

由醫學影像看神經解剖

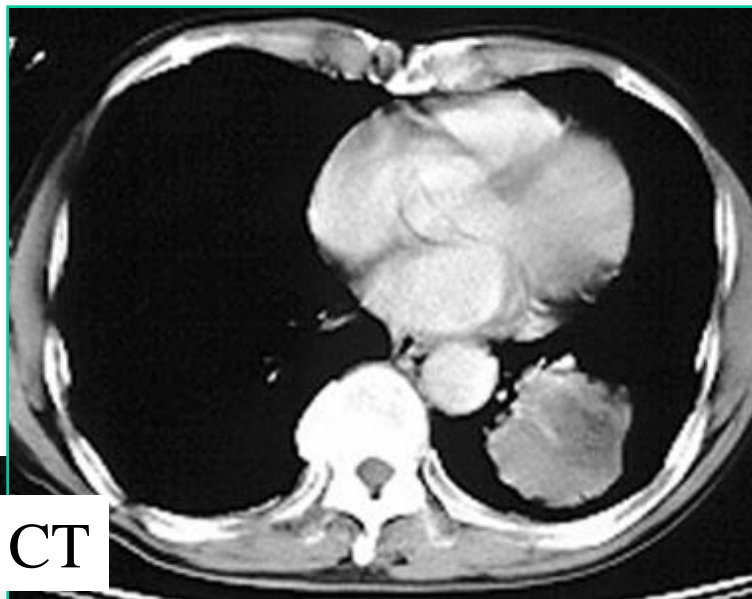
沈戊忠 醫師

中國醫藥大學 醫學系 講座教授
附設醫院 醫學影像部 顧問醫師

醫學影像的種類



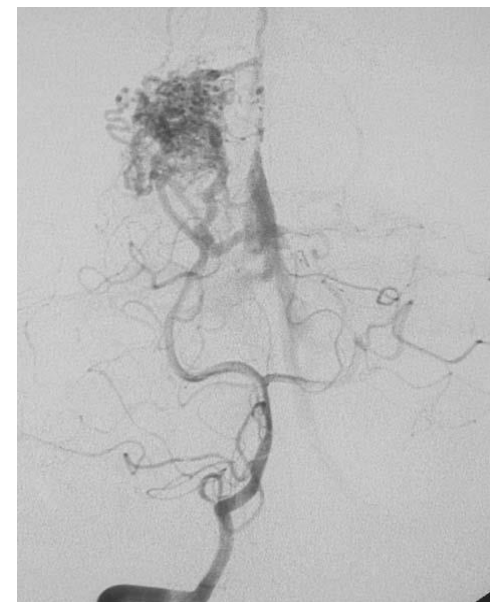
X-ray



CT



MRI



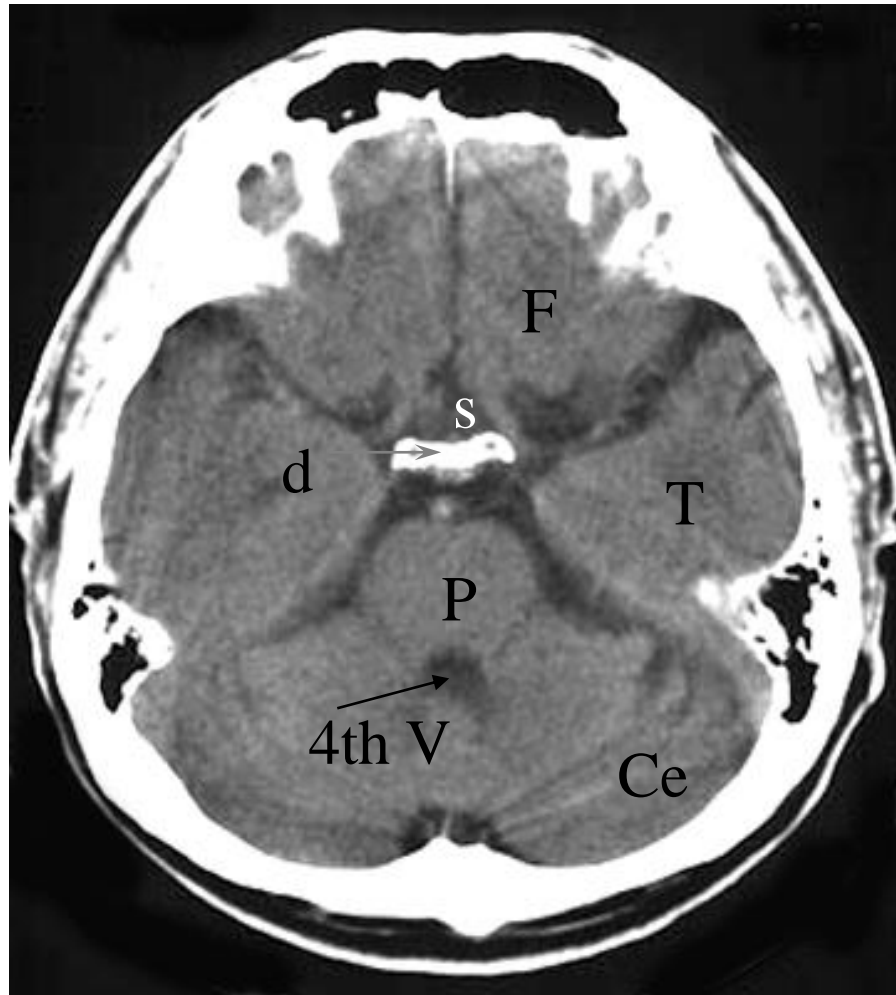
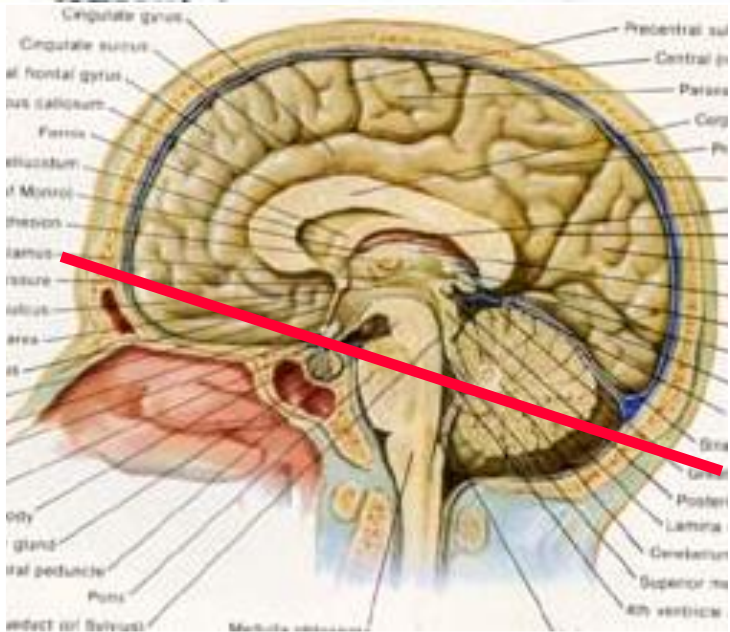
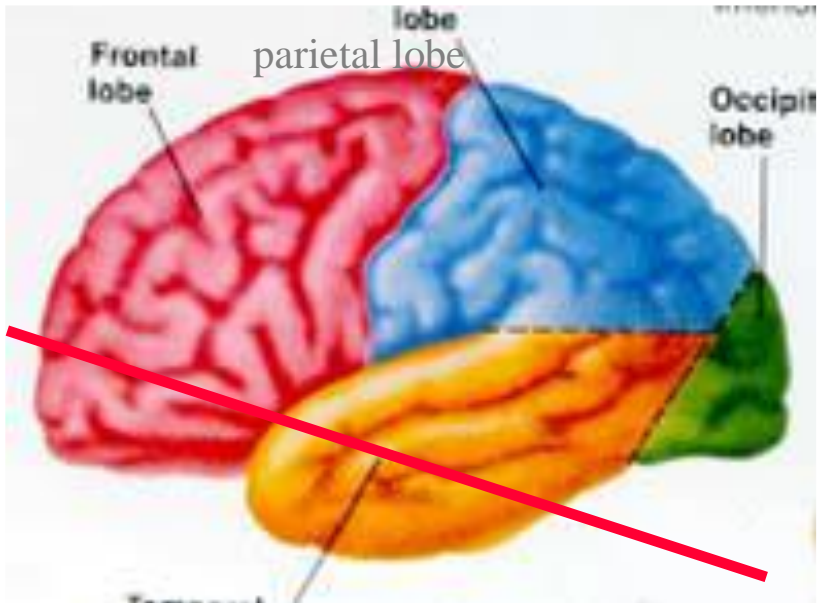
Angiography
血管攝影



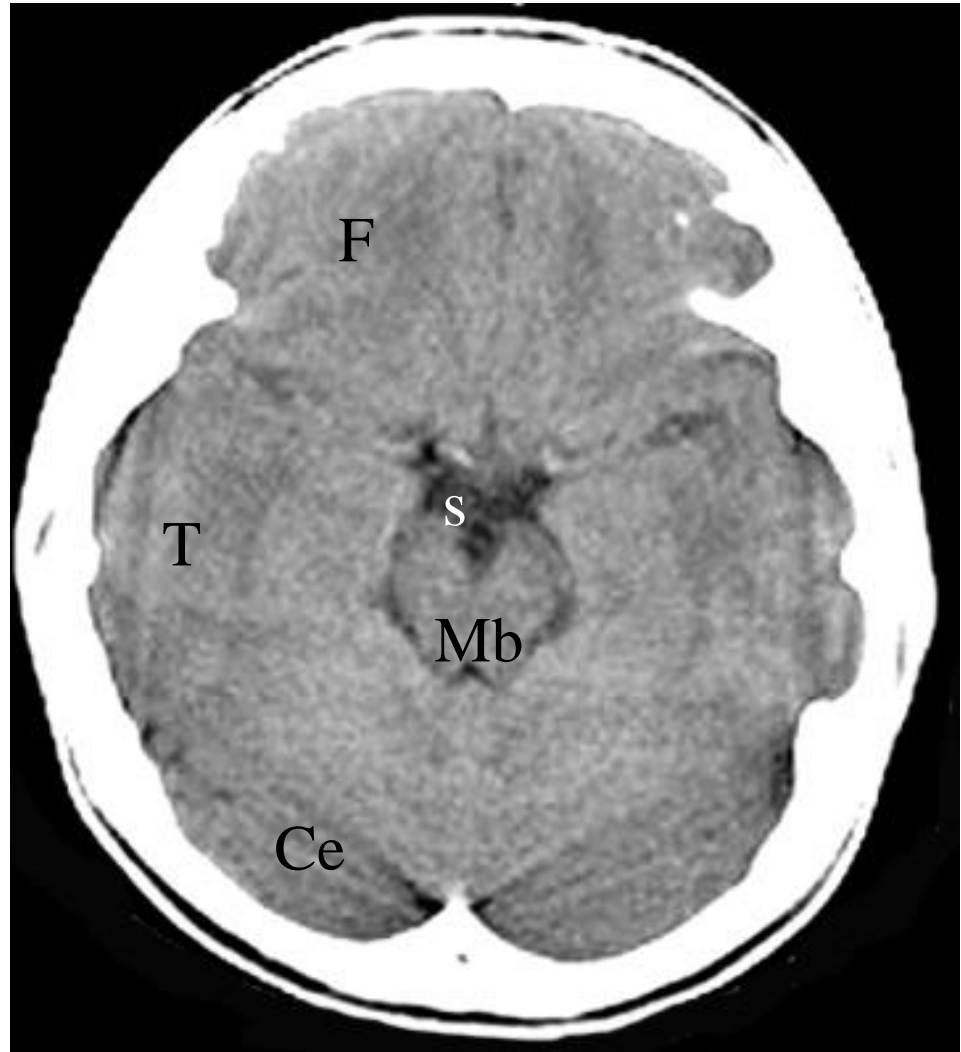
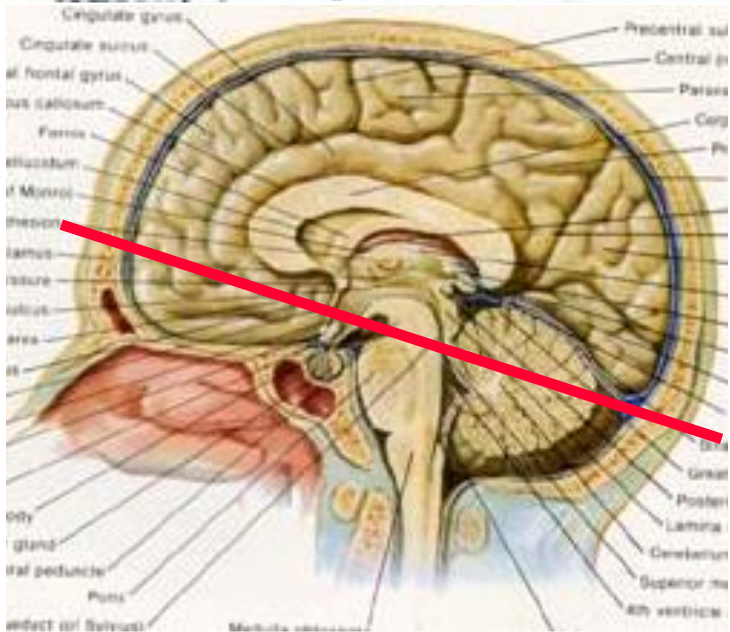
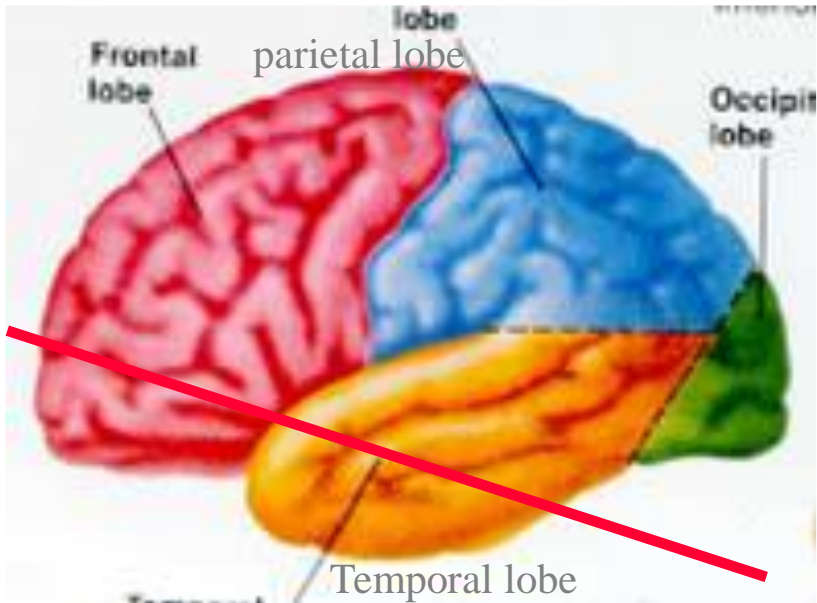
超音波

認識CT of Brain 的解剖

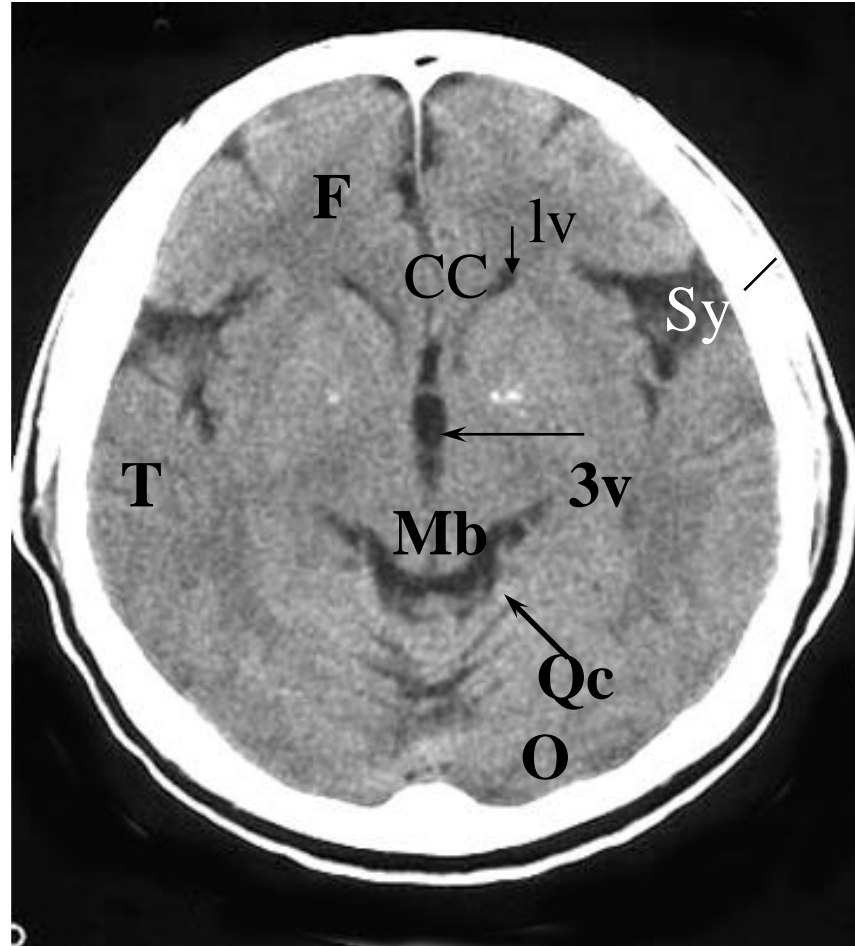
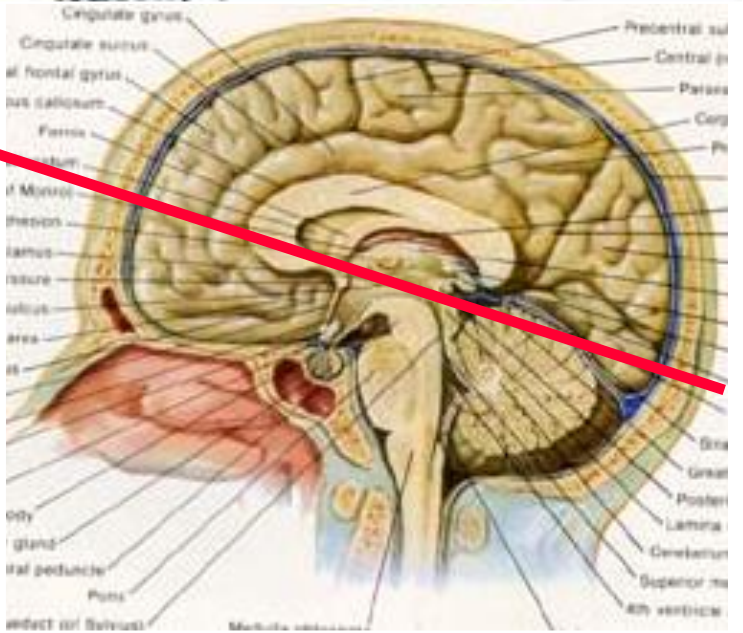
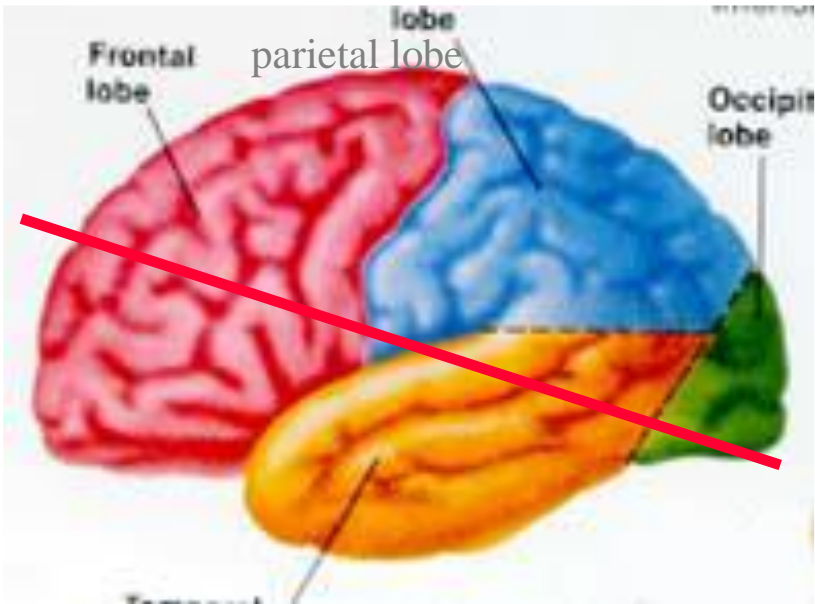
- Brain parenchyma (腦實質)
 - frontal lobe, temporal lobe, parietal lobe, occipital lobe, cerebellum, basal ganglia, brainstem, corpus callosum
- Subarachnoid spaces (蜘蛛網膜下腔, CSF spaces)
 - Ventricles (腦室)--- lateral, 3rd, 4th ventricles
 - Cisterns (腦池)--- suprasellar, quadrigeminal cisterns....
 - Fissures (腦裂)--- Sylvian, interhemispheric fissures...
 - Sulci (腦溝)



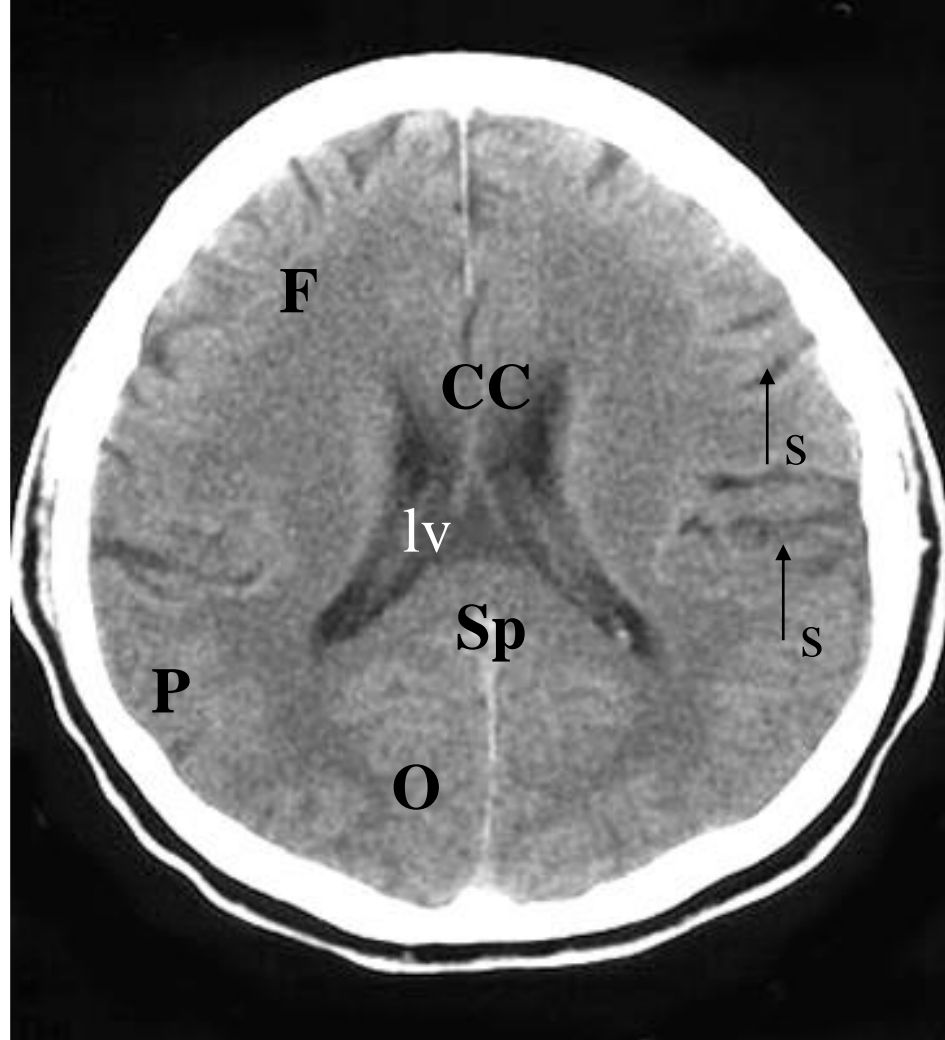
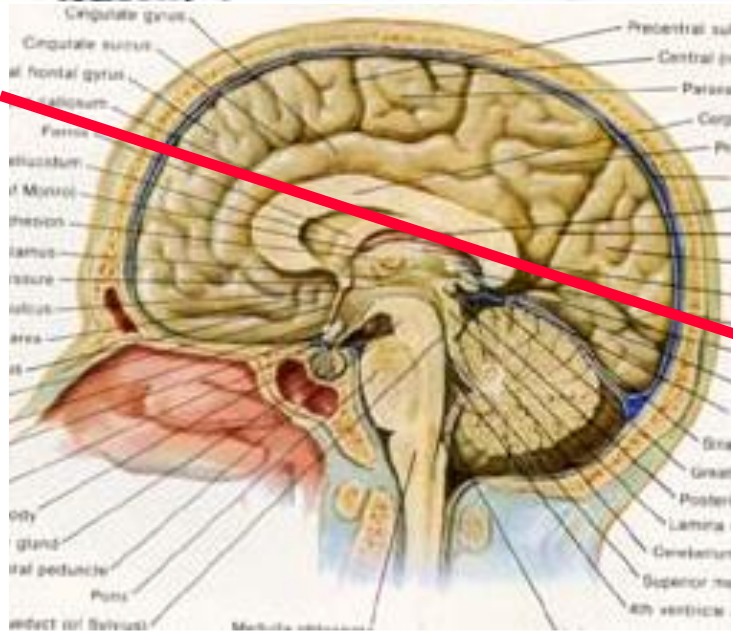
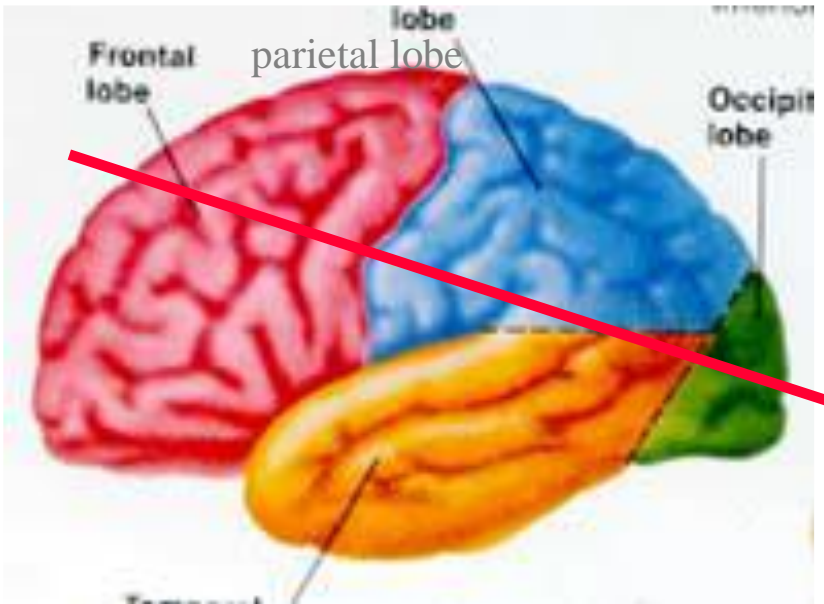
F: frontal lobe (額葉) P: pons(橋腦)
 T: temporal lobe (顳葉)
 s: suprasellar cistern (碟鞍上腦池)
 Ce: cerebellum (小腦) d: dorsum sellae(蝶鞍背)



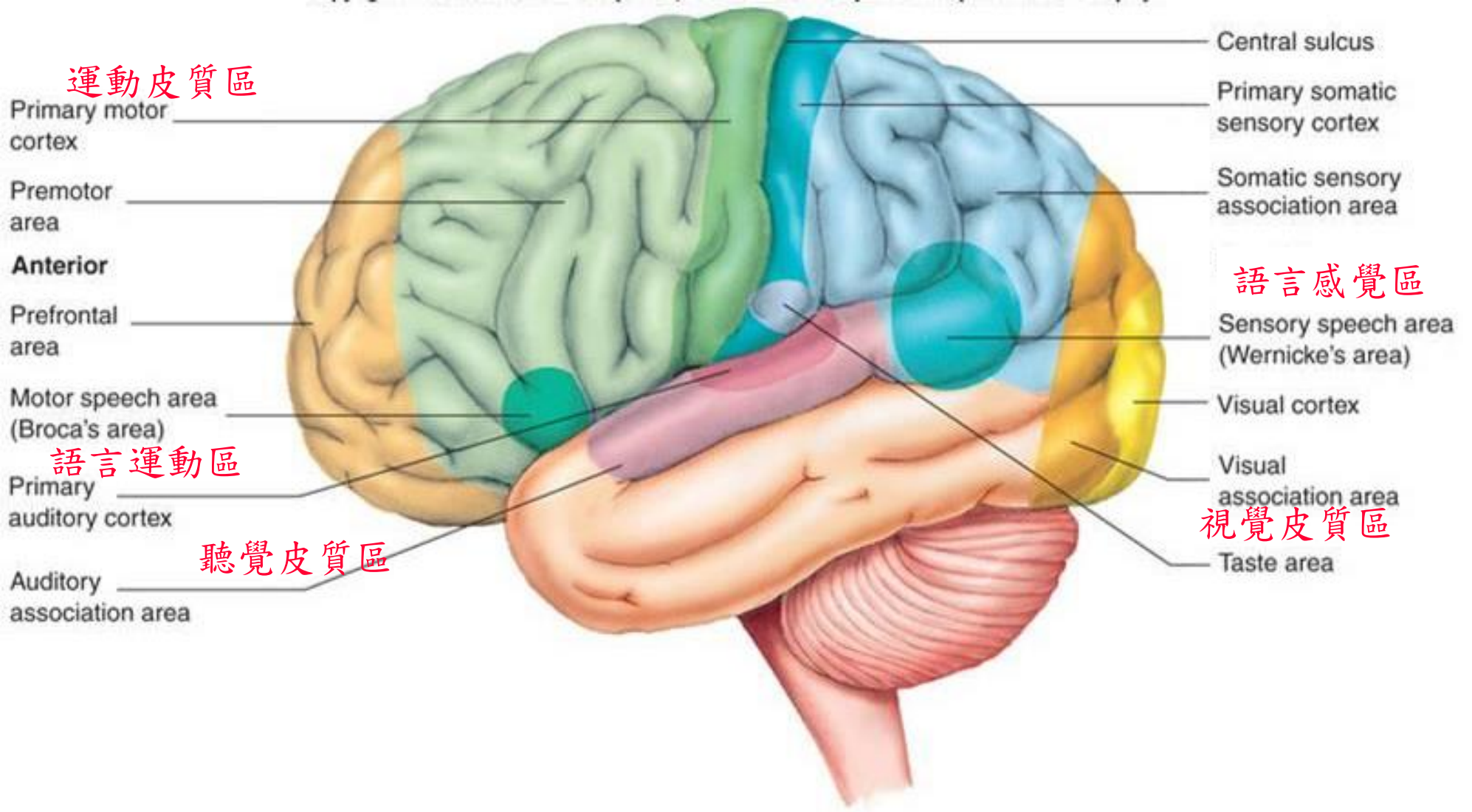
F: frontal lobe (額葉) Mb: midbrain(中腦)
 T: temporal lobe(顳葉)
 s: suprasellar cistern (蝶鞍上腦池)
 Ce: cerebellum(小腦)

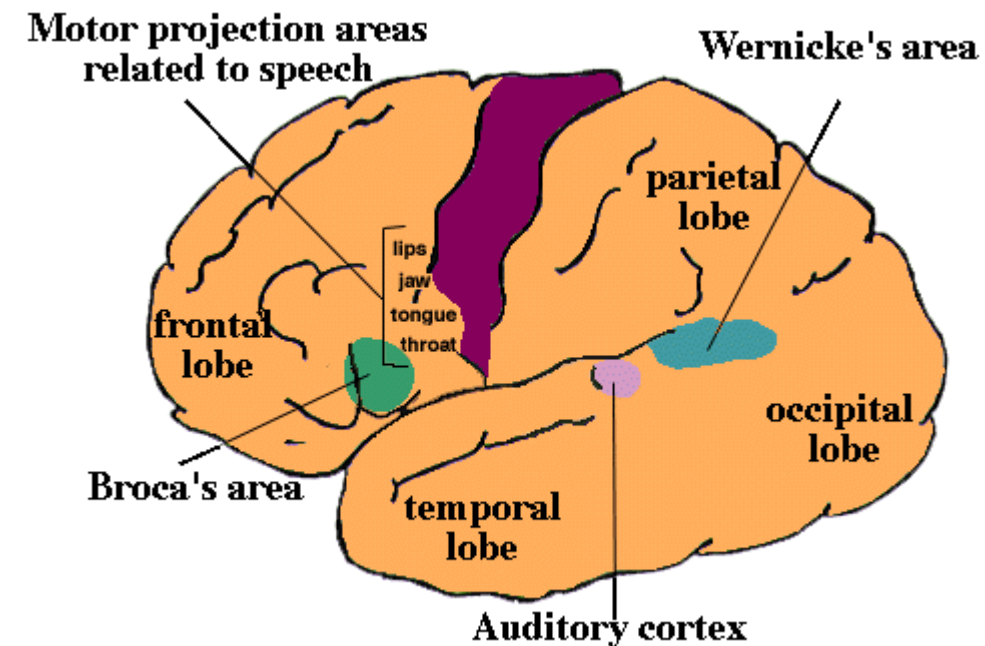
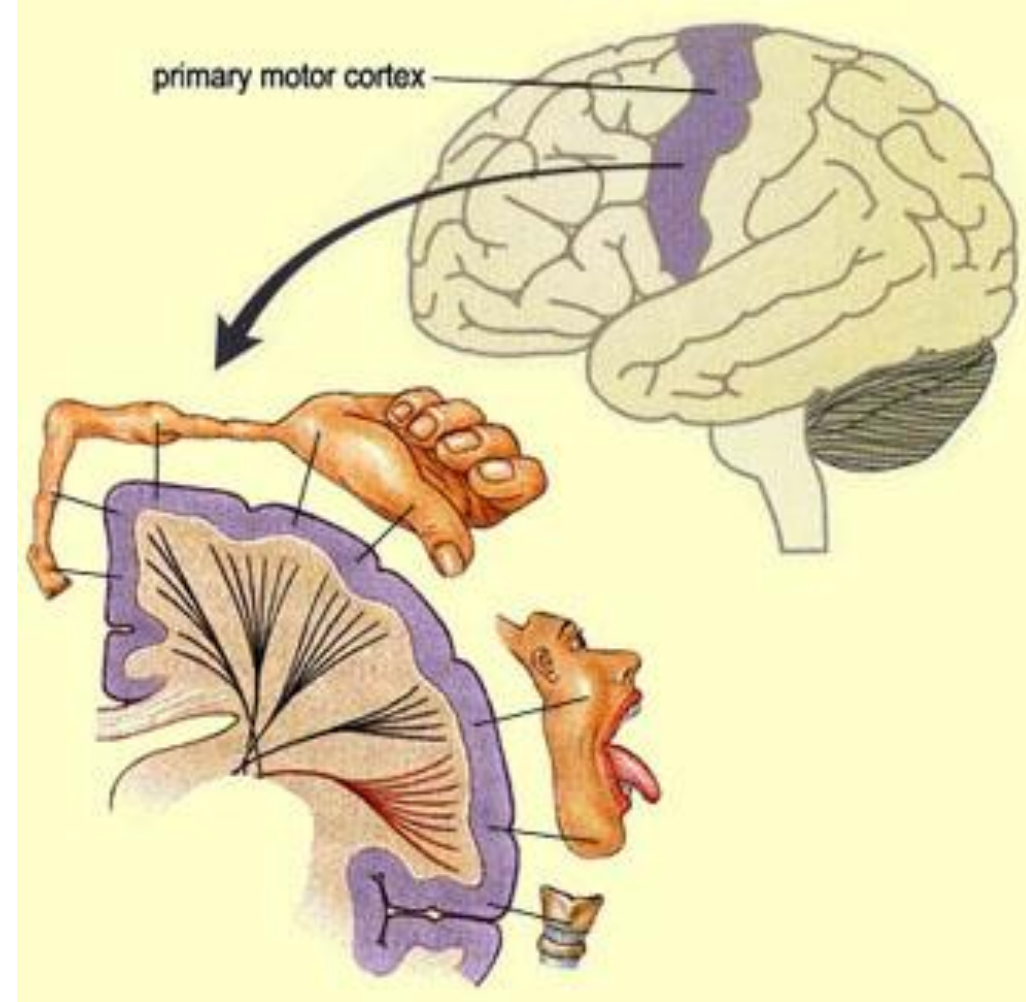
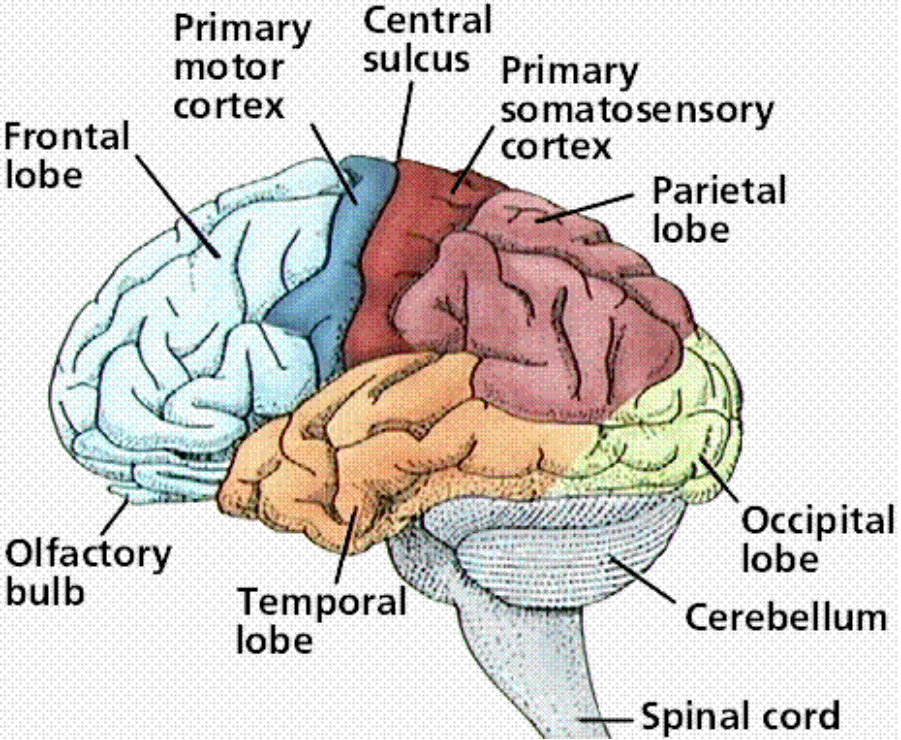


F: frontal lobe(額葉) Sy: Sylvian fissure(薛氏裂)
 T: temporal lobe(顳葉) O: occipital lobe(枕葉)
 Mb: midbrain(中腦) 3v: 3rd ventricle(第三腦室)
 lv: lateral ventricle(側腦室)
 CC: corpus callosum (genu)(胼胝體(膝部))
 Qc: quadrigeminal cistern (四疊體腦池)

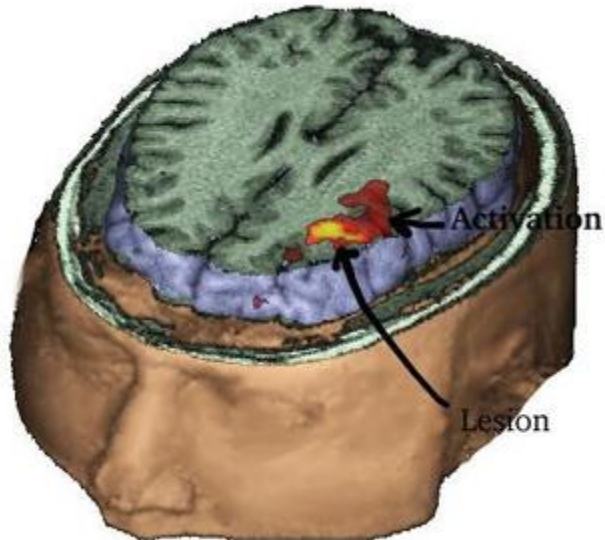
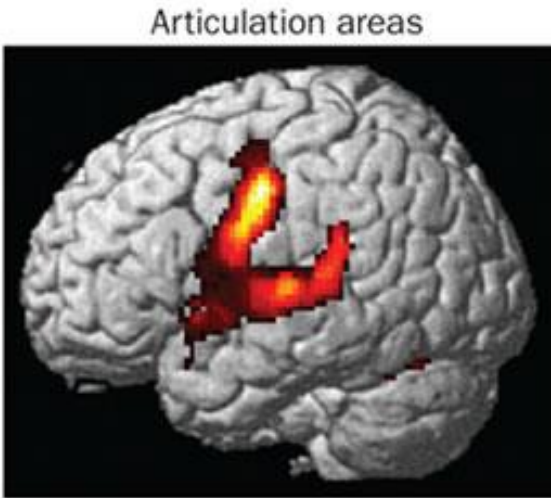
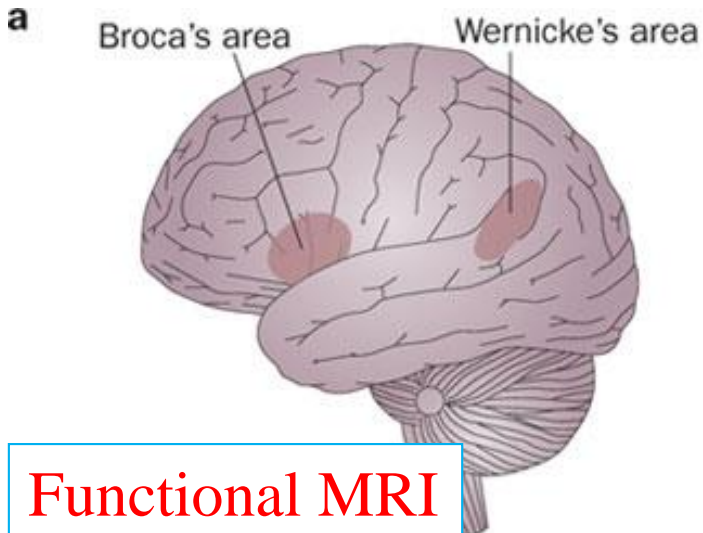


F: frontal lobe CC: corpus callosum(胼胝體)
 P: parietal lobe Sp: splenium of CC(胼胝體壓部)
 O: occipital lobe lv: lateral ventricle
 s: sulcus(腦溝)



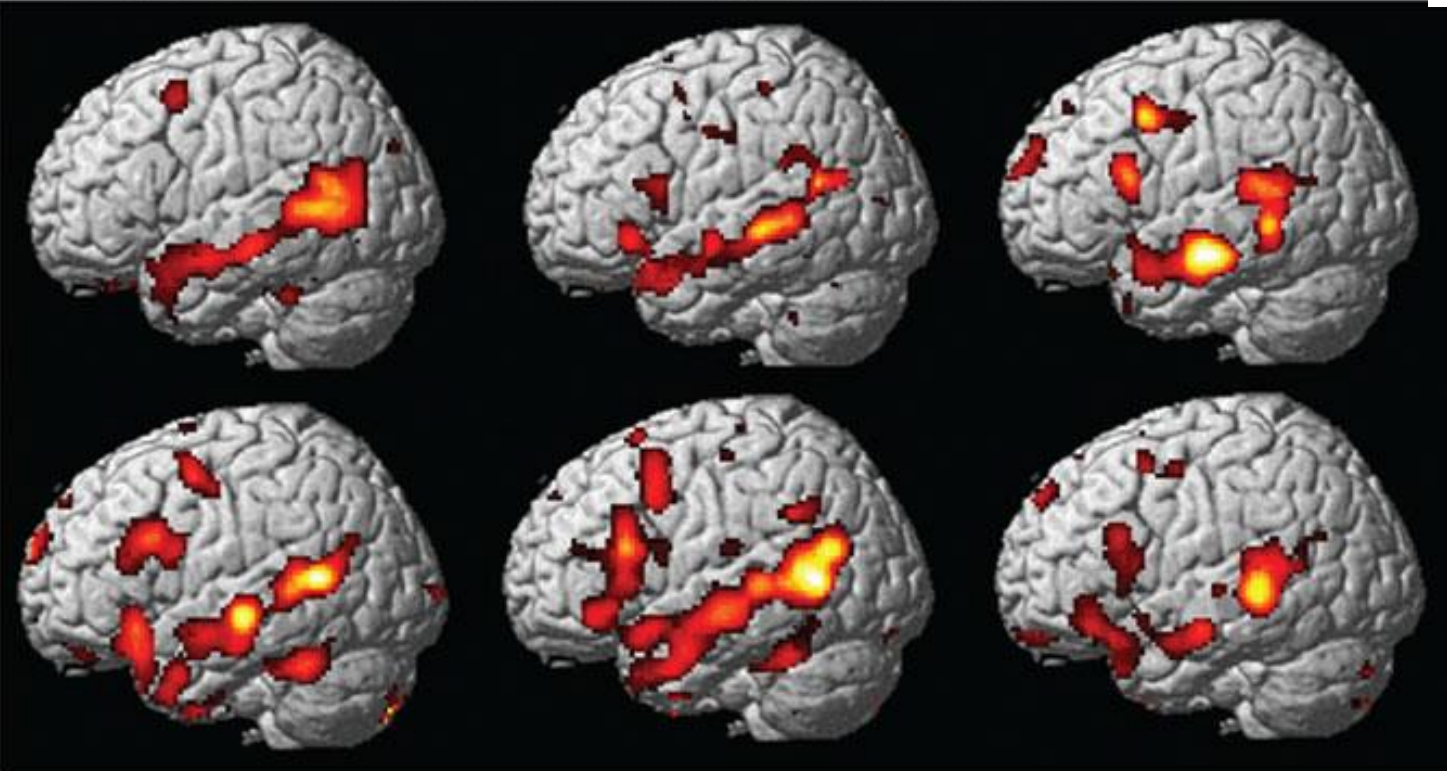


Wernicke's area is one of the two parts of the cerebral cortex linked since the late nineteenth century to speech (the other is the **Broca's area**). It is involved in the understanding of written and spoken language



Functional MRI

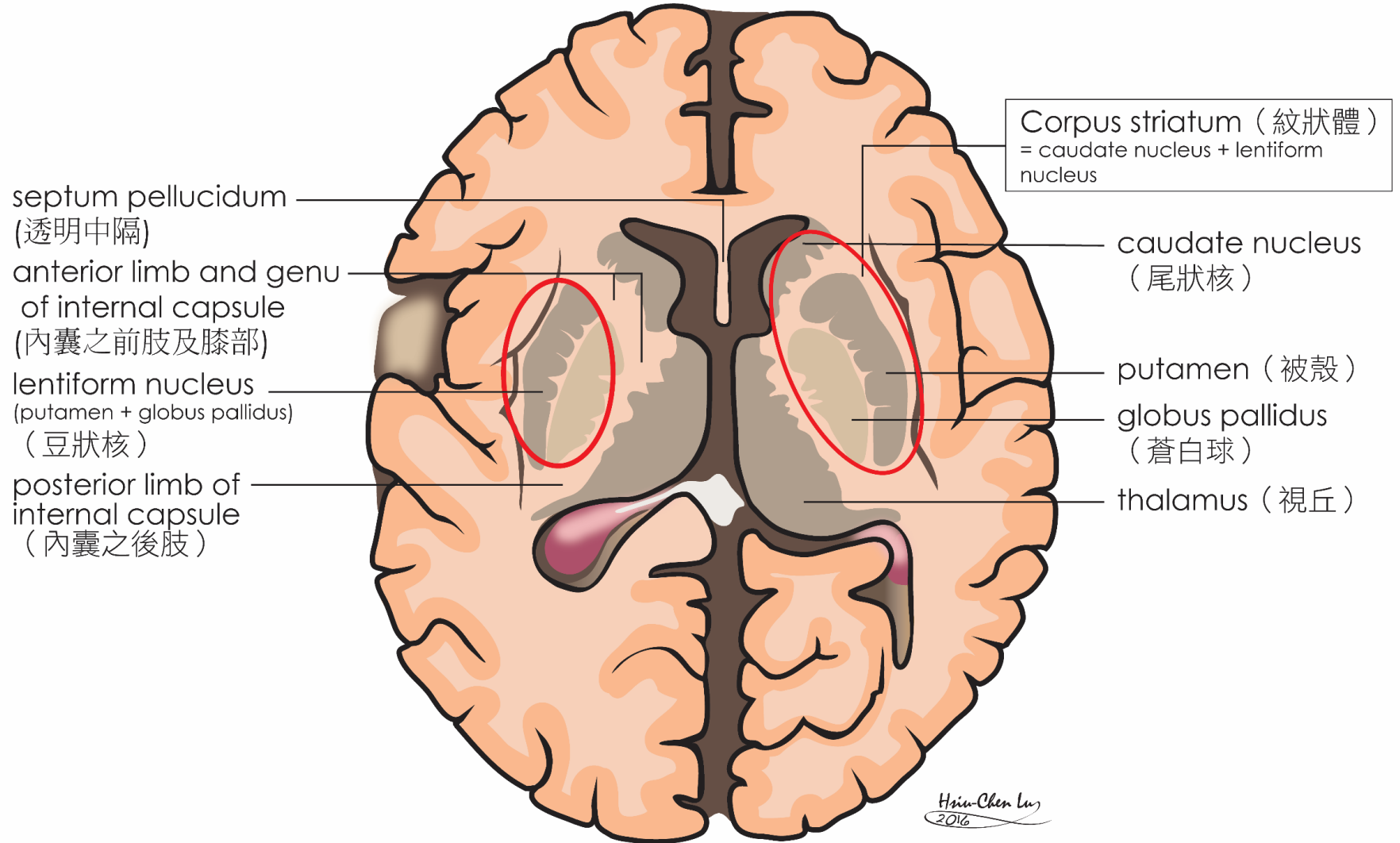
b Activation in six healthy individuals listening to stories > reversed speech

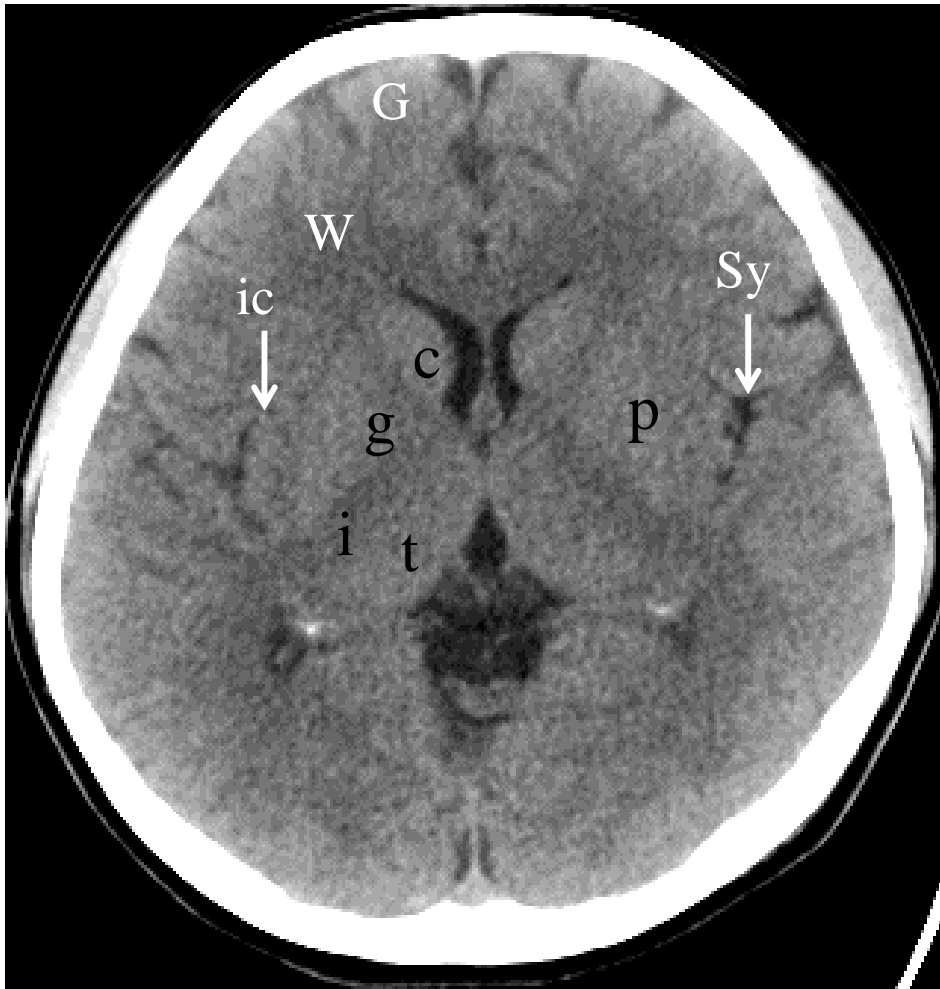


Infarction in Broca's area

Basal Ganglia(基底核)

Deep gray matter(深層灰質)





(CT: 灰質(G: gray matter)比較灰，白質(W: white matter)稍暗。在Sylvian fissure (arrow)內側的大腦深層可見明顯的灰質構造，就是基底核及視丘。在兩者之間有一長形白質構造，就是內囊(internal capsule)，在CT很明顯稍暗。Putamen與globus pallidus在CT不易區分。MRI FLAIR: globus pallidus 因為含鐵成份稍高，訊號稍暗，。

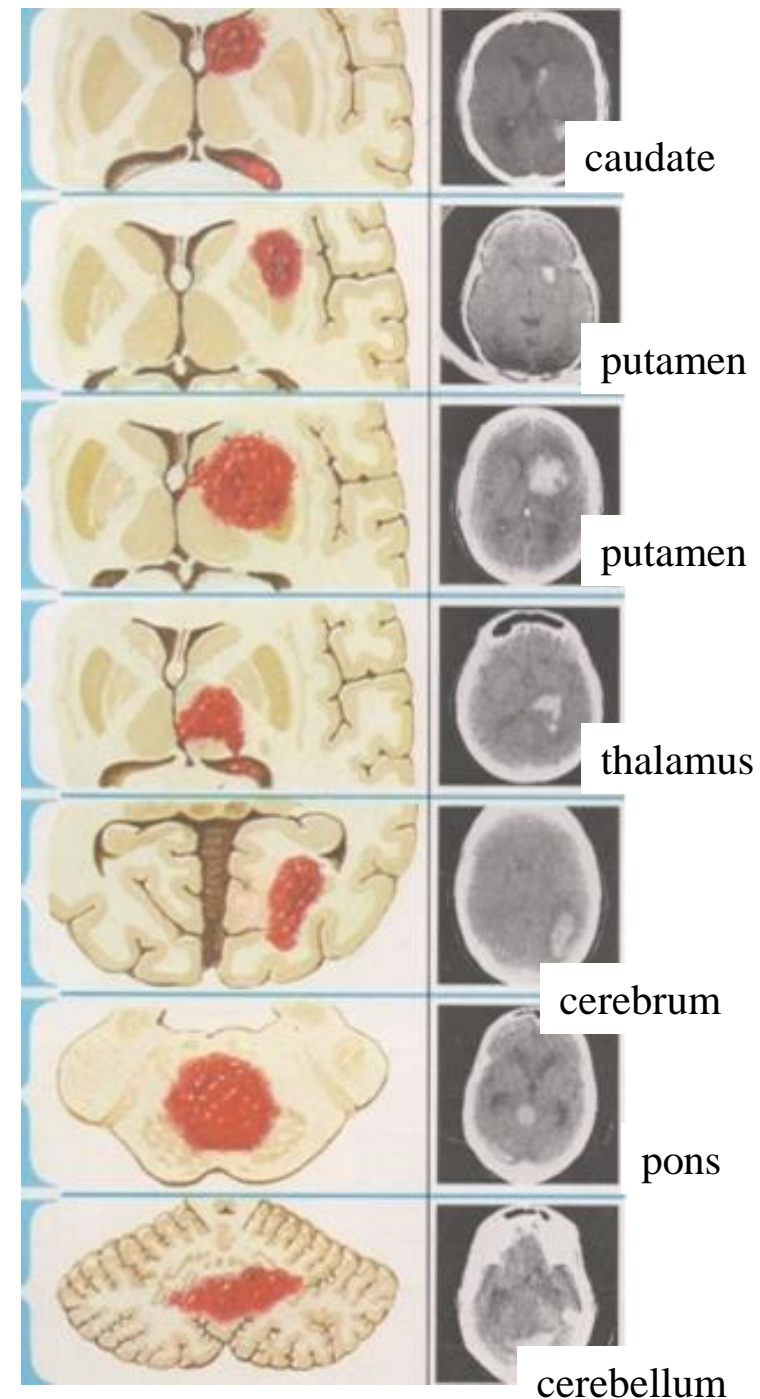
- c: caudate nucleus (尾狀核)
- p: putamen(被殼)
- g: globus pallidus(蒼白球)
- t: thalamus(視丘)
- i: internal capsule (內囊)
- ic: insular cortex (島回)
- Sy: Sylvian fissure (薛氏裂)

Locations of Hypertensive Intracerebral Hemorrhages:

- Basal ganglion:
 - putamen
 - caudate nucleus
- Thalamus
- Brainstem
- Subcortical white matter of cerebrum and cerebellum

高血壓出血性中風
好發位置

發生率順序：putamen→thalamus→
brainstem(pons) → cerebellum →subcortex of
cerebrum →caudate nucleus → brainstem(midbrain)
→ brainstem(medulla oblongata)



1. CVA due to left putaminal hemorrhage

(左側被殼出血引起腦中風)

2. Calcifications in bil. globus pallidus

(蒼白球鈣化)



ICH:

70~90Hu

Calcification:

150-300Hu

CVA: cerebral vascular accident, stroke, 腦血管意外, 腦中風



CT

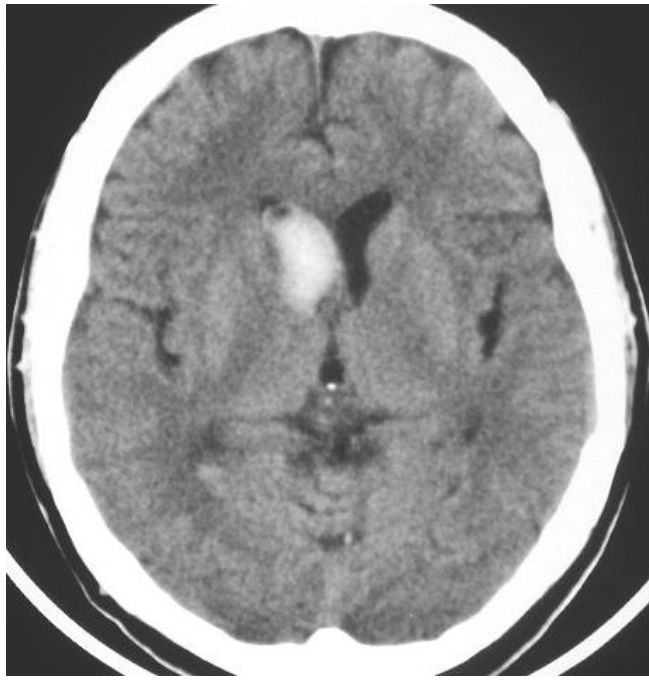
M/71

CVA due to left putaminal hemorrhage

(左側被殼出血引起腦中風)

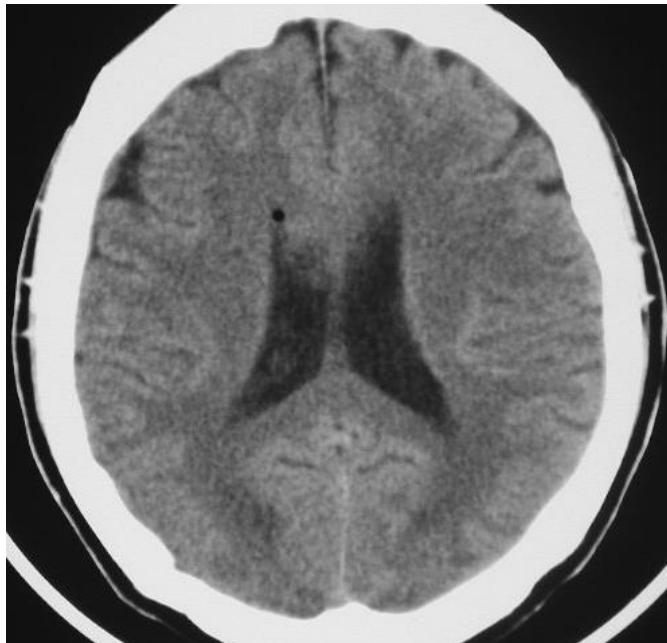
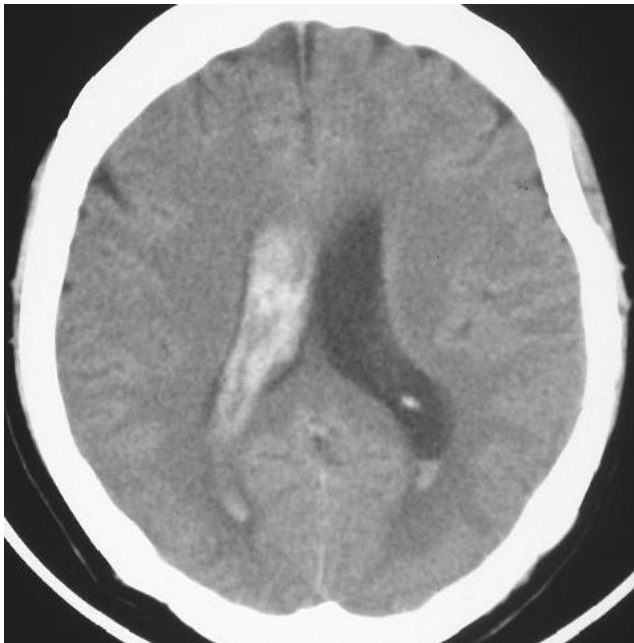
Male, 79 y/o,
CVA due to thalamic hemorrhage
(視丘出血引起腦中風)





(left figures)

90,4,27 CT: Acute hematoma in Rt. caudate nucleus with IVH.

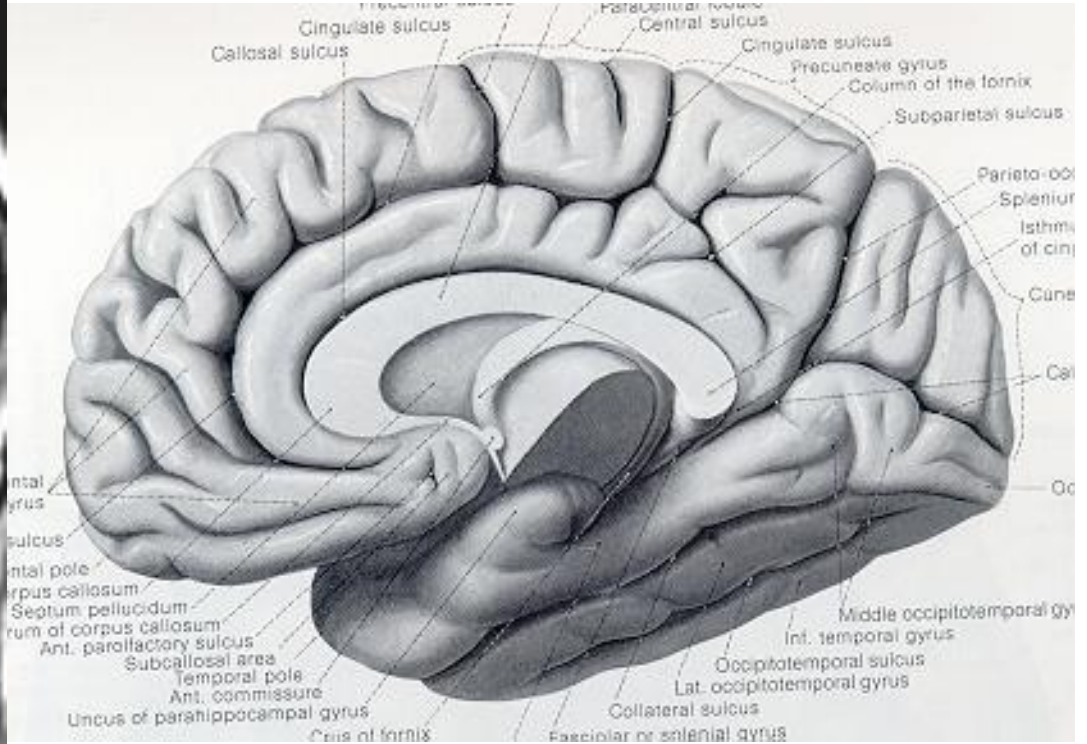
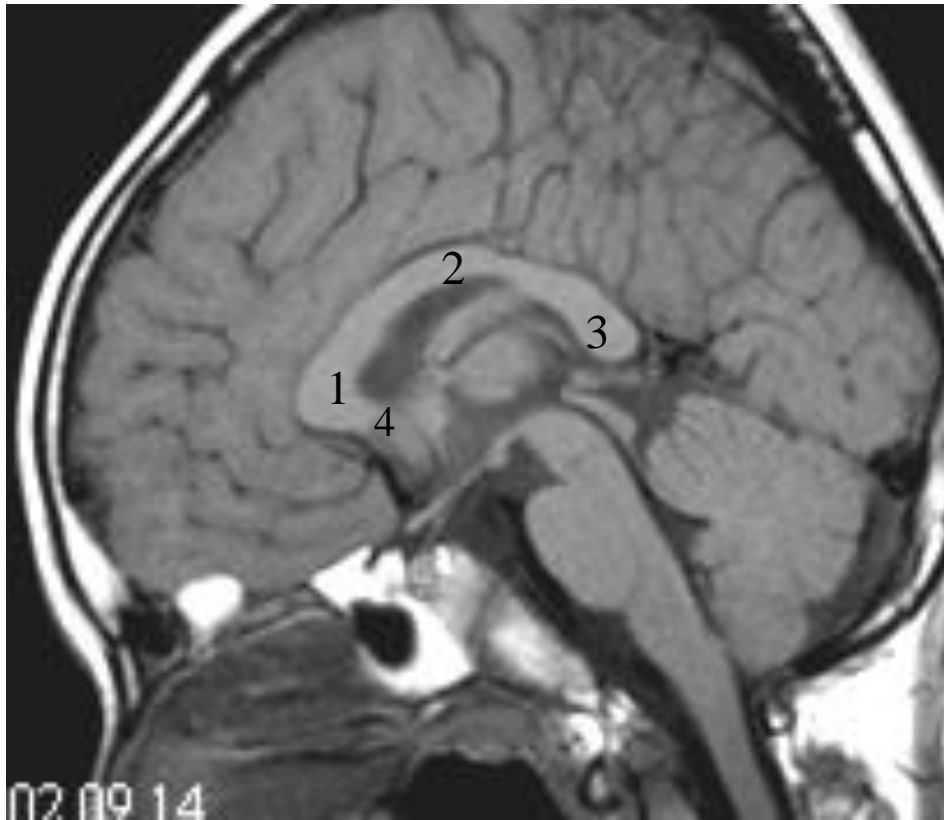


(right figures)

90,5,4 CT: residual hematoma in caudate nucleus, no IVH

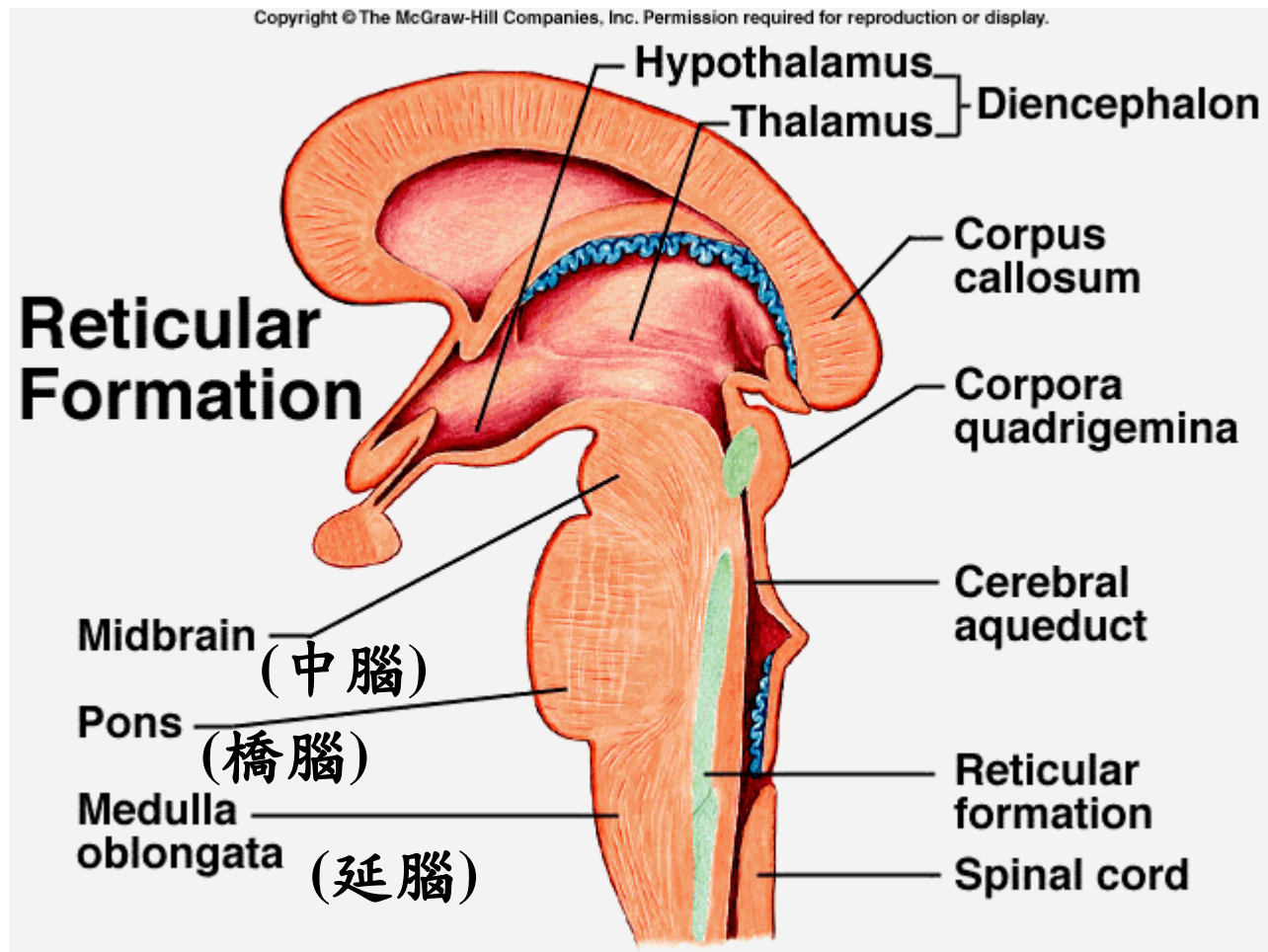
(尾狀核出血
引起腦中風)

Corpus callosum 胼胝體



1. Genu 膝部
2. Body 體部
3. Splenium 壓部
4. Claustrum 啄部

Brainstem(腦幹)



MRI, T1WI

(上丘、下丘構成四疊體)

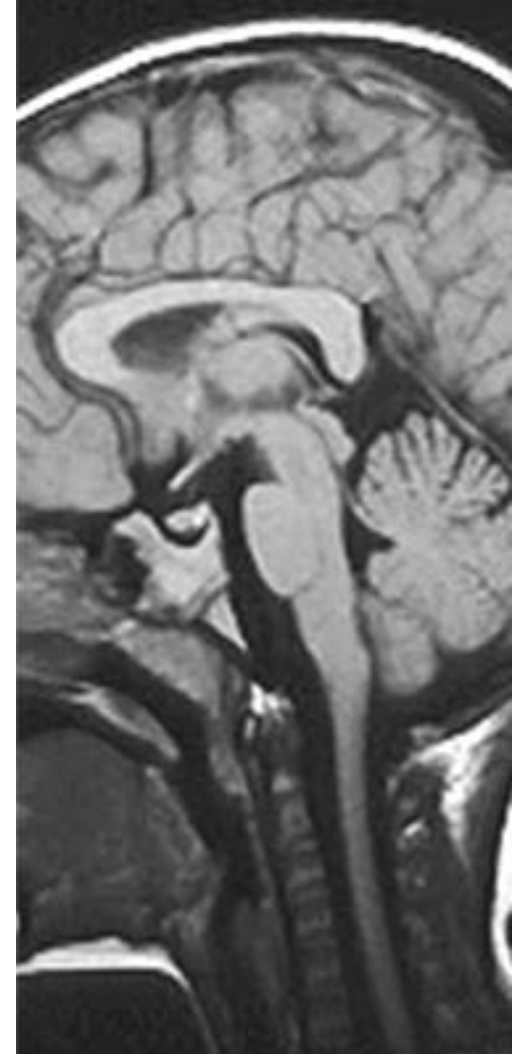
Pineal gland

Superior colliculus

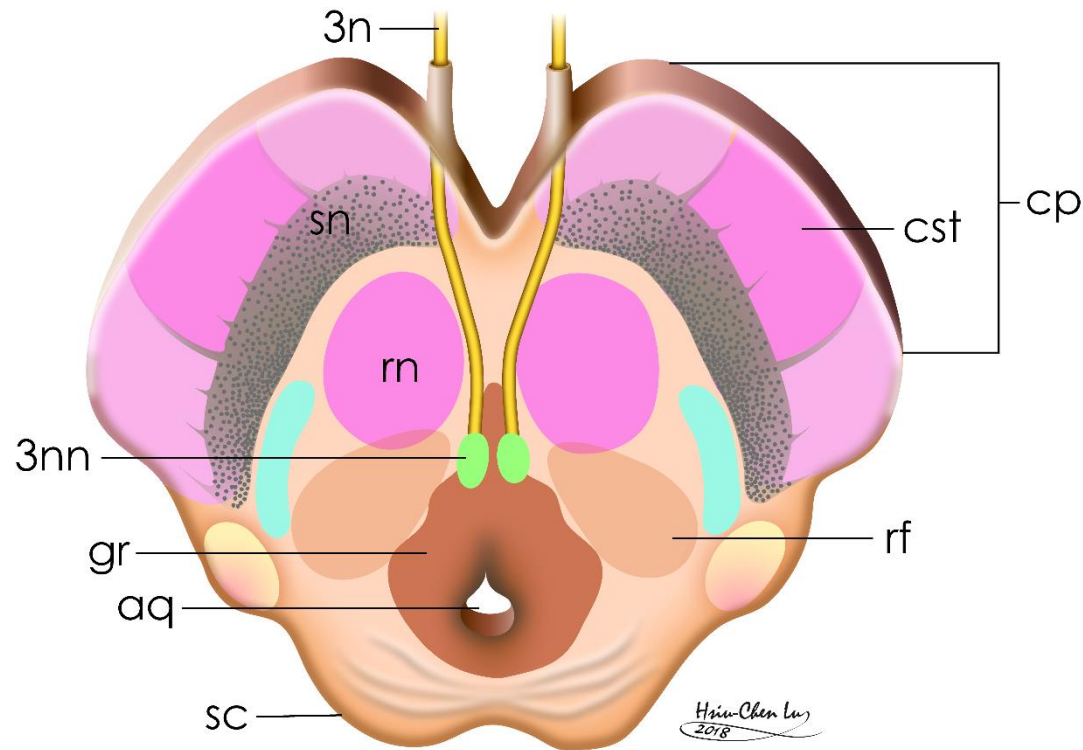
Inferior colliculus

= quadrigeminal plate

Brain stem



Midbrain



腦 (midbrain)

cp: cerebral peduncle (大腦腳)

cst: corticospinal tract (皮質脊髓徑)

rn: red nucleus (紅核)

sn: substantia nigra (黑質)

3n: 3rd cranial nerve, oculomotor nerve (動眼神經)

3nn: nucleus of 3rd n (第3顱神經核)

aq: aqueduct (導水管)

gr: periaqueductal gray matter (導水管旁灰質)

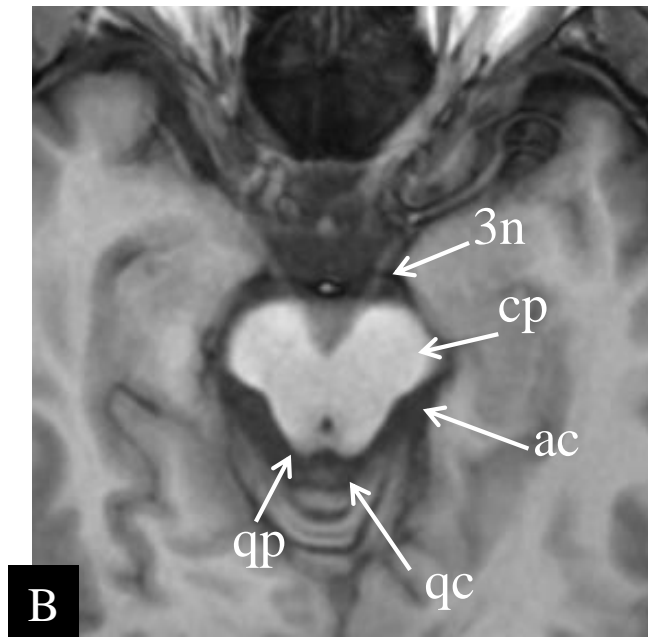
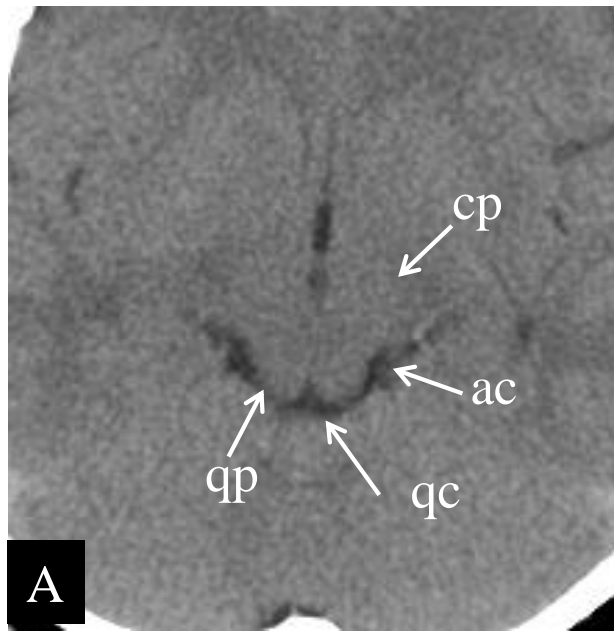
sc: superior colliculus (上小丘)

qp: quadrigeminal plate (四疊體)

rf: reticular formation (網狀結構)

qc: quadrigeminal cistern (四疊體腦池)

ac: ambient cistern (環池)



Midbrain

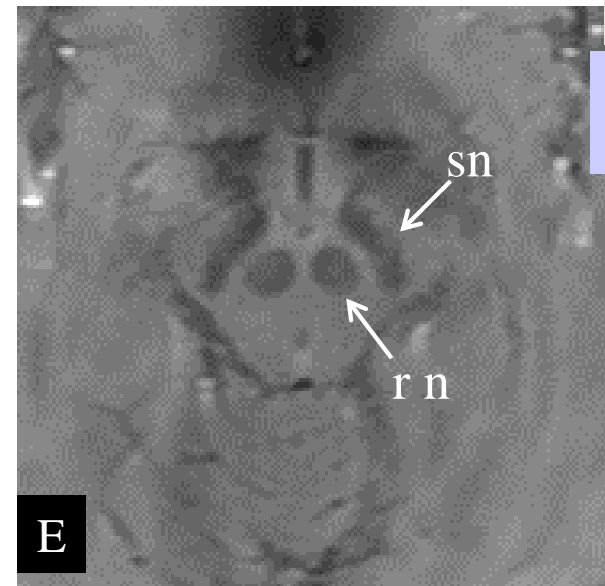
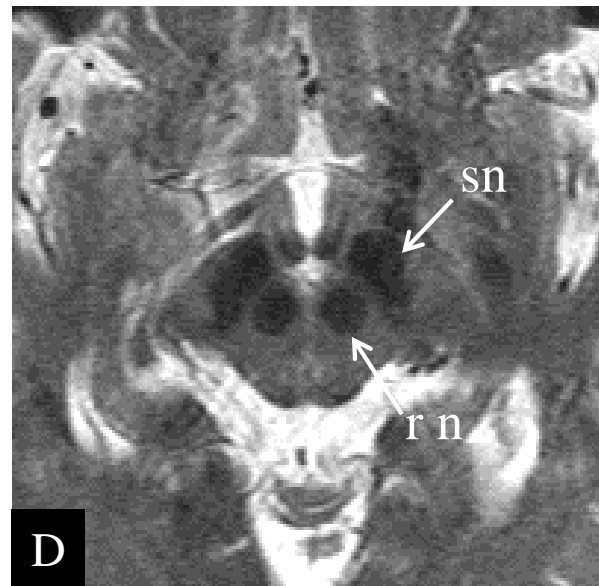
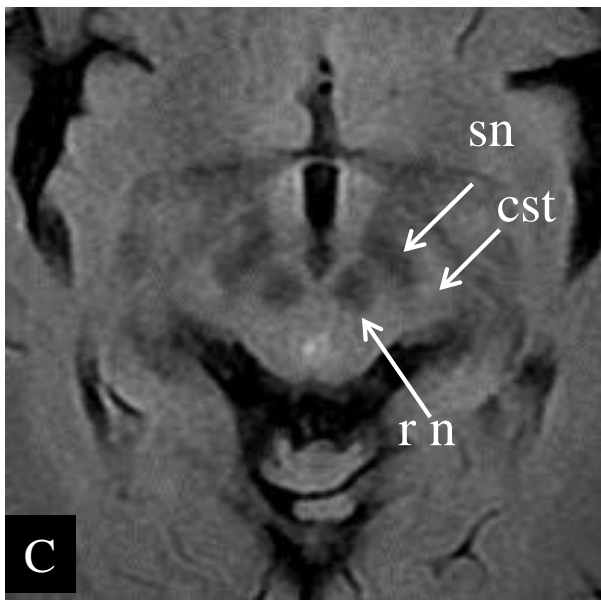
(A) CT: 只能看到midbrain 的外形。

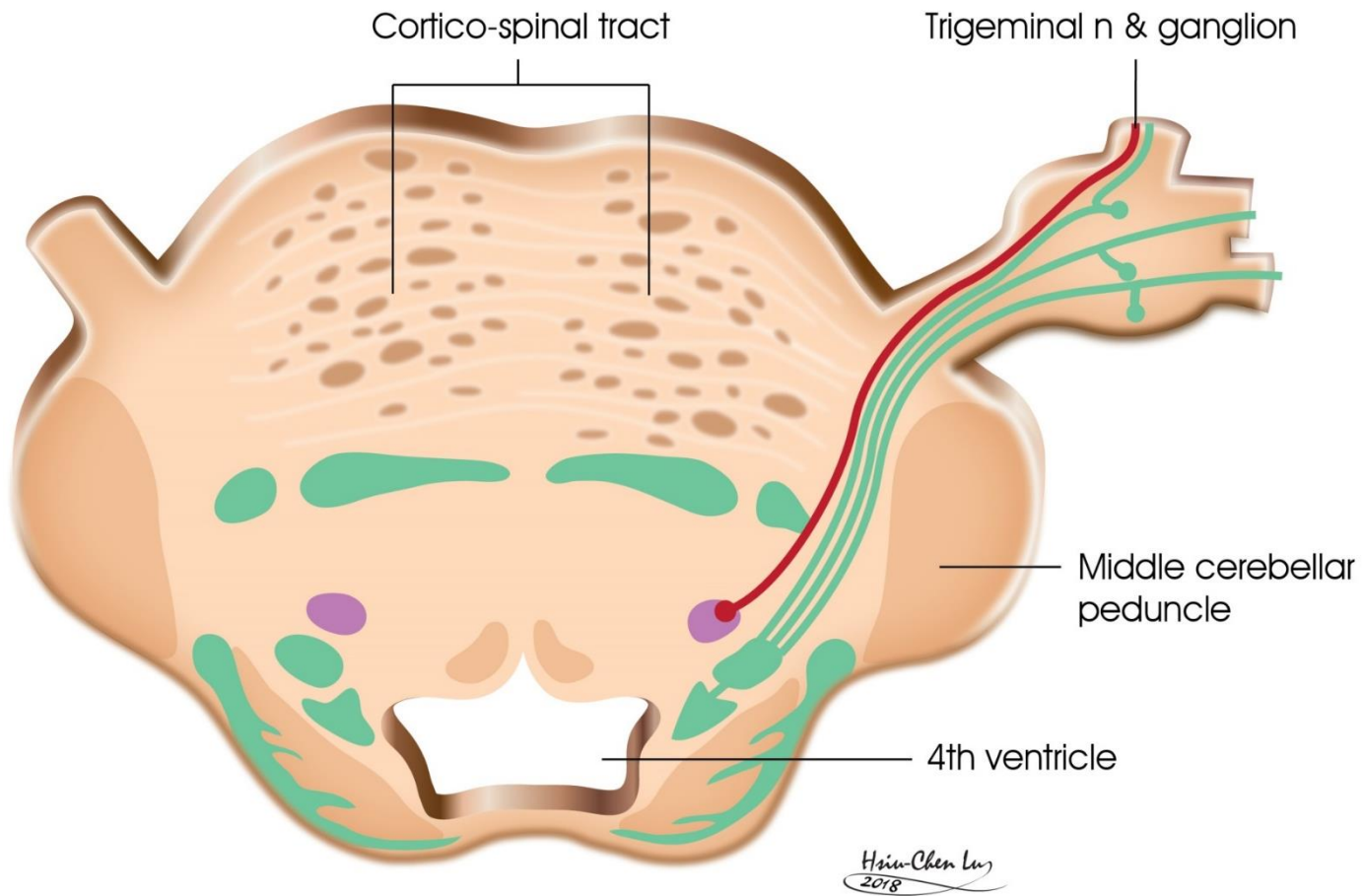
(B) T1WI 可比CT更清楚看到midbrain 的外形，

(C) FLAIR, (D) T2WI, (E) SWANI則可清楚看到red nucleus, substantia nigra.



牛角麵包
croissant





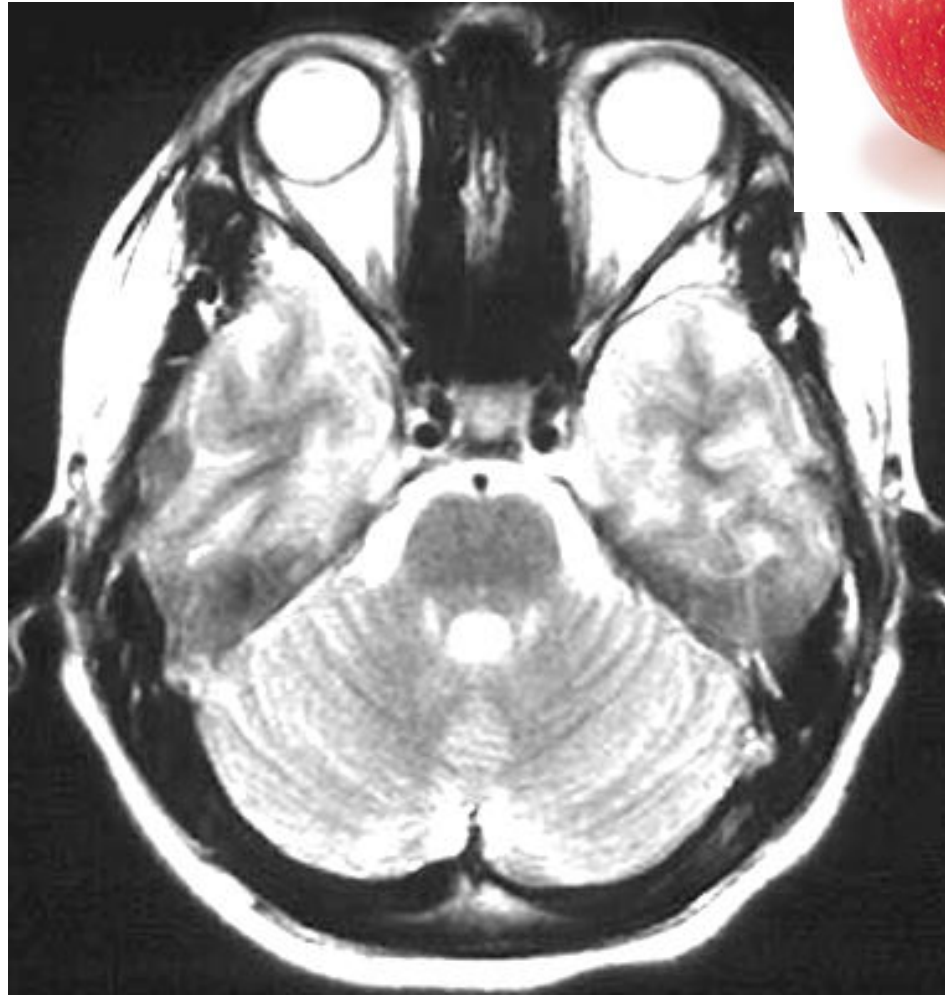
橋腦 (pons)

Pons

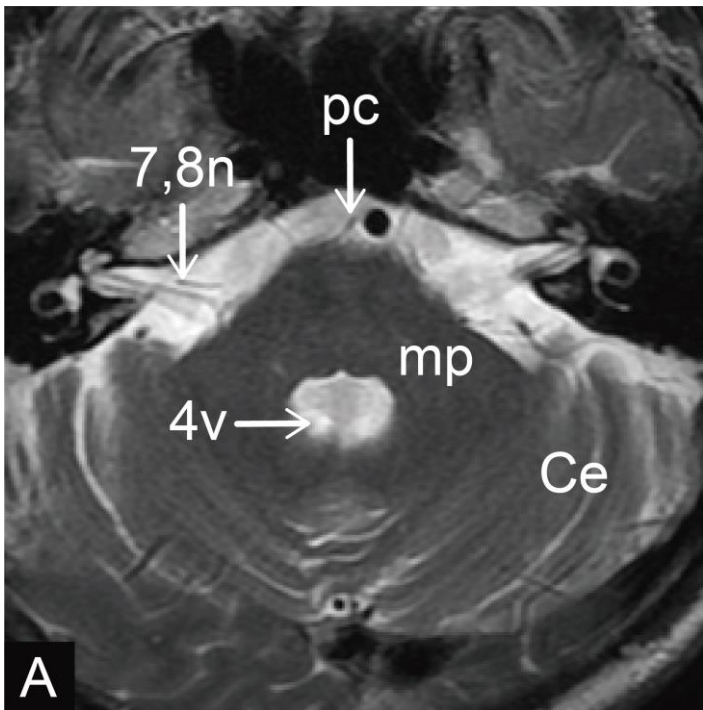
Pons is apple alike



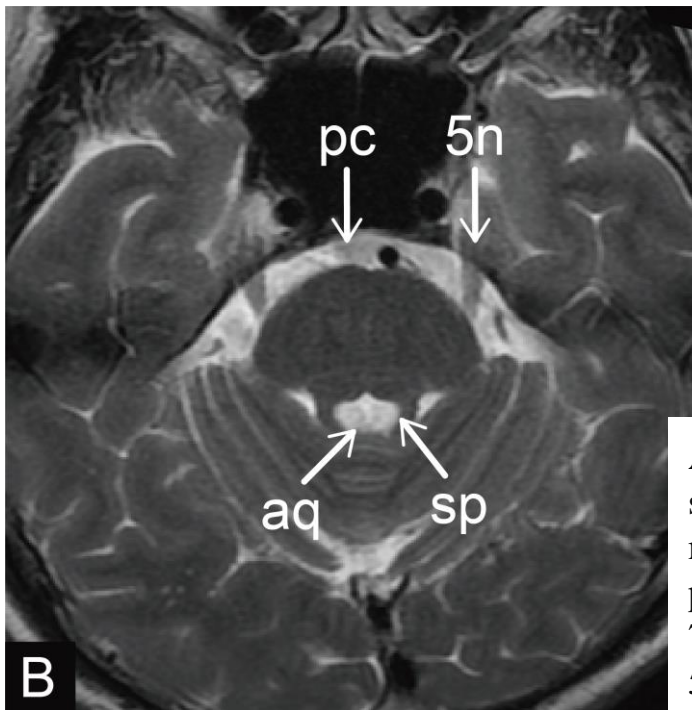
CT



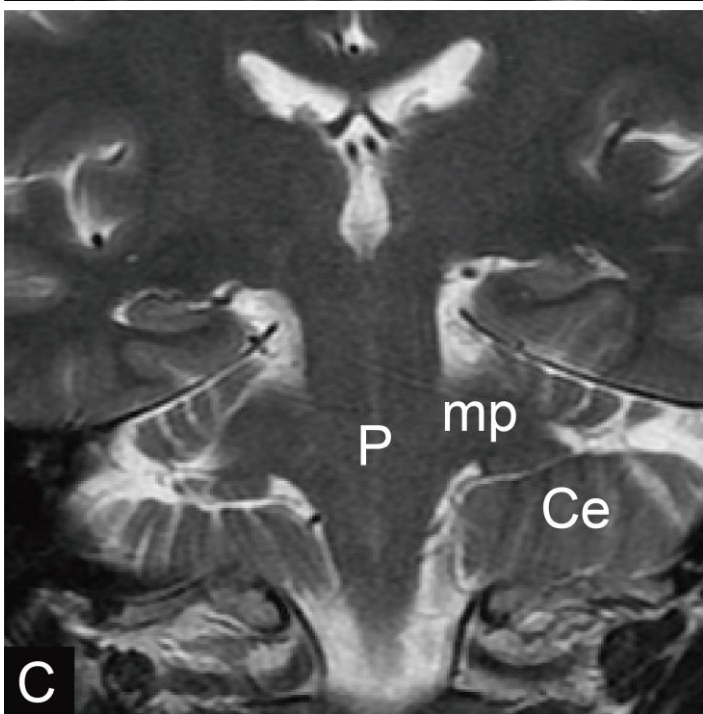
MRI, T2WI



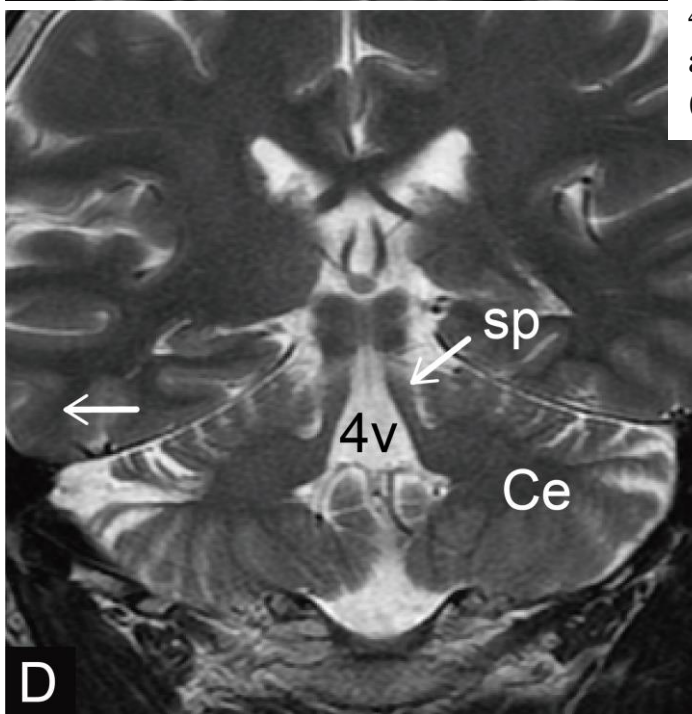
A



B

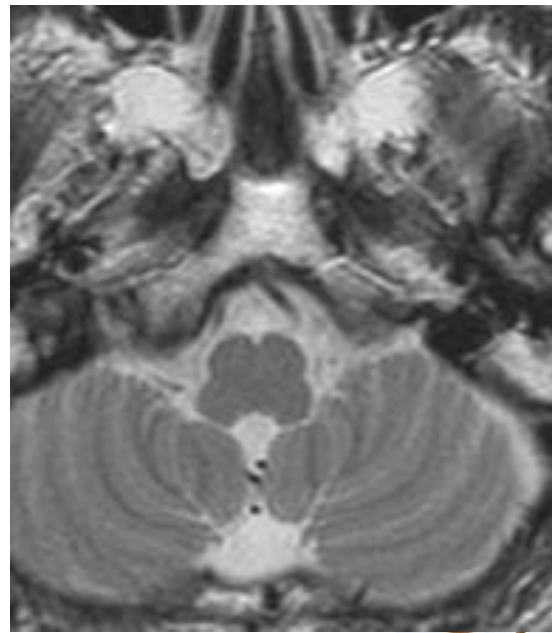
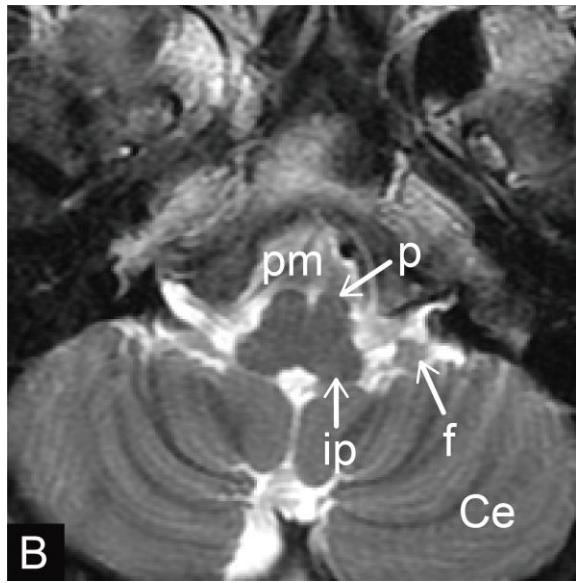
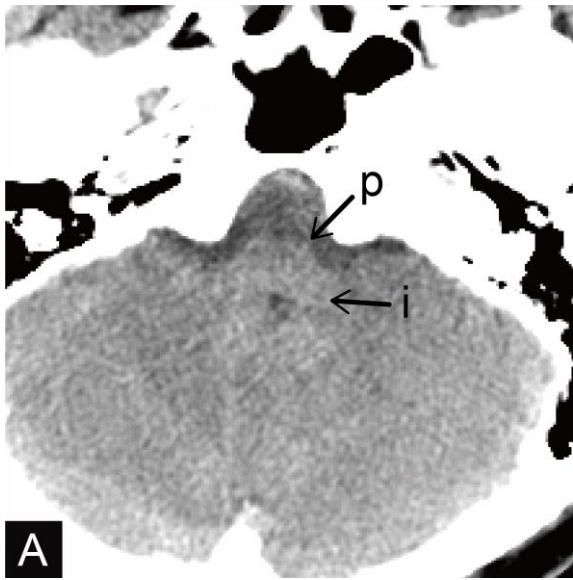


C



D

A. Pons 下段 B: Pons 上段
 sp: superior cerebellar peduncle (上小腦腳)
 mp: middle cerebellar peduncle (中小腦腳)
 pc: prepontine cistern (橋腦前腦池)
 7,8n: 7th and 8th cranial nerves (第7、8顱神經)
 5n: 5th cranial nerve (第5顱神經)
 4v: 4th ventricle (第4腦室)
 aq: aqueduct (導水管)
 Ce: cerebellar hemisphere (小腦半球)



延腦(medulla oblongata)

(A) CT 看延腦很不清楚。

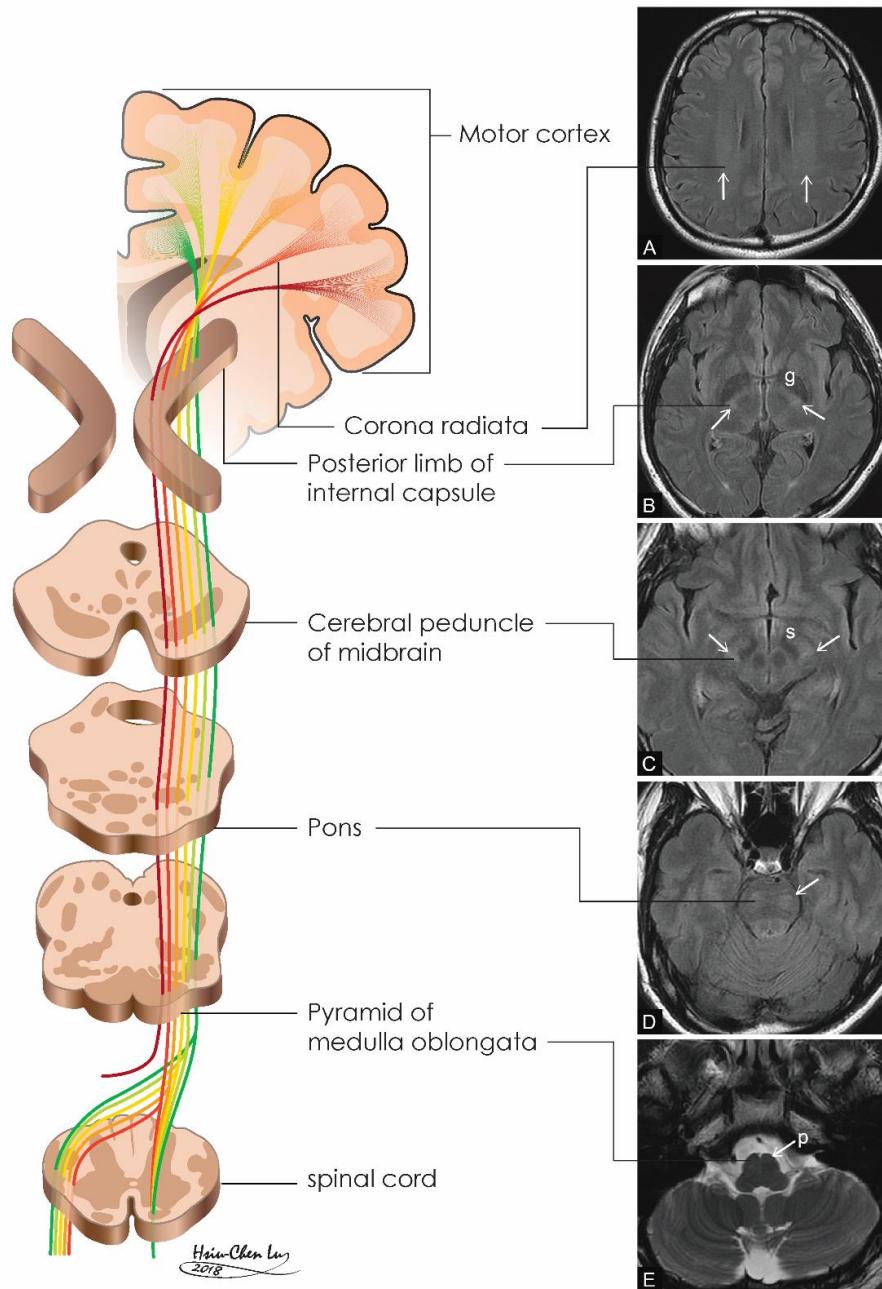
(B) MRI, T2WI 則可清楚看到延腦的外形以及周邊的構造。

整個延腦像一隻蝸牛。

Pyramid是傳達運動的corticospinal tract經過的一站，

因此這tract又稱為pyramidal tract。

- p: pyramid (錐體)
- ip: inferior cerebellar peduncle (下小腦腳)
- Ce: cerebellar hemisphere (小腦半球)
- f: flocculus (小腦絮球)
- t: tonsil (小腦舌部)
- pm: premedullary cistern (延腦前腦池)



大腦皮質脊髓徑(corticospinal tract) ， 又稱錐體徑(pyramidal tract)

正常corticospinal tract在MRI影像
(A)-(D)都是FLAIR, (E,F) T2WI

A. Corona radiata：在額頂葉之白質區，即
centrum semiovale之內，在FLAIR可見其內的
corona radiata稍白。

B. 往下在basal ganglia，corticospinal tract經
internal capsule的後肢(posterior limb)，呈現
比較白的小點。

g：globus pallidus

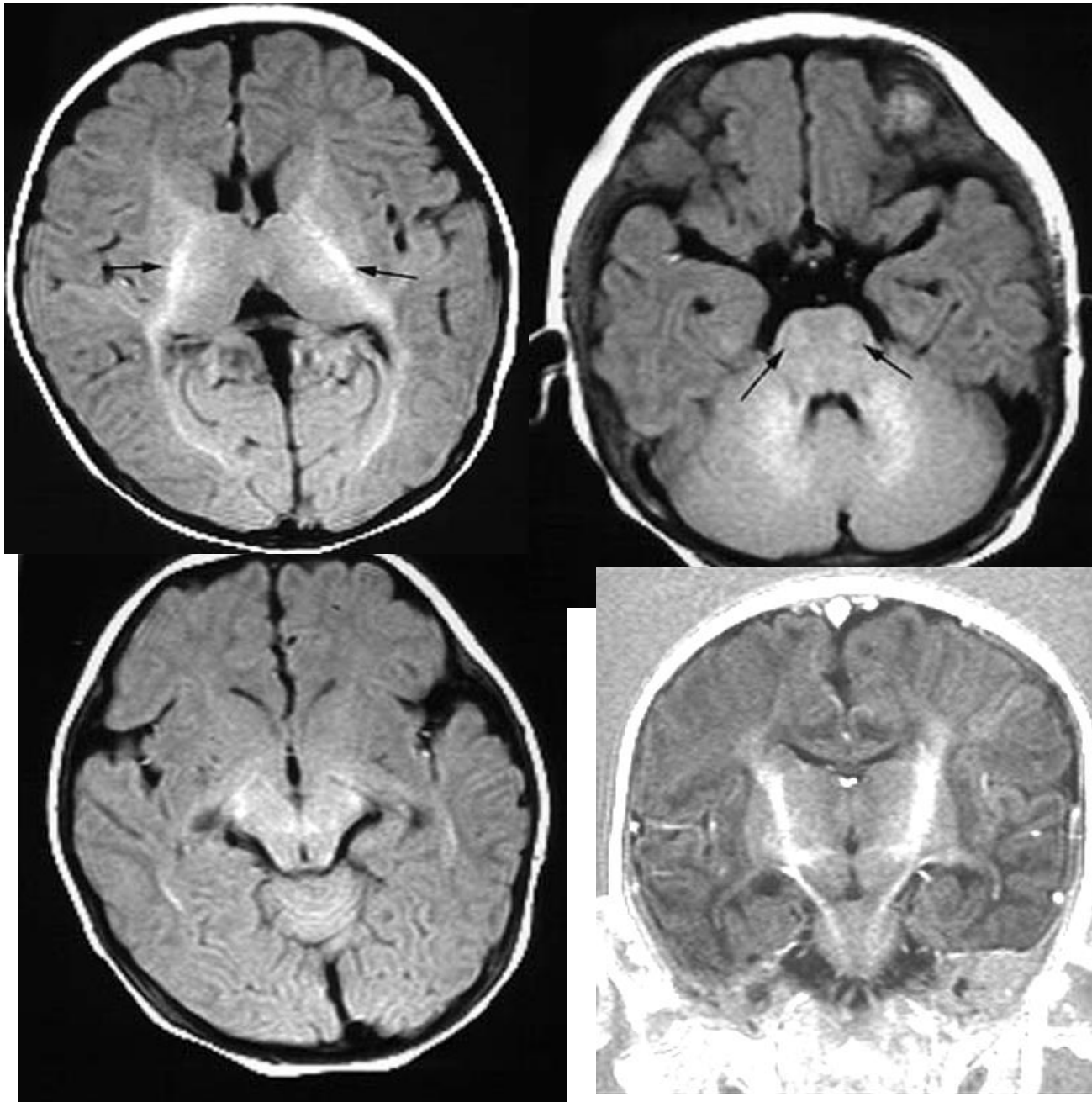
C. 往下到midbrain的大腦腳(cerebral
peduncle)，corticospinal tract在黑質之旁。

s：substantia nigra黑質

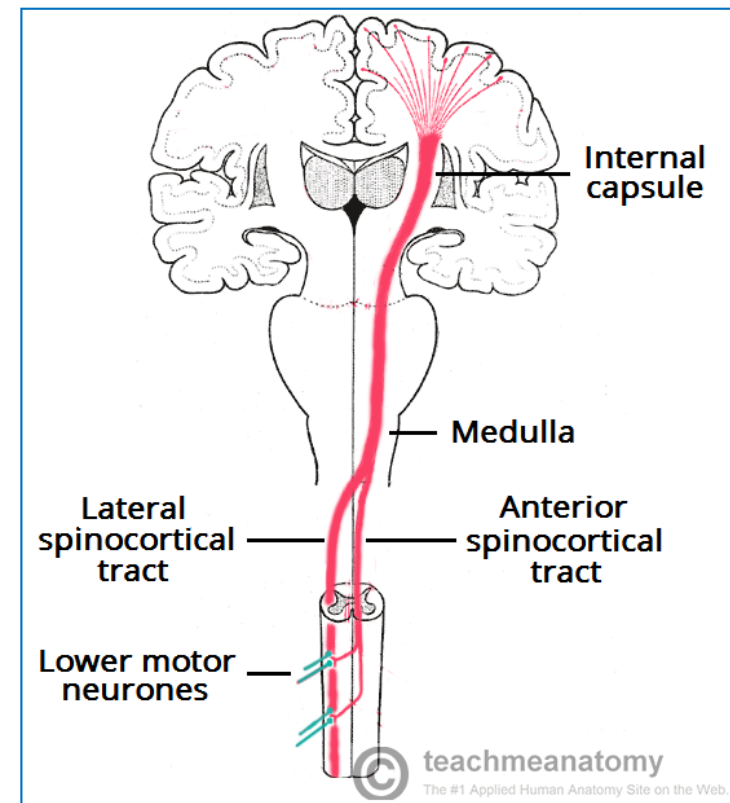
D. 往下到pons，corticospinal tract較白。

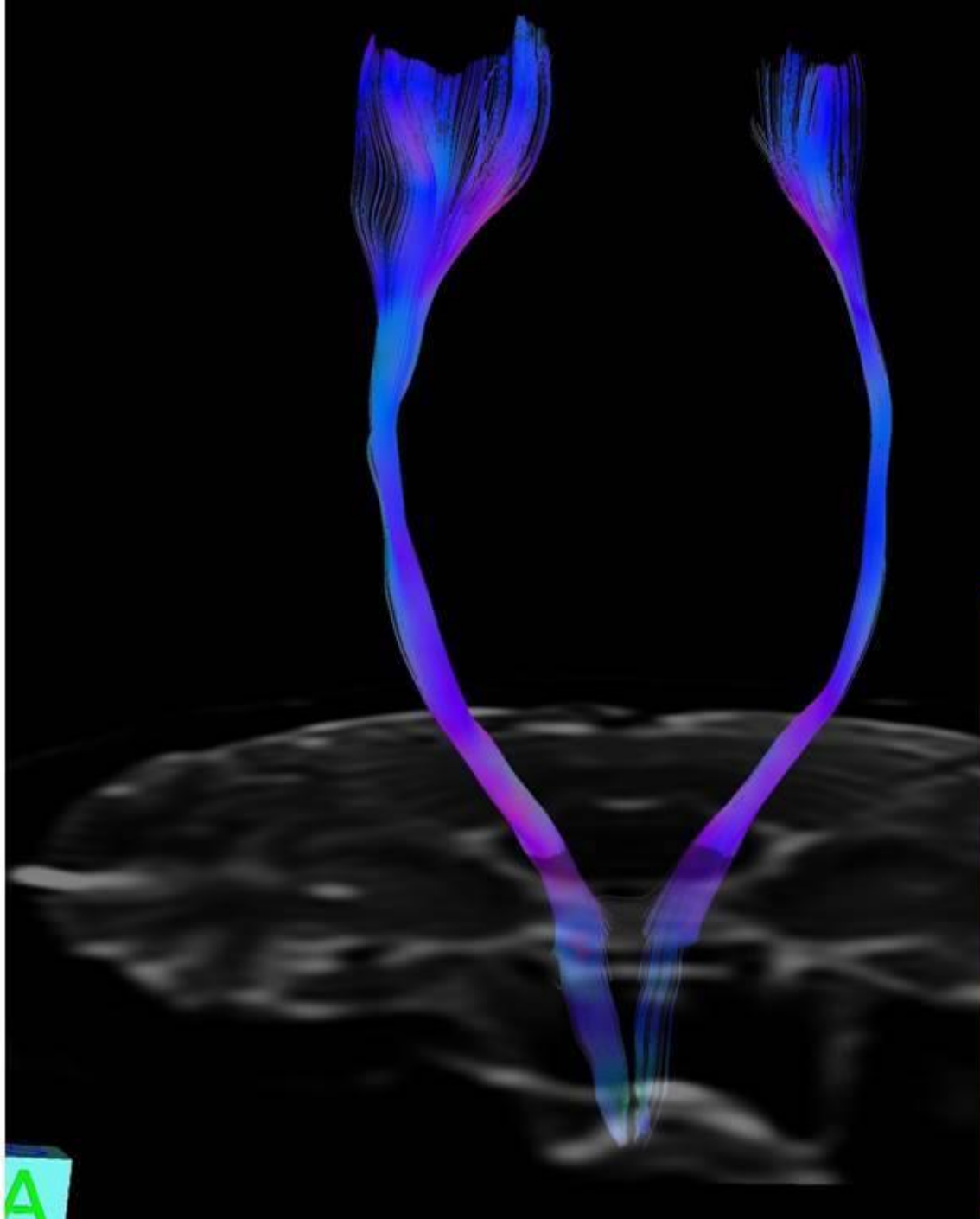
E. 往下到medulla oblongata的pyramid(p)。

F. coronal section，可見整條corticospinal
tract(arrows)。



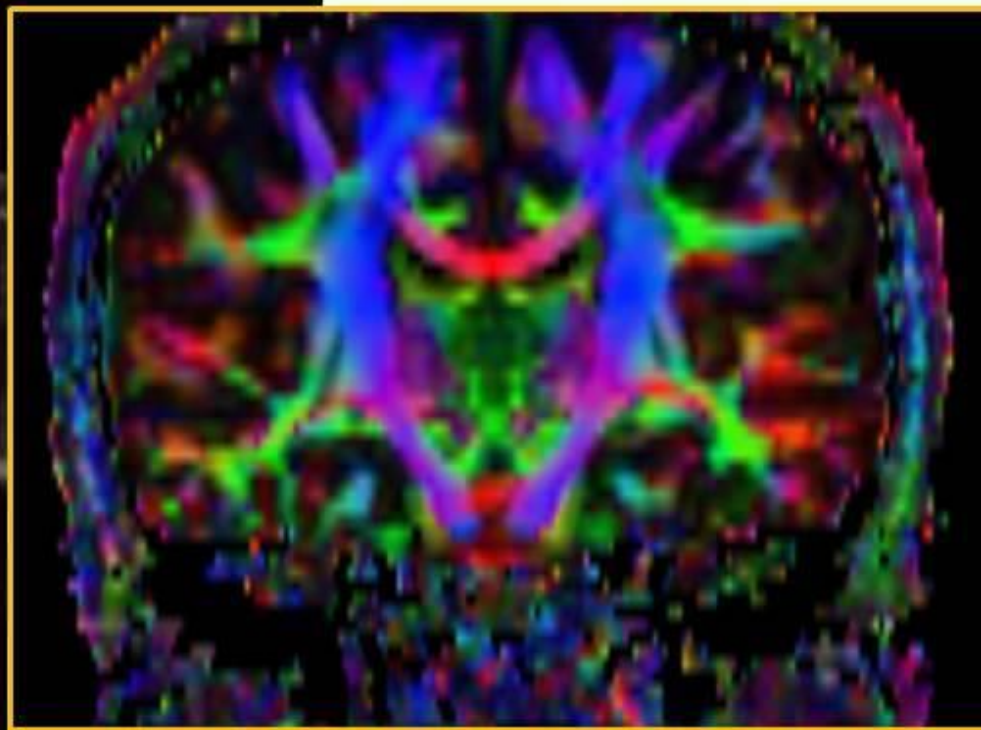
T1WI in a 2 m/o baby, showing the myelination areas (bright in T1WI) along the pyramidal tract

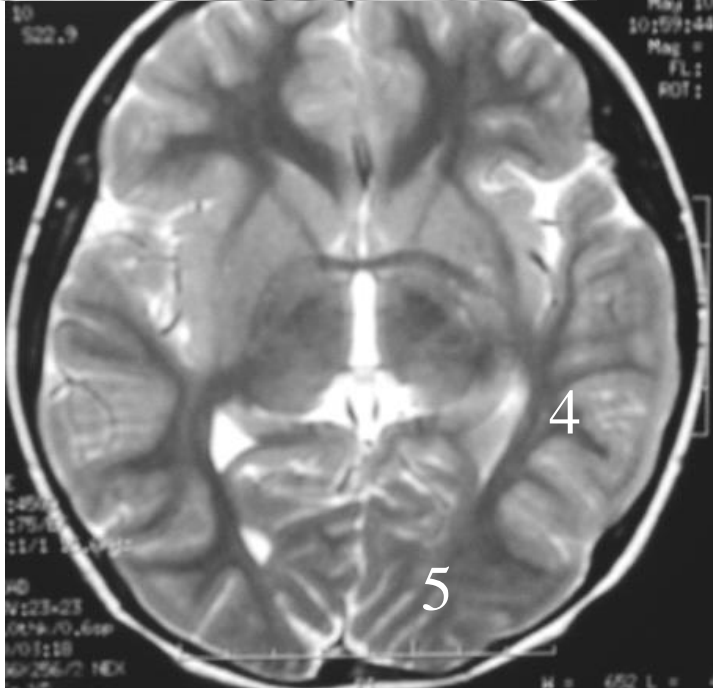
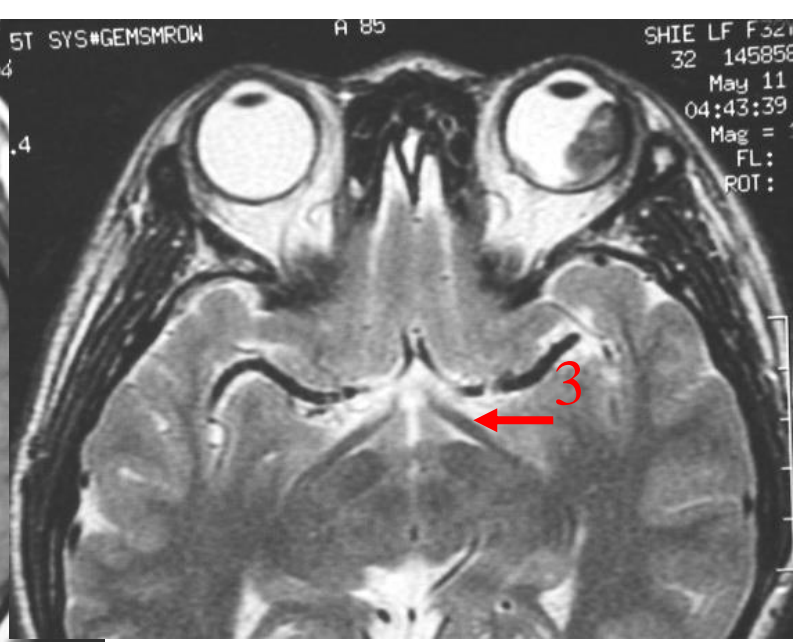
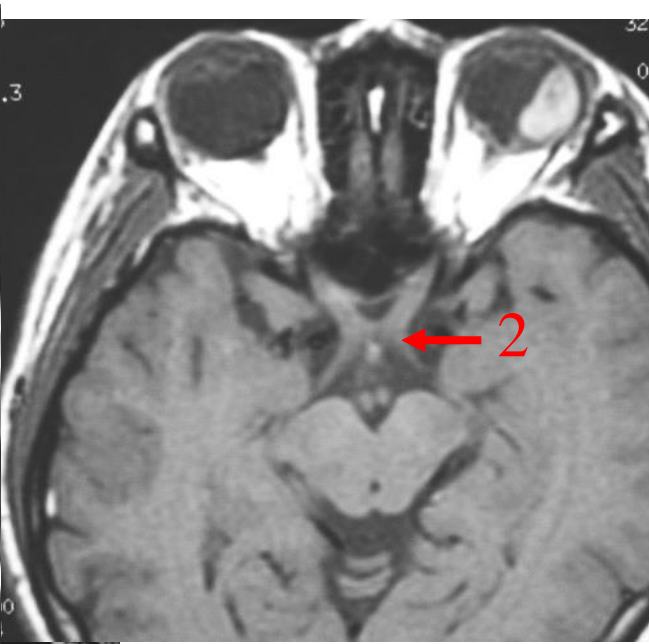




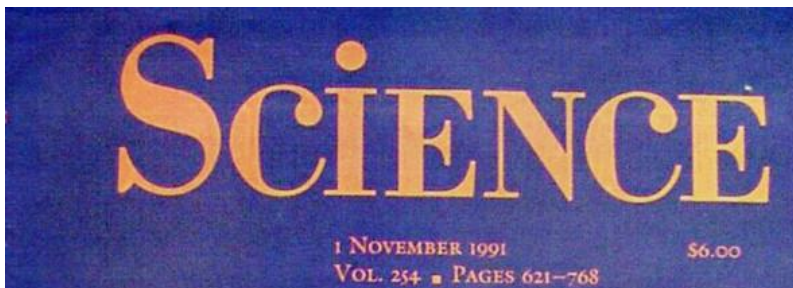
(圖11)
本院放射部使用
GE 3.0T MRI，DTI 技術做出
corticospinal tract 漂亮的
彩色影像。

放射部
陳君明博士研究員提供





- 1. Optic nerve.(視神經) 2. Optic chiasm.
3. Optic tract.
4. Optic radiation
5. Visual cortex (calcarine cortex)
(視覺皮質)



November, 1991,
Science

首篇論文以functional MRI
證實枕葉感應視覺



**Functional Mapping of the Human Visual Cortex by
Magnetic Resonance Imaging**

J. W. BELLIVEAU,* D. N. KENNEDY, R. C. MCKINSTRY,
B. R. BUCHBINDER, R. M. WEISSKOFF, M. S. COHEN, J. M. VEVEA,
T. J. BRADY, B. R. ROSEN

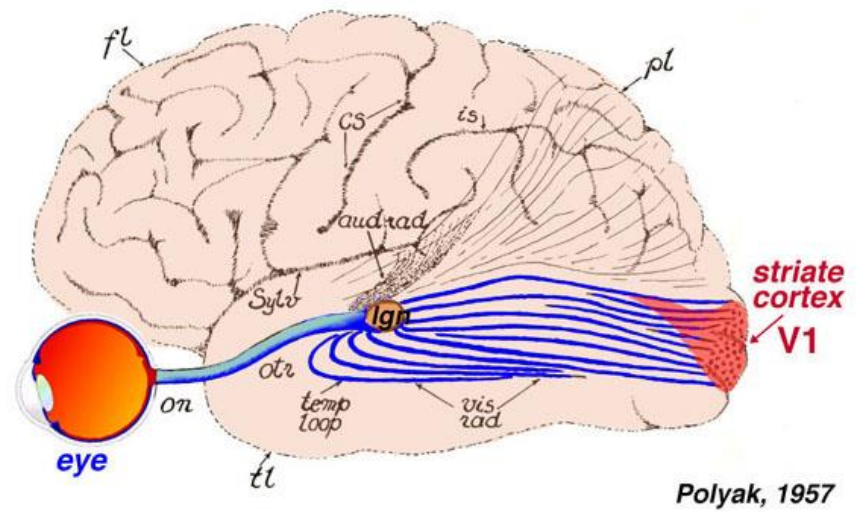
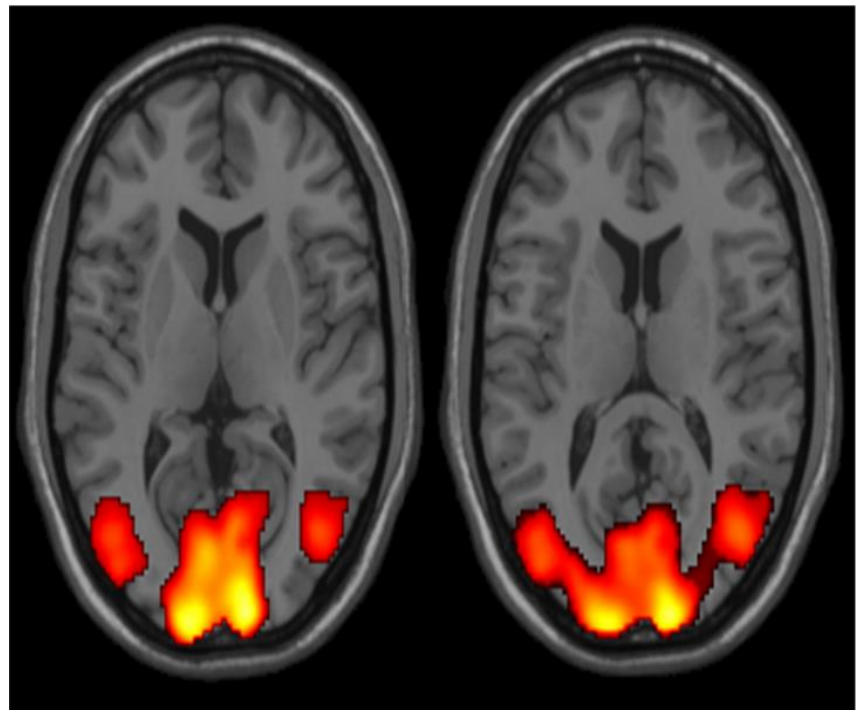
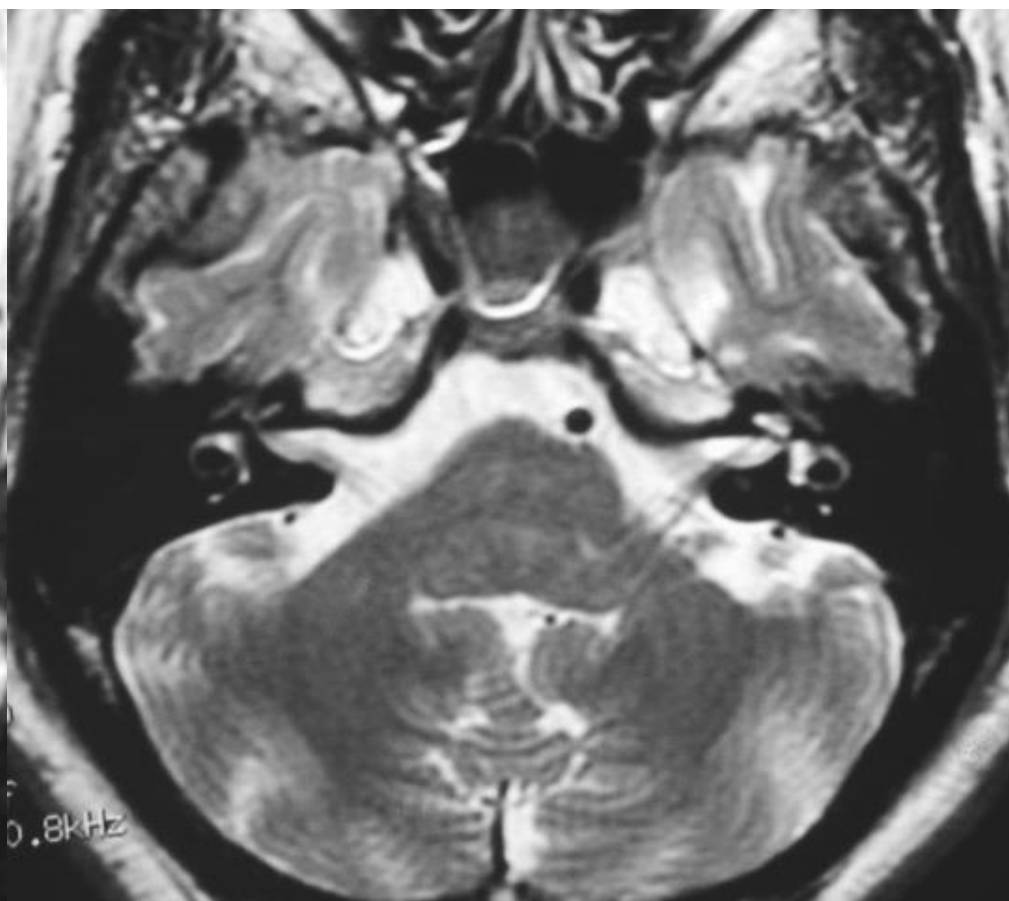
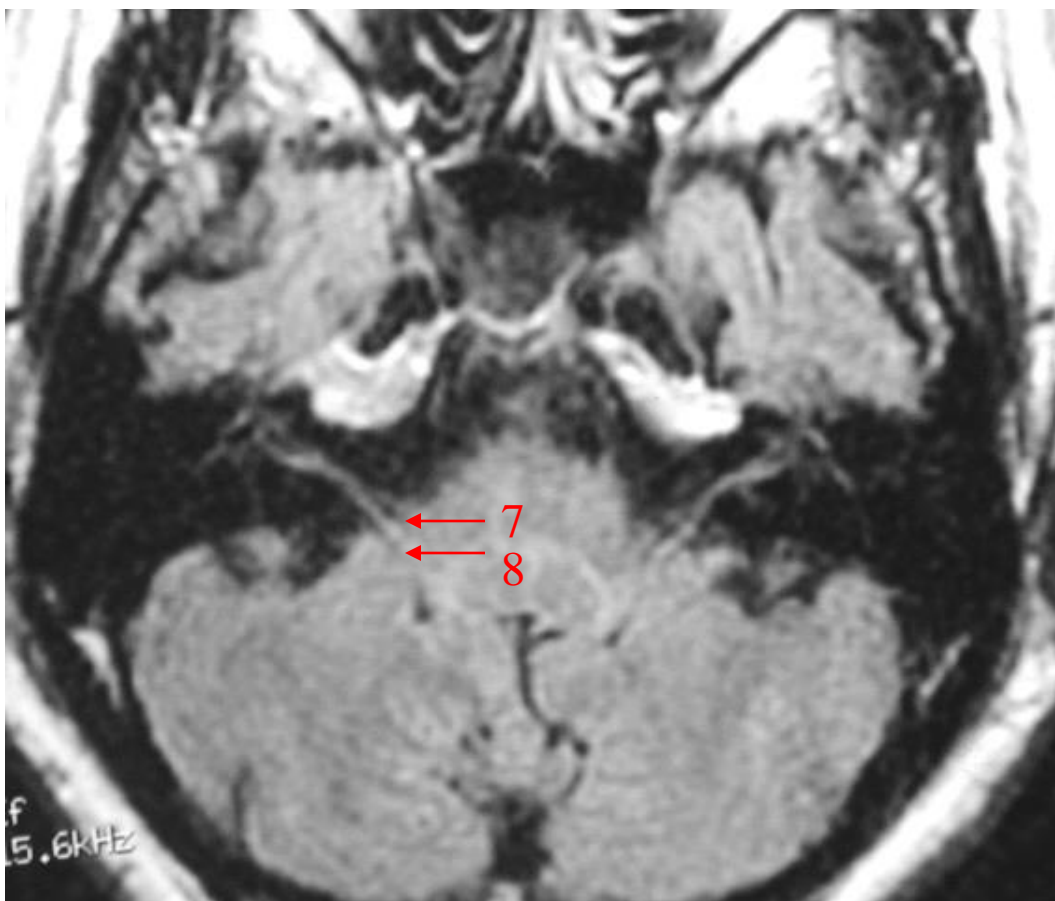


Figure 8. Visual input to the brain goes from eye to LGN and then to primary visual cortex, or area V1, which is located in the posterior of the occipital lobe. Adapted from Polyak (1957).

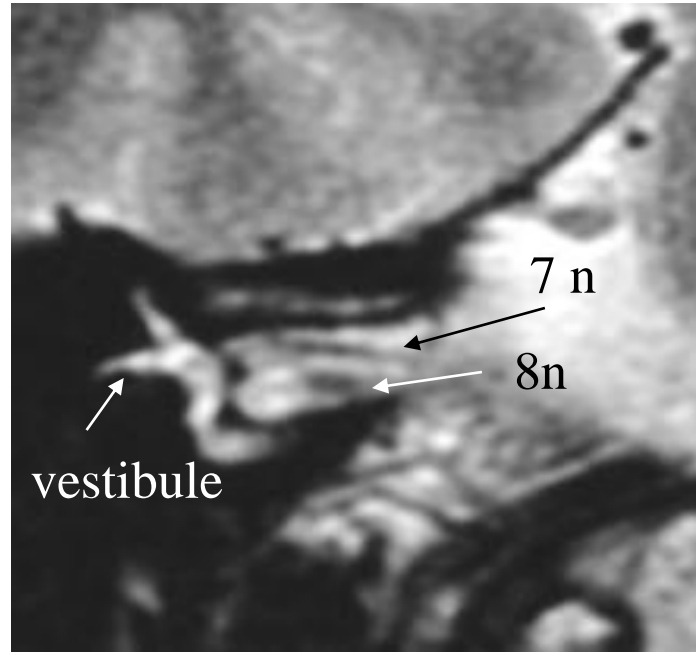
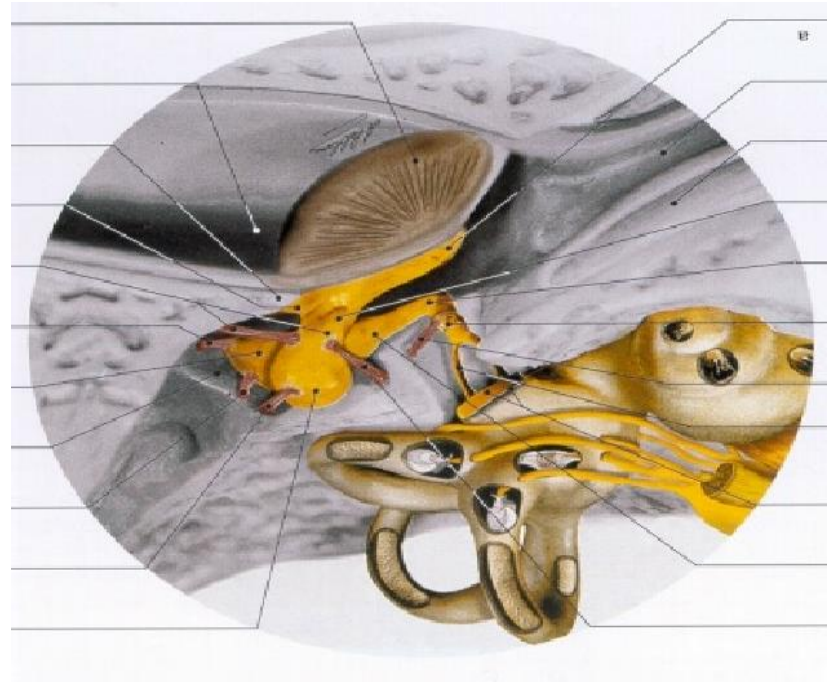
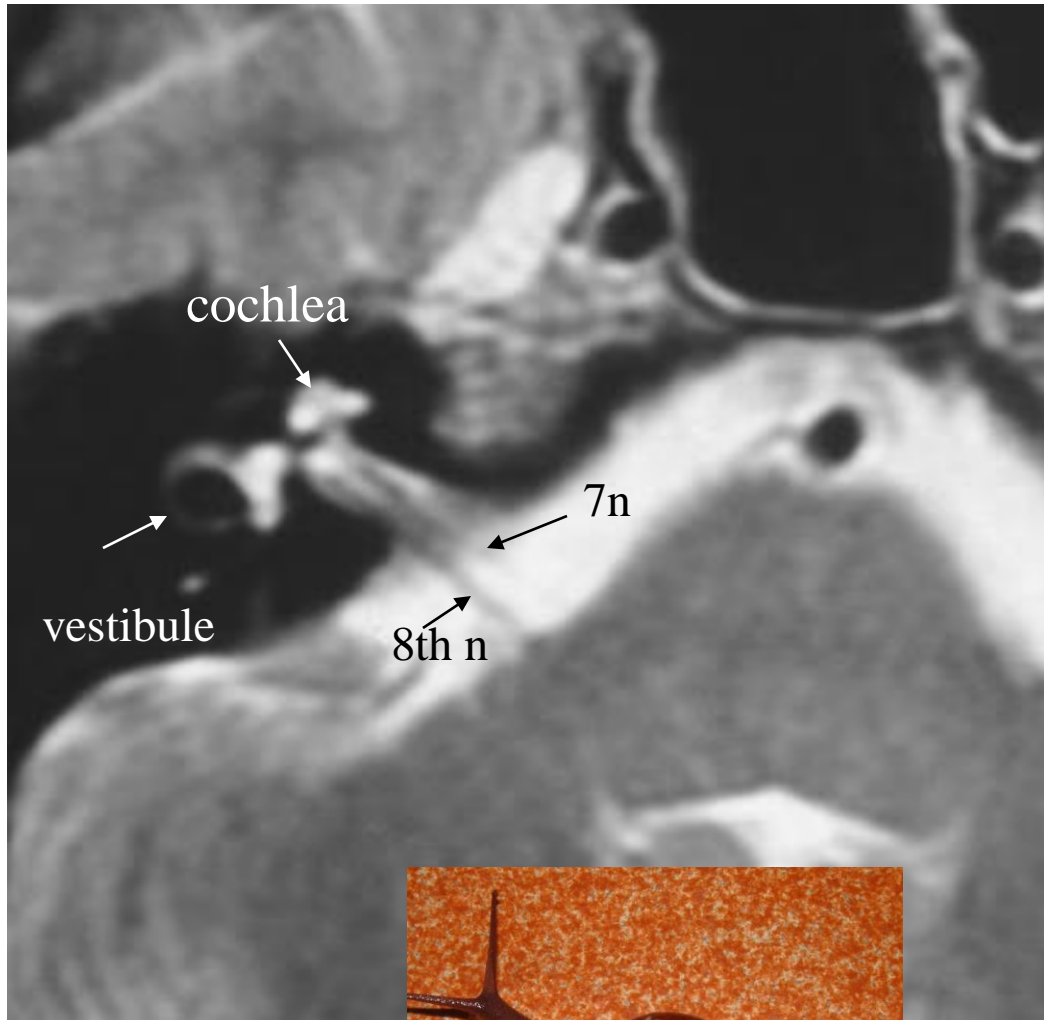


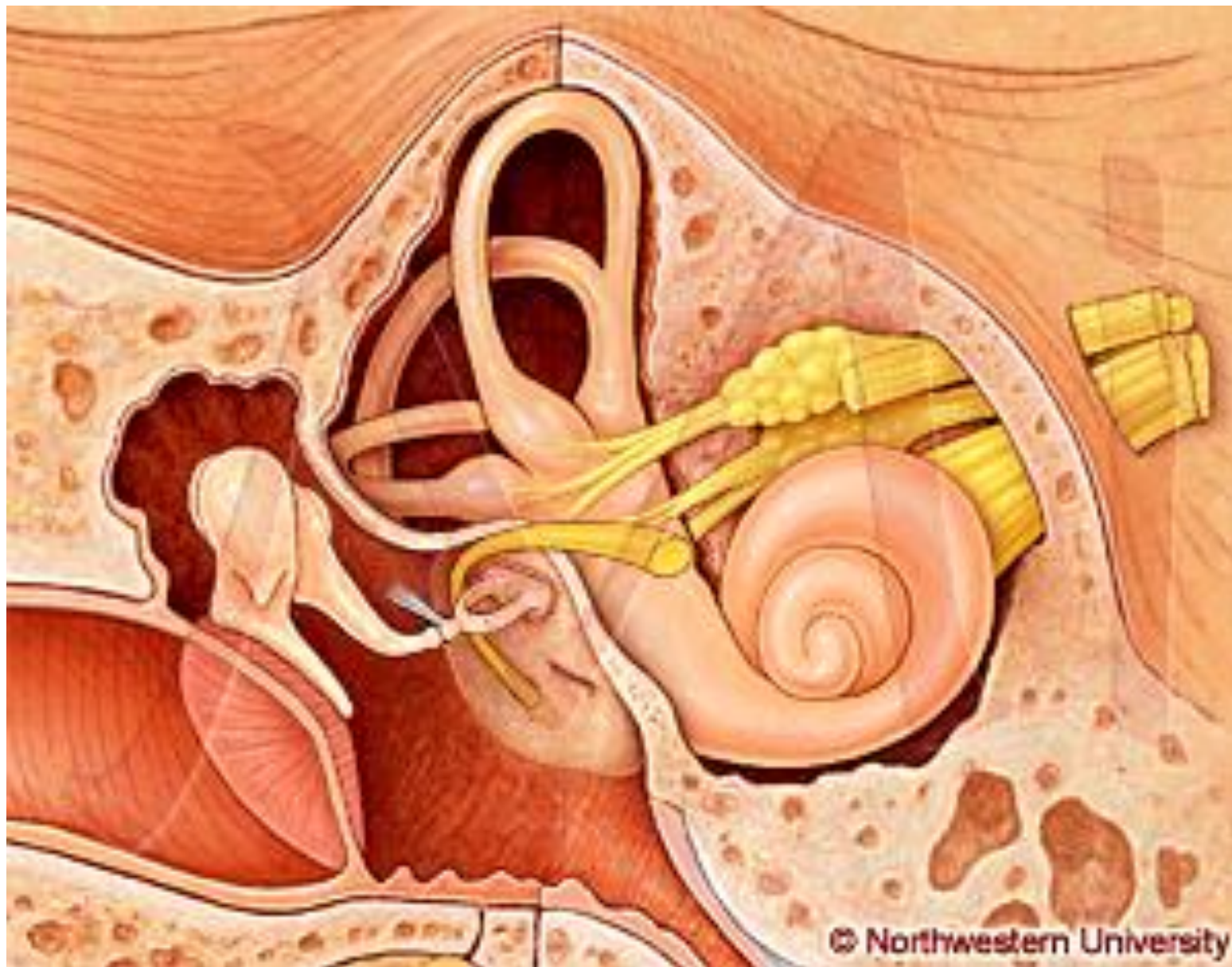
8th and 7th cranial nerves(第七、第八顱神經)



顏面神經

聽神經

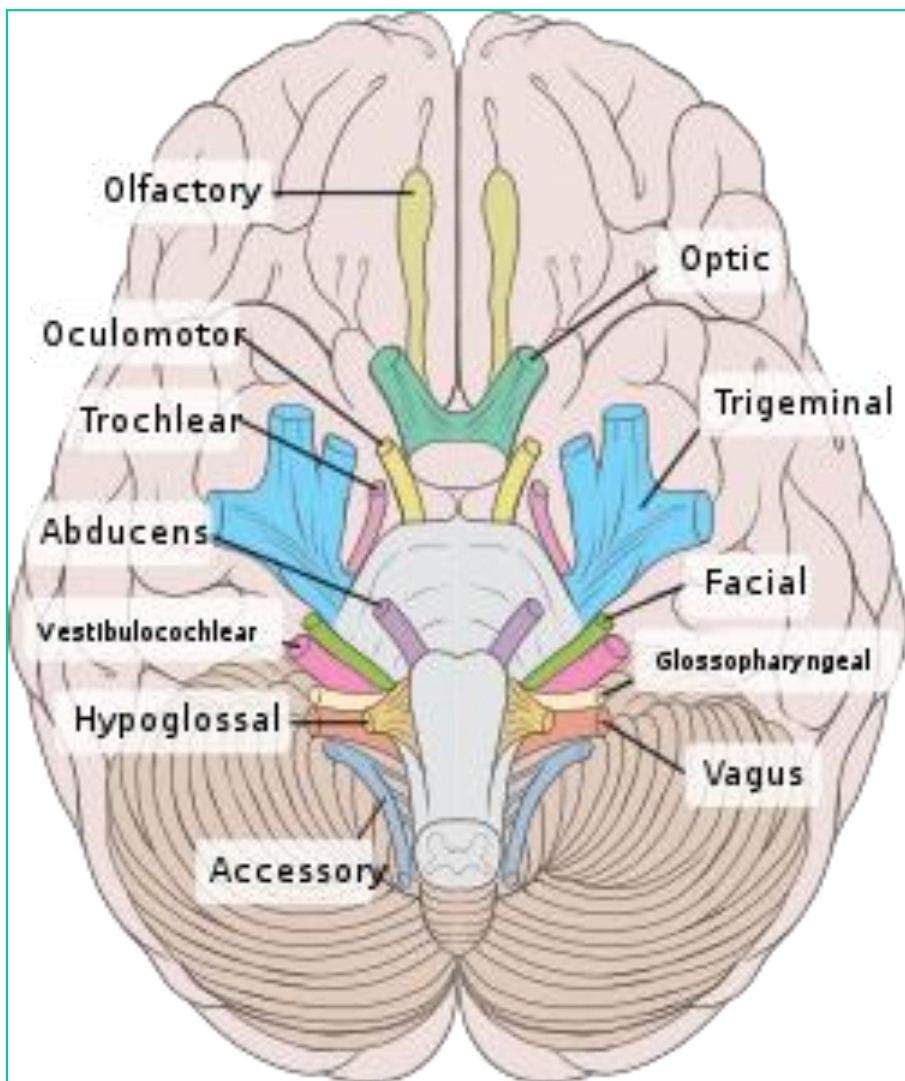




聽覺的產生

12對顱神經歌訣

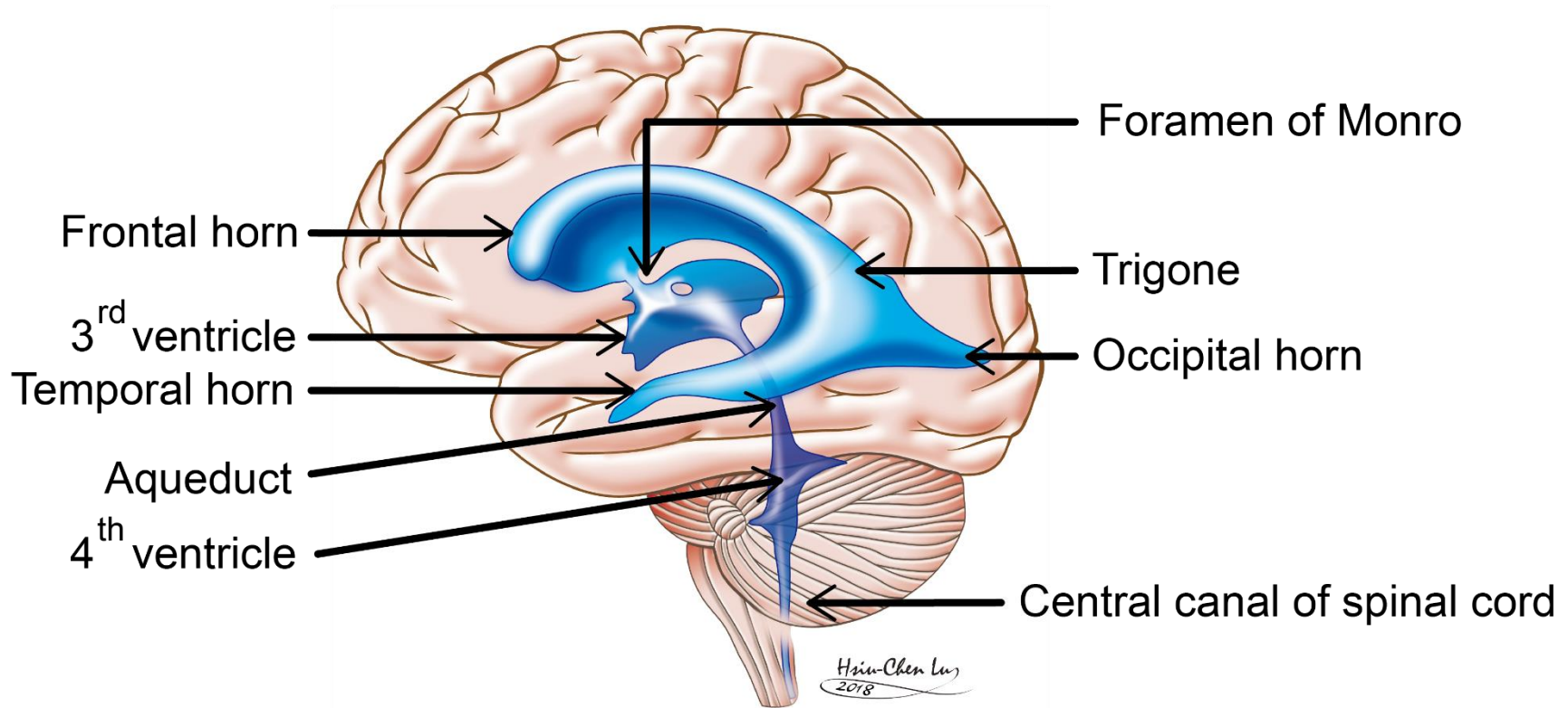
一嗅二視三動眼，四滑五叉六外旋，
七面八聽九舌咽，十迷十一副舌下全



<https://www.youtube.com/watch?v=sAFaTaavmO8&index=5&list=PL4Cuo-fGFLUhg4fE0WBpzEbMgMZIJxv5C&t=0s>

https://www.youtube.com/watch?v=0lbwshg_Kj4&t=0s&index=6&list=PL4Cuo-fGFLUhg4fE0WBpzEbMgMZIJxv5C

認識 腦室 及 腦池

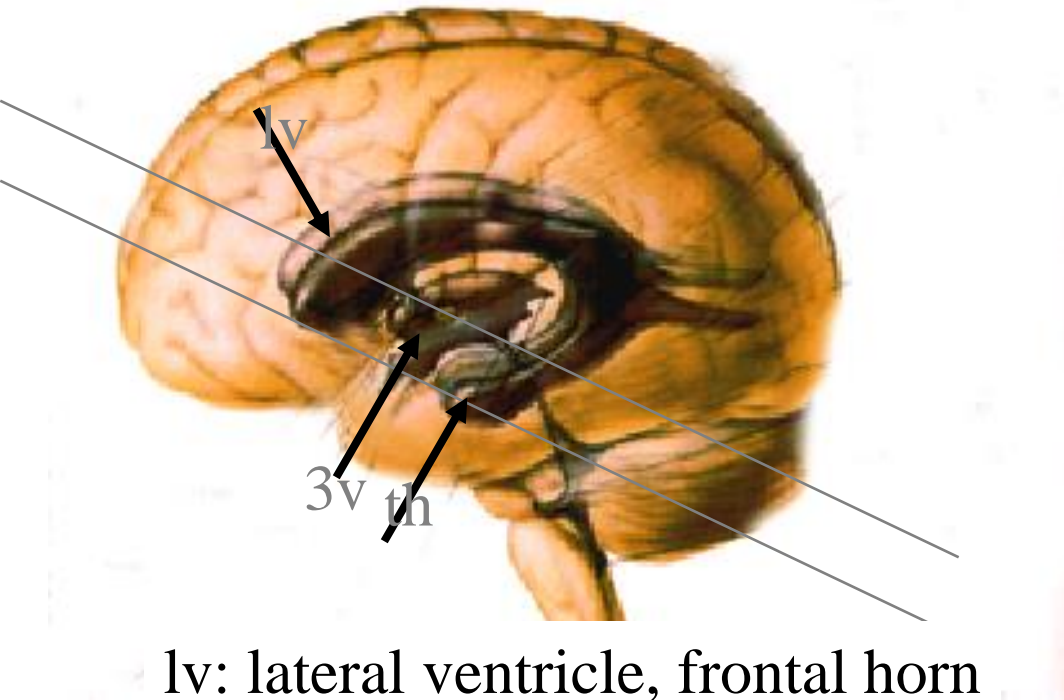
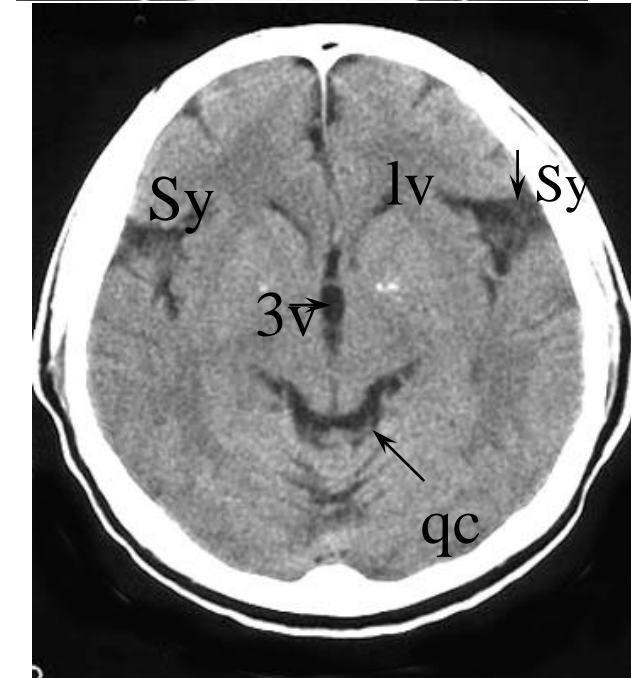
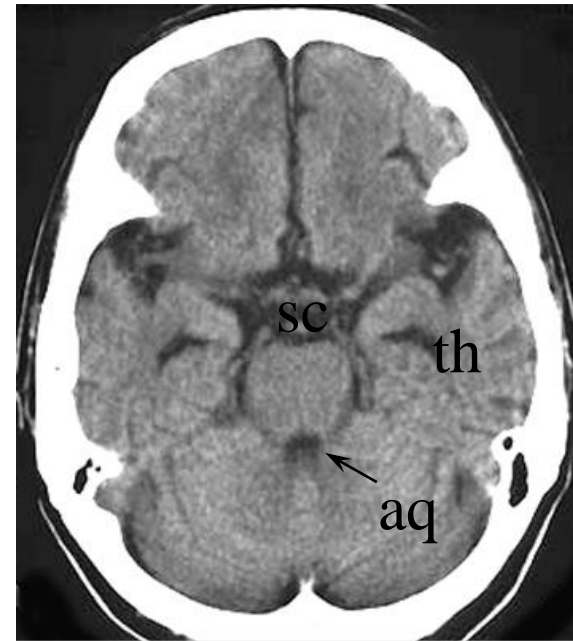


認識腦室及腦池

sc: suprasellar cistern(蝶鞍上腦池)

aq: aqueduct(大腦導水管)

th: temporal horn of lateral ventricle

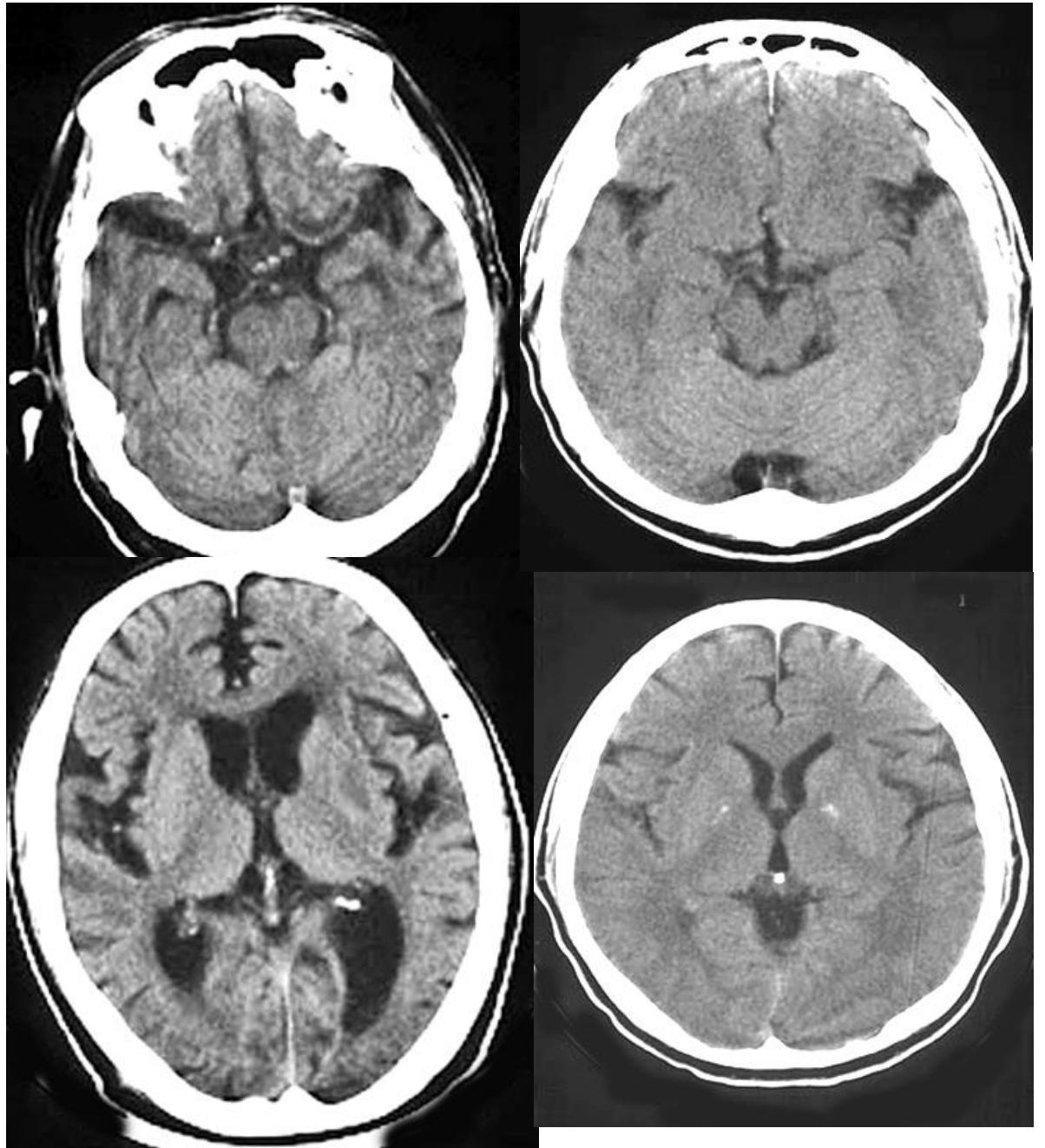
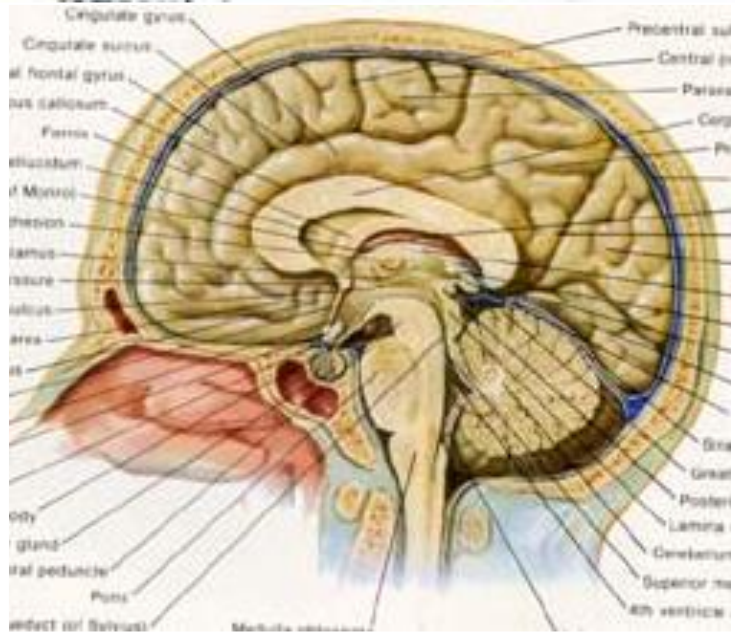
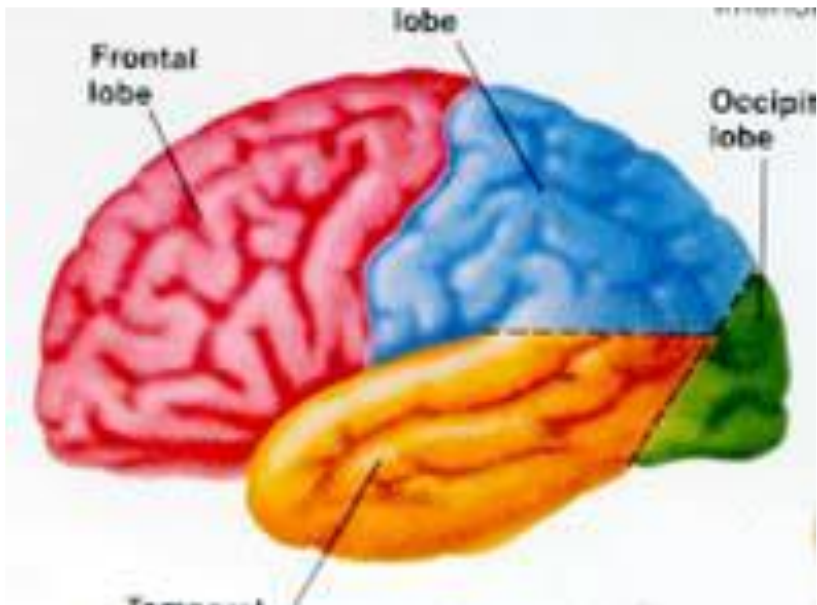


lv: lateral ventricle, frontal horn

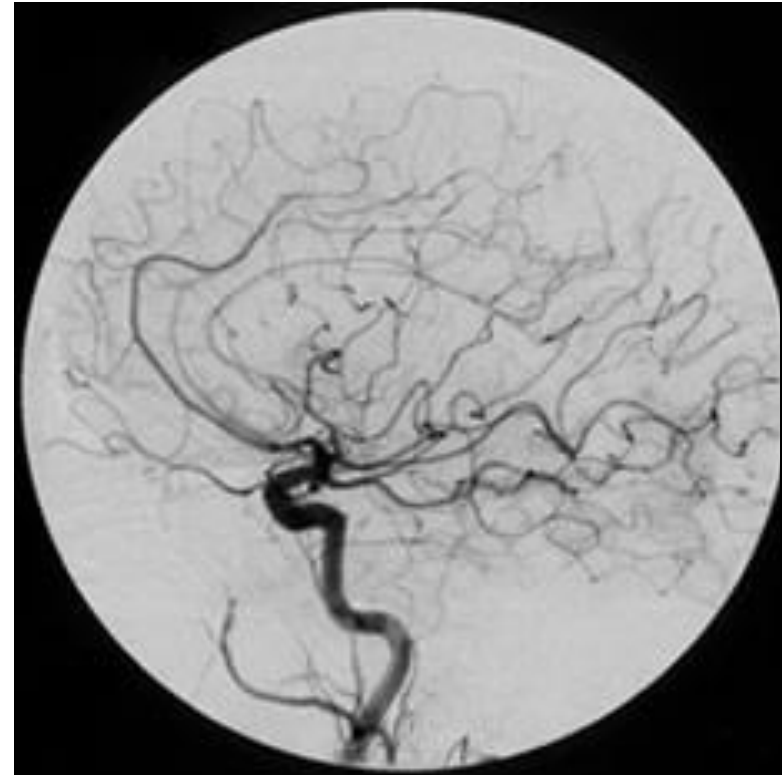
3v: 3rd ventricle

qc: quadrigeminal cistern

Sy: Sylvian fissure



Angiography, 血管攝影



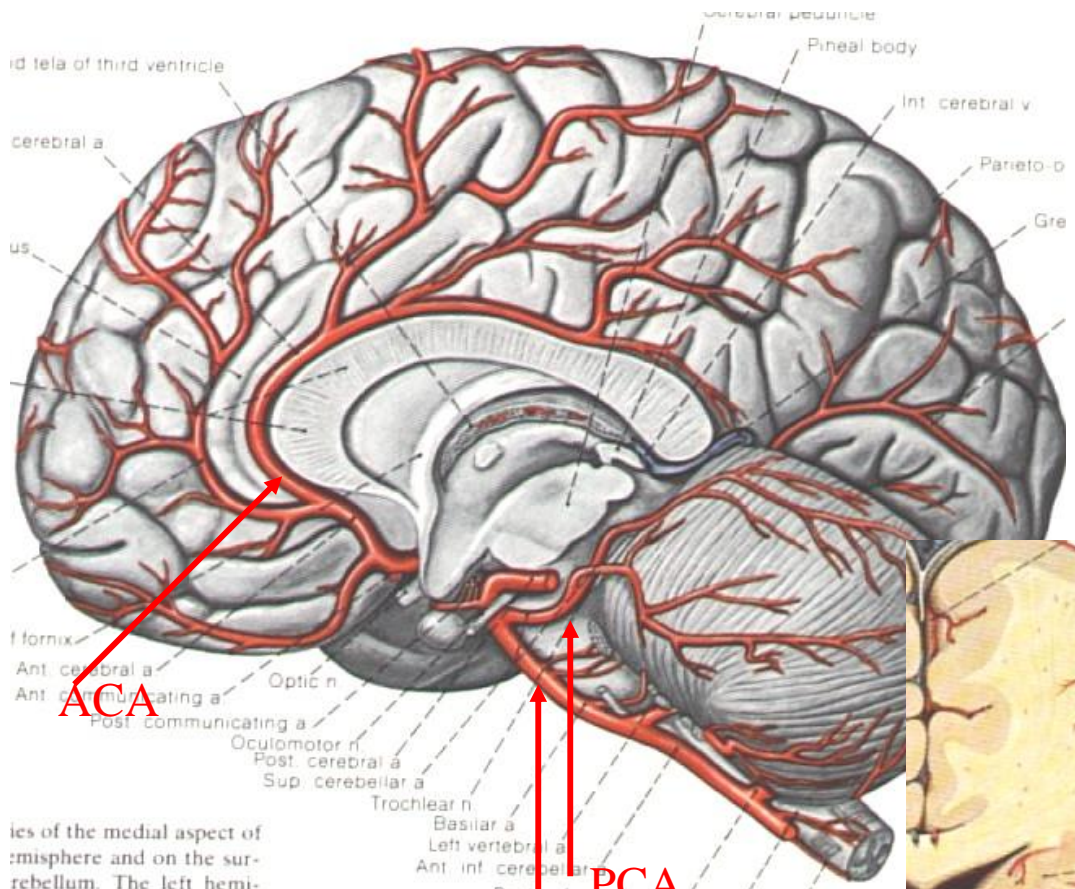
DSA:
Digital subtraction angiography
(數位贅影去除血管攝影)



CTA:
CT angiography



MRA:
MR angiography



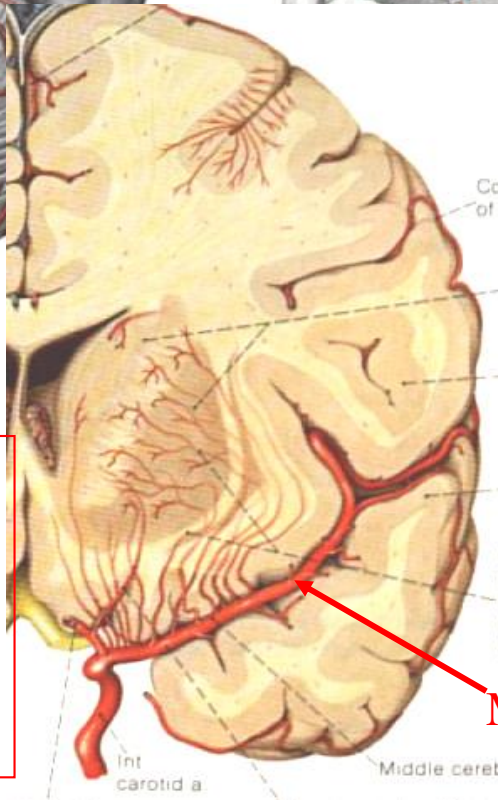
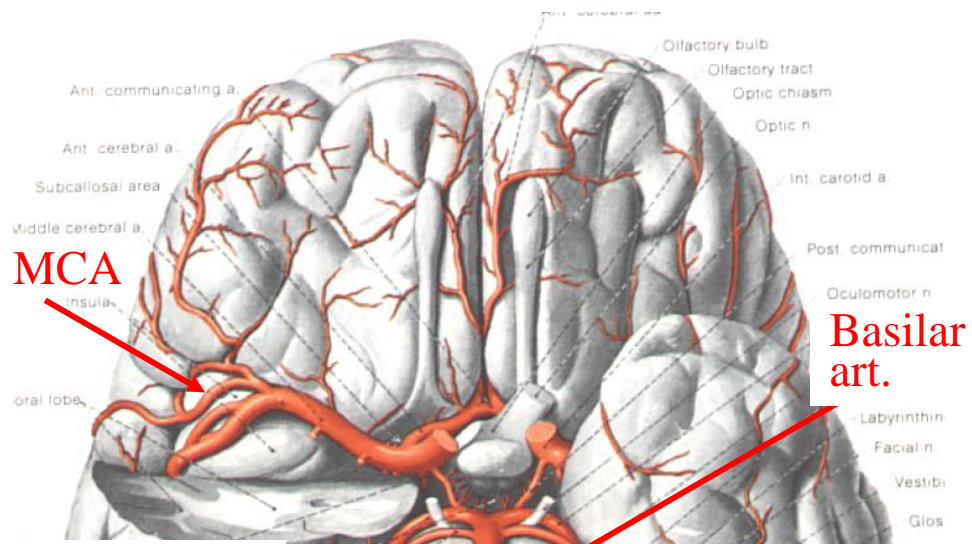
ACA

PCA

Basilar artery

MCA

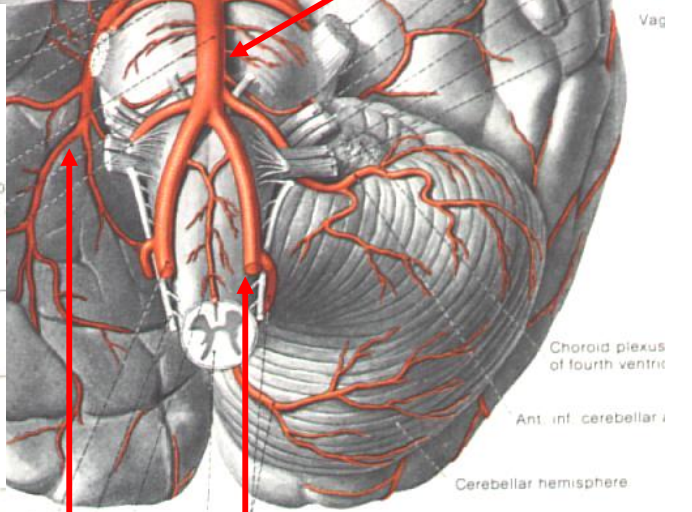
Basilar art.



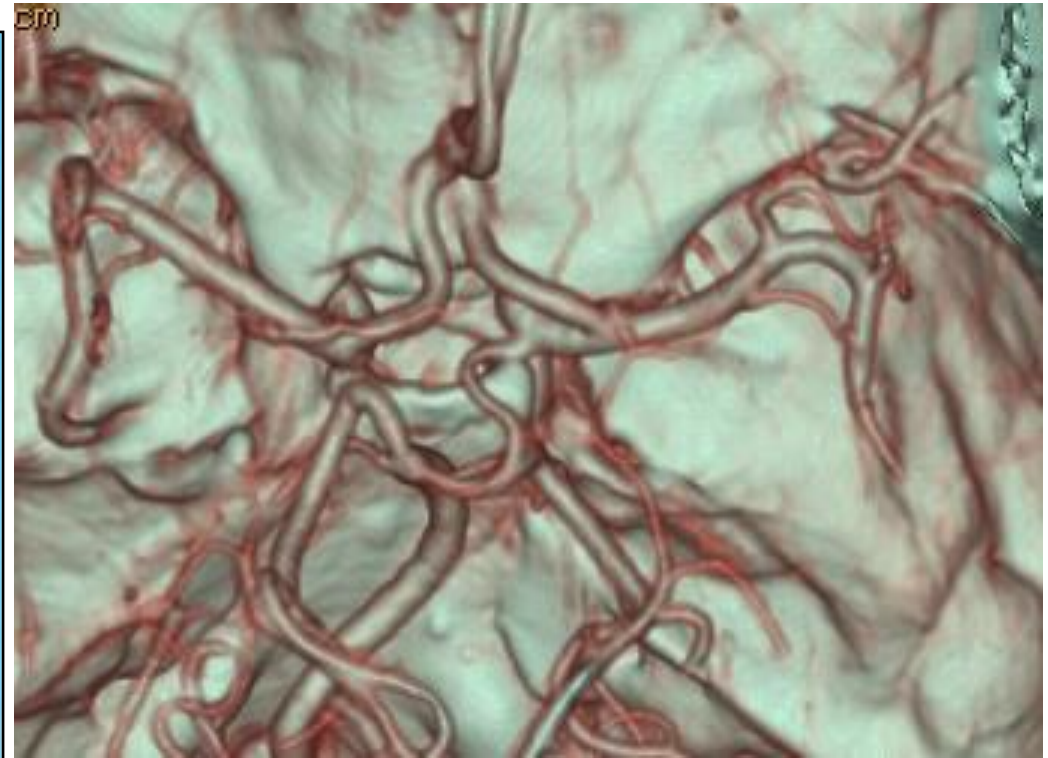
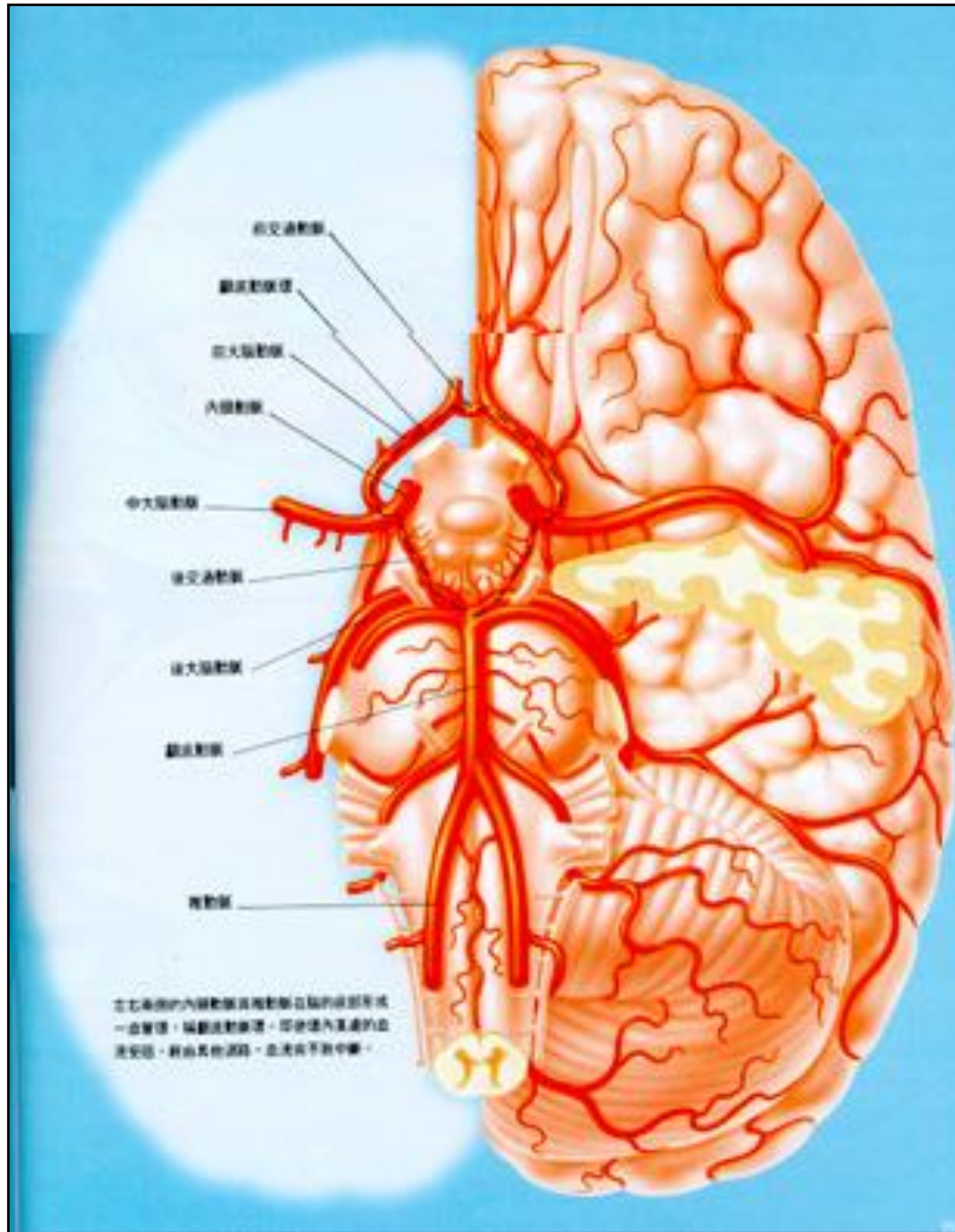
MCA

PCA

Vertebral artery



Anterior cerebral artery (ACA) 前腦動脈
 Middle cerebral artery (MCA) 中腦動脈
 Posterior cerebral artery (PCA) 後腦動脈
 Basivertebral arteries 基底動脈
 (basilar art. and bilateral vertebral art.)



Circle of Willis:

Posterior communicating arteries (PCoA)

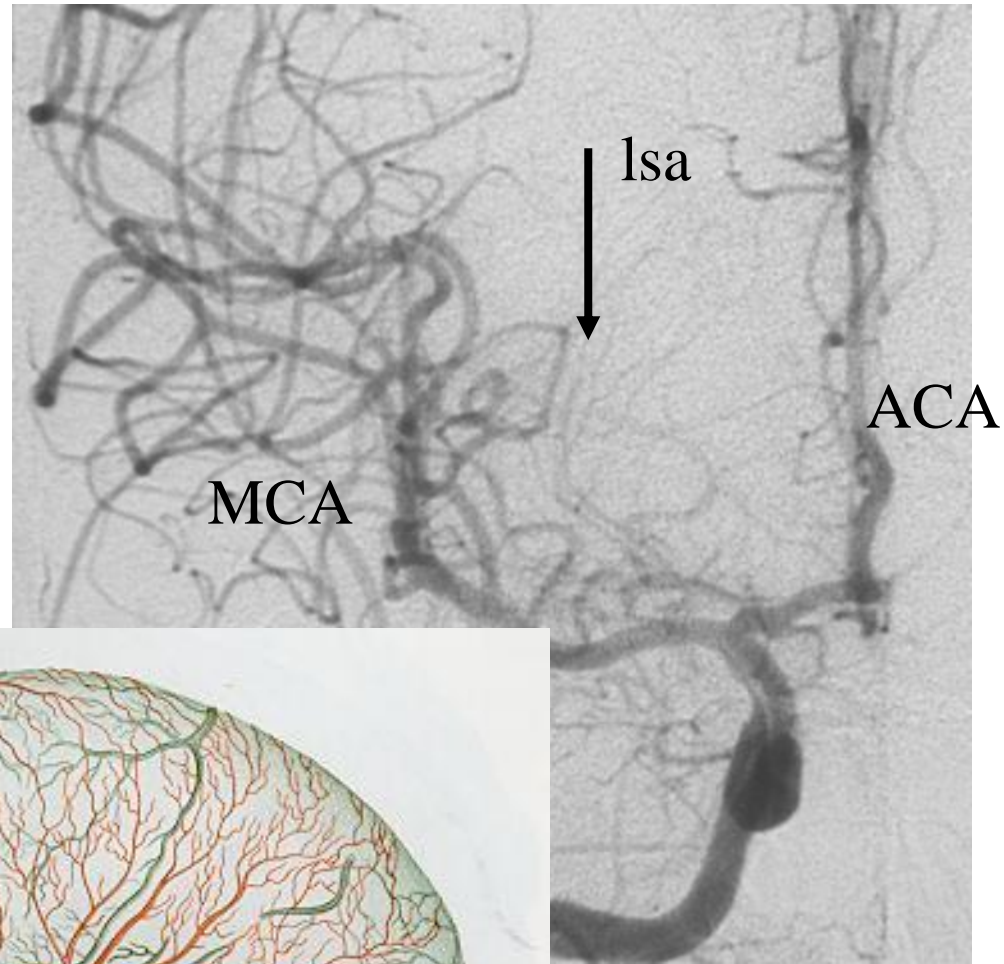
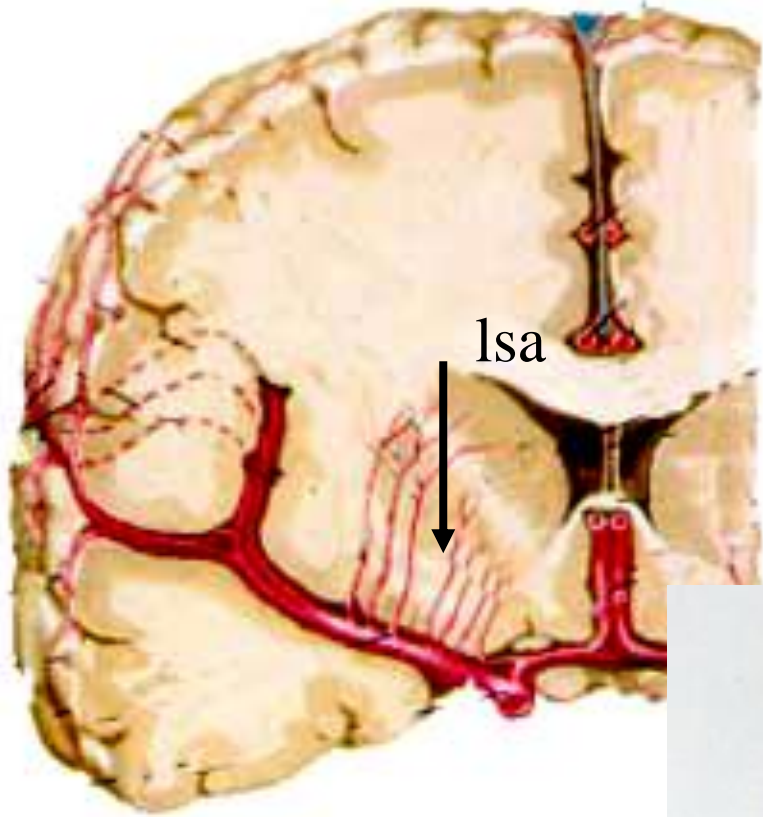
Anterior communicating artery (ACoA)

Proximal posterior cerebral arteries (PCA)

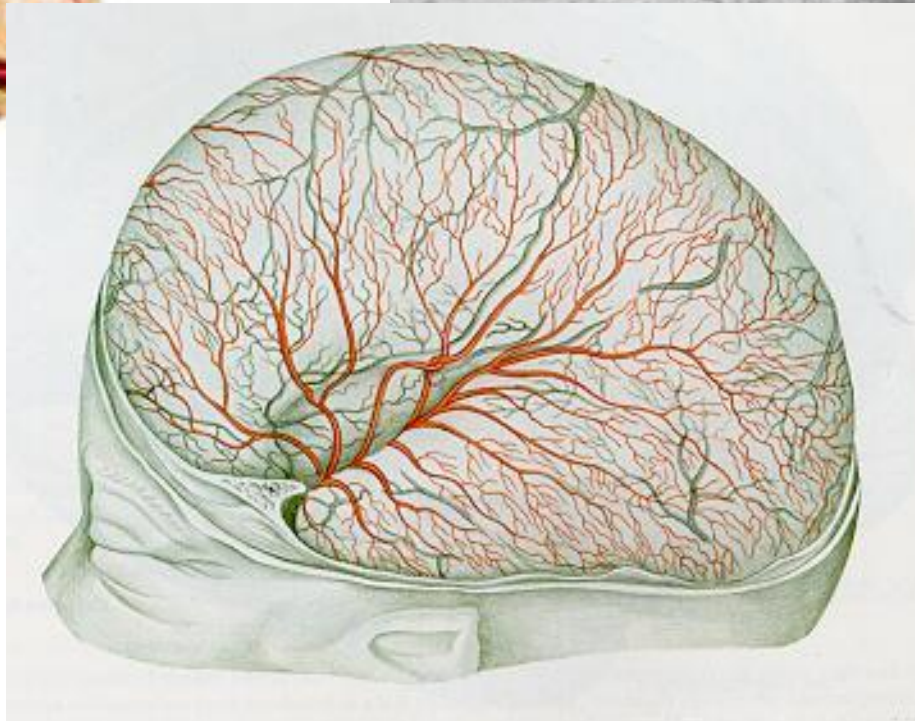
Distal internal carotid arteries (ICA)

A1 portions of anterior cerebral arteries (ACA)

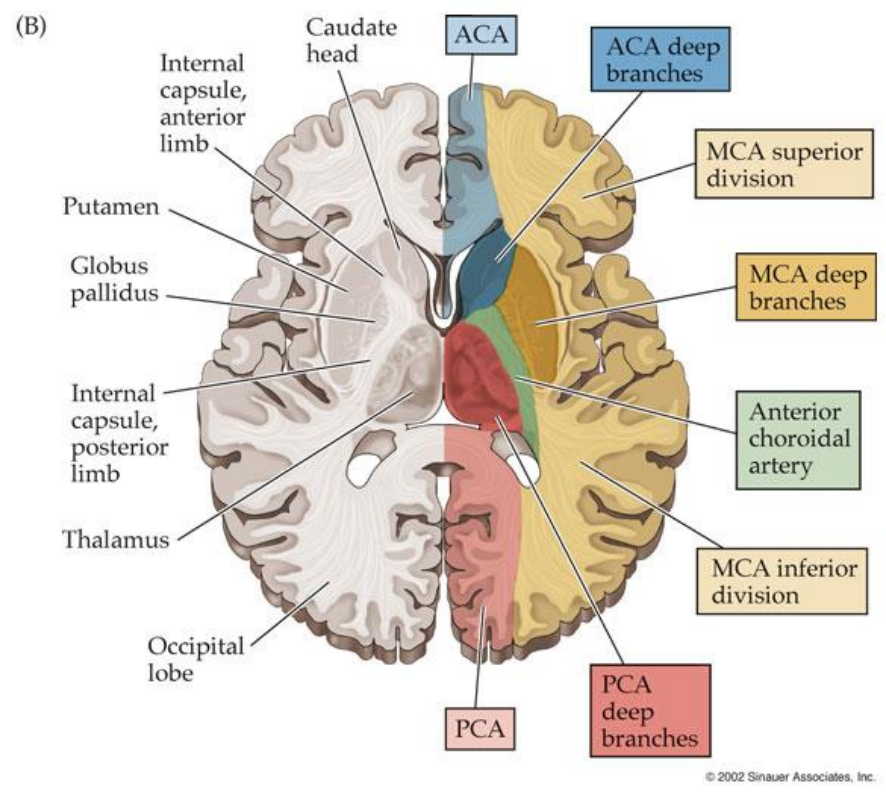
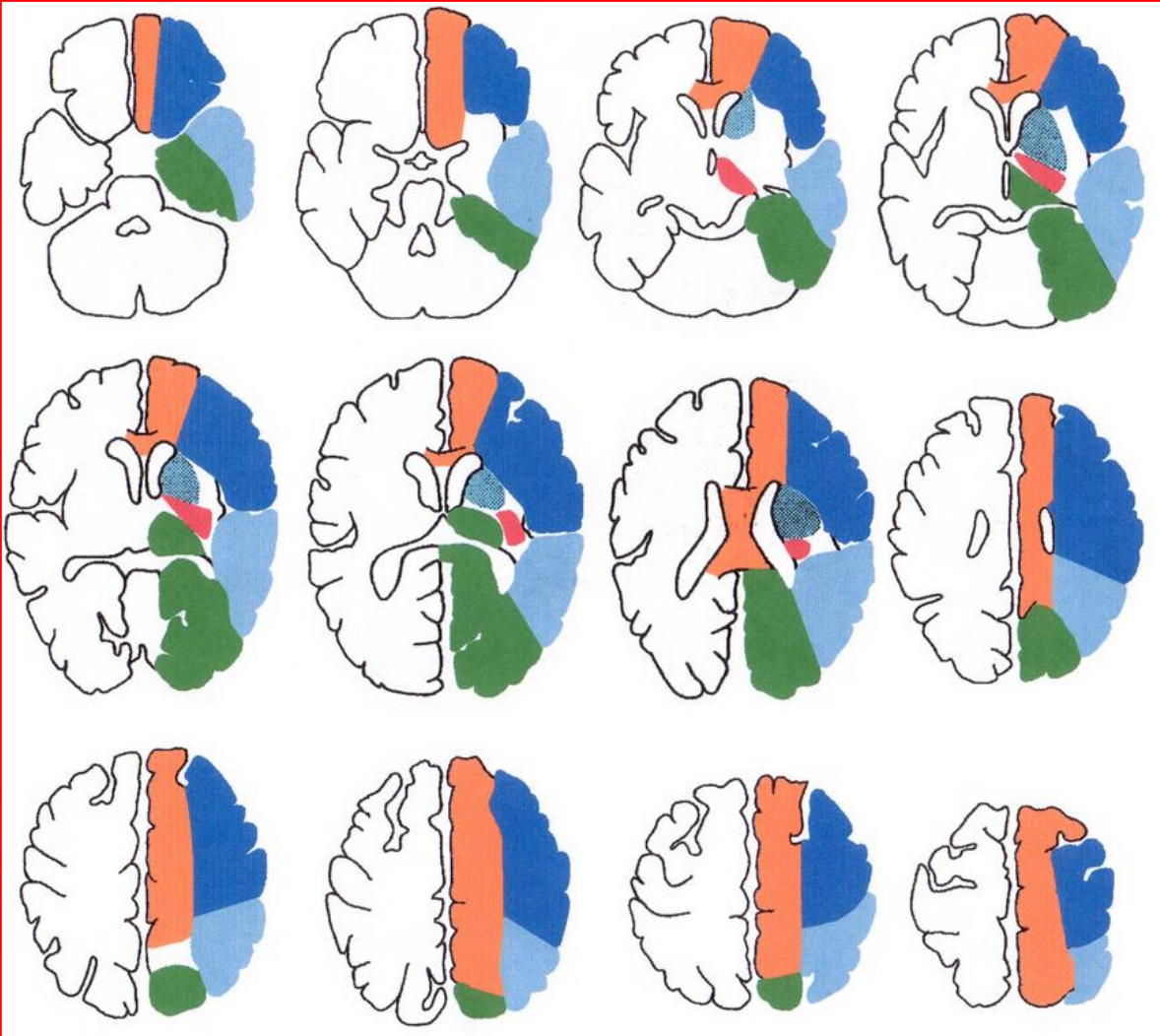
韋氏環



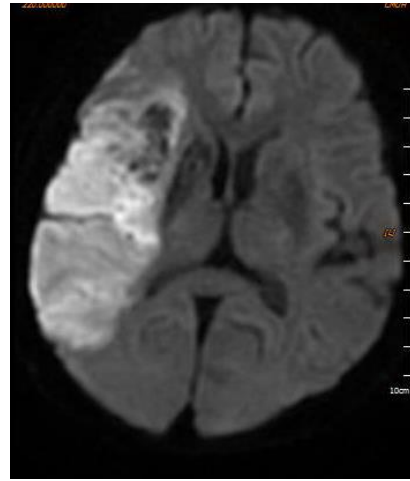
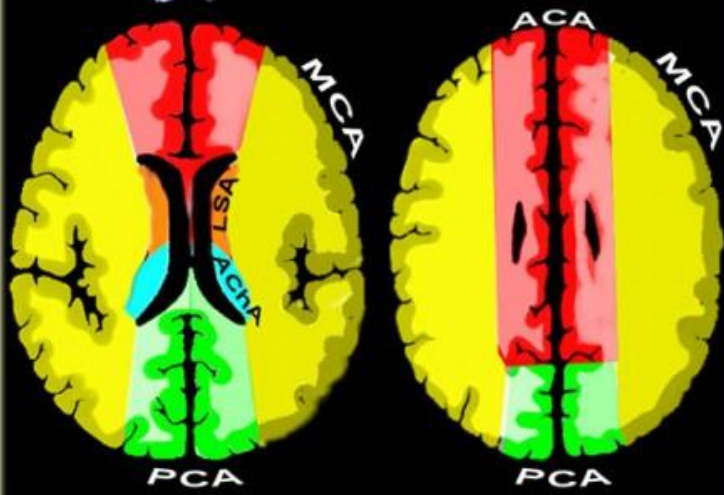
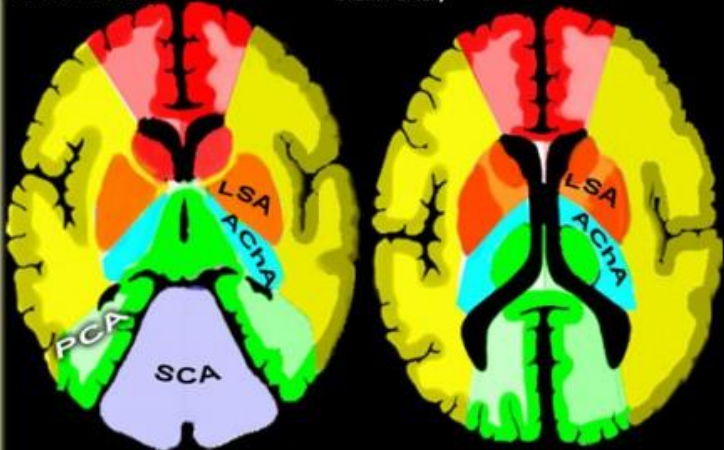
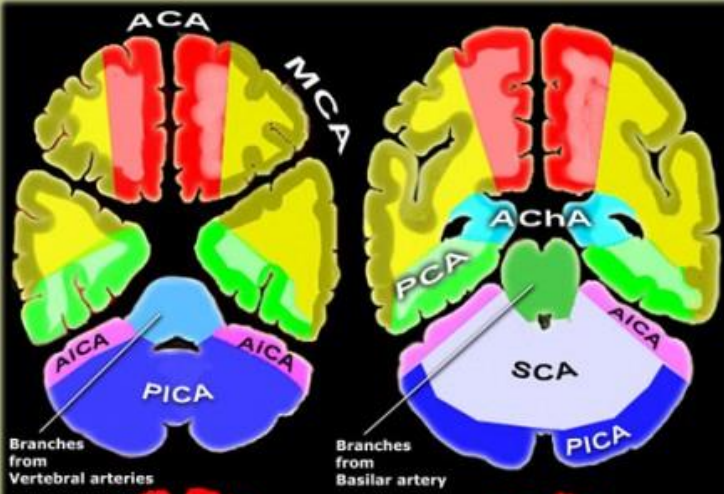
Anterior cerebral artery (ACA)
Middle cerebral artery (MCA)
Lenticulostriate arteries (lsa)
to basal ganglia



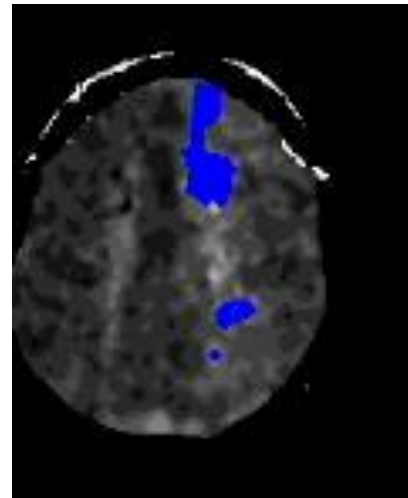
Main arterial territories



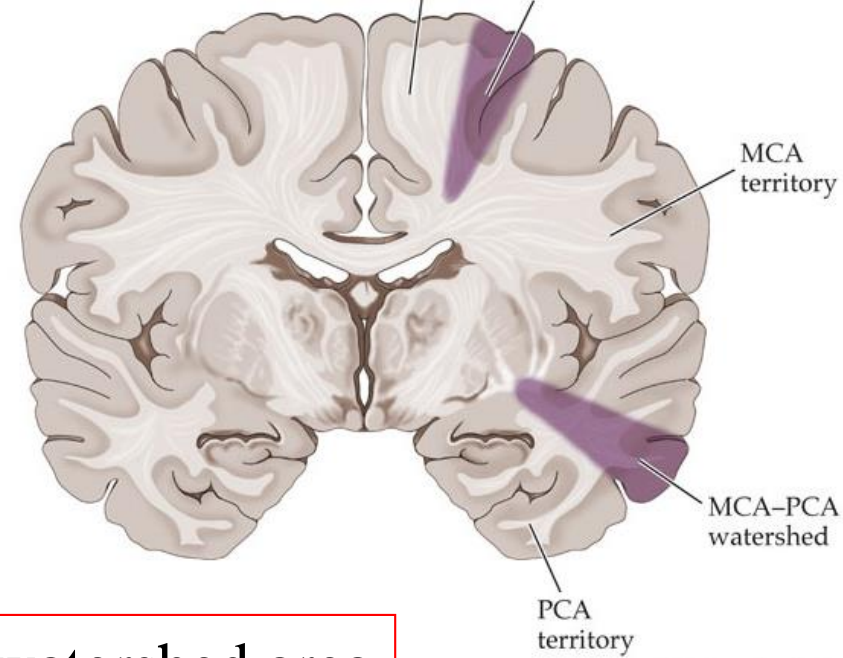
- Middle Cerebral Artery: Superior Division
- Middle Cerebral Artery: Inferior Division
- Middle Cerebral Artery: Lenticulostriate
- Posterior Cerebral Artery
- Anterior Cerebral Artery
- Anterior Choroidal



Rt. MCA infarction

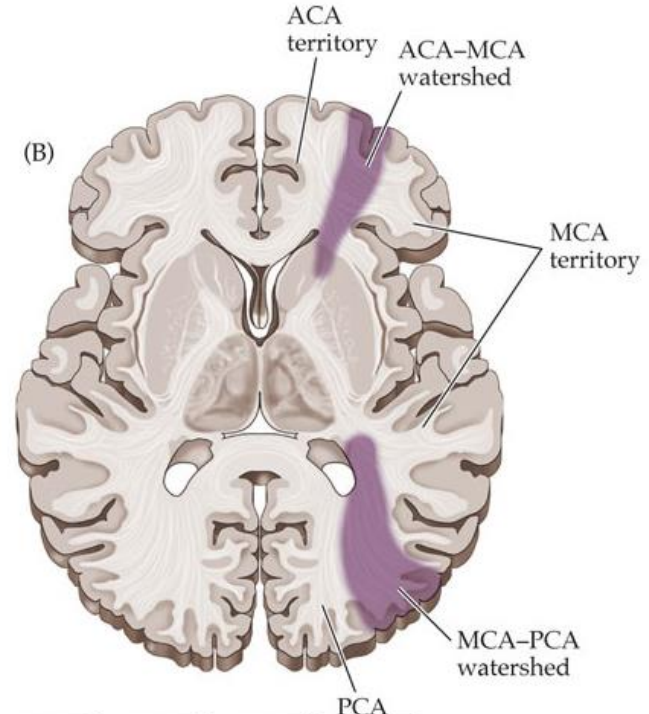


Lt. ACA hypoperfusion



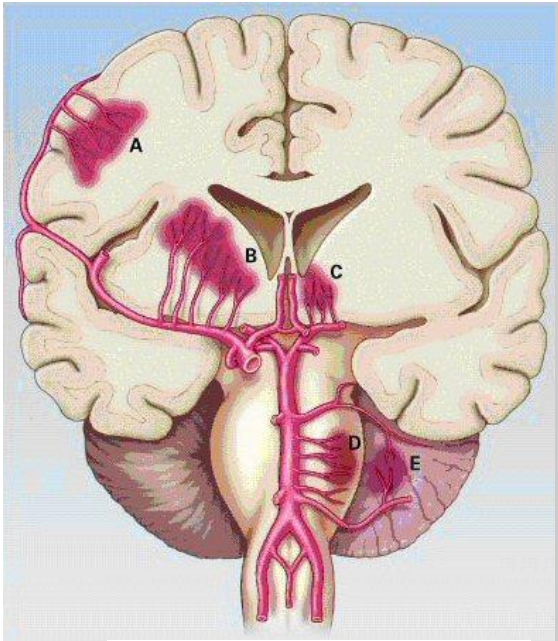
watershed area

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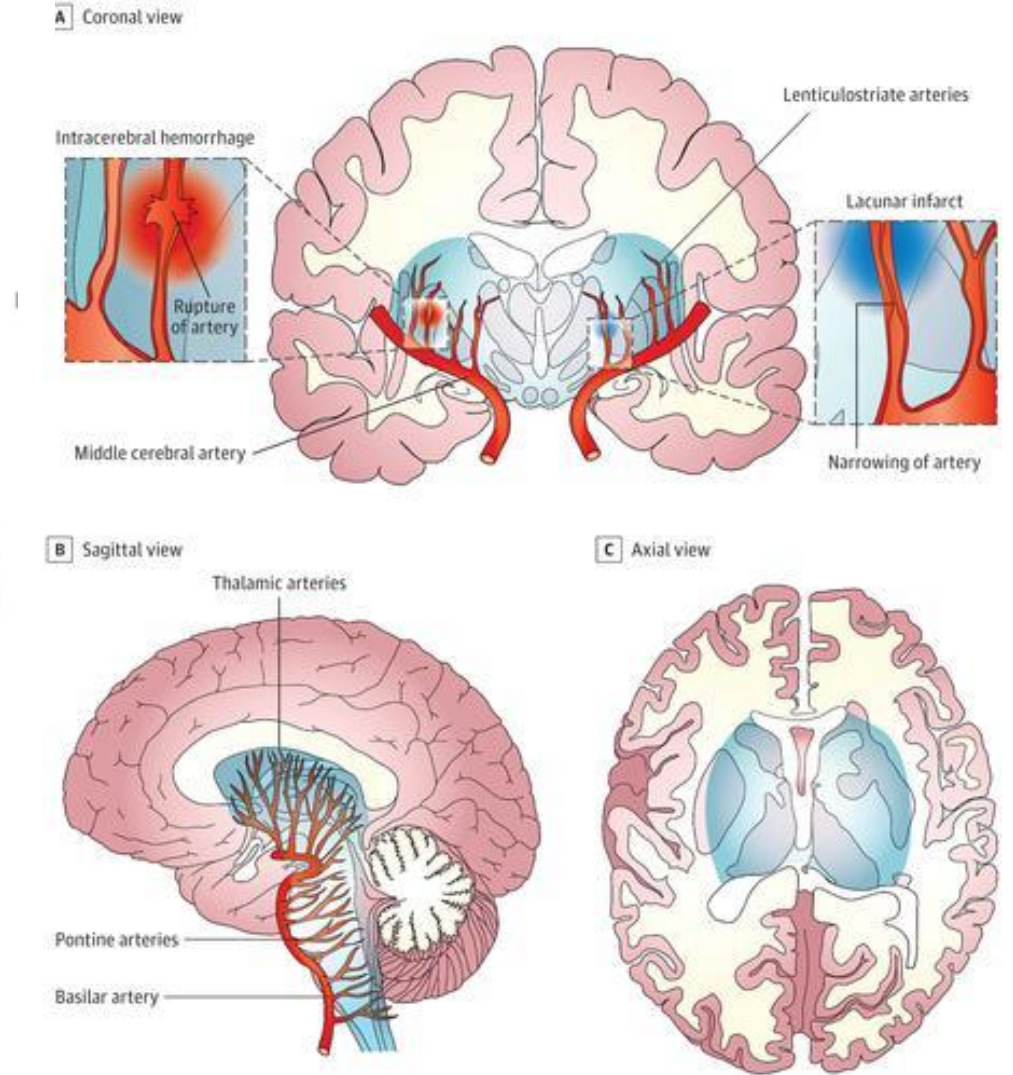


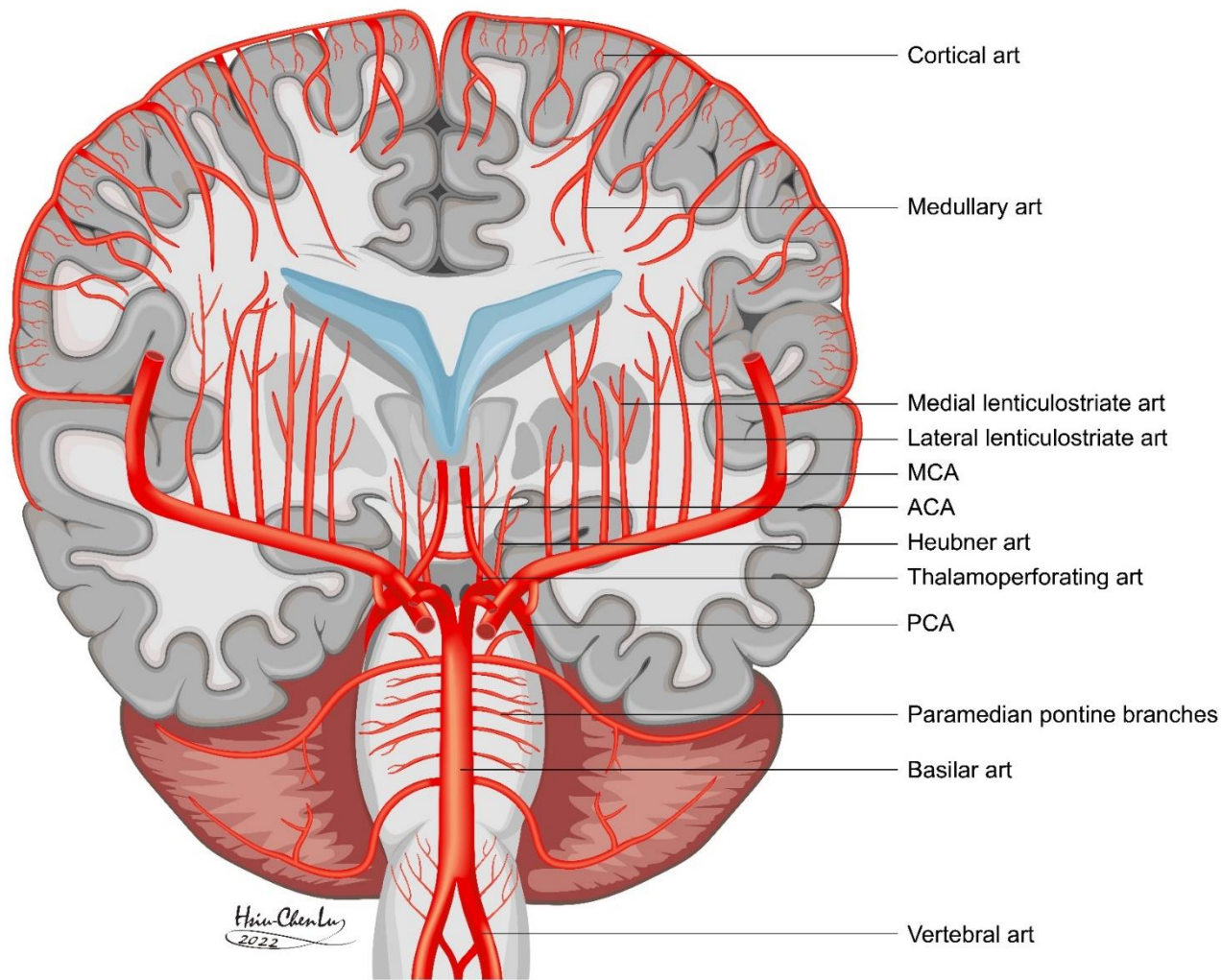
Small vessels (小血管) 的觀念

Perforating artery (penetrating artery) 穿透動脈



Qureshi: Spontaneous ICH.
NEJM, 2001





穿透小動脈 (penetrating artery 或稱 perforating artery)

中腦動脈 (MCA) 的內及外側豆狀核紋狀體動脈 (medial and lateral lenticulostriate arteries)

後腦動脈 (PCA) 的視丘穿透動脈 (thalamoperforating artery)

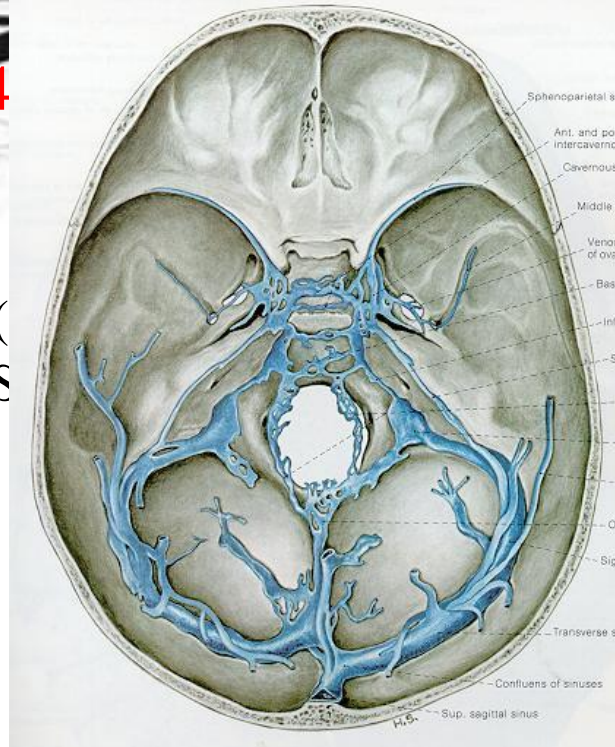
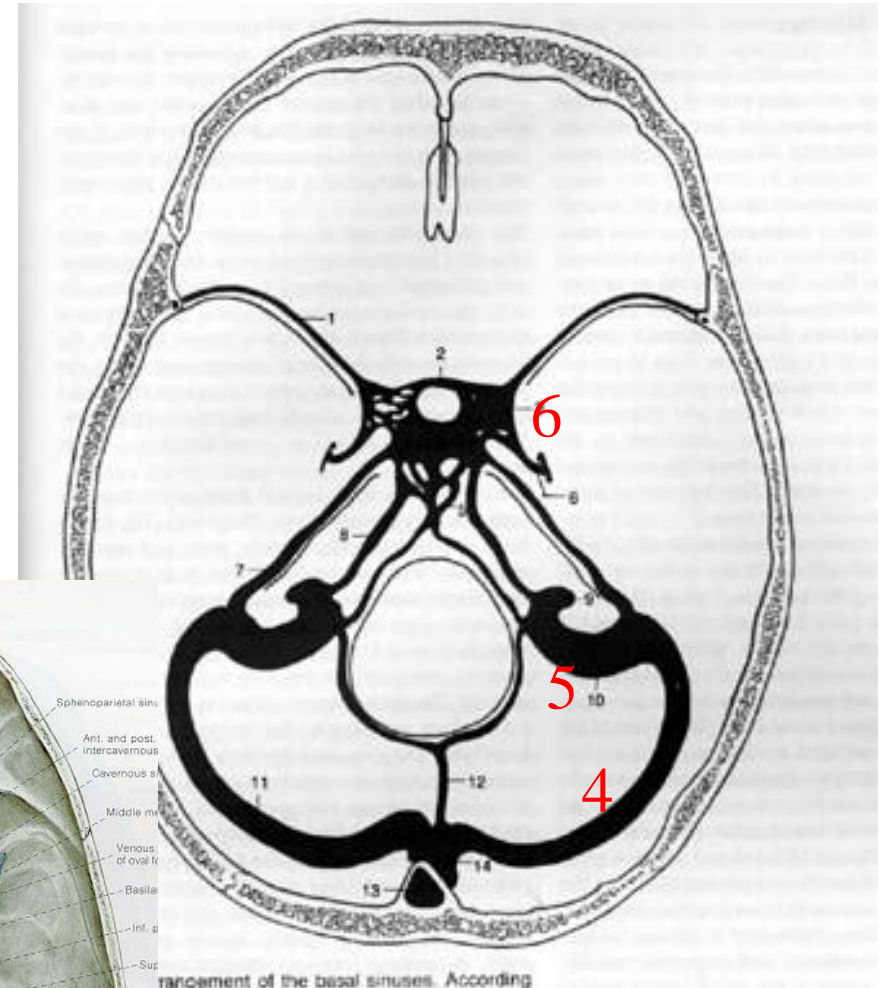
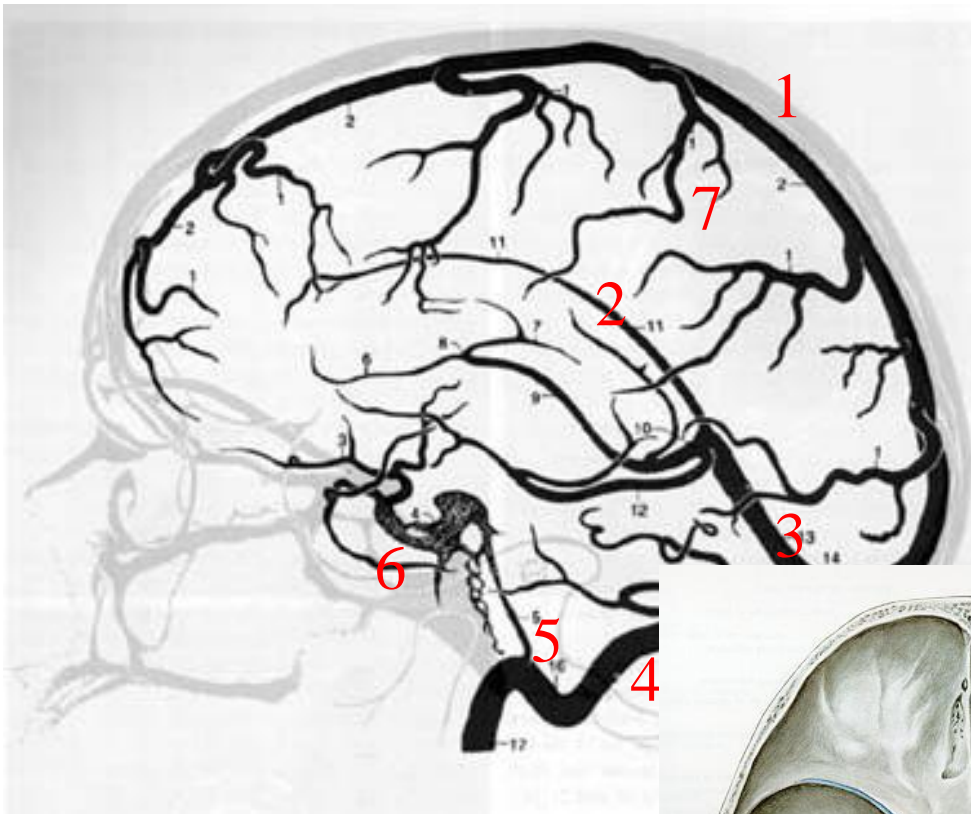
前腦動脈 (ACA) 的 recurrent artery of Heubner.

前脈絡叢動脈 (anterior choroidal artery) 的分枝。

基底動脈 (basilar artery) 的正中傍分枝 (paramedian branches).

以上都是由 circle of Willis 附近大血管發出的 penetrating artery。

另外，ACA、MCA、PCA 的遠端在大腦皮質外的軟腦膜動脈 (pia arteries) 發出的髓動脈 (medullary artery) 供應腦葉皮質下白質，包括 centrum semiovale。

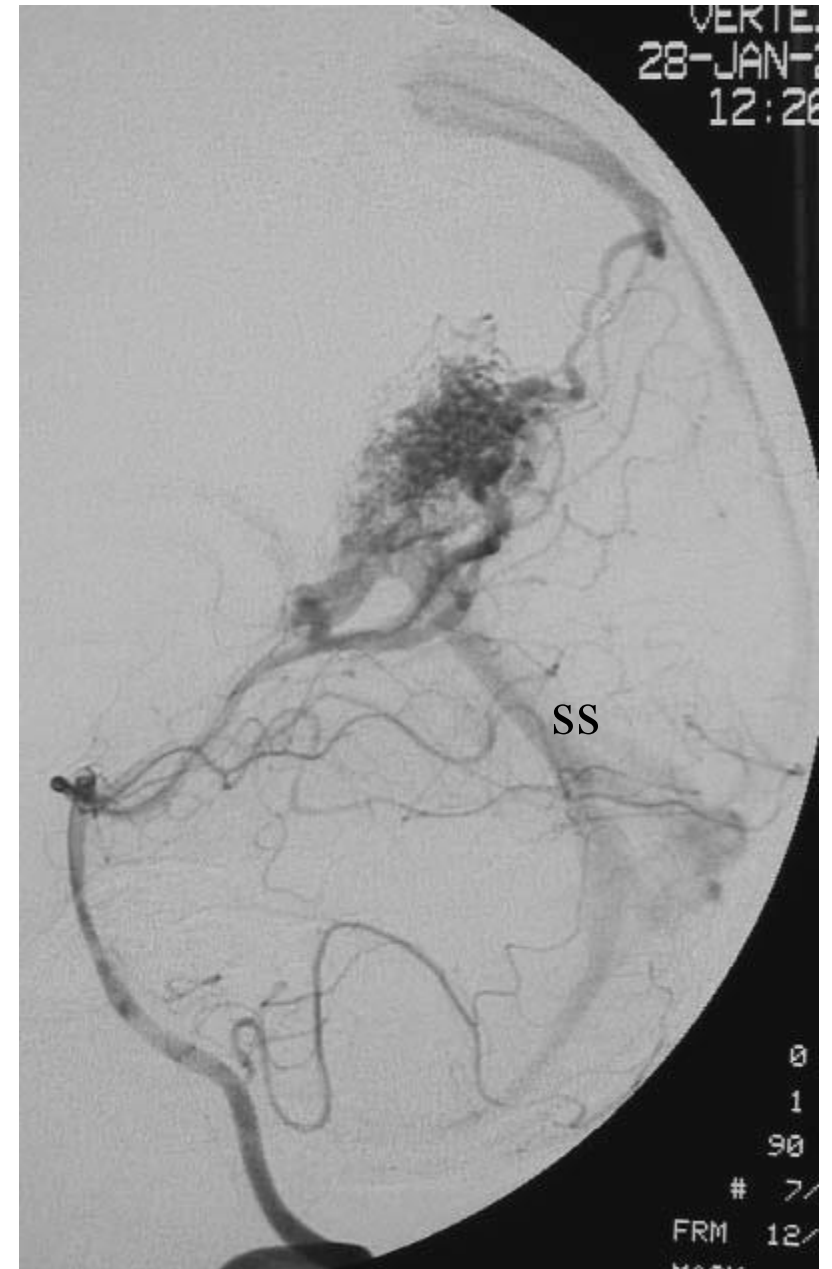
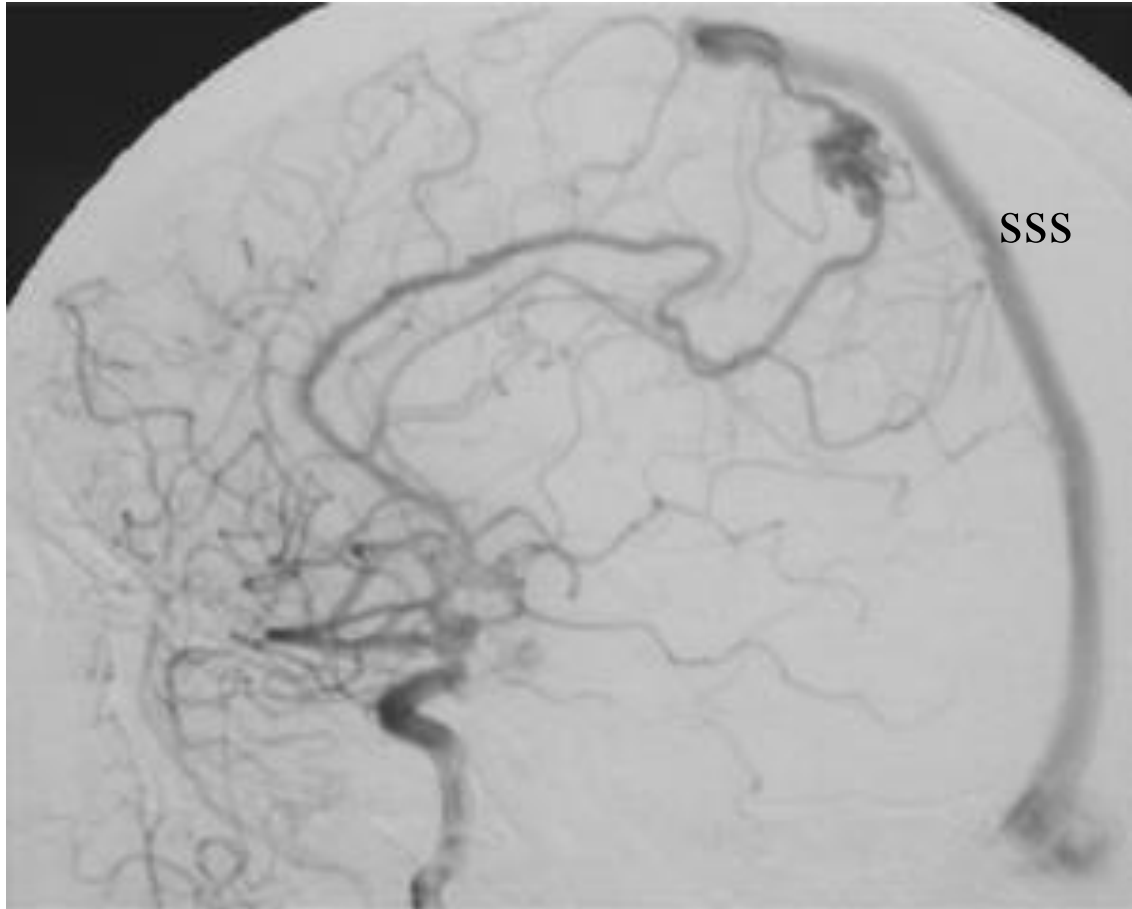


Venous sinuses:

1. Superior sagittal sinus (SSS)
2. Inferior sagittal sinus (ISS)
3. Straight sinus
4. Transverse sinus
5. Sigmoid sinus
6. Cavernous sinus
7. Cortical veins

Arrangement of the basal sinuses. According to

靜脈竇



2 cases of arterio-venous malformation, AVM
sss: superior sagittal sinus 動靜脈畸形
ss: straight sinus