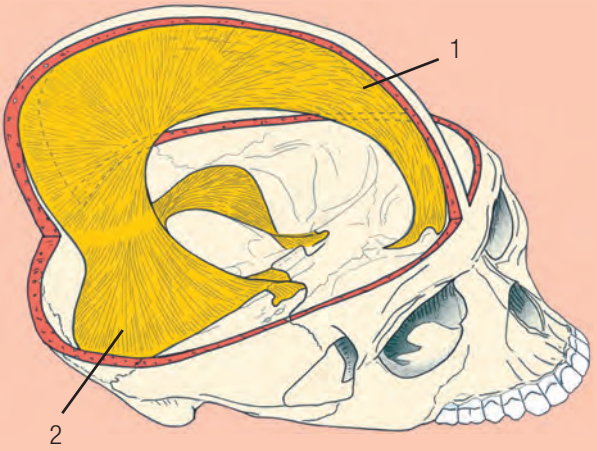
Composed of thick connective tissue

Space b/n Skull and DM = EXTRADURAL SPACE (hence extra-dural haemorrhage)

Space b/n DM and Pia – Arachnoid maters = SUBDURAL SPACE (hence sub-dural haemorrhage)

The DM is pain sensitive and may be the cause of local headache or spinal pain or referred pain to structures associated with the exiting Ns.

- 1 Falx Cerebri – contains and prevents movement of the main cerebral hemispheres supports the superior sagittal sinus
- 2 Tentorium Cerebelli – separates the Cerebrum and the Cerebellum forming a roof over the cerebellum - supports the straight and transverse sinuses
- 3 DM – covering the SC – lumbar region
- 4 Zygapophyseal jt
- 5 Spinous process
- 6 Intervertebral disc
- 7 PLL (at the back of the VB)
- 8 Sinuvertebral N
- 9 SN
- 10 Sinuvertebral artery



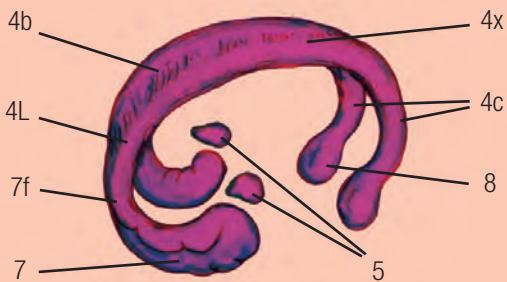
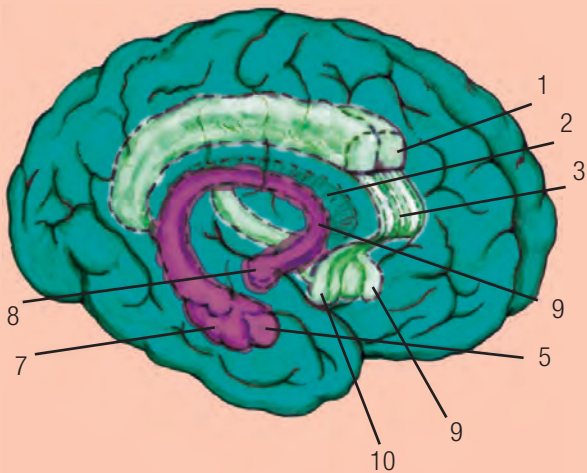
Fornix = arch

Lateral view – in situ

Lateral view isolated

The Fornix is an arch of fibres carrying signals from the Hippocampus (Hp) to the mammillary bodies and anterior nuclei of the thalamus and septal nuclei. Beginning in the (Hp) the fimbria converge as the crura of the fornix joining in the midline with fibres crossing from one side of the fornix body to the other via the fornix commissure. Running along the inf edge of the Septum Pellucidum, the fornix redivides just before the anterior commissure, forming the columns of the fornix.

- 1 Cingulate gyrus
- 2 Corpus callosum
- 3 Suprcallosal gyrus
- 4 Fornix
b = body, c = columns,
f = fimbria, L = crura,
x = commissure
- 5 Amygdala & amygdaloid bodies
- 6 Lateral sulcus
- 7 Hippocampus f = fimbria
- 8 Mammillary bodies
- 9 Nucleus accumbens + septal nuclei
- 10 Anterior commissure



Language centres

cortical centres of verbal expression

The frontal lobe contains zones for expressive language, hence motor aphasia results when damaged; difficulty speaking \pm writing. The temporo-parieto-occipital regions contain zones for receptive language interpretation, hence sensory aphasia results with damage; difficulty understanding \pm reading. Traditionally 2 areas are described Broca's and Wernicke's both lying in the peri-Sylvian area, around the lateral sulcus, and more highly developed in the dominant CH. This is the LEFT CH (for R handed people). However the 2 functions are not exclusive to these areas. Brodmann areas 22, 41, 42, 44 & 45 are all involved in language production and comprehension. The exact boundaries of these areas vary, and their precise roles are interrelated.

B – Broca's area ~ inferior-frontal gyrus (pars triangularis + pars opercularis) - for speech + writing

W – Wernicke's area ~ superior temporal gyrus + auditory cortex - for comprehension and reading

Language processing is a global brain activity and apart from the listed areas. Other Brodmann areas associated with aspects of language activities are:

4 hand and finger movements, tone and sound formation

7 calculation

18 recognition of objects

19 recognition of colours

21 auditory attention, understanding of sounds with respect to music

22 understanding of sound sequences

37 understanding of numbers

39 recognition of numbers

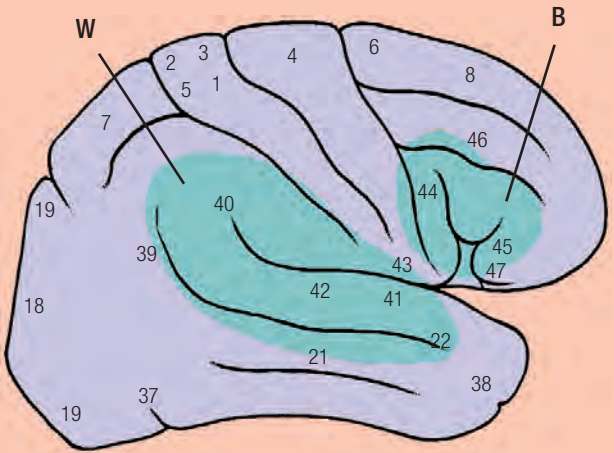
40 writing

41/42 understanding sequences of sounds + speech

44 formation of phrases and sentences

45 articulation of sentences

46 articulation of names



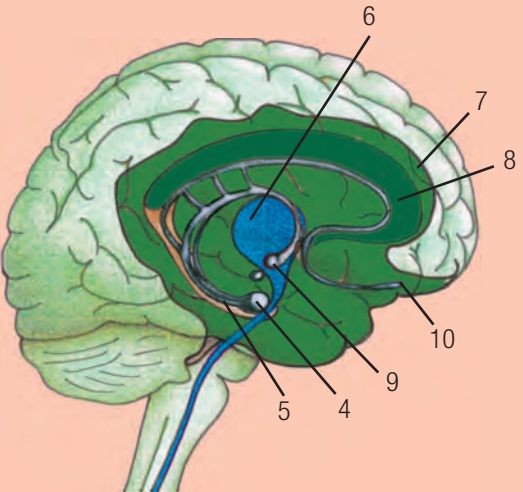
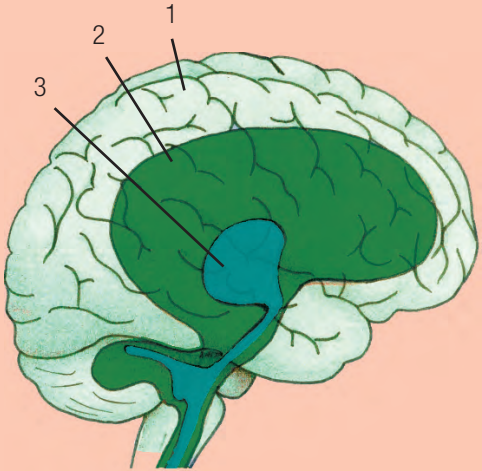
Limbic System

Lateral

Sagittal

Definition – *Limbus Gk = limb* -It is the 2nd layer of evolving “Brain structures” overlaying the Brainstem – the 1st layer – and underlying the CC and providing substantial interconnections b/n them. Allowing for bodily/physiological response to emotional input and visa versa overriding of the autonomic response by the CC. It contains several interconnected structures, and connects extensively with the Rhinencephalon or “Smelling brain” and the Diencephalon which contains the Thalamic structures.

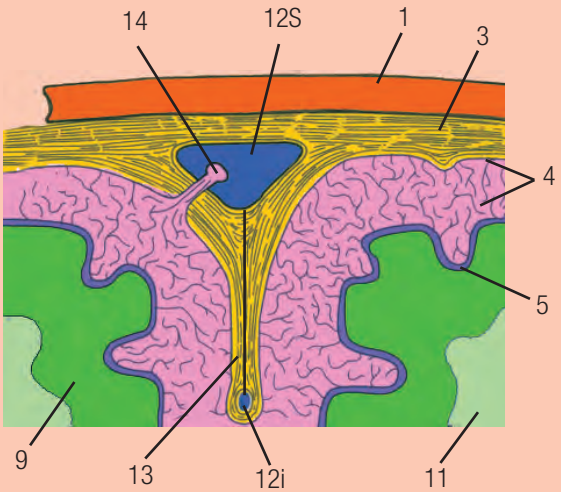
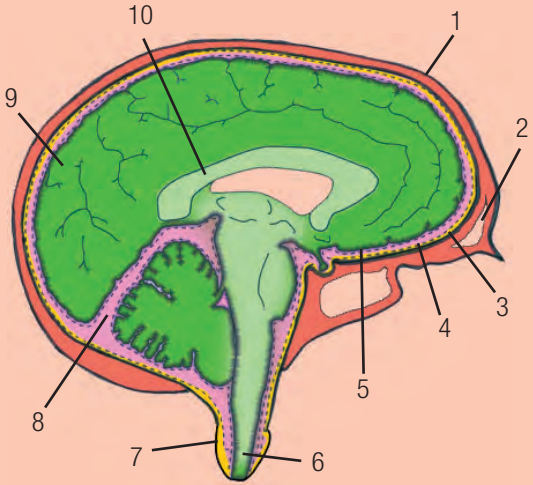
- 1 Cerebral Cortex = CC – higher thinking centres
- 2 Limbic system
- 3 Brainstem
- 4 Amygdala – associated with fear and aggression connecting mainly to the Rhinencephalon
- 5 Hippocampus – associated with memory and learning
- 6 Hypothalamus – associated with body temp regulation and the ANS
- 7 Cingulate gyrus – main connection with the superior CC
- 8 Corpus Callosum – major decussation joining the R & L CH
- 9 Anterior thalamic nuclei
- 10 Olfactory bulb & tract (CN I)



Meninges and the Brain

- 1 Bone - Skull
- 2 Frontal sinus
- 3 DM
- 4 AM + Subarachnoid space
- 5 PM
- 6 SC
- 7 Dural sac of the SC (continuing on from the cranial cavity)
- 8 Subarachnoid space (b/n Cerebrum and Cerebellum)
- 9 CC – GM
- 10 Corpus Callosum
- 11 WM of the brain
- 12 Sagittal sinus i = inferior / s = superior
- 13 Falx cerebri
- 14 Arachnoid granulations

See also Dura Mater (DM) aqua and bold

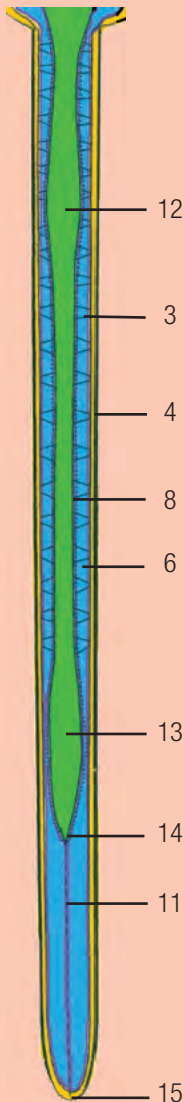
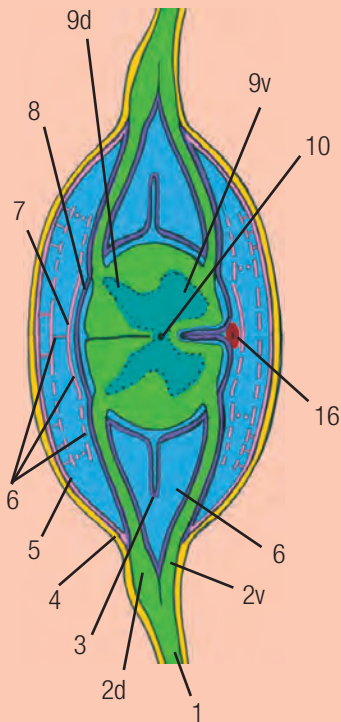


Meninges and the Spinal Cord (SC)

Transverse view of the SC and coverings – cross-section

Coronal view – cutting down the VC showing the SC and coverings.

- 1 SN - once it has exited from the VC
- 2 Nerve root (mixed N) w/n the VC
d = dorsal root (pure sensory)
v = ventral root (pure motor)
- 3 Denticulate lig. (from the PM)
- 4 DM
- 5 Outer layer of the AM
- 6 Subarachnoid space (b/n the intermediate layers of the AM)
- 7 Dorsal lig (from the AM)
- 8 PM
- 9 SC – GM
d = dorsal horn
v = ventral horn
- 10 Central canal
- 11 Filum terminale (PM)
- 12 Thoracic enlargement of the SC
- 13 Lumbar enlargement of the SC
- 14 SC termination – at L1/2 in adults (L3/4 in children)
- 15 Spinal canal termination – at S2
- 16 Anterior spinal artery



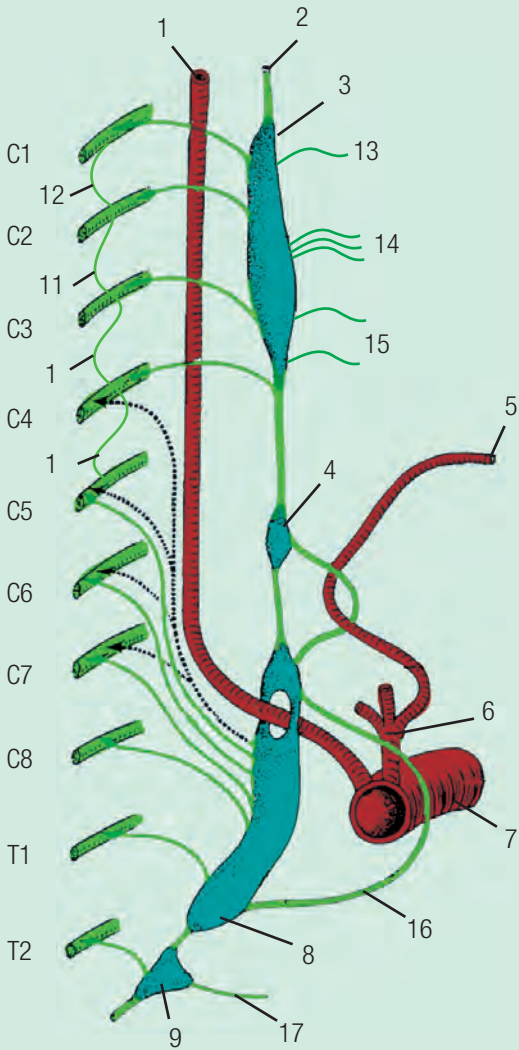
Meninges – arteries

Lateral – looking into the inner skull surface

The 3 main meningeal arteries arise from the maxillary artery. They all arise from the maxillary artery and the middle meningeal artery is the largest and the most commonly involved in trauma causing an epidural haematoma. Its supply is extensive as it has large ant. middle & post branches. It supplies the skull and DM.

Other meningeal art arise from the local BS.

- 1 Main meningeal arteries
 - a = anterior
 - m = middle
 - p = posterior
- 2 Frontal bone s = frontal sinus
- 3 Parietal bone
- 4 Occipital bone
 - a = meningeal art from occipital art
- 5 meningeal arteries arising from vertebral art
- 6 ascending pharyngeal art + branches
- 7 external carotid art
- 8 Mandible
 - c = canal
- 9 Palatine bone
- 10 inf nasal concha
- 11 Sphenoid
 - s = sinus
- 12 Temporal bone
- 13 Occipital art



Notes

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