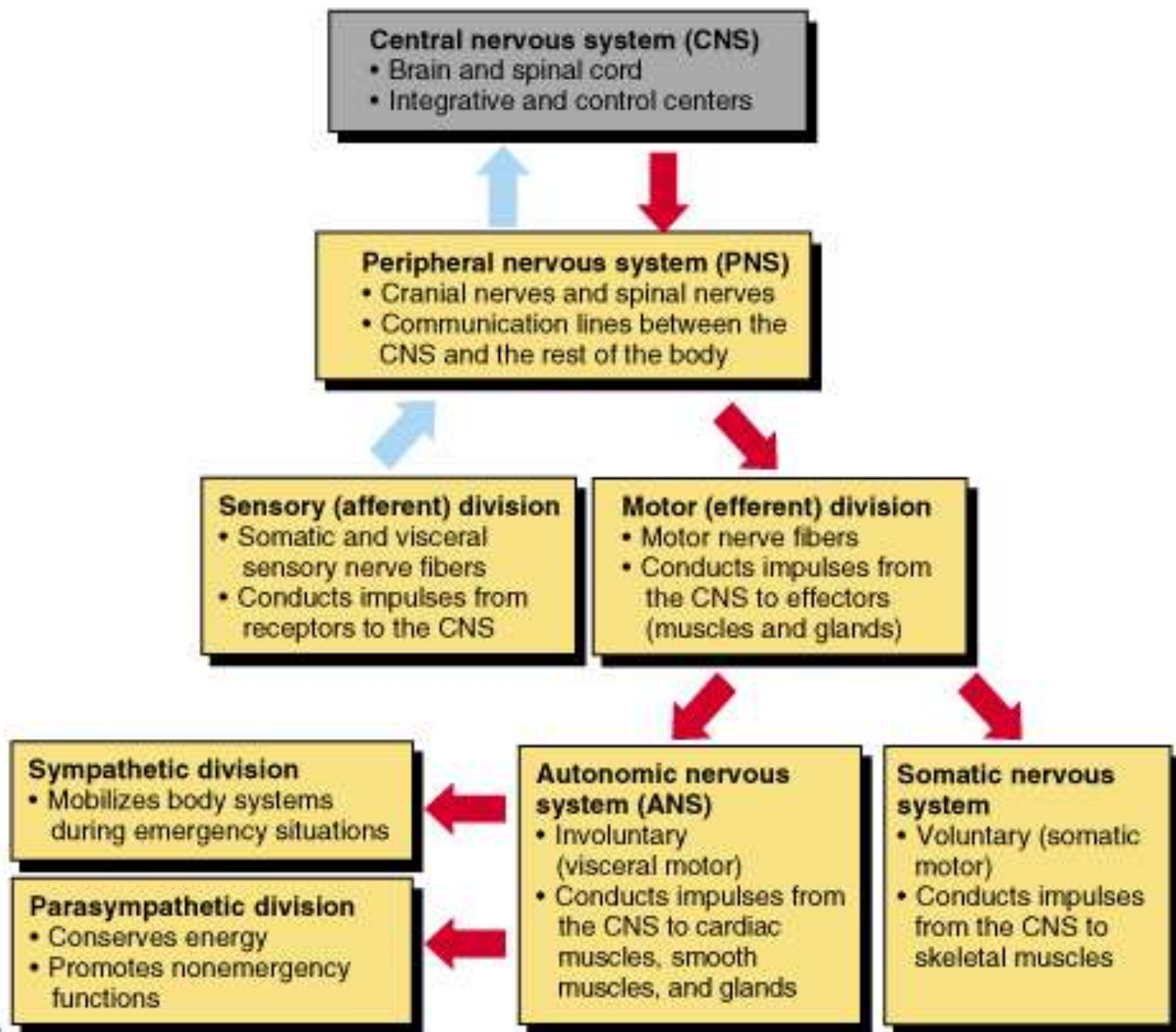


NEURO ANATOMI DIAGNOSA TOPIS



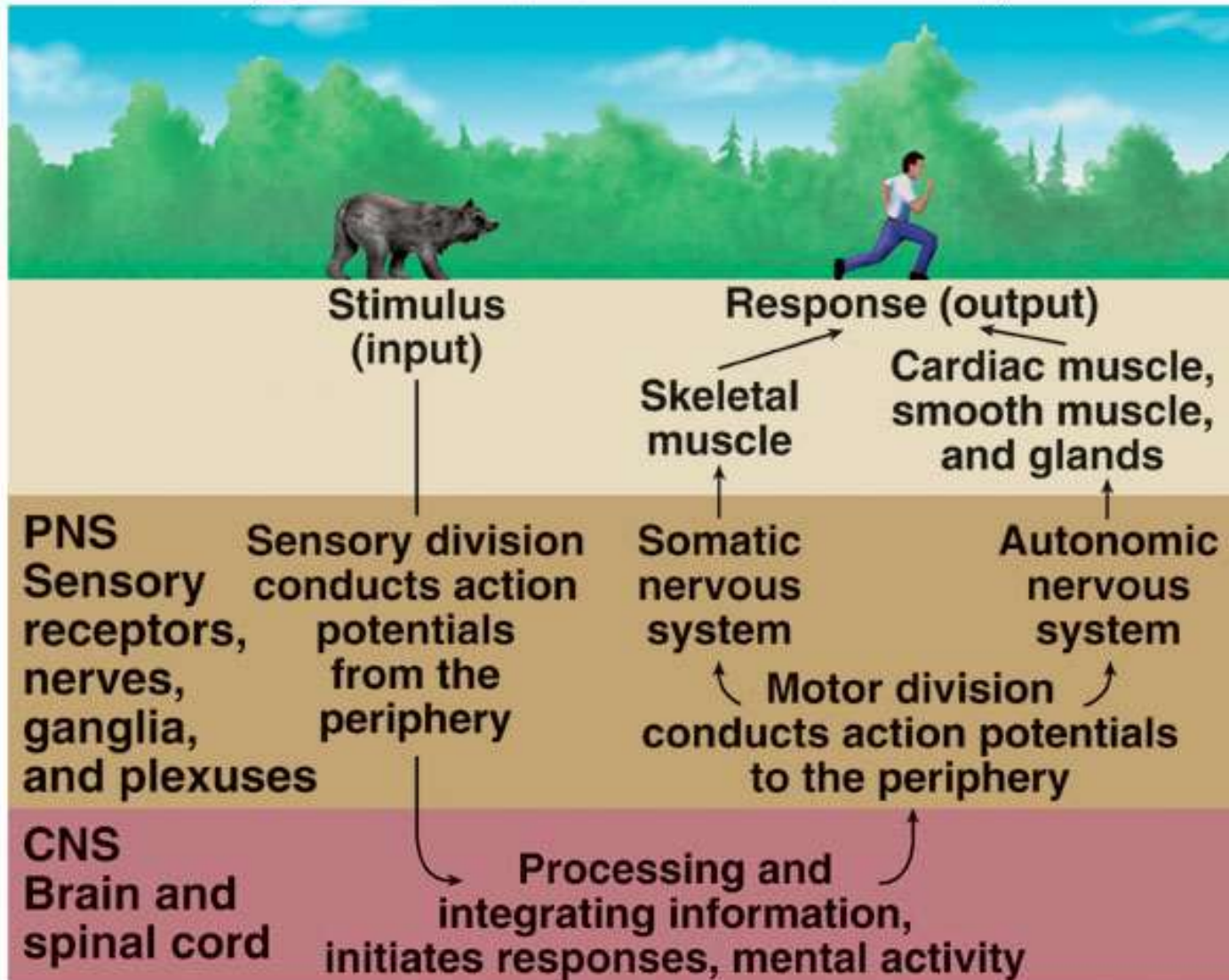
Dr. Moch. Bahrudin, Sp.S



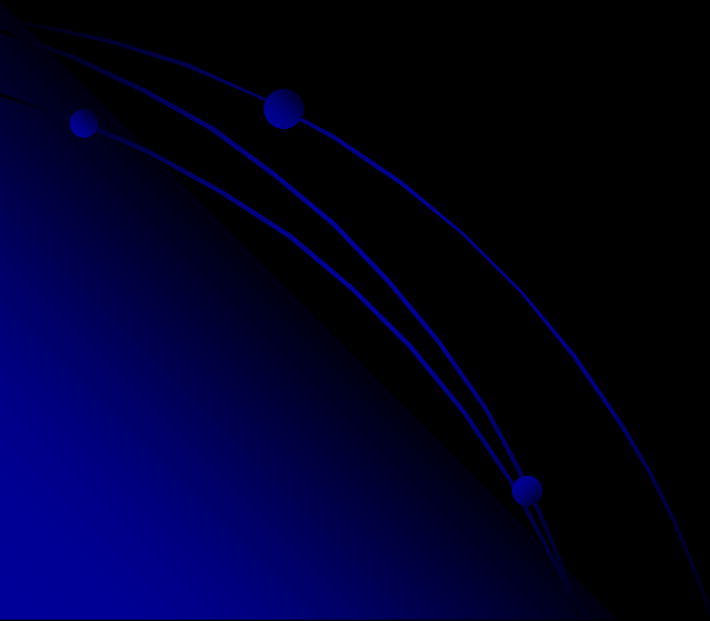
(a)

Nervous System Organization

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SUSUNAN SARAF PUSAT



SSP

Otak (ensefalon)

Serebrum

Telensefalon

Korteks

Subkorteks

Ganglia Basalis

Diensefalon

Talamus

Hipotalamus

Subtalamus

Epitalamus

Batang Otak

Mesensefalon

Pons

Medula oblongata

Otak Kecil (serebelum)

Paleoserebelum

Neoserebelum

Arkiserebelum

Sumsum tulang belakang (medula spinalis)

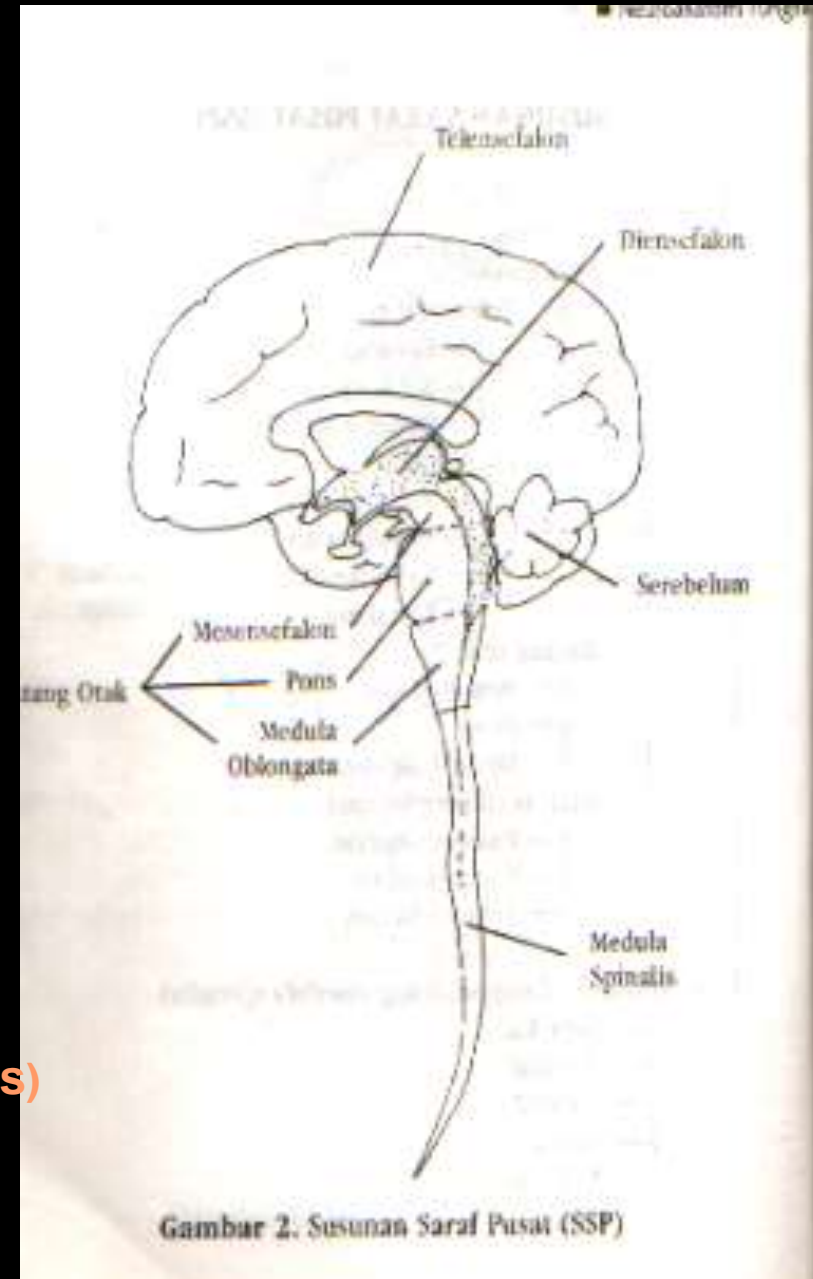
Servikal

Torakal

Lumbal

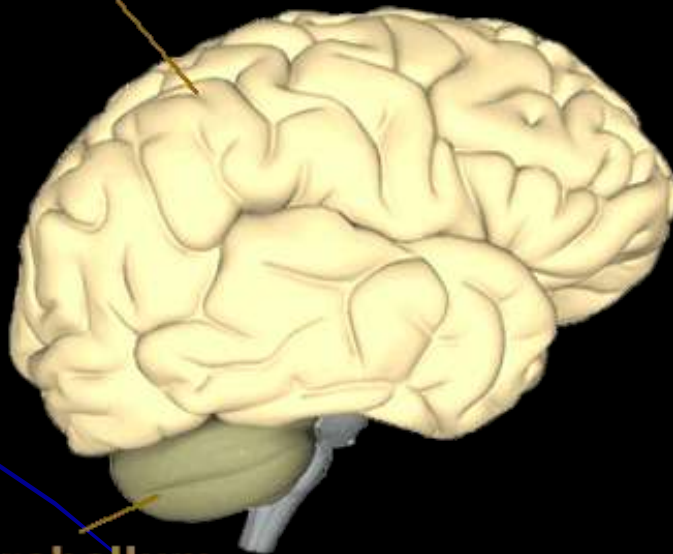
Sakral

Koksigeal



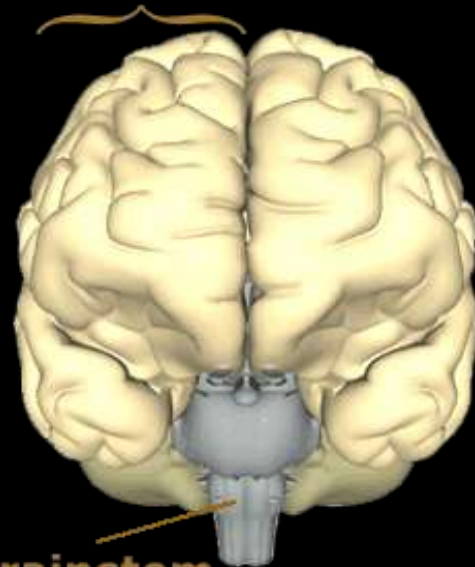
BRAIN / OTAK

Cerebrum



Cerebellum

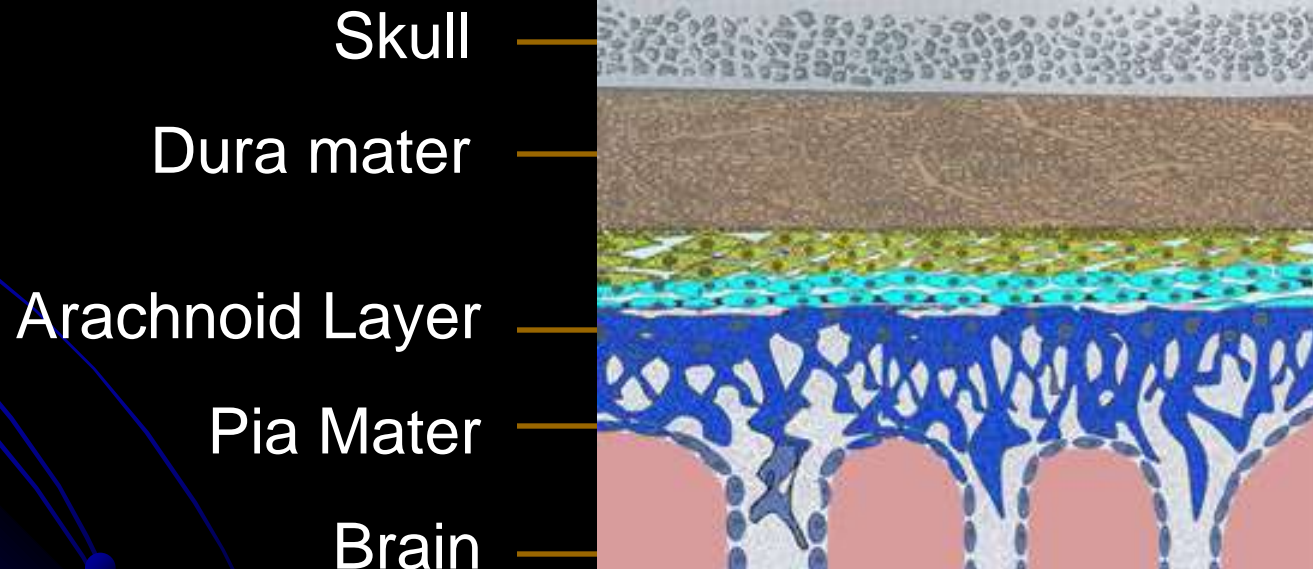
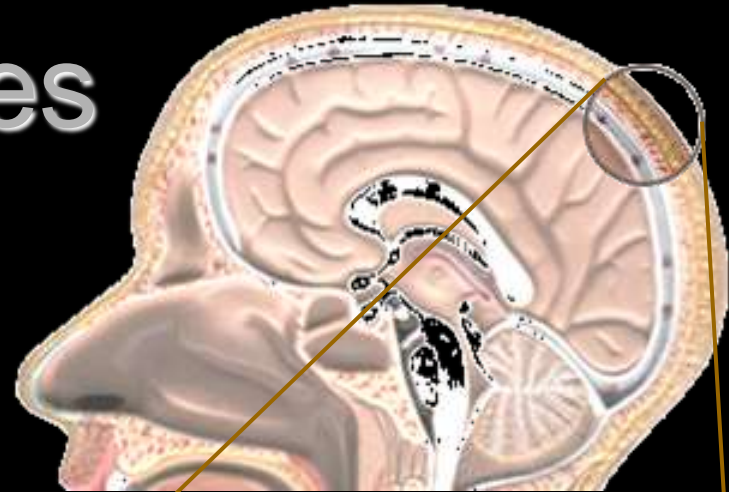
Cerebral Hemisphere



Brainstem

The Meninges

The meninges are layers of tissue that separate the skull and the brain.

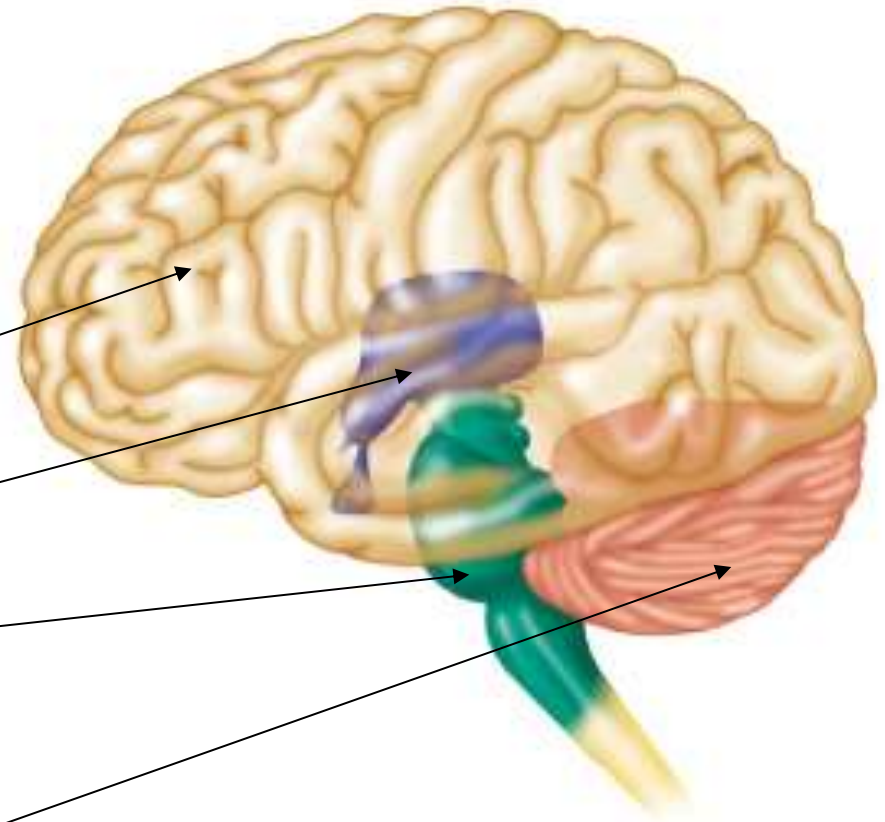


The Brain

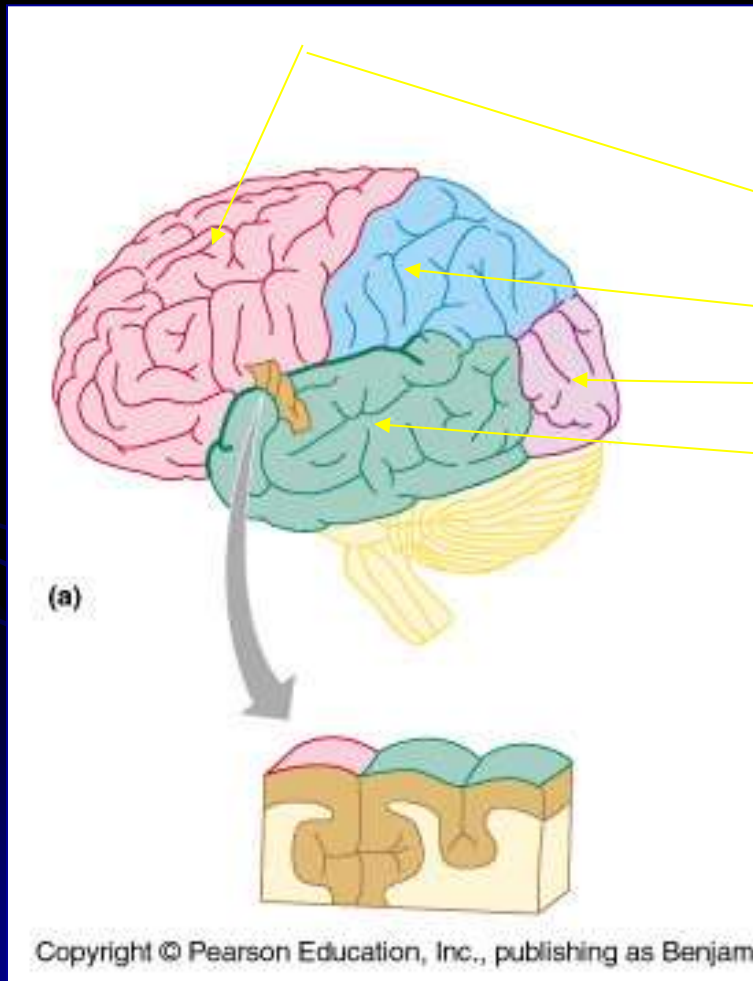
- 4 Parts

- Cerebrum
- Diencephalon
- Brain Stem
 - Pons
 - Medulla
 - Midbrain
- Cerebellum

- Gray matter surrounded by White matter

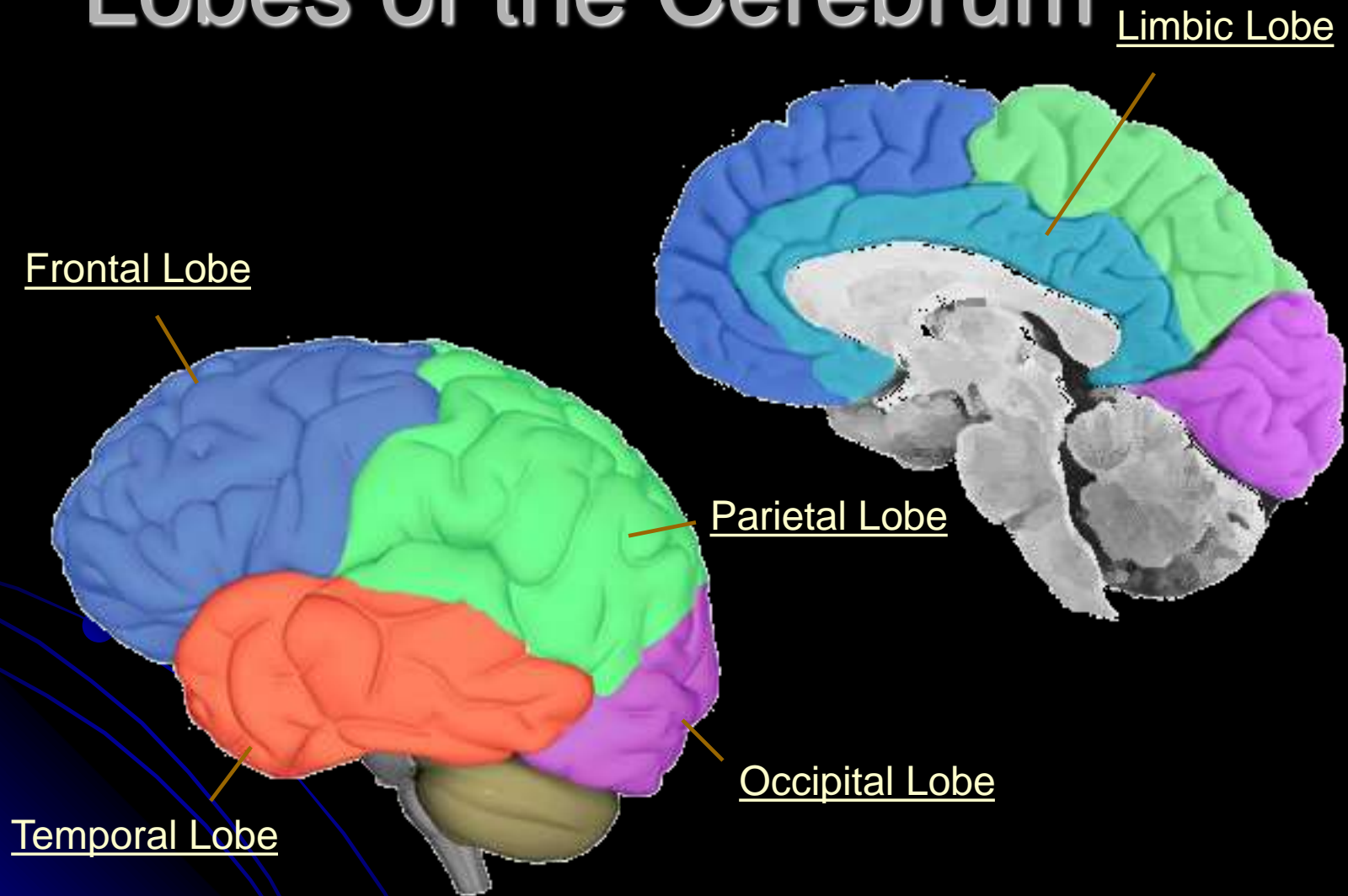


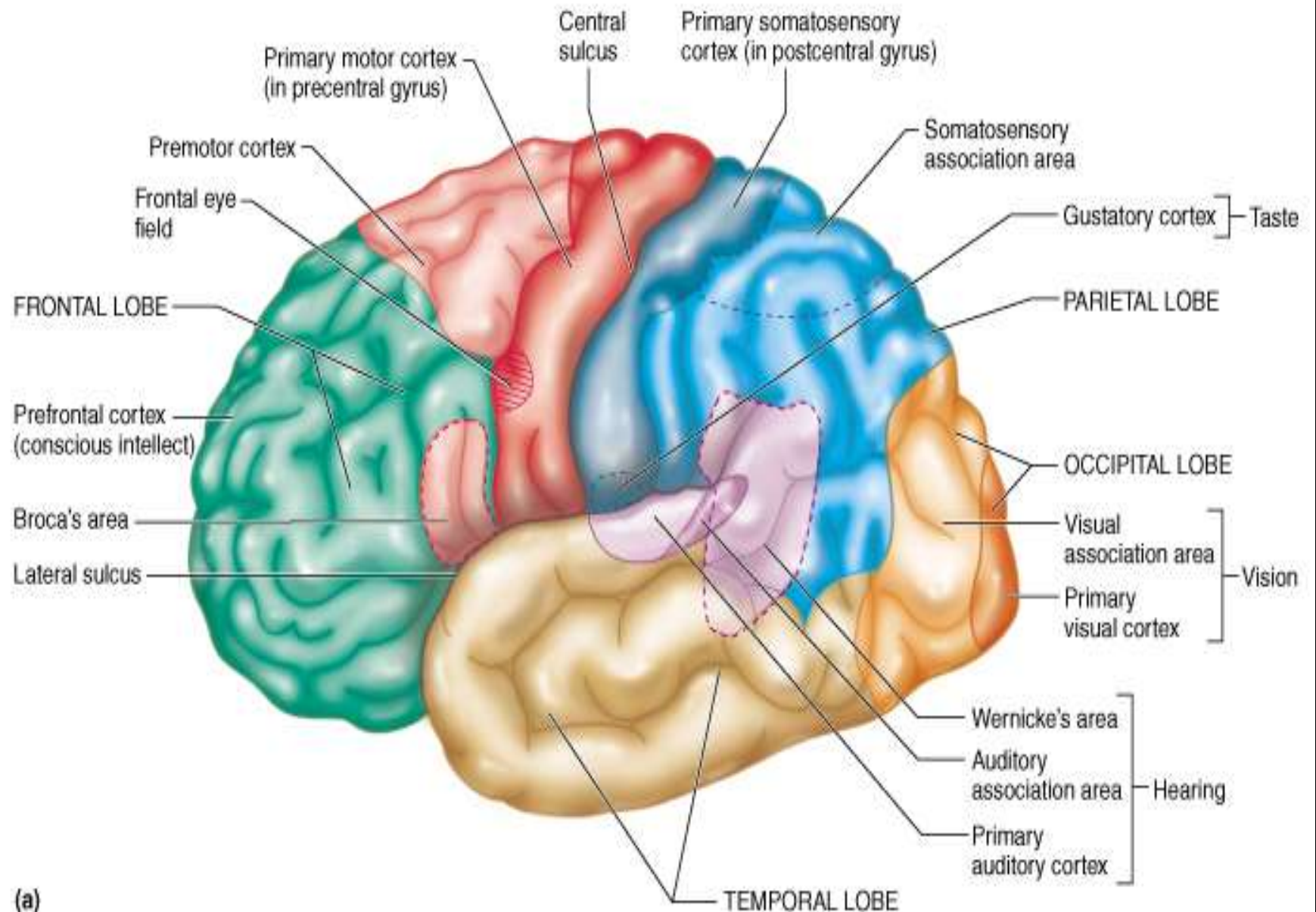
Cerebral Hemispheres:



- Each hemisphere divided into 5 lobes
 - Frontal
 - Parietal
 - Occipital
 - Temporal
 - Insula
- Created by deep sulci
- Functional areas: motor, sensory
- Associative areas: integrate

Lobes of the Cerebrum





(a)

Lobus	Defisit Neurologik	Fenomena Positif	Psikopatologi/ Neuropsikologi
FRONTALIS	Hemiparesis spastik (kontralateral) <i>Gaze paresis</i> (kontralateral)	Bangkitan motorik fokal <i>Adversive fits</i> (gerakan tonik mata, kepala, anggota gerak kontralateral)	Tak punya inisiatif Afek datar Moria (<i>witzelsucht</i>) Afasia motorik Broca (dominan)
PARIETALIS	Sindroma hemisensorik (kontralateral) Homonim kwadrananopsia bawah (kontralateral) Hemispasial <i>neglect</i> Hilangnya nistagmus optokinetik	Bangkitan sensorik fokal (Jacksonian)	Disorientasi ruang Agnosia taktil Apraksia konstruksional Afasia amnesik (dominan) Aleksia (dominan)
TEMPORALIS	Homonim kwadrananopsia atas (kontralateral)	Bangkitan psikomotor <i>Uncinate fits</i>	Mudah marah Disinhibisi Defisit memori Afasia sensorik/ Wernicke (dominan)
OKSIPITALIS	Homonim hemianopsia (kontralateral) Gangguan nistagmus optokinetik	Sensasi dan halusinasi visual	Agnosia warna Disorientasi visuospasial Agnosia visual Aleksia

LESI CORTEX

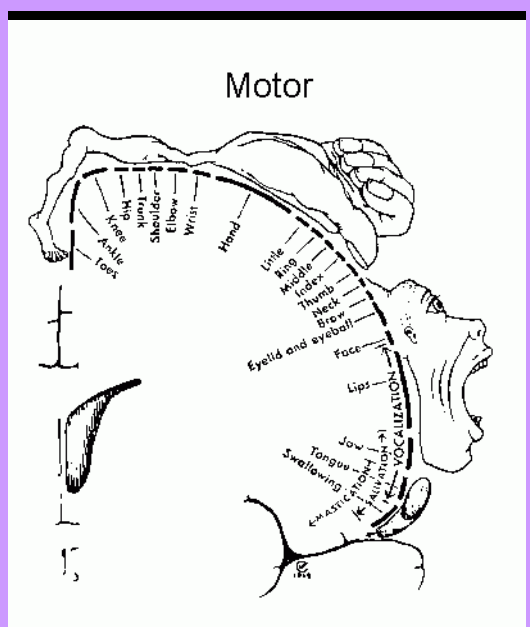
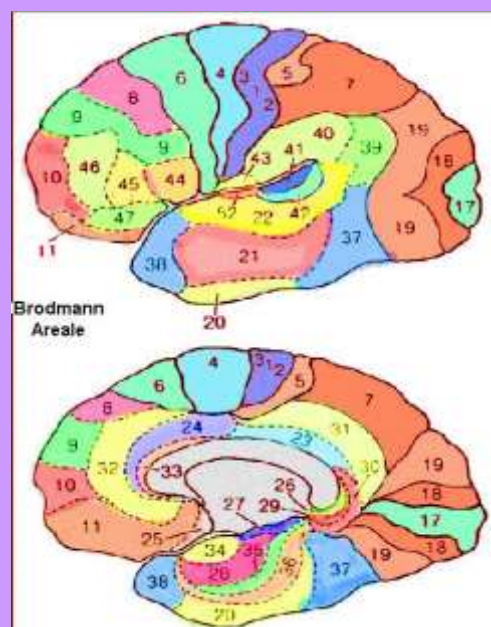
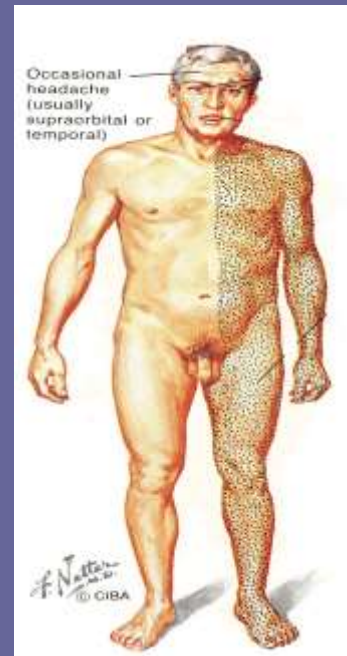
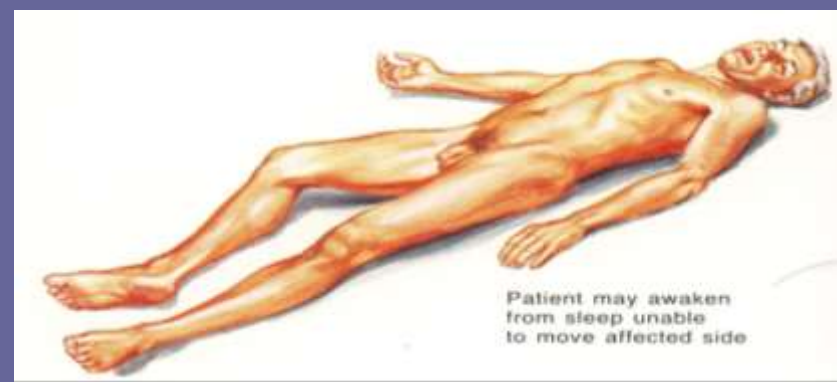
Hemiplegi / hemiparese kontralateral
(derajat kelumpuhan lengan &
tungkai berbeda)

Parese N.cranialis kontralateral (N.VII &
XII) UMN

Hemihipestesia kontralateral (terutama
pada sebelah distal)

Gangguan inervasi nn. Cranialis
kontralateral

Aphasia (+/-), tergantung letak lesi



LESI CAPSULA INTERNA

Hemiplegi/ hemiparese kontralateral
(derajat

kelumpuhan lengan & Tungkai
sama)

Parese N.cranialis kontralateral (N.VII &
XII)

UMN

Hemihipestesia kontralateral (terutama
pada

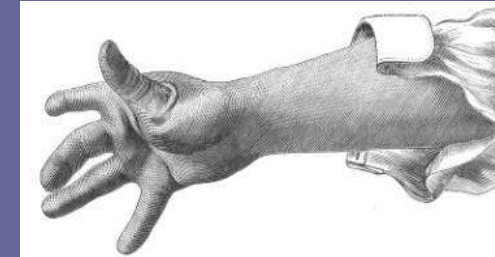
sebelah distal)

Gangguan inervasi nn. Cranialis
kontralateral

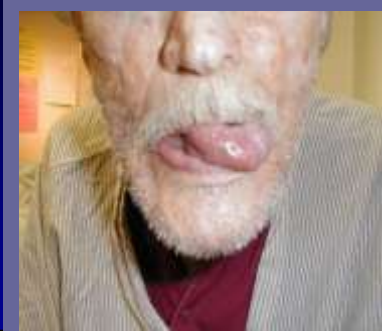
Aphasia (-), Disartria (+)

Rigiditas, atetosis, distonia, tremor,
hemianopia

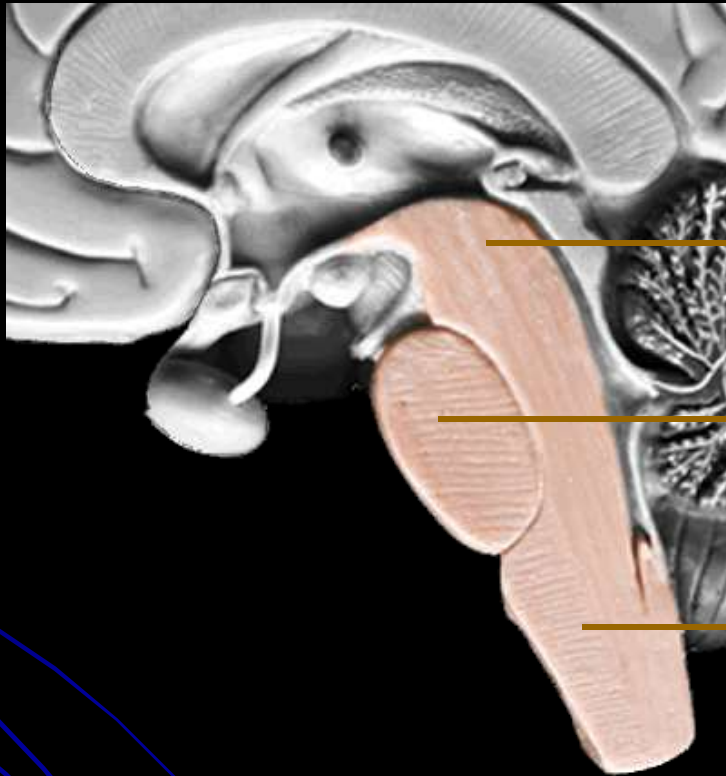
Gerakan sekutu patologis (+)



CAPSULA INTERNA na horizontálním řezu hemisférou



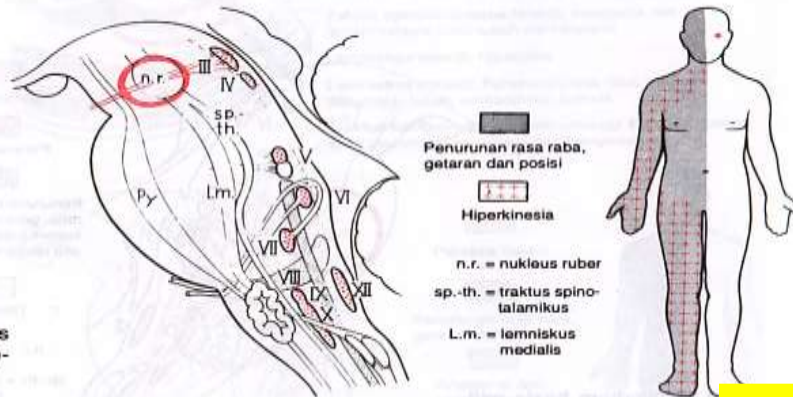
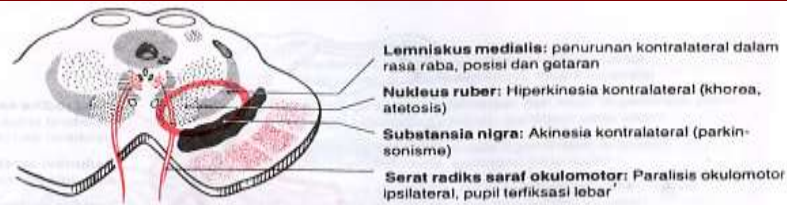
Brainstem Divisions



Midbrain / Mesencephalon

Pons

Medulla Oblongata



Gambar 3.62 Sindrom nukleus ruber bawah (sindrom Benedikt).

LESI MESENSEFALON

Hemiplegi alternans (Hemiplegi kontralat UMN, ggn N III Ipsilat LMN, parese n. XII kontralat UMN, parese n.IX,X kontralateral UMN

SINDROMA WEBER :

Hemiplegi alternans N. III kiri

UMN : Otot tubuh sisi kanan (N. XII, N. IX dan X)

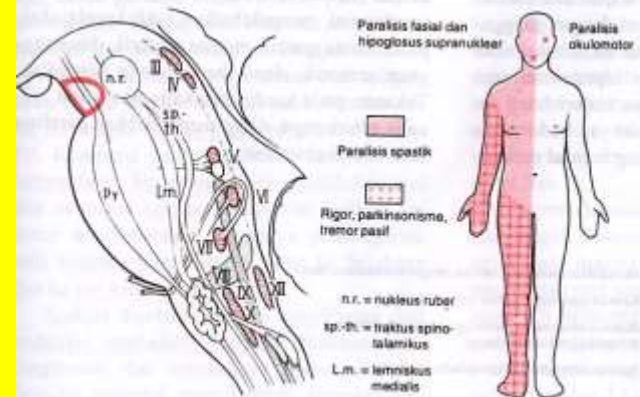
LMN : N. III kiri (midriasis, strabismus divergen, diplopia, ptosis)

SINDROMA BENEDICT :

Hemiplegi alternans ringan

Parese N.III ringan

Gerakan involunter lengan & tungkai yg paretik (ringan)



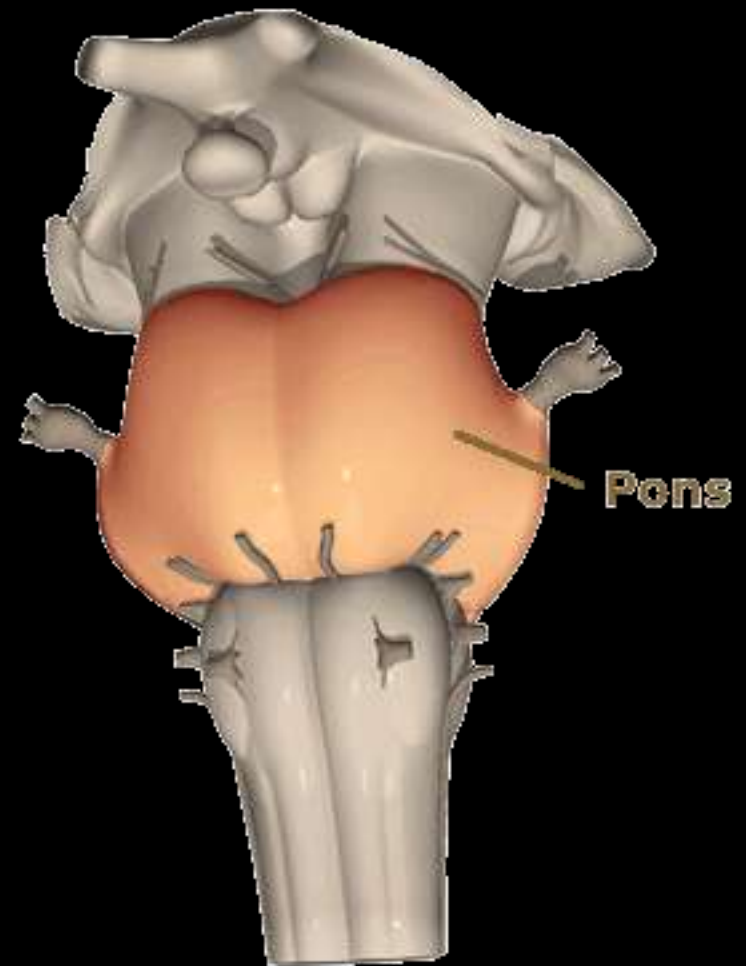
Gambar 3.63 Sindrom pedunkel otak tengah (sindrom Weber).

The Pons

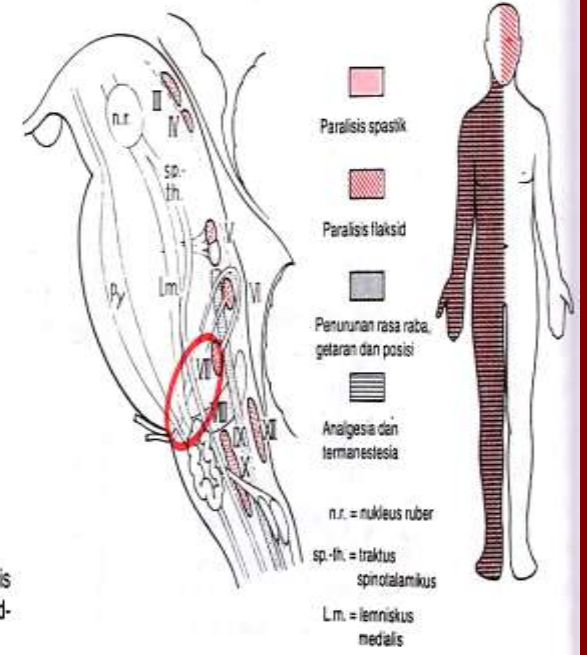
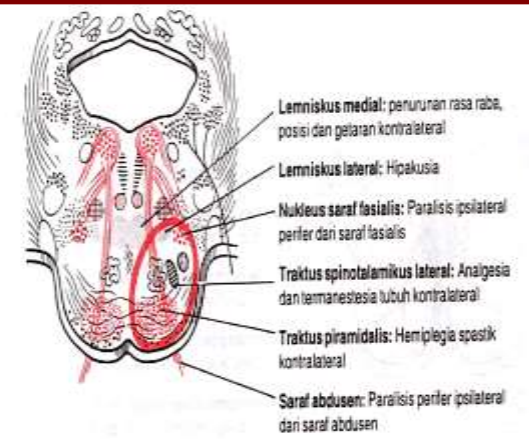
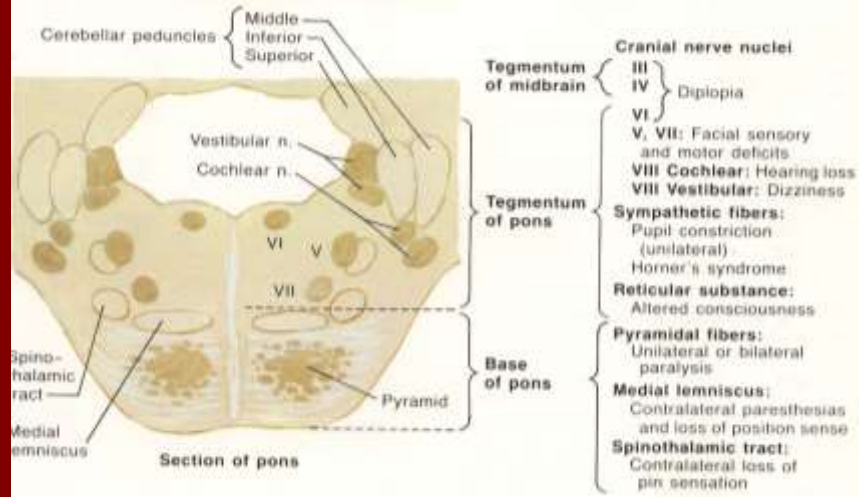
The pons is the rounded brainstem region between the midbrain and the medulla oblongata. In fact, pons means “bridge” in Latin.

The main function of the pons is to connect the cerebellum to the rest of the brain and to modify the respiratory output of the medulla.

The pons is the origin of several cranial nerves.



LESI PONS



Gambar 3.58 Sindrom basis pontin kaudal (sindrom Millard-Gubler atau Foville).

- ❖ Hemiplegi alternans (Hemiplegi kontralat UMN, ggn N.VI & N.VII Ipsilateral LMN)
- ❖ **SINDROMA MILLIARD GUBLER :**
 - ❖ Kelumpuhan LMN yg melanda otot – otot yg disarafi N.VI, VII, ipsilat
 - ❖ Strabismus convergen
- ❖ **SINDROMA FOVILLE :**
 - Lesi yg mengenai serabut kortiko bulbar N.VI (deviasi conjugate)

The Medulla Oblongata

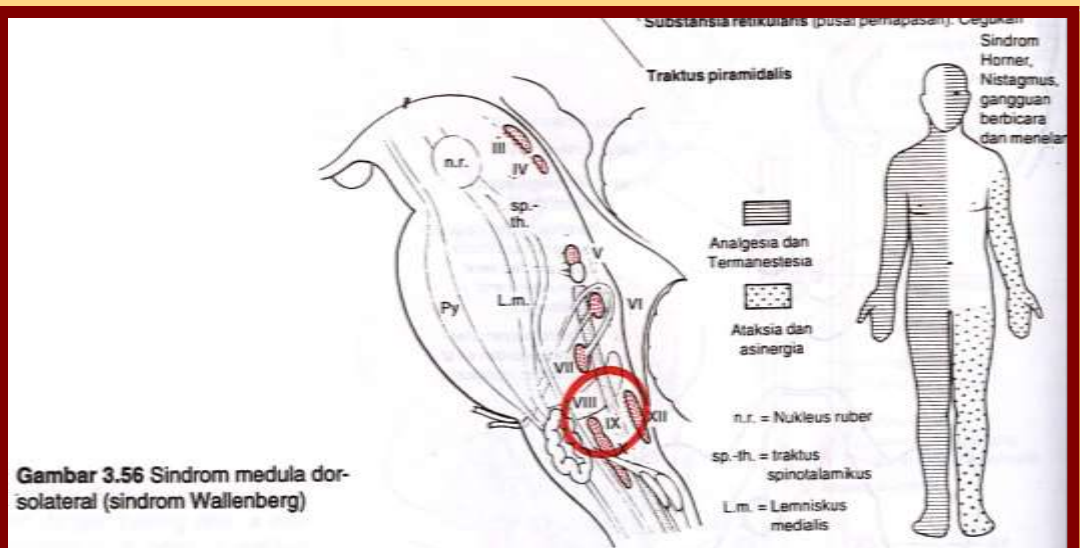
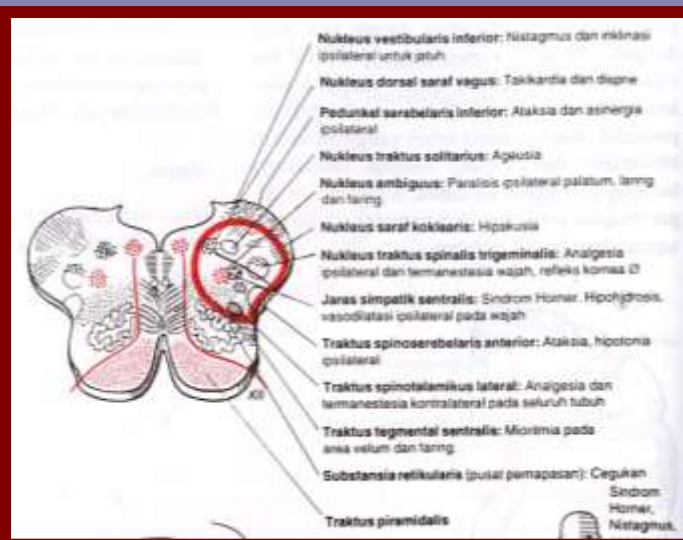
The medulla oblongata merges seamlessly with the spinal cord and creates the base of the brainstem.

The medulla is primarily a control center for vital involuntary reflexes such as swallowing, vomiting, sneezing, coughing, and regulation **cardiovascular and respiratory activity**

The medulla is also the origin of many cranial nerves. N.IX / X



LESI MEDULA OBLONGATA (lateral)

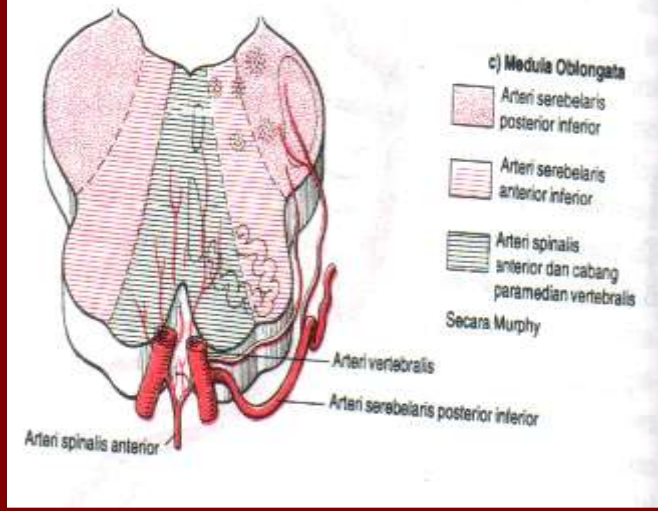
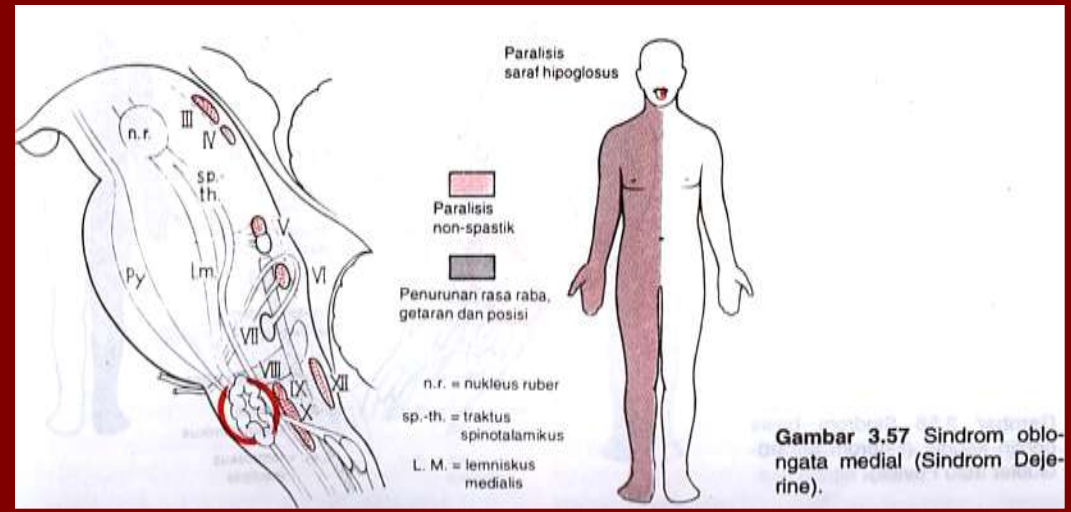
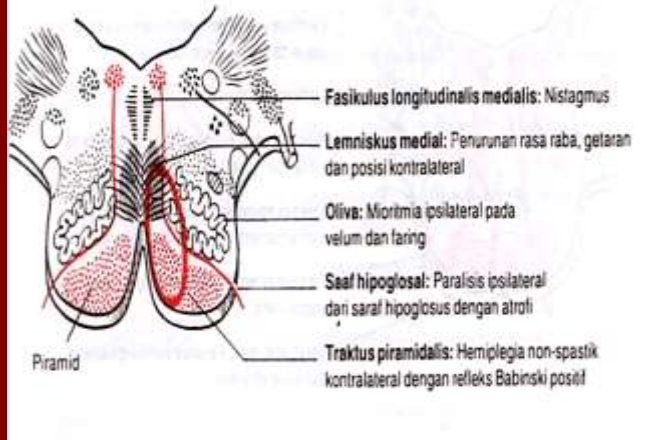


Gambar 3.56 Sindrom medula dorso-lateral (sindrom Wallenberg)

1. SINDROMA MEDULAR LATERAL (SINDROM WALLEMBERG)

- ❖ Hemihipestesi alternans, Hipestesi tubuh kontralateral, Hipestesi wajah ipsilateral
- ❖ Ataksia ipsilateral
- ❖ Vertigo
- ❖ Sindroma Horner ipsilateral, nistagmus, gangguan bicara, gangguan menelan

LESI MEDULA OBLONGATA (medial)



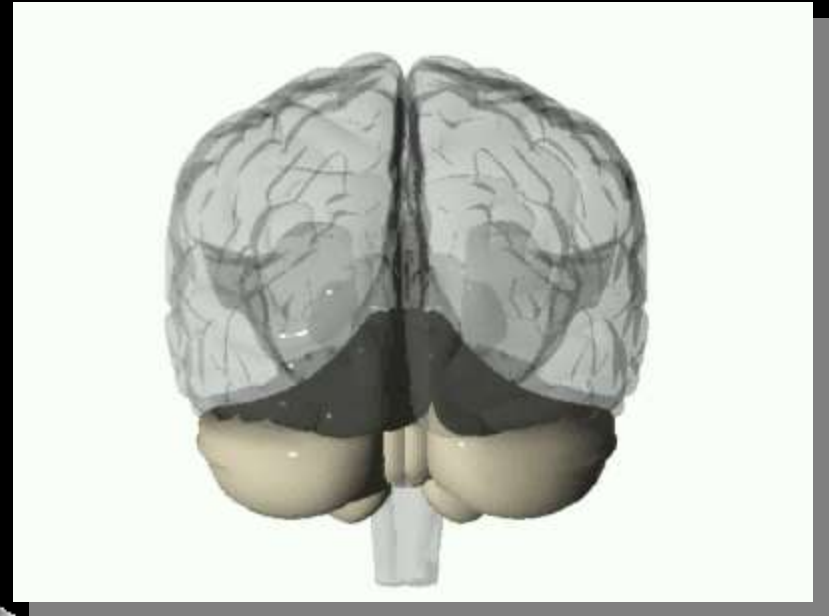
Disebabkan OBSTRUKSI Cab paramedian Dari Arteri basilaris atau Vertebralis

2. SINDROMA MEDULAR MEDIAL HEMIPLEGI ALTERNANS = MEDIAL (BASAL) MEDULLARY SYNDROME (DEJERINE SYNDROME)

- Lumpuh UMN tubuh kontralateral di bawah leher
- Lumpuh LMN lidah ipsilateral

Cerebellum

The cerebellum is connected to the brainstem, and is the center for body movement and balance.



Click image to play or pause video



Cerebellum

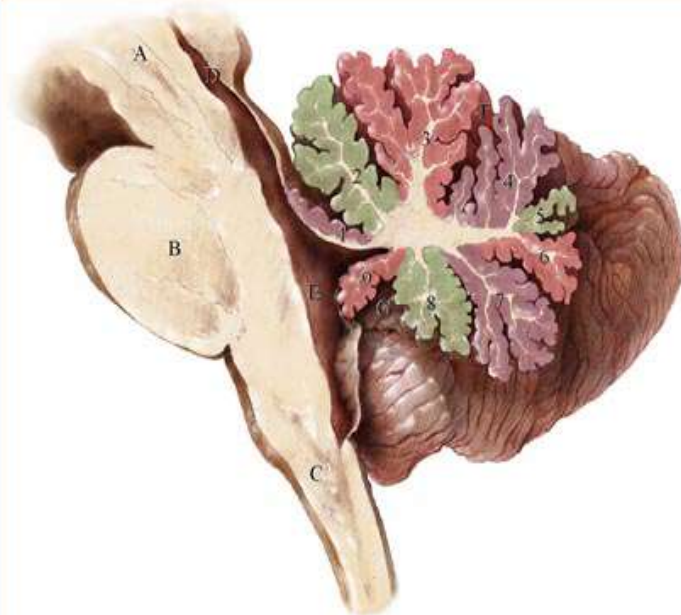
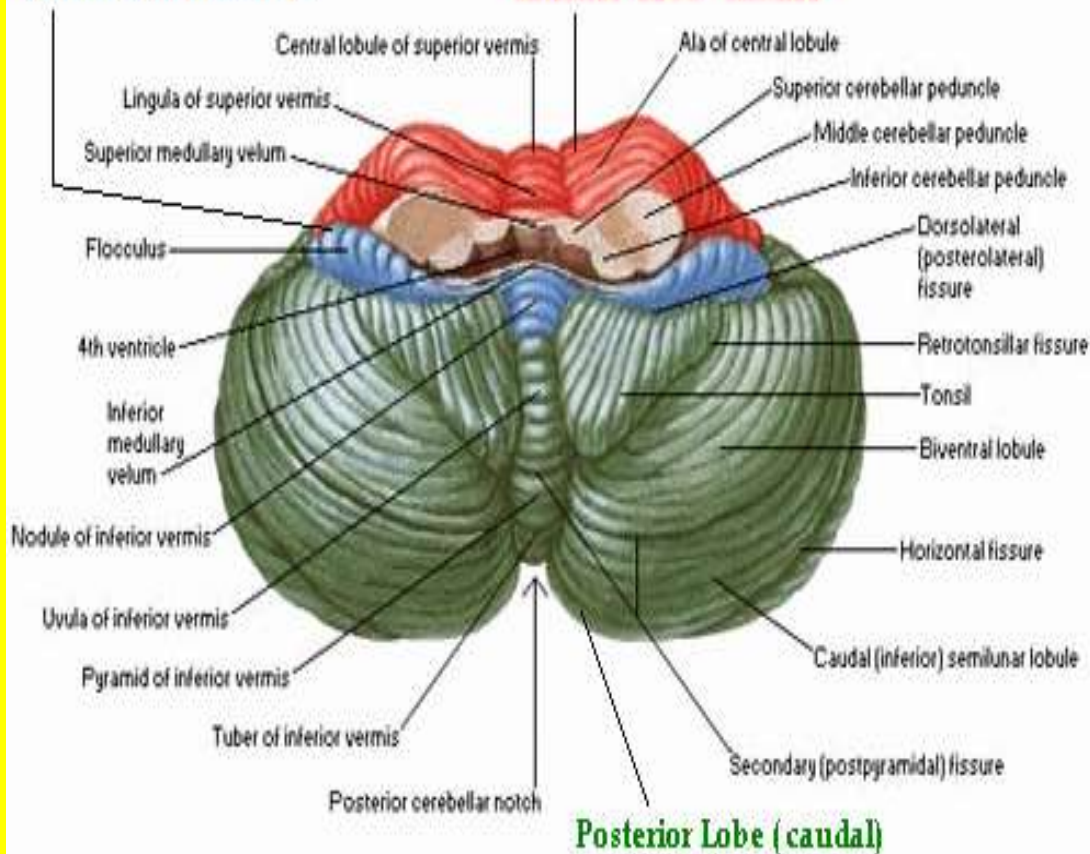


Cerebellum

Inferior Surface

Flocculomodular lobe

Anterior Lobe Rostral



Lobules of Vermis

- 1 Lingula
- 2 Central lobule
- 3 Culmen
- 4 Declive
- 5 Folium
- 6 Tuber
- 7 Pyramis
- 8 Uvula
- 9 Nodulus

Brainstem Anatomy

- | | |
|---|------------------------|
| A | Midbrain |
| B | Pons |
| C | Medulla |
| D | Cerebral aquaduct |
| E | Fourth ventricle |
| F | Primary fissure |
| G | Posterolateral fissure |

LESI CEREBELLUM

1. DISEKUILIBRIUM

ASTENIA (otot – otot anggota gerak
Terasa lembek dan cepat lelah)

PENDULAR (turunnya refleks tendon)

2. DISKOORDINASI MUSKULAR

- ❖ ASINERGIA (Kesimpangsiuran gerakan)
- ❖ DEKOMPOSISI GERAKAN (Gerakan urutan kontraksi otot secara volunter tdk bisa)
- ❖ DISDIADOKINESIA (gerakan cepat yang arahnya berlawanan)
- ❖ DISMETRIA (Hipometria – jangjauan gerakan volunter yang terlampau pendek)
- ❖ HIPERMETRIA

LESI CEREBELLUM

LOBUS FLOKULONODULARIS

NISTAGMUS

TREMOR

DISARTHRIA

VERMIS

ROSTRAL

CAUDAL

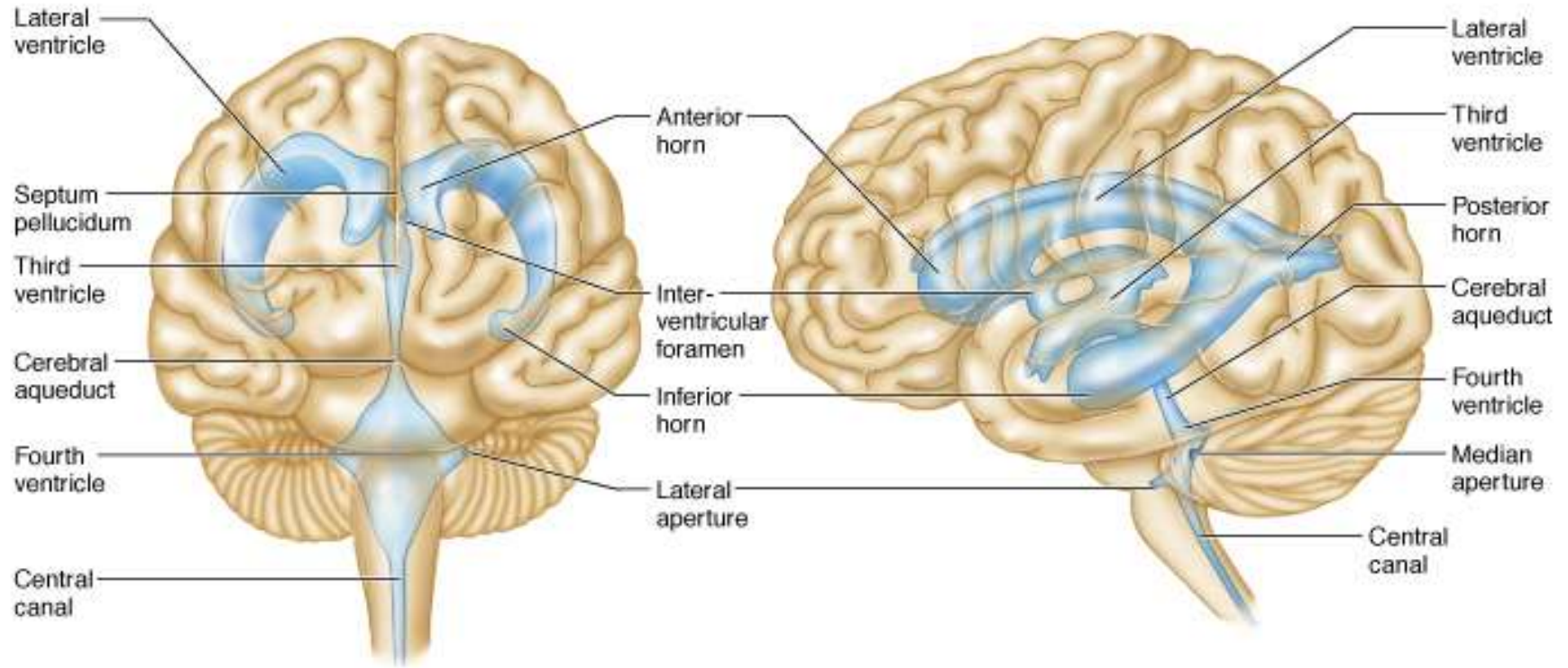
GAIT ATAKSIA (kedua tungkai
Melangkah secara simpang siur dan ke2
Kaki ditelapakkan secara acak - acakkan

TRUNKAL ATAKSIA (badan yg tdk
Bersandar tidak dapat memlihara sikap
Yang mantap shg bergoyang – Goyang)

HEMISFER CEREBELLUM

LIMB ATAKSIA (ataksia yg timbul terutama pd kedua lengan)

Ventricles

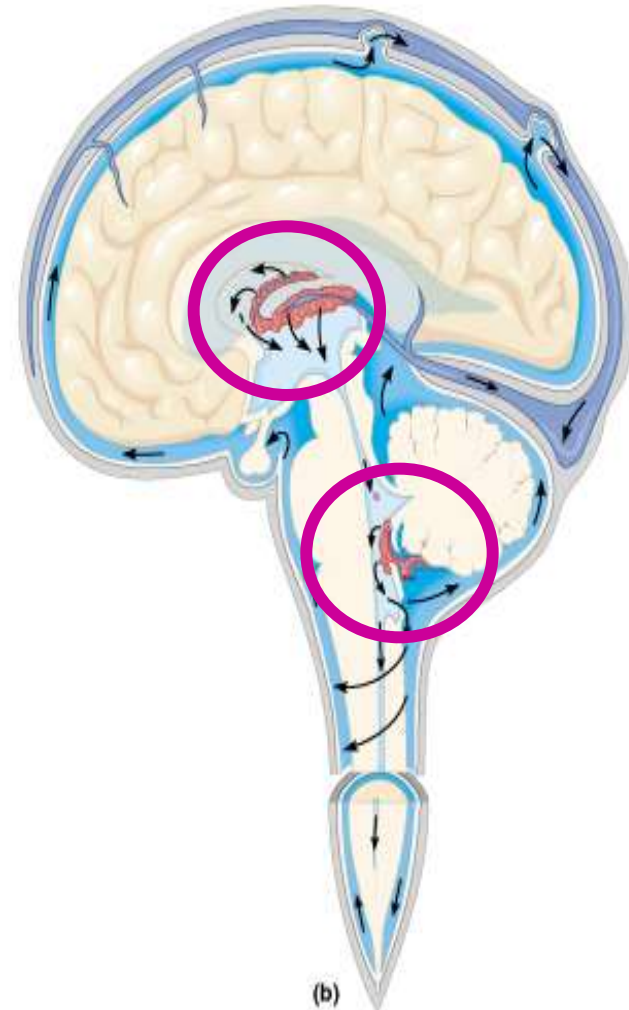


(a) Anterior view

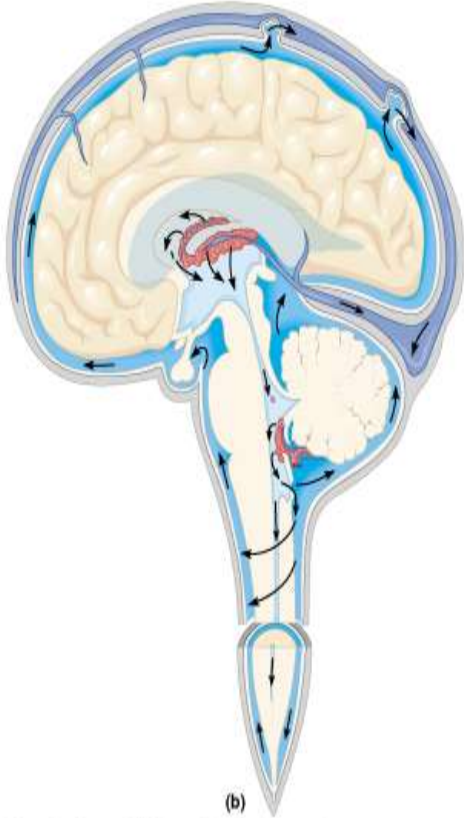
(b) Left lateral view

CSF: sodium, chloride ions, proteins, glucose, O₂

- Liquid cushion for brain and spinal cord
- Nourishes brain
- Removes waste
- Conducts chemical signals between parts of CNS
- Produced in **Choroid Plexuses**: group of capillaries surrounded by ependymal cells
- Forms as a filtrate of blood



Flow of CSF



- Formed in Choroid plexuses
- Through Ventricles
- Into Subarachnoid space & central canal from 4th ventricle
- Through Arachnoid Villi into Superior Sagittal Sinus
- Into Internal Jugular Vein

- Aspek klinis :
 1. Hydrosepalus komunikans
 2. Hydrosepalus non komunikans

Lintasan ekstrapiramidal

Yaitu semua jaras, inti dan srkuit yang mempengaruhi aktivitas somatomotorik, selain Intasan piramdal

Terdiri dari :

1. Korteks motorik
2. Basal ganglia
3. Inti – inti talamus dan subthalamus
4. Nukleus ruber dan substansia nigra (mesensefalon)
5. Inti – inti di formasio retikularis (pons dan medula oblongata)
6. Sirkuit feedback, jaras dan lintasannya
(kotikospinalis, kortikoretikulospinalis, dan vestibulospinalis)

Susunan ekstrapiramidal dengan formasio retikularis :

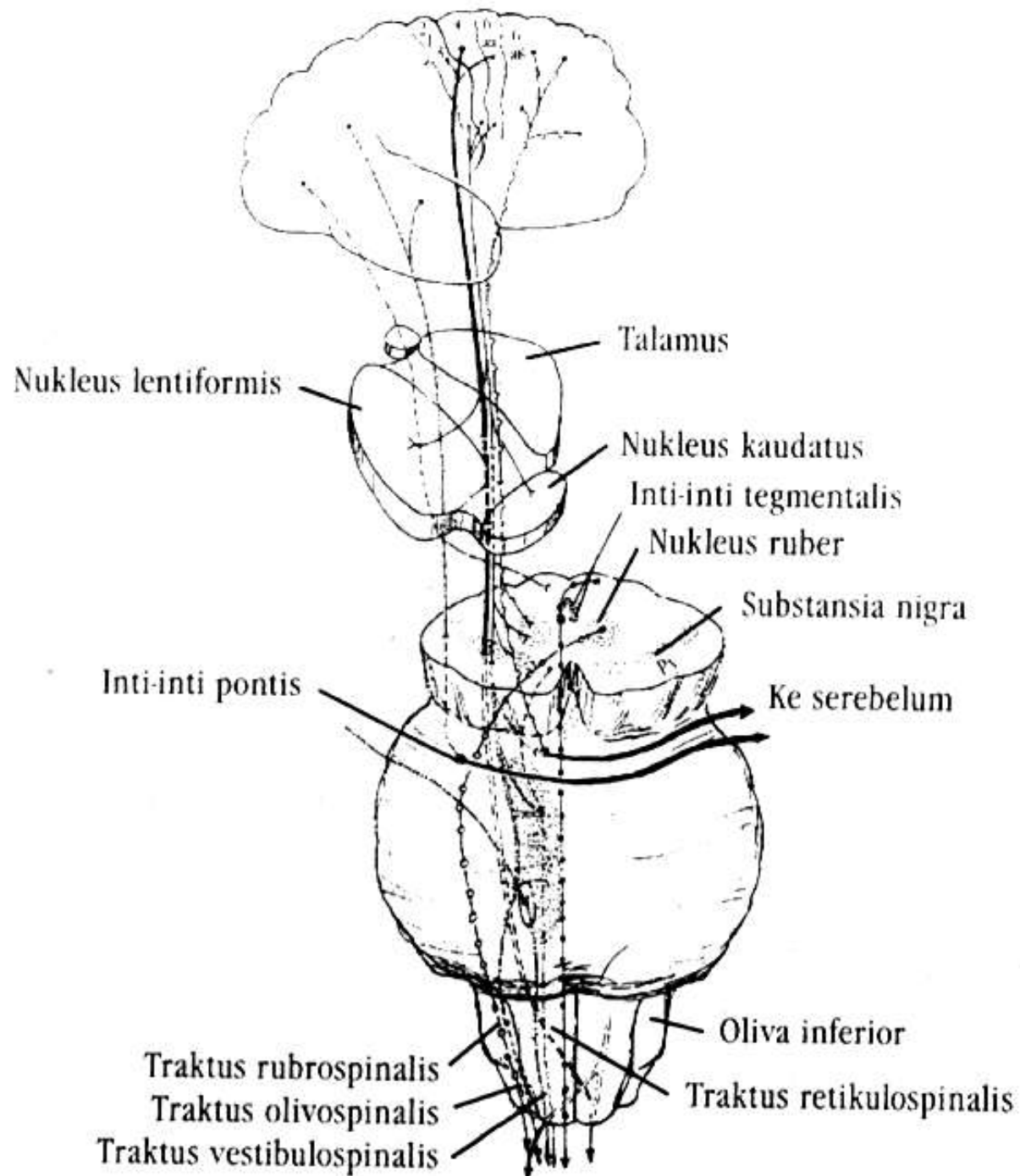
- Pusat eksitasi / fasilitasi : mempermudah pengantar impuls ke korteks maupun ke motor neuron.
- Pusat inhibisi : menghambat aliran impuls ke korteks/motor neuron.
- Pusat kesadaran

Fungsi susunan ekstrapiramidal :

Berkaitan dengan fungsi Intasan piramidal, terutama dalam memulai dan memperhalus gerakan – gerakan tubuh dan anggota gerak (terutama jari – jari)

Gangguan pada susunan ekstrapiramidal :

- Kekakuan / rigiditas
- Pergerakan-pergerakan involunter :
 - Tremor
 - Atetose
 - Khorea
 - Balismus



LESI GANGLIA BASALIS



CORPUS STRIATUM KONTRALATERAL

HIPERKINESIA - HIPOTONIA

Korea (Hemikorea kontralateral), yaitu Gerakan involunter mirip gerakan Tangan menari.

Atetosis yaitu keadaan motorik dimana Jari tangan, lidah, kaki atau otot wajah Tidak bisa diam sejenak

HIPO / BRADIKINESIA

Hipokinesia, yaitu tidak mampu bergerak namun tonus otot masih ada

Bradikinesia, yaitu kelambatan bergerak namun tonus otot masih ada



PARKINSON DISEASE

LESI GANGLIA BASALIS

NUKLEUS SUBTALAMIKUS KONTRALATERAL &
KORPUS STRIATUM KONTRALATERAL

SINDROMA BALISTIK

BALISMUS, yaitu mirip Korea tapi gerakan lebih kasar

DISTONIA, yaitu sikap Menetap dari salah satu Atetotik yang hebat, dapat berupa hiperextensi Atau hiperflexi tangan, Hiperinversi kaki

HIPERTONIA/ RIGIDITAS, yaitu tonus Otot yg meningkat yg Melawan gerakan flexi – extensi secara pasif

LESI GANGLIA BASALIS

**SUBSTANSIA NIGRA PARS KOMPAKTA &
KORPUS STRIATUM KONTRALATERAL**

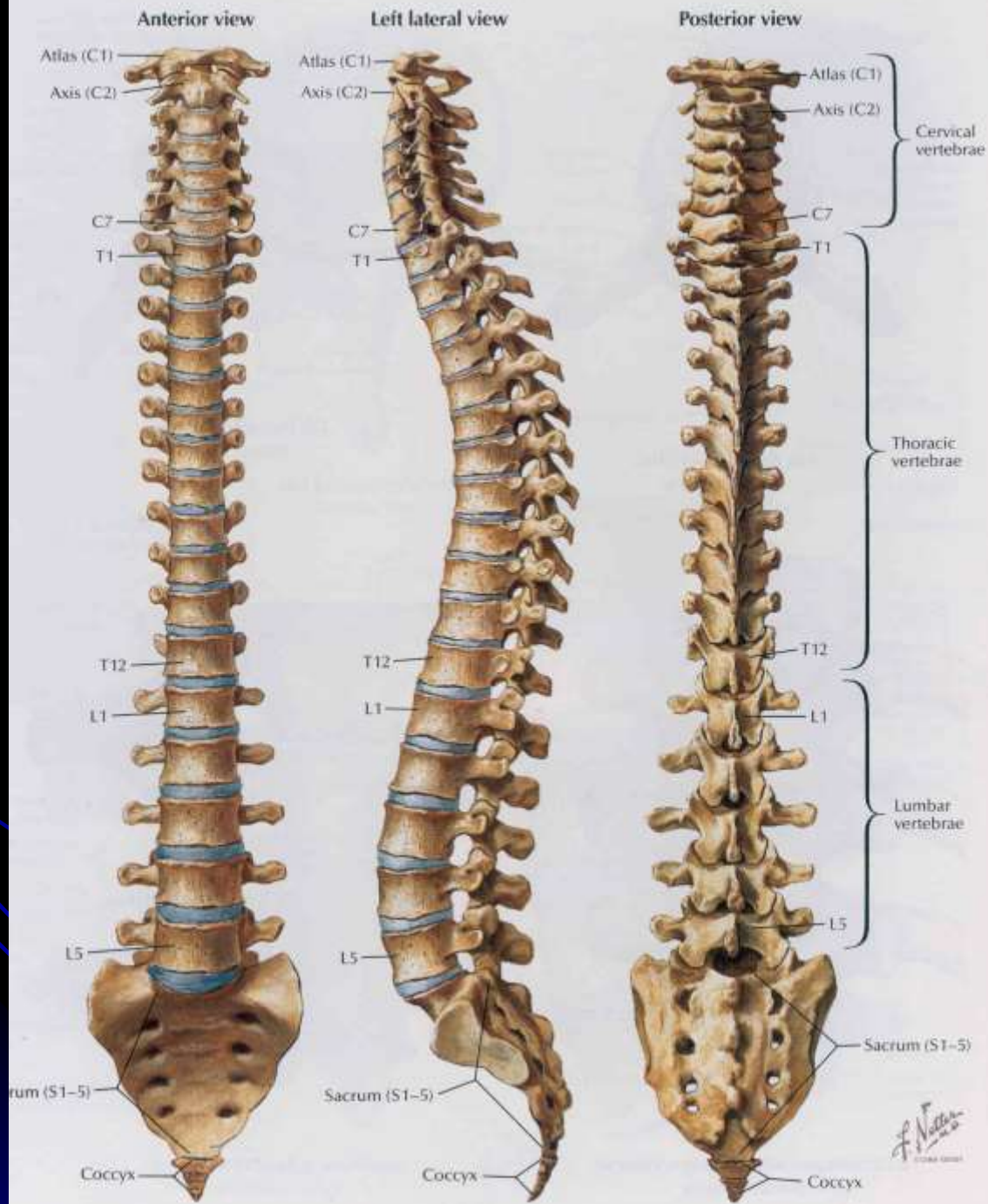
SINDROMA HYPOKINESIA – HIPERTONIA (PARKINSON)

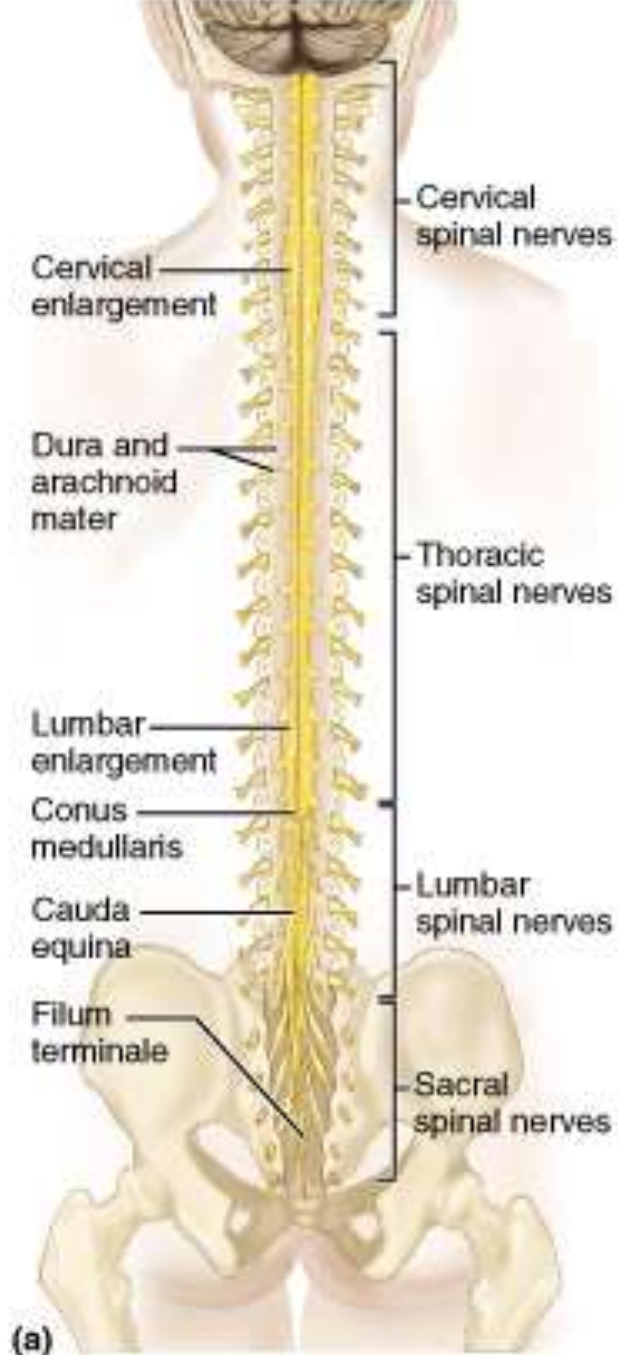
AKINESIA, yaitu
Mobilitas gerak lambat
Meliputi pro/retro/
lateropulsi

RIGOR /RIGIDITY,
yaitu otot tidak
Dapat relaksasi dan terjadi
Cogwheel rigidity tanpa
Parese

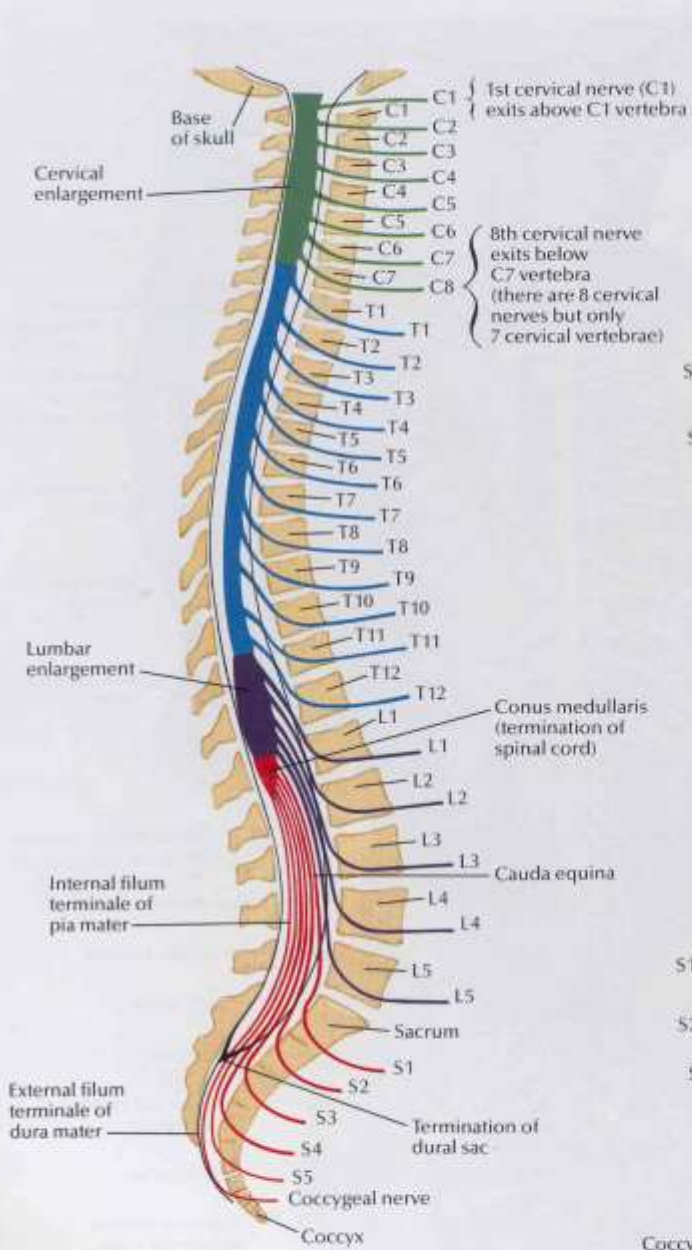
RESTING TREMOR
Gerakan ritmik tangan
pada saat istirahat

MEDULA SPINALIS

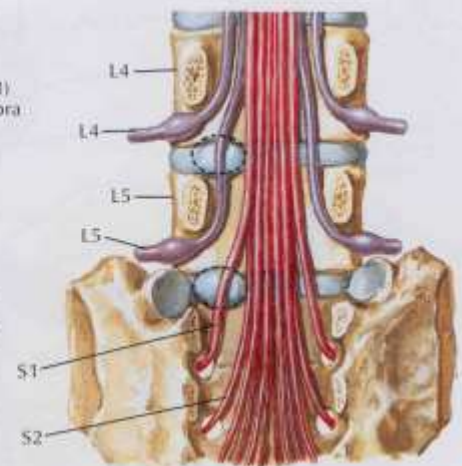




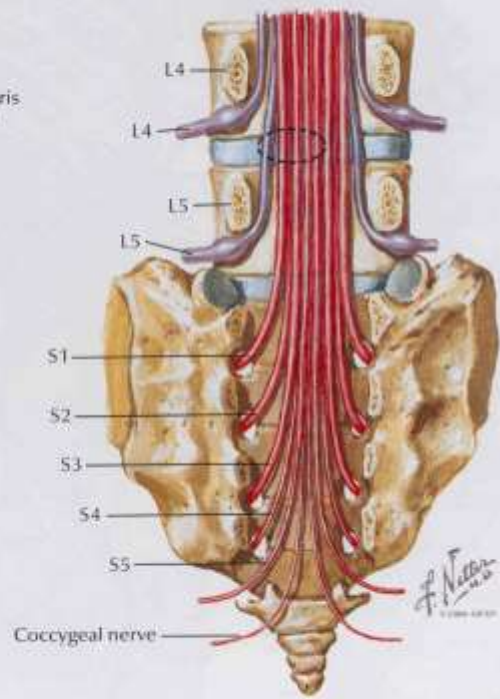
(a)



- Cervical nerves
- Thoracic nerves
- Lumbar nerves
- Sacral and coccygeal nerves



Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4-5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5-S1 affects 1st sacral nerve, not 5th lumbar nerve



Medial protrusion at disc level L4-5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st-4th sacral nerves

Myelum dari Foramen magnum  vertebra L1-2

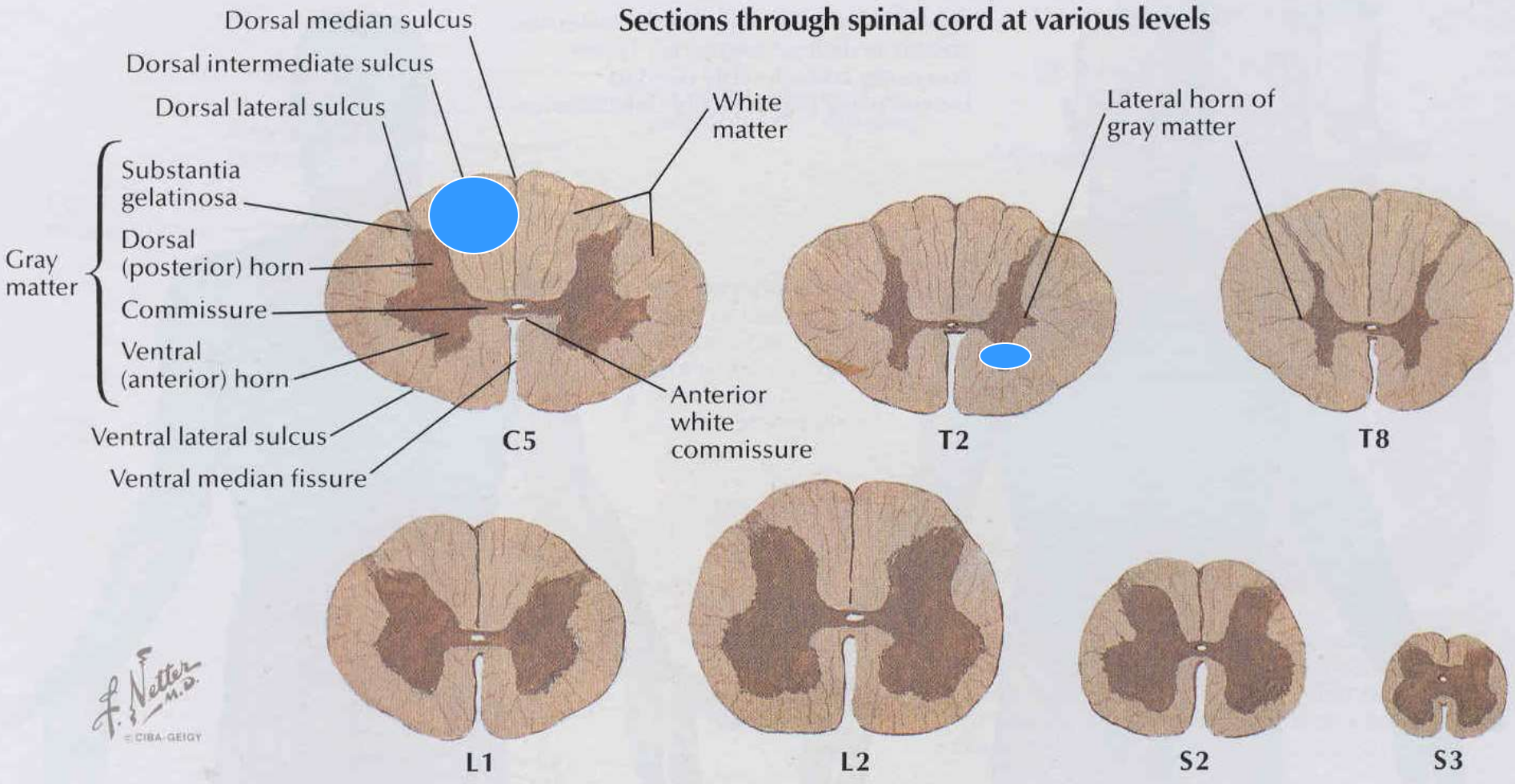


ASCENDENS MEDULARE

TEMPAT KELUARNYA SEGMENT NERVUS SPINALIS
BERBEDA DENGAN VERTEBRA

VERTEBRA	SEGMENT MYELUM
Cervical	+1
Thoracal	+2
Lumbal-Sacral	+3

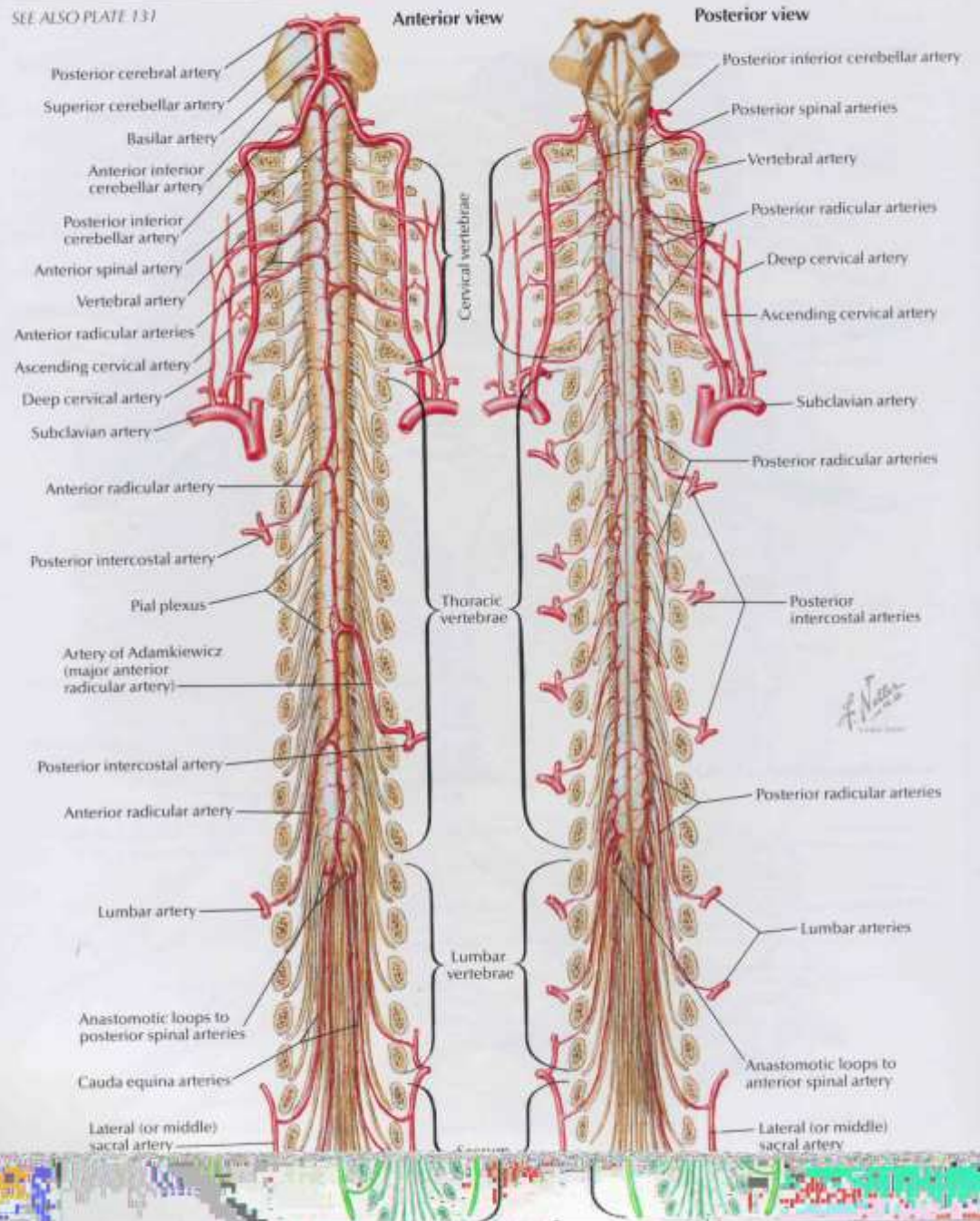
Sections through spinal cord at various levels

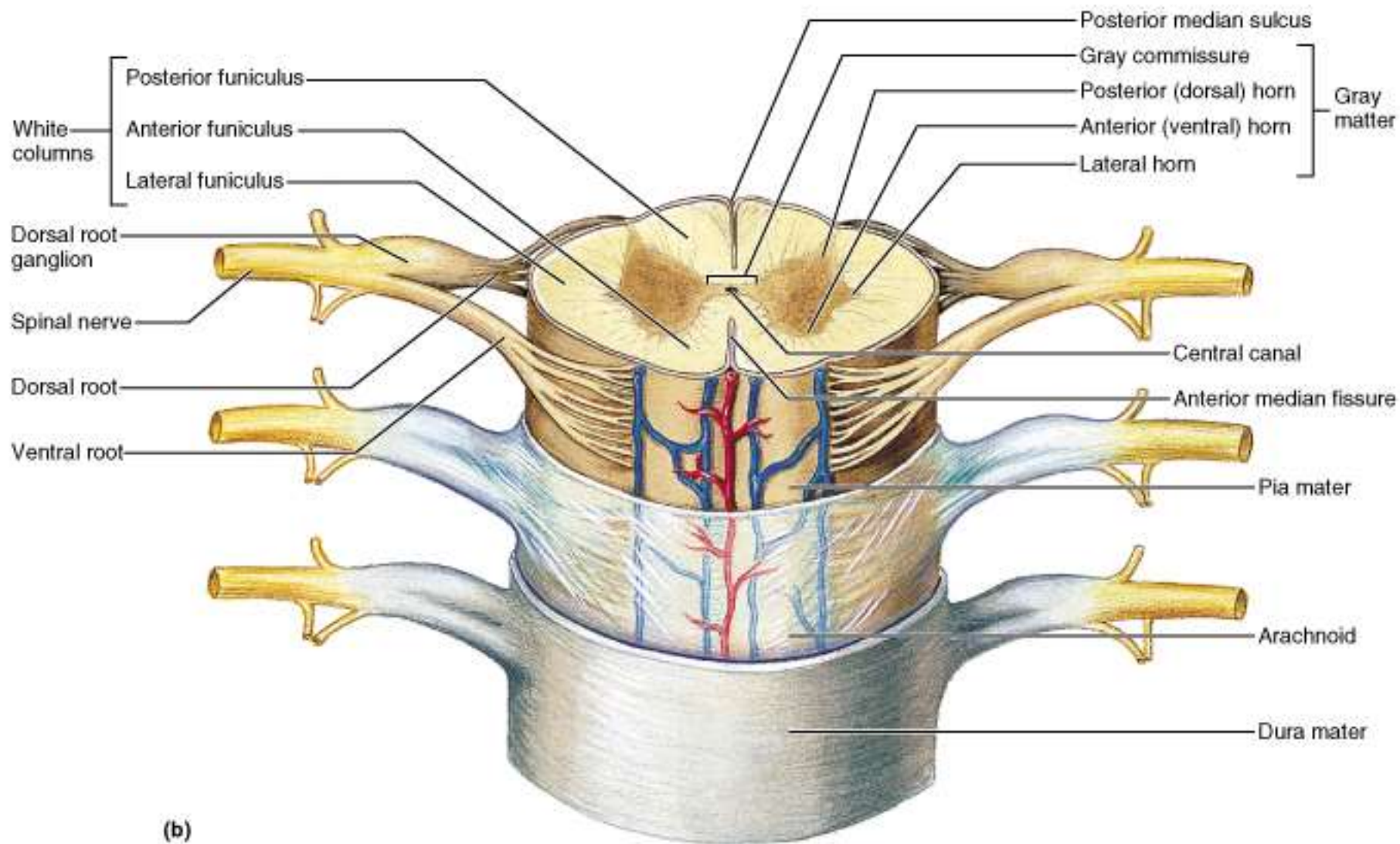


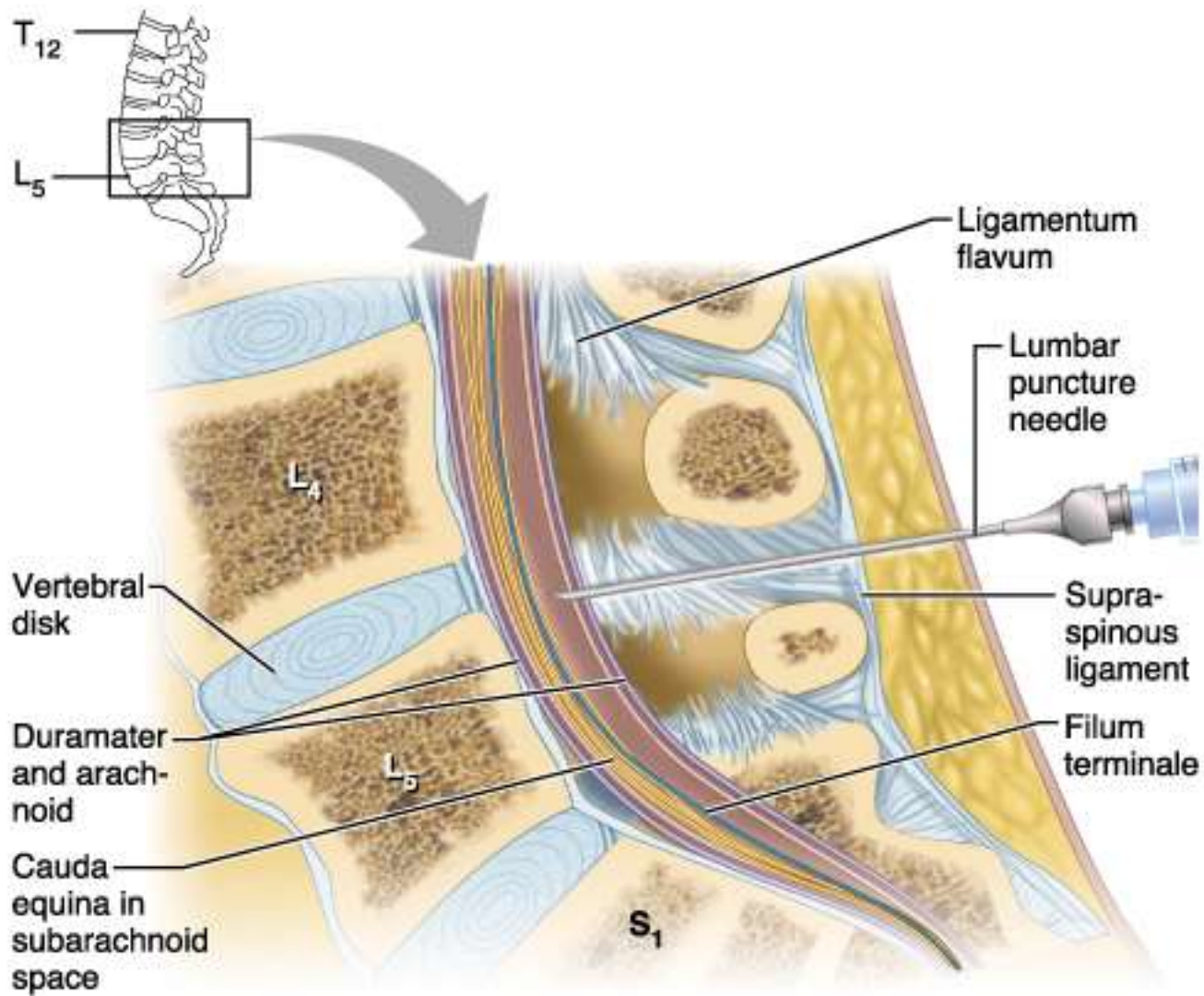
F. Netter M.D.
© CIBA-GEIGY

Arteries of Spinal Cord: Schema

SEE ALSO PLATE 131

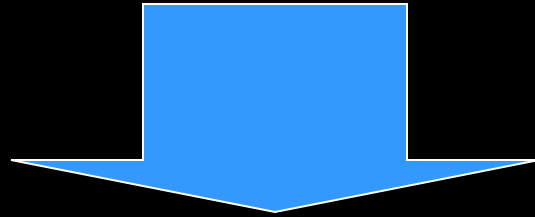






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Secara klinis ada 4 traktus yang penting

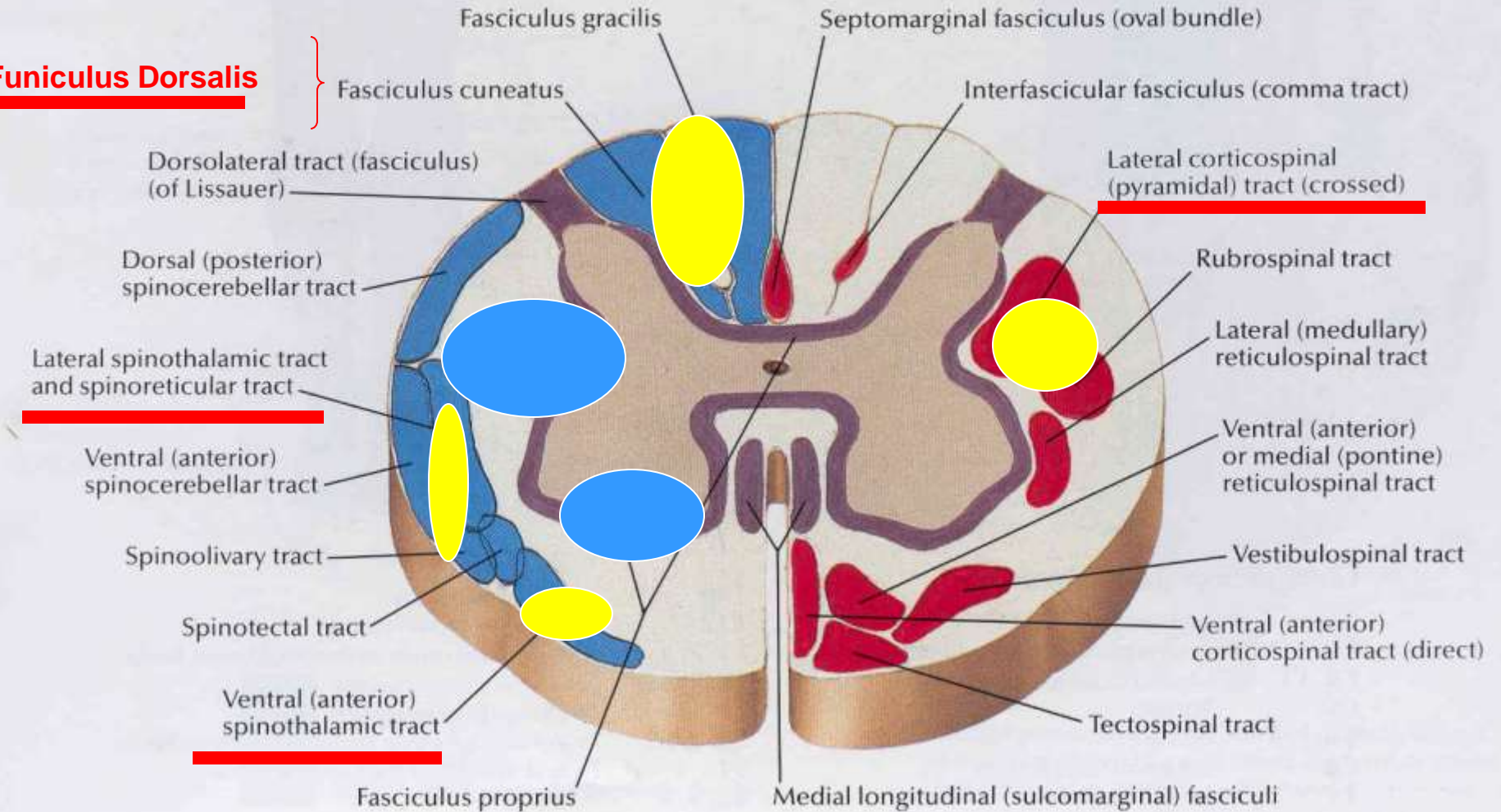


- 1. Traktus spinotalamikus anterior** (Rangsangan raba)
- 2. Traktus spinotalamikus lateralis** (rangsangan nyeri dan suhu)
- 3. Kolumna dorsalis medula spinalis** (Rangsangan proprioseptif disalurkan melalui)
- 4. Tractus Kortikospinalis lateralis** (Motorik)

Principal fiber tracts of spinal cord

- Ascending pathways
- Descending pathways
- Fibers passing in both directions

Funiculus Dorsalis



Menentukan tinggi lesi medula spinalis

berdasarkan : **gangguan motorik**
gangguan sensibilitas
gangguan susunan saraf otonom

Gangguan motorik biasanya timbul kelumpuhan yg sifatnya **paraparese / tetraparese**

- Paraparese UMN : lesi terdapat supranuklear thd segmen **medula spinalis lumbosakral (L2-S2)**.
- Paraparese LMN : lesi setinggi segmen medula spinalis **L2-S2 atau lesi infra nuklear**.
- Tetraparese UMN : lesi terdapat supranuklear terhadap segmen medula spinalis servikal
- Tetraparese : ekst.superior LMN
ekst. Inferior UMN

Gangguan sensibilitas :

- **Gangguan rasa eksteroseptif**
- **Gangguan rasa propioseptif**

Biasanya yg dipakai u/ tinggi lesi →

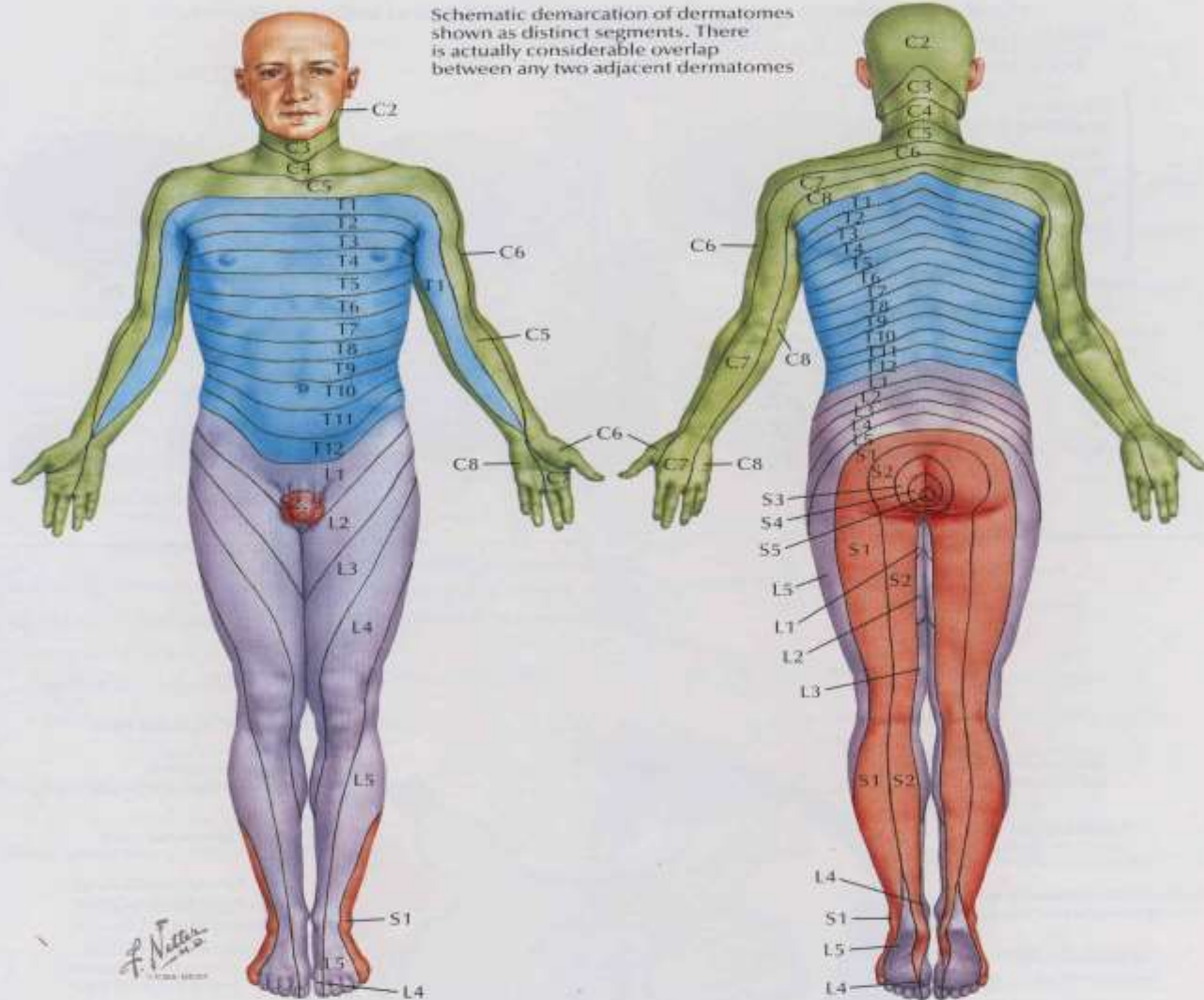
pemeriksaan eksteroseptif
(Dermatoma)

Gangguan sensibilitas segmental :

- Lipatan paha : **lesi Medula spinalis L1**
- Pusat : **lesi medula spinalis thorakal 10**
- Papila mammae : **lesi medula spinalis th. 4**
- Saddle Anestesia : **lesi pada konus**

SEE ALSO PLATES 455, 511; FOR MAPS OF CUTANEOUS NERVES SEE PLATES 18, 445, 447, 448, 449, 451, 454, 506-510

Schematic demarcation of dermatomes shown as distinct segments. There is actually considerable overlap between any two adjacent dermatomes



Levels of principal dermatomes

- C5 Clavicles
- C5, 6, 7 Lateral parts of upper limbs
- C8, T1 Medial sides of upper limbs
- C6 Thumb
- C6, 7, 8 Hand
- C8 Ring and little fingers
- T4 Level of nipples

- T10 Level of umbilicus
- T12 Inguinal or groin regions
- L1, 2, 3, 4 Anterior and inner surfaces of lower limbs
- L4, 5, S1 Foot
- L4 Medial side of great toe
- S1, 2, L5 Posterior and outer surfaces of lower limbs
- S1 Lateral margin of foot and little toe
- S2, 3, 4 Perineum

Gangguan sensibilitas radikuler :

Extremitas atas / bawah

- **Ggn sensibilitas sesuai dgn radiks post.**

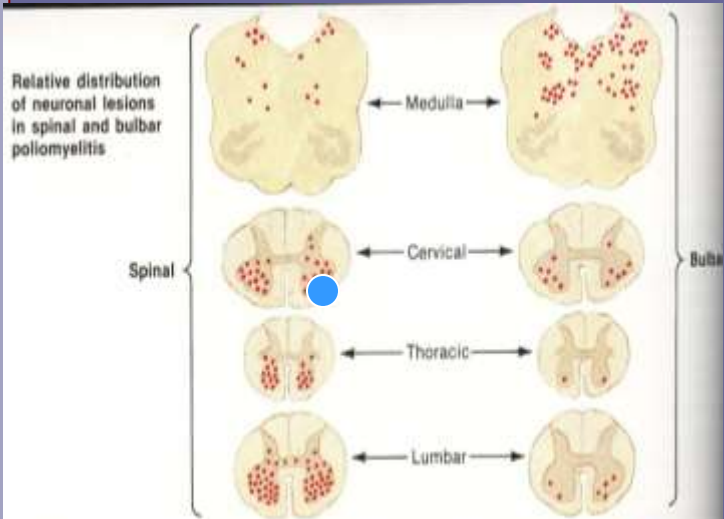
Ggn sensibilitas perifer :

- **Glove/stocking anestesia**

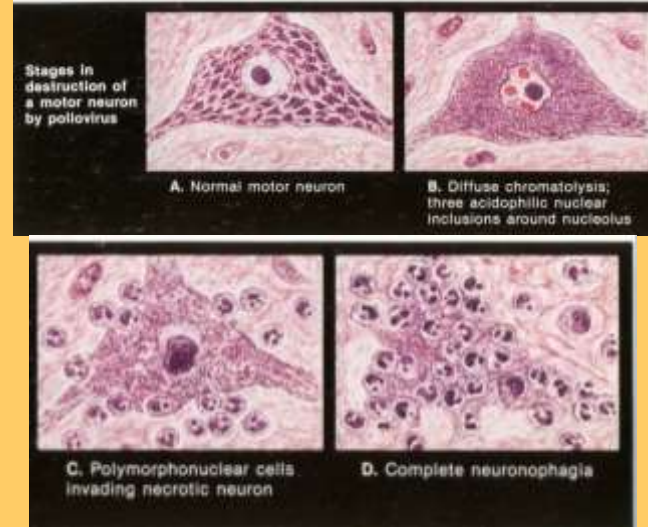
Gangguan Susunan Saraf Otonom :

- Produksi keringat**test perspirasi**
- Bladder : berupa inkontinensia urinae atau uninhibited bladder.
 - Autonomic bladder / spastic bladder
lesi medula spinalis supranuklear terhadap segmen sakral.
 - Flaccid bladder/overflow incontinence
lesi pada sakral medula spinalis.

LESI CORNU ANTERIOR MEDULA SPINALIS

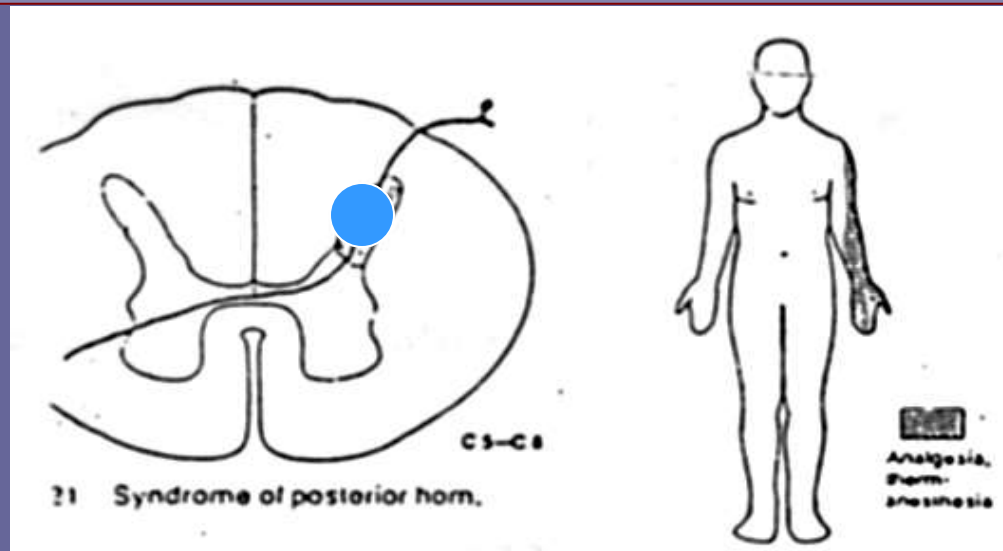


Paralytic residua of spinal poliomyelitis



- ☐ Mono / para/ tetraparesis (LMN)
- ☐ Paralyse flaccid
- ☐ Atrofi otot, fasikulasi
- ☐ Gambaran klinis yang lain sesuai gejala penyakit (Cth Poliomyelitis)

LESI CORNU POSTERIOR MEDULA SPINALIS



Defisit sensorik terutama proprioseptif, gerakan pasif sendi di bawah tingkat lesi dengan dermatome pada sisi yang sama

LESI MOTOR NEURON & JARAS KORTIKOSPINAL/ KORTIKOBULBAR

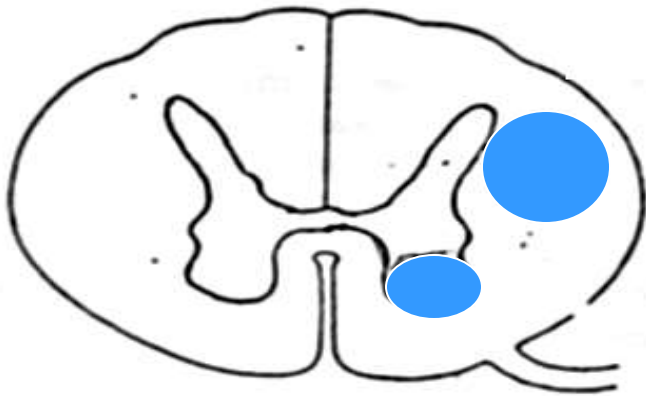


Fig. 2.25 Syndrome of combined lesions in anterior horns and lateral pyramidal tract (amyotrophic lateral sclerosis).



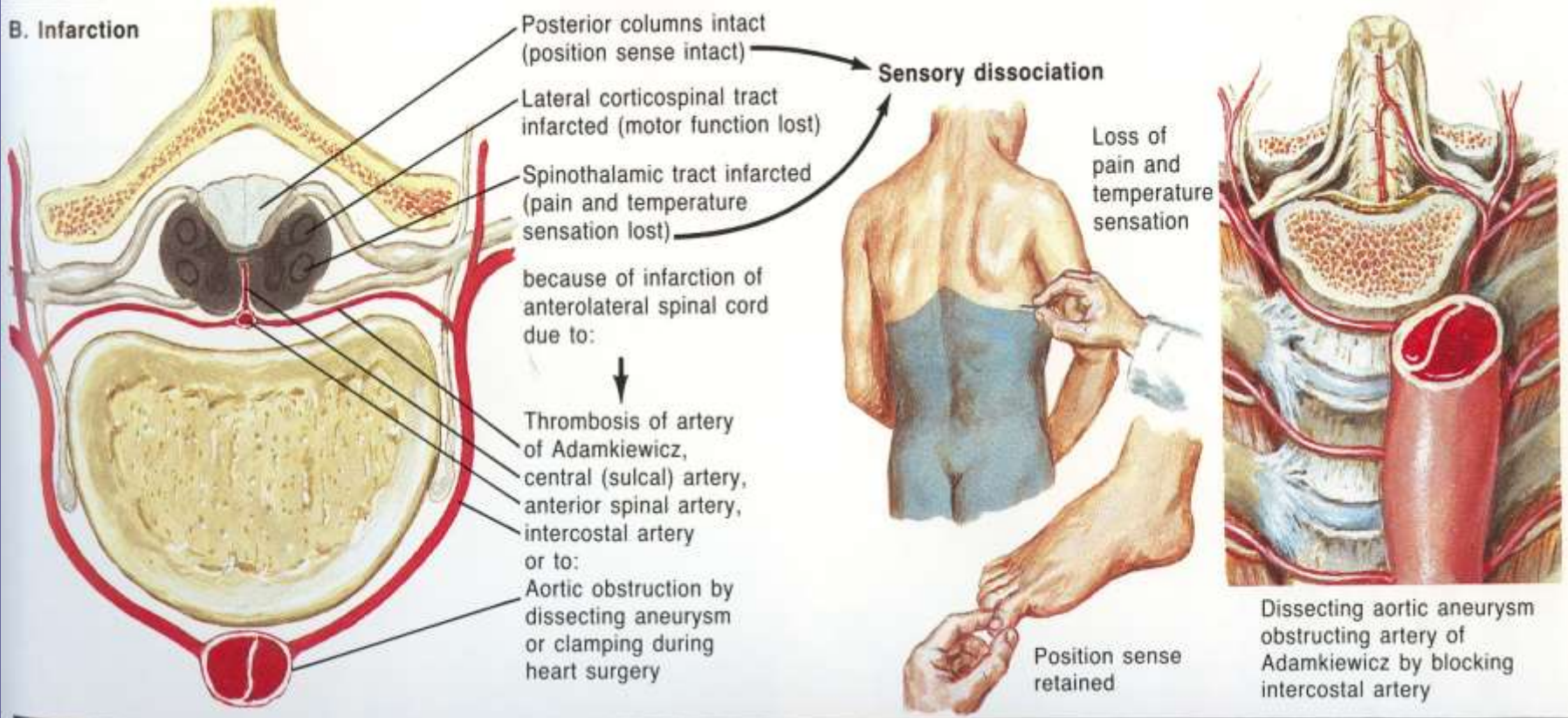
AMYOTROPHIC LATERAL – SCLEROSIS Atau MOTOR NEURON DISEASE

Mono/paraparese (flaccid) ditambah pola
Kelumpuhan UMN (tergantung letak lesi)

- ✳ Gejala UMN & LMN berbaur.
 - ✳ Tahap awal (UMN+LMN), tahap akhir (LMN)
- ✳ Gejala LMN : Mono/para/tetraparese, atrofi otot, Fasikulasi
- ✳ Gejala UMN : Kelumpuhan bilateral (bila inti saraf Otak motorik → degenerasi, cth lidah)
- ✳ Hiperefleksia (Force crying / force laughing)
- Kelumpuhan UMN dan LMN secara berbauran
- Tetraparese, tangan parese LMN, tungkai parese UMN
- **Sensoris dan otonom normal**

SINDROMA ARTERI SPINALIS ANTERIOR

B. Infarction

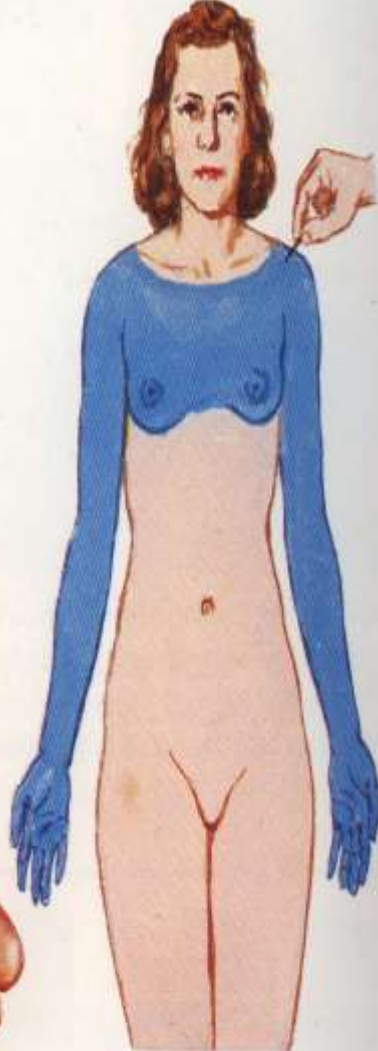


- ☐ Kelompokan UMN bilateral
- ☐ Disosiasi sensibilitas (hanya terjadi defisit sensorik protopatik bilateral Tingkat lesi ke bawah)
- ☐ Proprioseptif terganggu

Lesi pada canalis centralis / SINDROMA SIRINGOMYELIA



Atrophy of hand muscles due to neurotrophic deficit



Capelike distribution of pain and temperature sensation loss



Magnetic resonance image: area of diminished signal within cervical and upper spinal cord (arrows) is fluid-filled syrinx. Cerebellar tonsil extends below foramen magnum

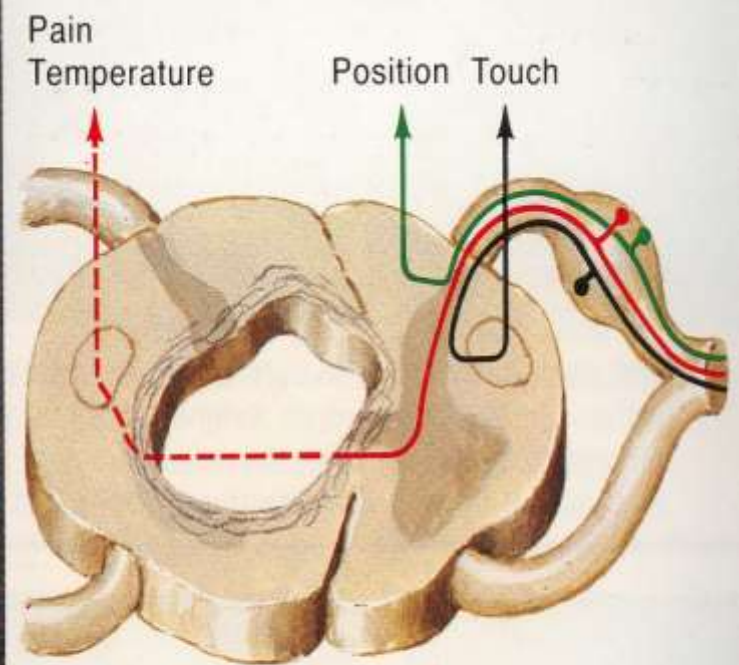
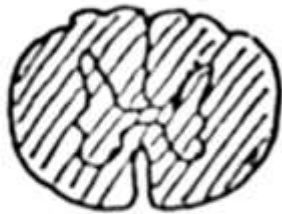


Diagram demonstrating interruption of crossed pain and temperature fibers by syrinx. Uncrossed light touch and proprioception fibers preserved

- ☐ Kelompokan bilateral (LMN) tergantung Letak lesi
- ☐ Disosiasi sensibilitas
- ☐ Reaksi neurovegetatif (-)

LESI MYELUM TRANSVERSAL CERVICAL ATAS

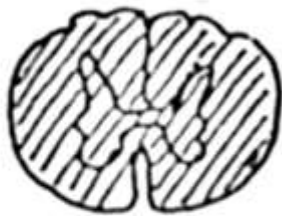
LESI TRANSVERSAL



- ▣ Tetraplegi UMN di bawah lesi, pd tingkat lesi bersifat LMN
- ▣ Hipestesi setingkat lesi
- ▣ Reaksi neurovegetatif (-)
- ▣ Lesi di atas C3 fatal (menghentikan Pernafasan – paralisa n.phrenicus Dan interkostalis)

LESI MYELUM TRANSVERSAL CERVICAL BAWAH

LESI TRANSVERSAL



- Kelumpuhan UMN di bawah tingkat lesi (kedua tungkai)
- Kelumpuhan LMN di tingkat lesi (kedua tungkai)
- Dari tingkat lesi ke bawah, penderita quadriplegia atau tetraplegia
- Anestesi protopatik
- Anestesi proprioseptif
- Retensi urin
- Retensi alvi
- Gangguan pada fungsi motorik, somatosensorik, fungsi neurovegetatif dan autonom

LESI MYELUM TRANSVERSAL THORACAL ATAU LUMBAL ATAS

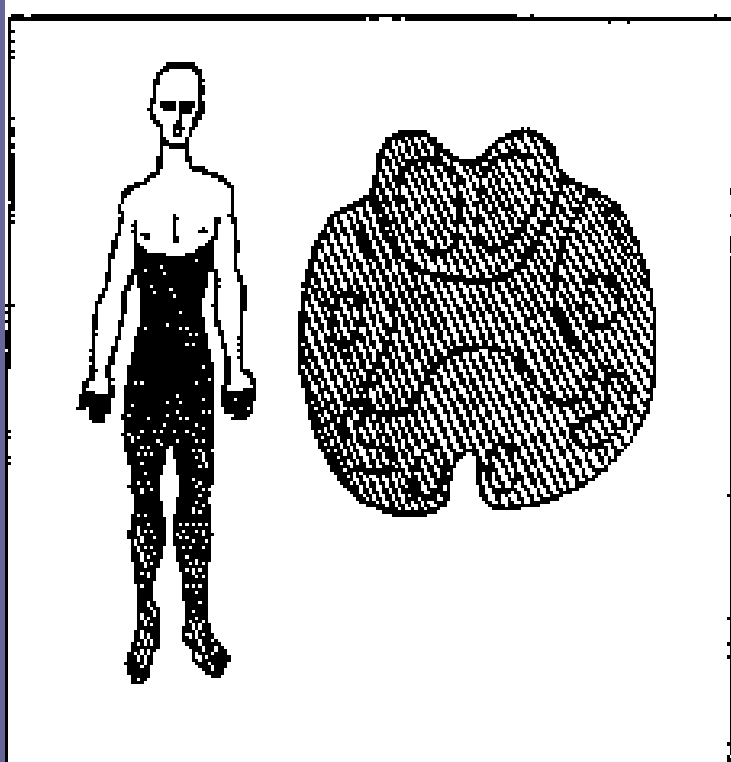


Figure 2-30: Complete spinal cord transection

- ▣ Paraplegi UMN di bawah lesi, pada Tingkat lesi bersifat LMN
- ▣ Hipestesi setingkat lesi
- ▣ Tidak bisa defekasi dan miksi
- ▣ Gangguan otonom

LESI MYELUM TRANSVERSAL LUMBAL PALING BAWAH BAWAH DAN SAKRAL

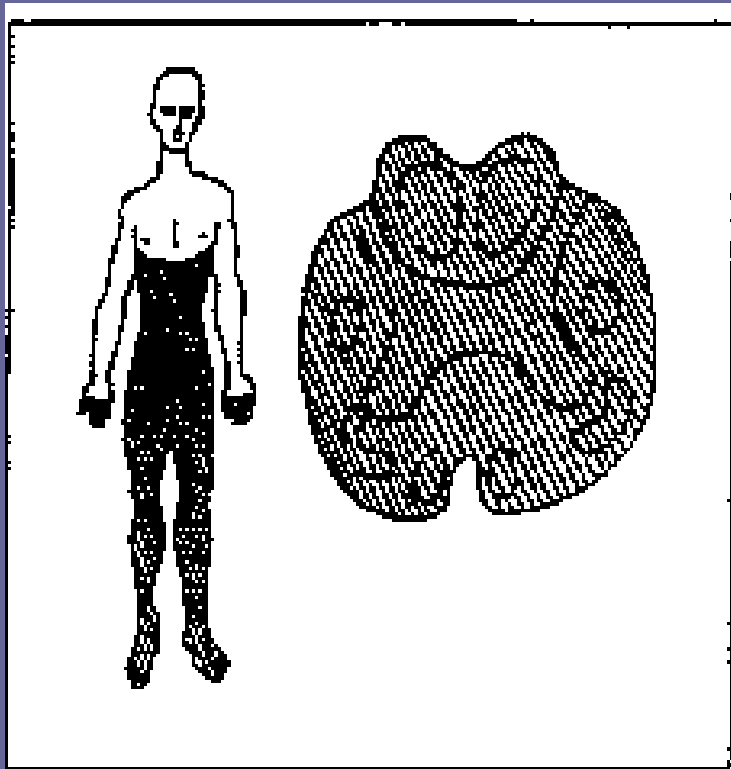


Figure 2-30: Complete spinal cord transection

- ▣ Paraplegi UMN di bawah lesi, pada Tingkat lesi bersifat LMN
- ▣ Hipestesi setingkat lesi
- ▣ Tidak bisa defekasi dan miksi
- ▣ Gangguan otonom

LESI MYELUM HEMITRANSVERSAL

SINDROMA BROWN-SEQUARD

- ☐ Hemiplegi ipsilateral setinggi lesi (LMN)
- ☐ Kelumpuhan ipsilateral UMN di bawah Tingkat lesi
- ☐ Defisit sensorik proprioseptif ipsilateral
- ☐ Defisit sensorik protopatik kontralateral

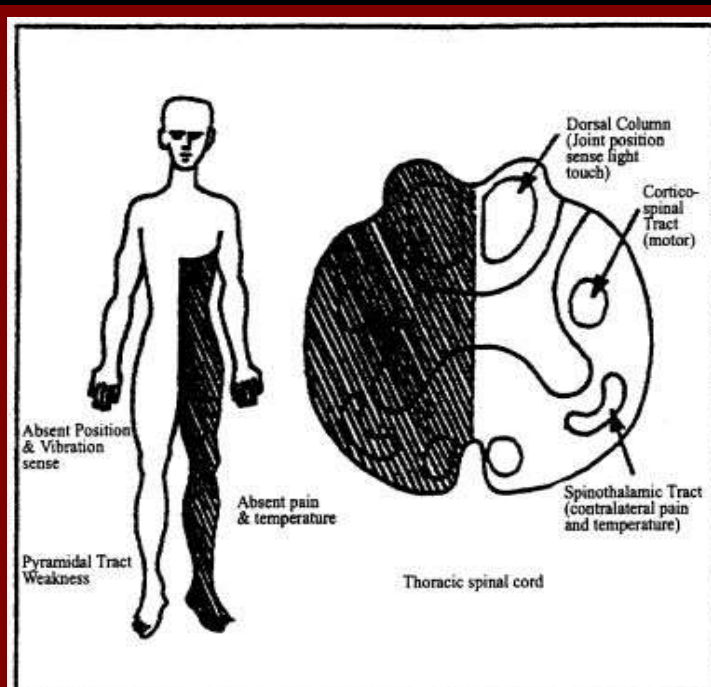


Figure 2-27: Brown-Séquard Syndrome (Unilateral hemi-cord lesion).

Noyaux gracile et
cunéiforme

HEMISECTION DROITE
(sur Th 6 par ex.)

Th 6

Voie lemniscale
(cordon post.)

Voie cortico-spinale
croisée

Voie spino-thalamique ST
(thermo-algésique)

DU COTE
(HOMOL.)

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** Syndrom

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RESUME

- Hemiparese / hemiplegia

Tipika → hemisfere
Alternans → brainstem

- Involuntari movement :

- ggn pd susunan ekstrapiramidal.

- Ggn. Koordinasi , Keseimbangan, tonus:

- ggn pd serebellum.

- Gangguan medula spinalis :

- Gangguan motorik
- Gangguan sensorik
- Gangguan autonomik

Terima Kasih

SEMOGA BERMANFAAT

