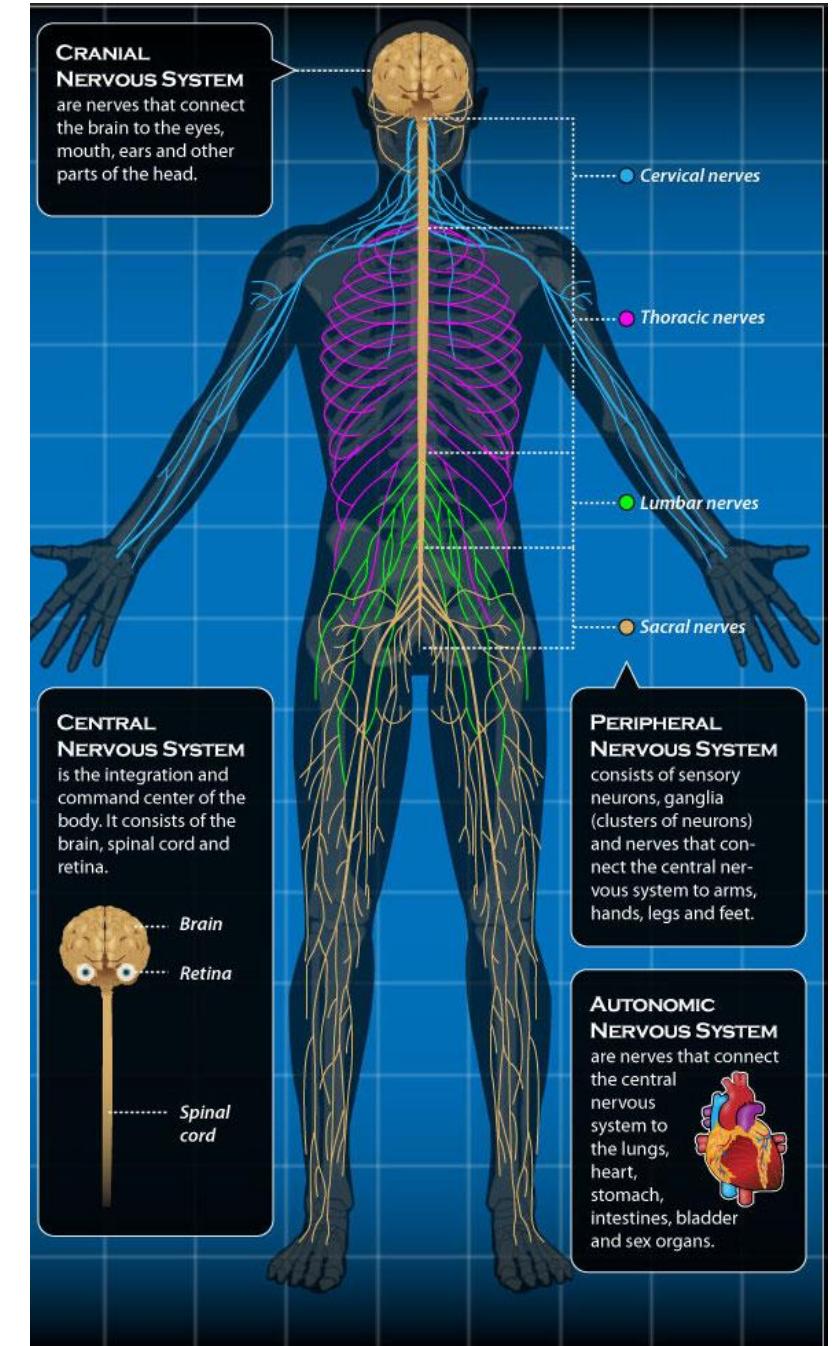


# Common Neurological Diseases and Diagnostics

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Neurologist, QMH  
BCHM 4608

# Nervous system

- Central nervous system
- Peripheral nervous system
- Autonomic nervous system



# **Diagnosis of Neurological Disorders**

## **Localization**

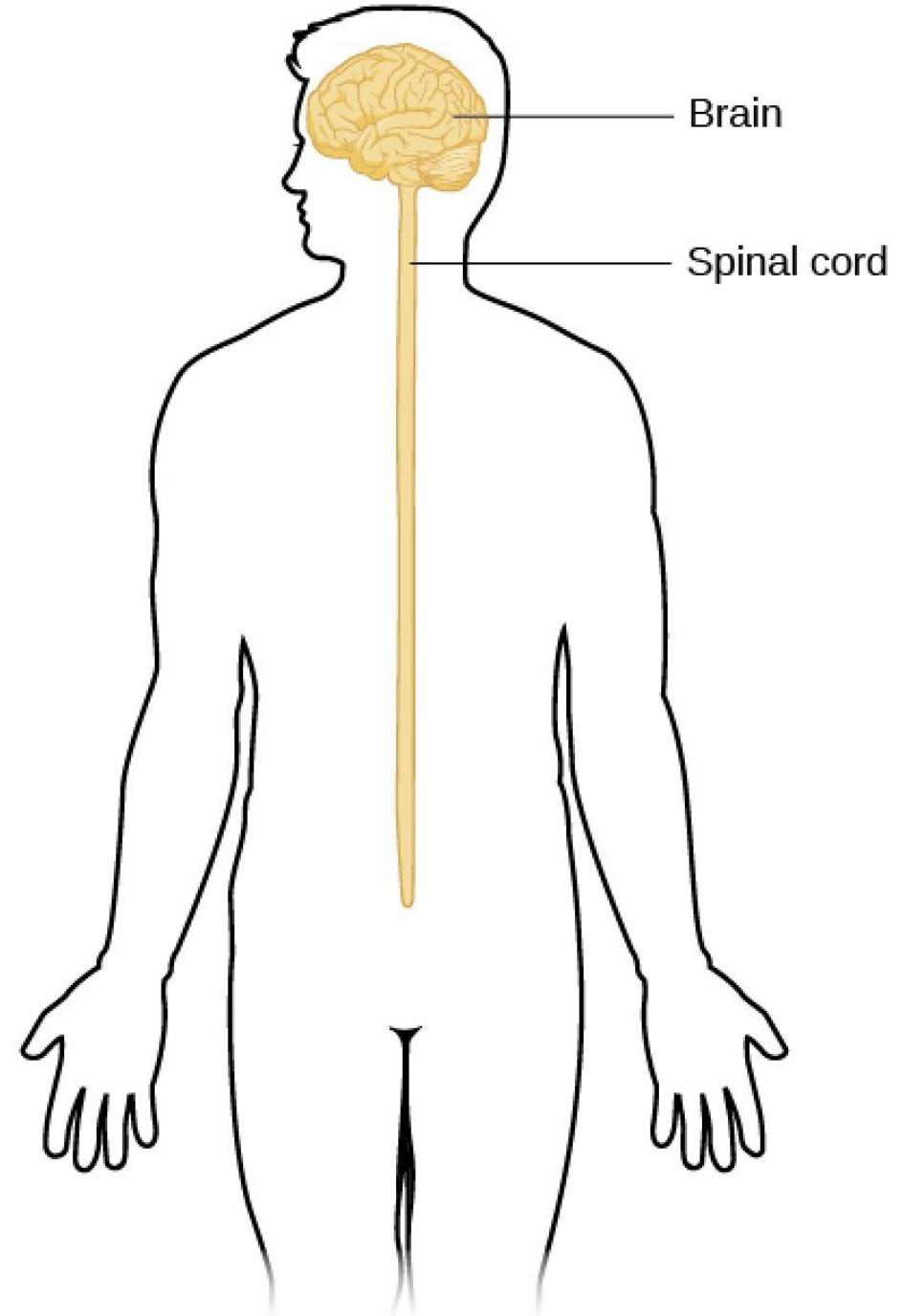
- **Where** is/are the lesion(s)?

## **Etiology**

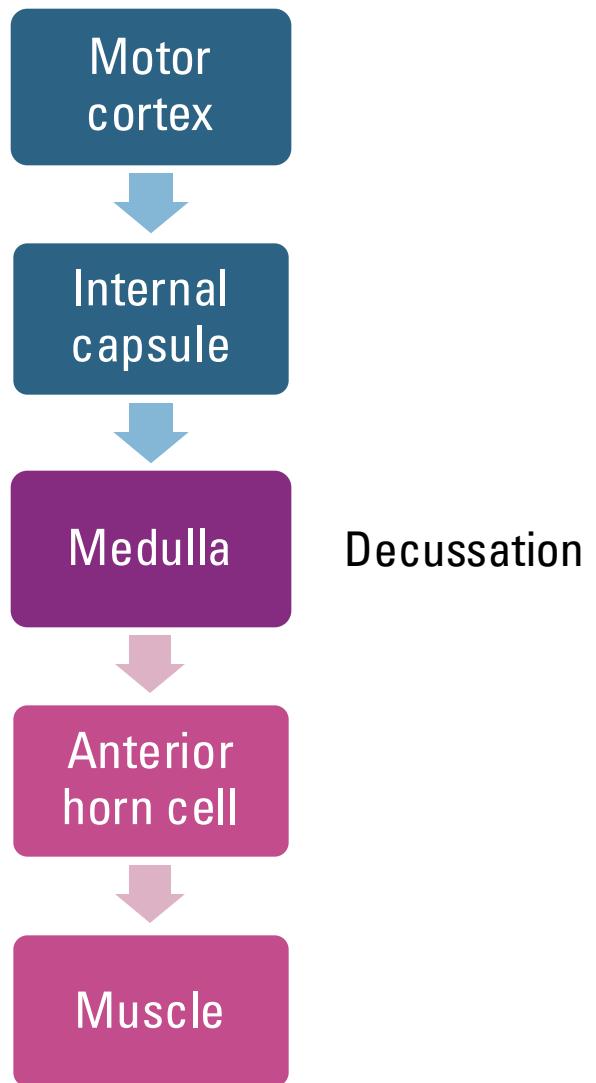
- **What** caused the lesion(s)?

# CNS

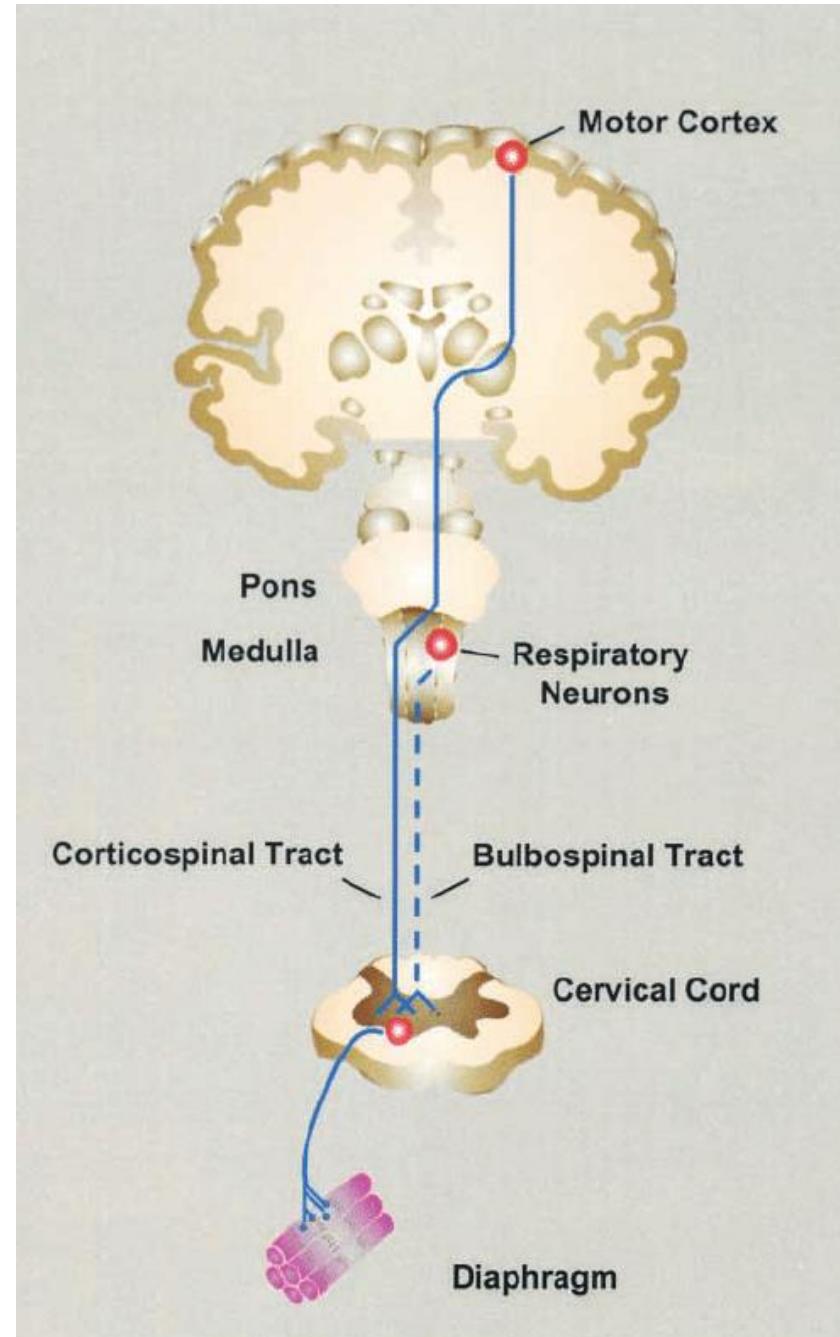
- Motor
- Sensory
- Coordination
- Higher cortical function
  - Memory, Learning, Behavior, Emotion



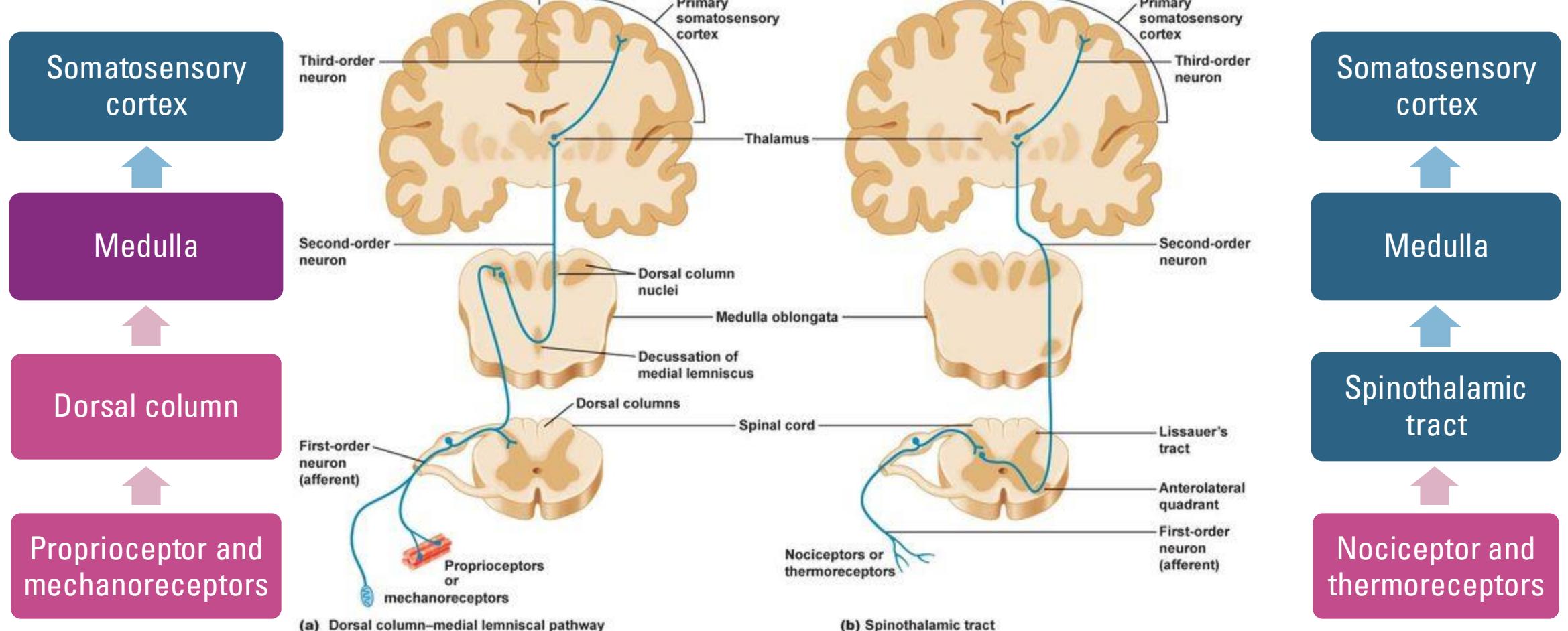
# Motor Pathway: output to contralateral side



Decussation



# Somatosensory cortex: Receives input from contralateral side

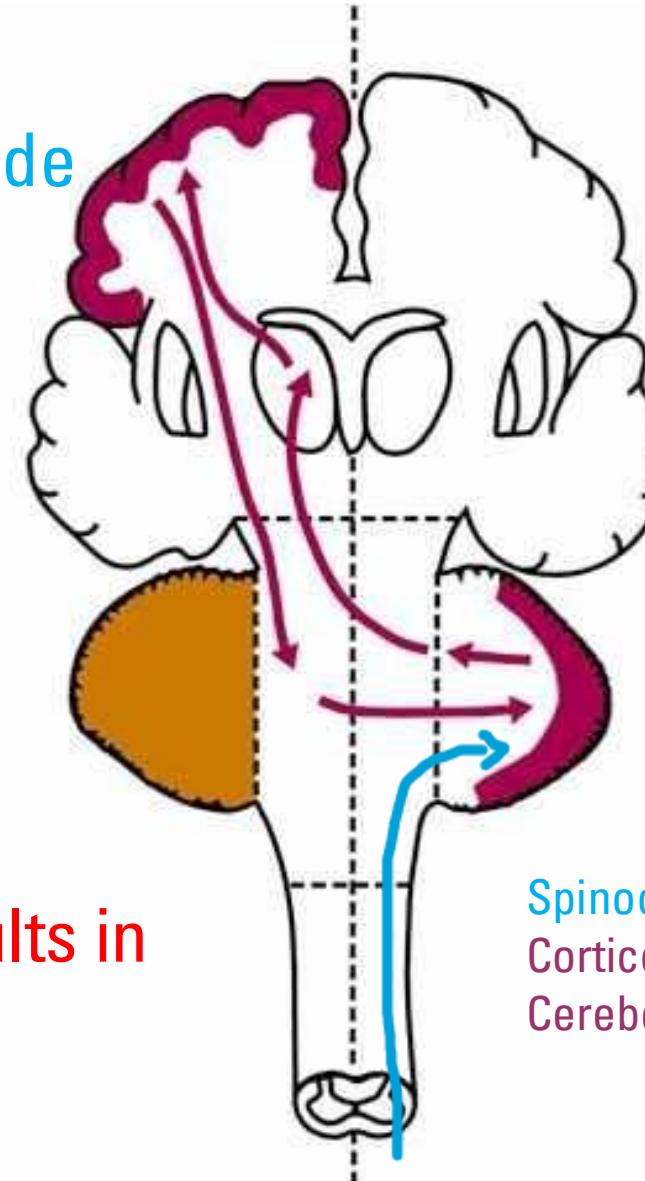


# Cerebellum:

Input from spinal cord of ipsilateral side

Input and output to motor cortex:

- Double crossed

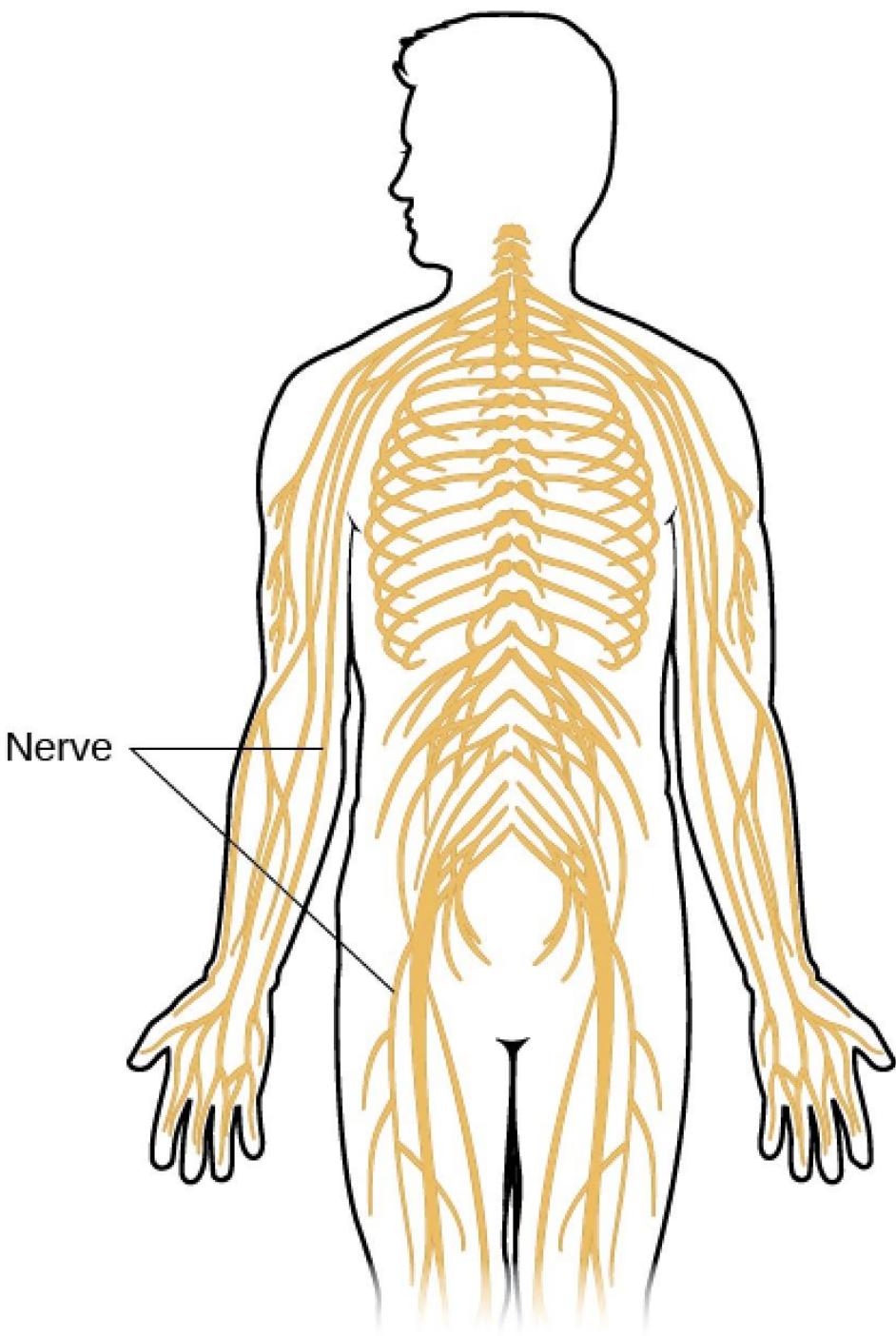


Unilateral lesion in cerebellum results in  
IPSILATERAL deficits

Spinocerebellar tract  
Corticopontocerebellar pathway &  
Cerebello-thalamic-cortical pathway

# PNS

- Nerve roots
- Nerves
- Neuromuscular junction
- Muscles



# Lesion localization

- Pattern of neurological deficits:
  - Motor/sensory/both?
  - Distribution: One side? One limb? Face and bulbar muscles affected? Generalized?
  - Upper or lower motor neuron signs?

# Etiology

- Clues from history:
- Onset
- Course
- Associated symptoms
- Family history

VINDICATE		
V	Vascular	
I	Infectious	
N	Neoplastic	
D	Degenerative	
I	Iatrogenic	Intoxication
C	Congenital	
A	Autoimmune	
T	Traumatic	
E	Endocrine	Metabolic

# Diagnostic tools

- History
  - Onset, course
  - Symptoms, distribution
- Physical examination
- Investigations



# Common Neurological Diseases



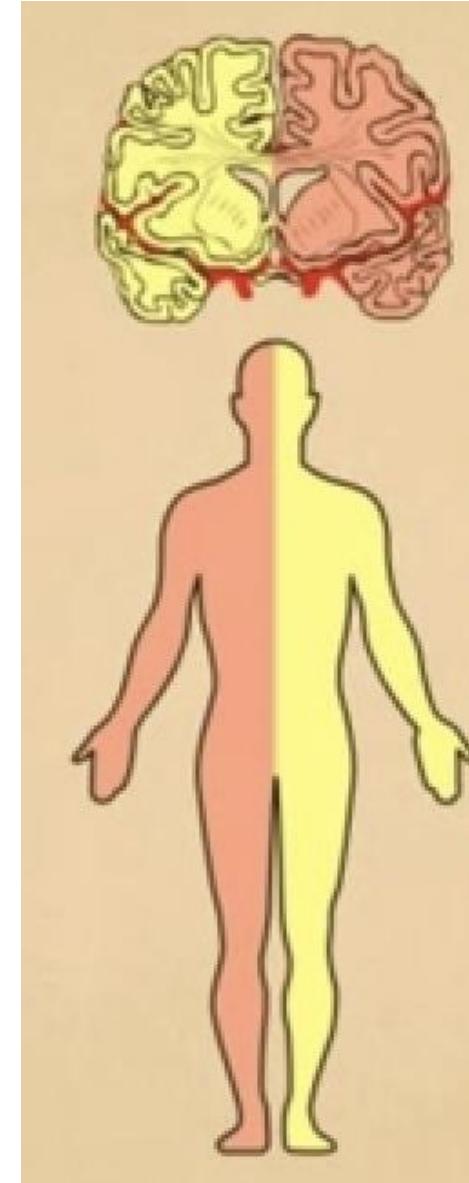
- And how to diagnose them

# Mr. A

- 60 years old chronic smoker
- Known hypertension and hyperlipidemia
- Sudden onset of right sided weakness for 1 hour
- Associated with slurred speech
- Examination showed right facial, upper and lower limb weakness and numbness

# Where is the lesion?

**Left brain**



# What is the cause of the lesion?

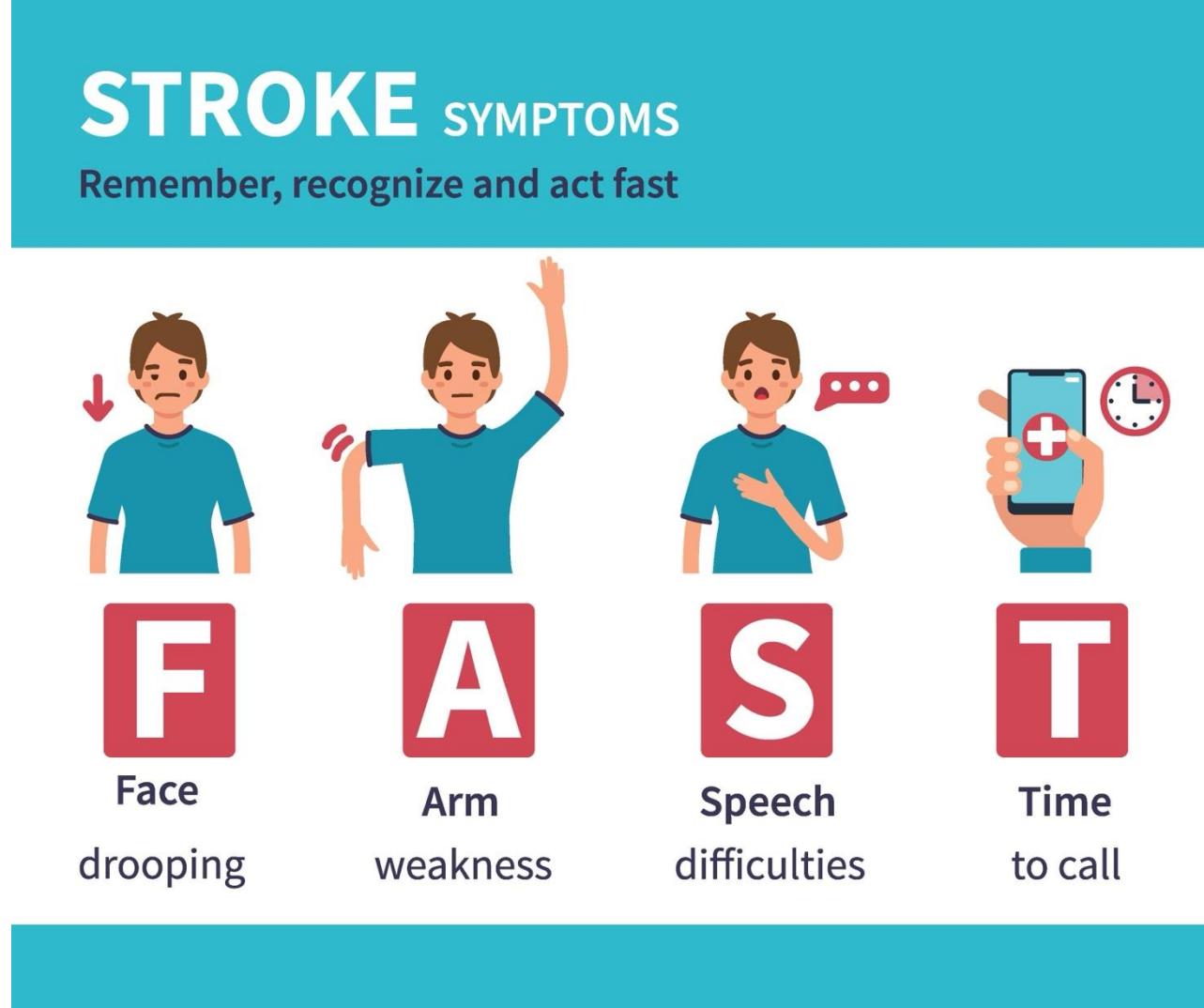
- Sudden onset
- Premorbid hypertension and hyperlipidemia
- Chronic smoker

→ **Vascular**

VINDICATE		
V	Vascular	
I	Infectious	
N	Neoplastic	
D	Degenerative	
I	Idiopathic	Intoxication
C	Congenital	
A	Autoimmune	
T	Traumatic	
E	Endocrine	Metabolic

# Stroke

- Ischemic or hemorrhagic
- Sudden onset of focal neurological deficits
- Medical emergency
- May be treatable with acute intravenous thrombolysis and/or mechanical thrombectomy

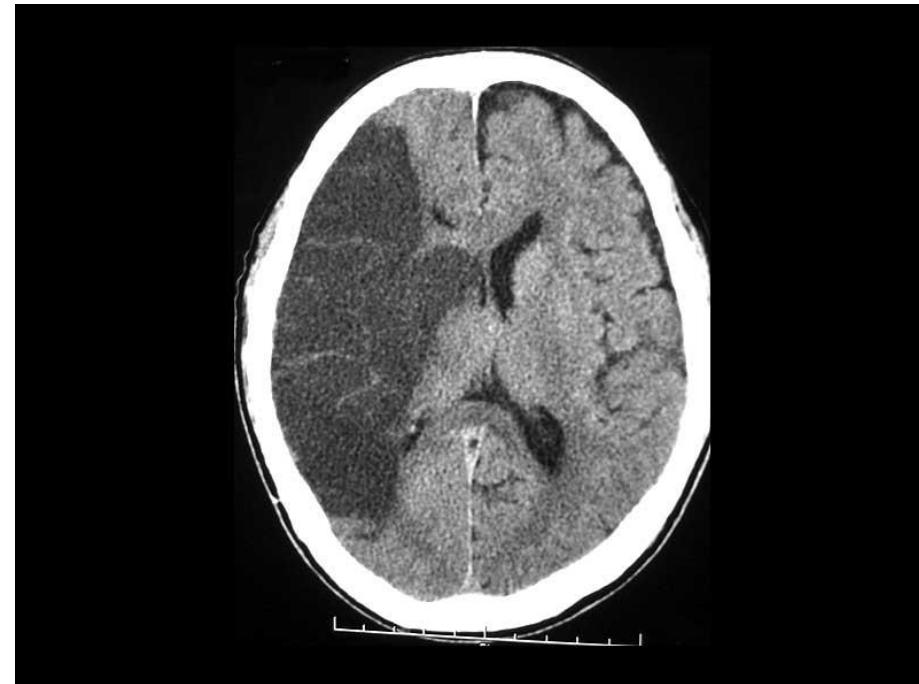


# Brain Imaging (CT scan)

Ischemic stroke

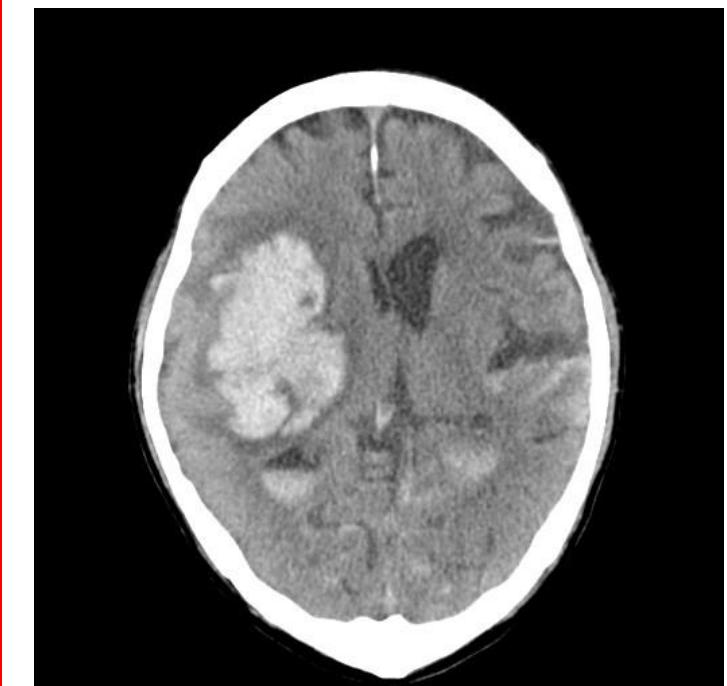


Early



Delayed

Hemorrhagic  
stroke



# Miss B

- 24 years old lady; works as a clerk
- Episodes of left sided headache since teenage
- Severe, associated with nausea and photophobia
- Sometimes preceded by visual blurring
- Physical examination: no neurological deficits

# Migraine

- Recurrent attacks
- Aura: present in about 25% of patients
  - Gradual development over 5 minutes to 1 hour
  - Complete reversibility
  - Most often visual
- Headache:
  - Often but not always unilateral
  - Throbbing
  - Nausea, photophobia, phonophobia
  - If untreated: lasts for hours to days

# Secondary headache

- Headache due to an underlying condition
  - Brain hemorrhage
  - Infections e.g. meningitis
  - Space occupying lesion

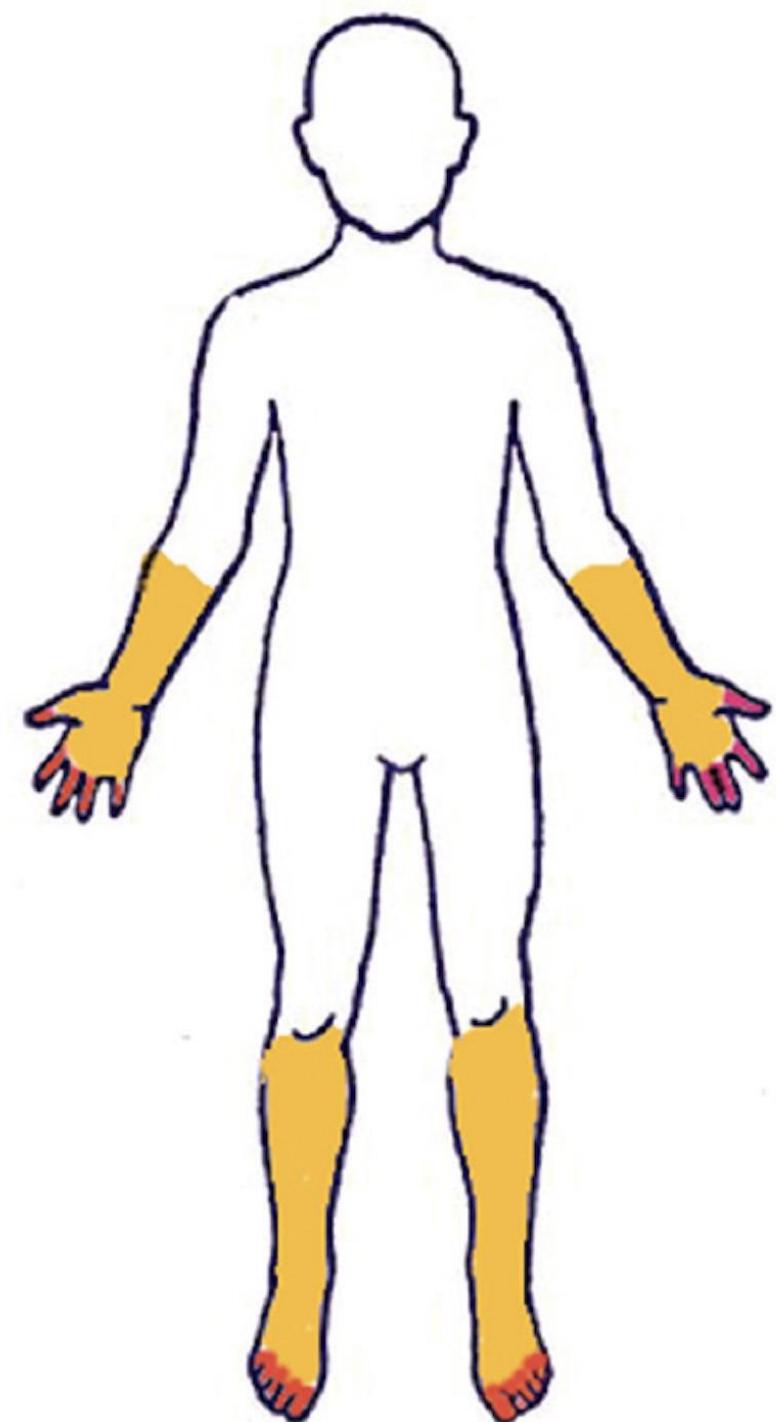
# **Headache: Red flags warranting neuroimaging**

- “First or worst” headache
- Recent significant change in headache characteristics
- New onset headache after age 50
- Unexplained abnormal findings on physical exam



# Mrs C

- 68-year-old lady
- Diabetes for many years; poor control
- Complains of numbness of the hands and feet
- Neurological examination:
  - Impaired pinprick sensation in glove and stocking distribution
  - No motor weakness
  - Reflexes diminished
  - Plantar response downgoing bilaterally



# Neuropathy

- Polyneuropathy
- Mononeuropathy
- Mononeuropathy multiplex

# Polyneuropathy: causes

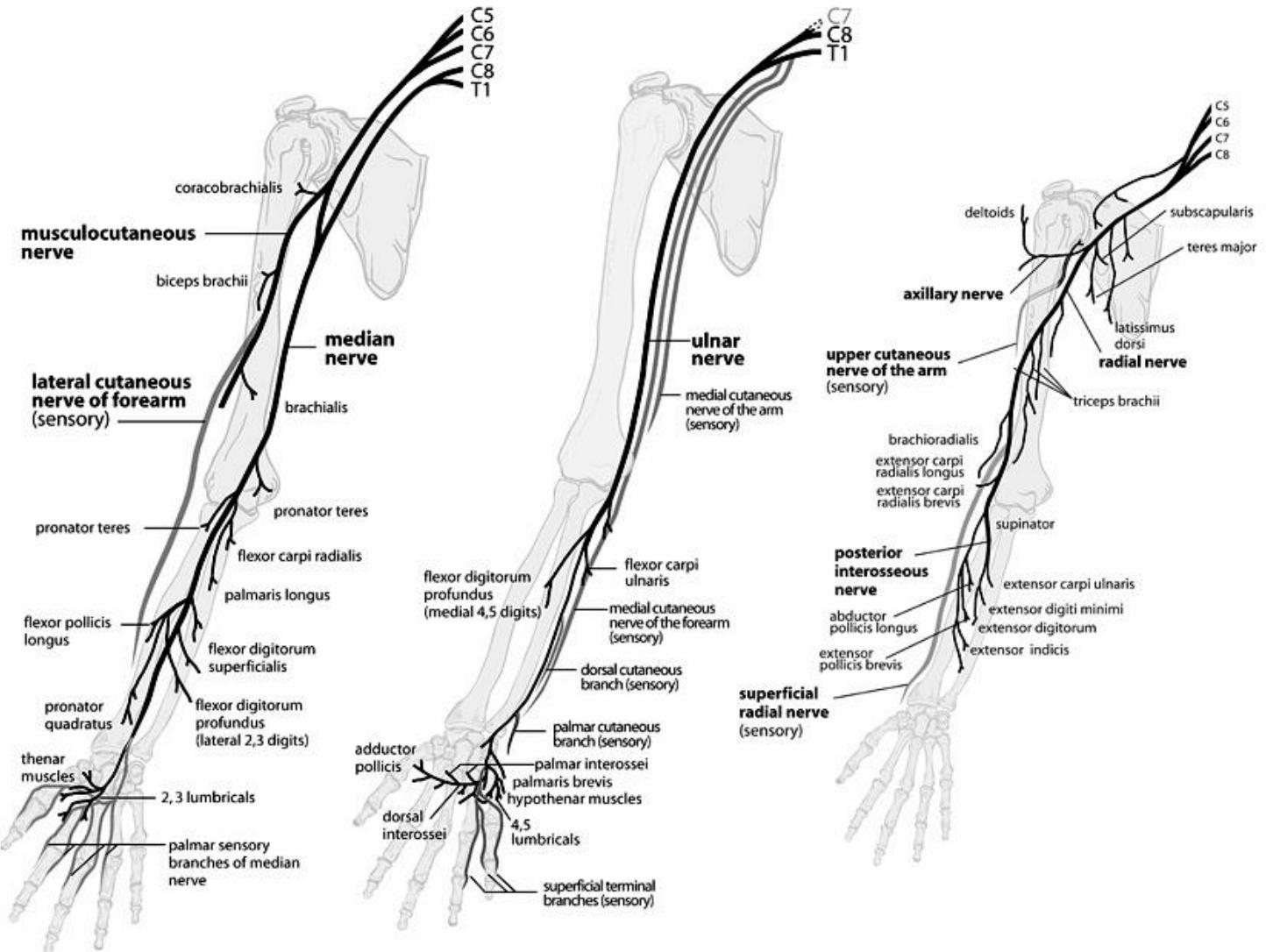
- Diabetes
- Systemic diseases: renal failure, critical illness, hypothyroidism, vitamin deficiencies
- Autoimmune, paraneoplastic
- Toxic: alcohol, chemotherapy, some drugs
- Hereditary
- Idiopathic

# **Neuropathy: Features warranting full evaluation**

- Asymmetry
- Non-length dependence
- Motor predominance
- Acute onset
- Severe or rapidly progressive

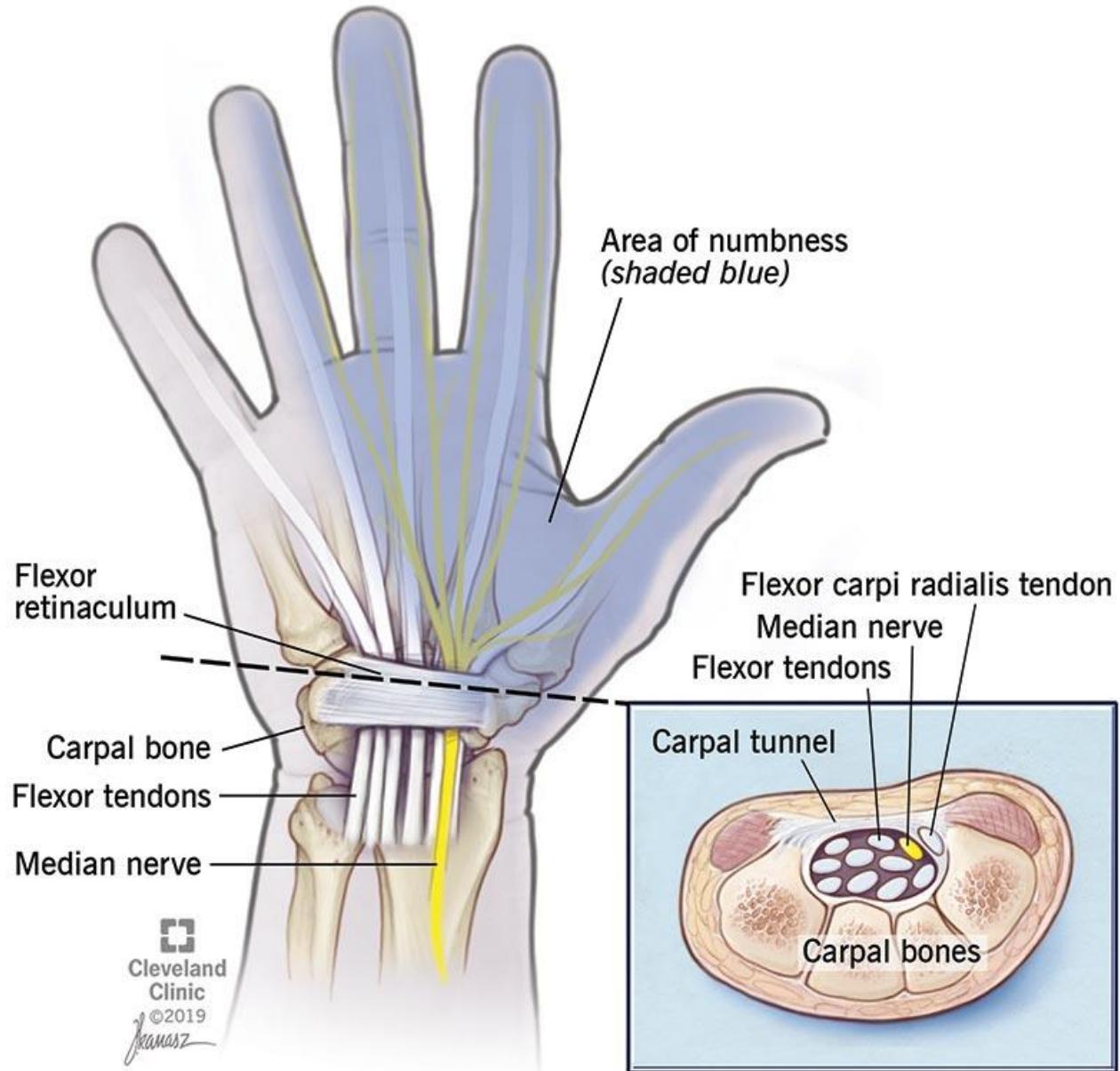
# Upper extremity peripheral nerve syndromes

- C5-T1 nerve roots
- Deficit localization
- Causes:
  - Compression: e.g. radiculopathy, carpal tunnel syndrome
  - Inflammatory: herpes zoster, idiopathic (e.g. brachial neuritis)



# Carpel tunnel syndrome

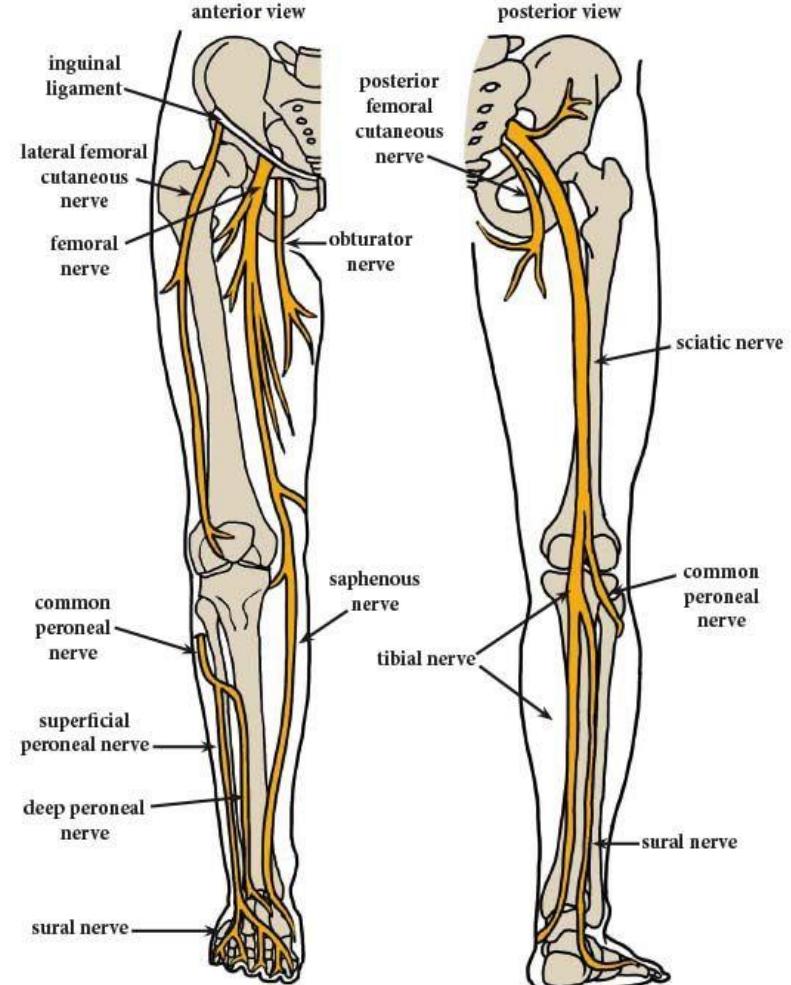
- Compression of median nerve in the carpal tunnel
- Risk factors:
  - Obesity
  - Pregnancy
  - Diabetes
  - Hypothyroidism



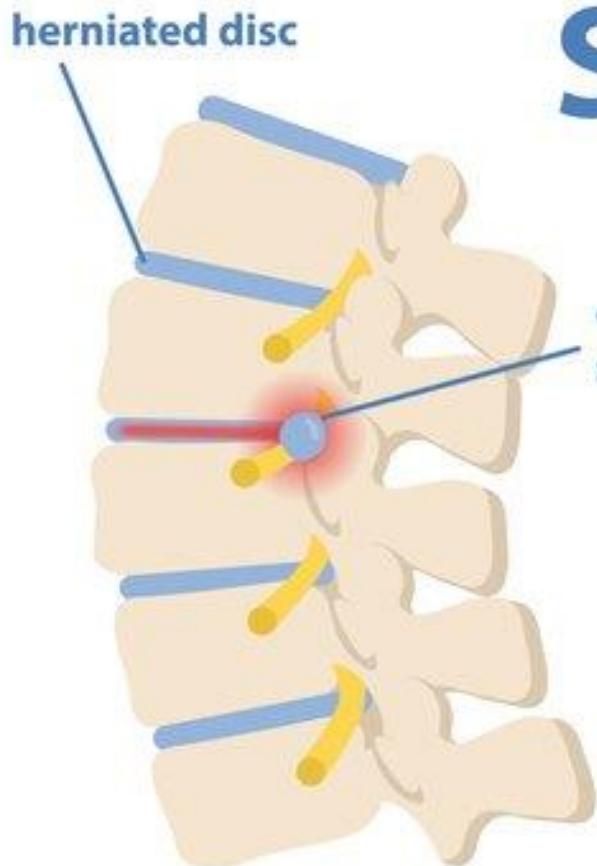
# Lower extremity peripheral nerve syndromes

- L2 to S4 nerve roots
- Causes:
  - Compression by herniated disc, peroneal nerve compression at fibular neck, tarsal tunnel syndrome
  - Inflammatory: herpes zoster, idiopathic, diabetic amyotrophy

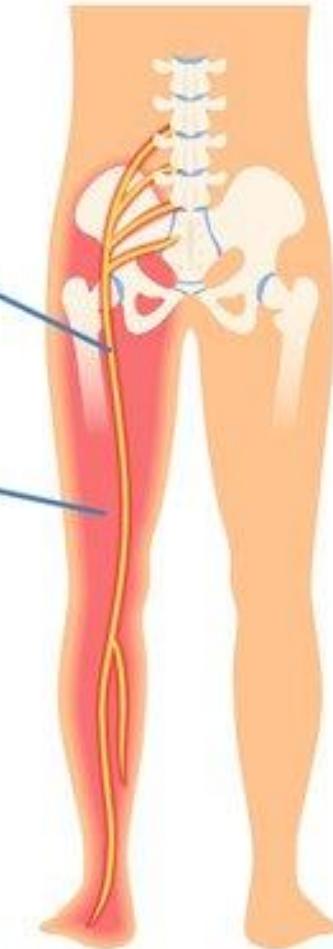
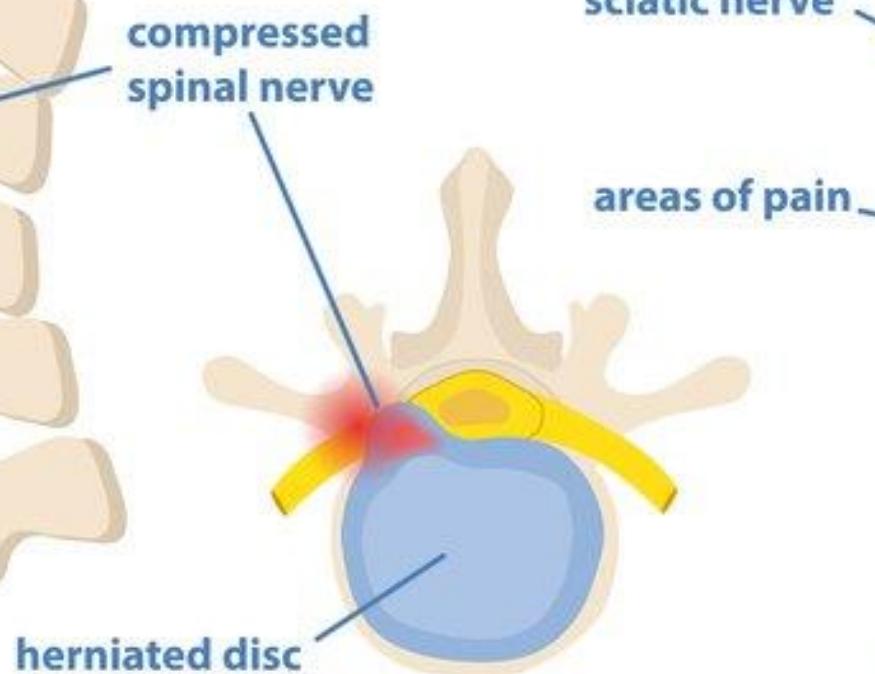
The Peripheral Nerves of the Pelvis, Buttock and LEGS



# SCIATICA



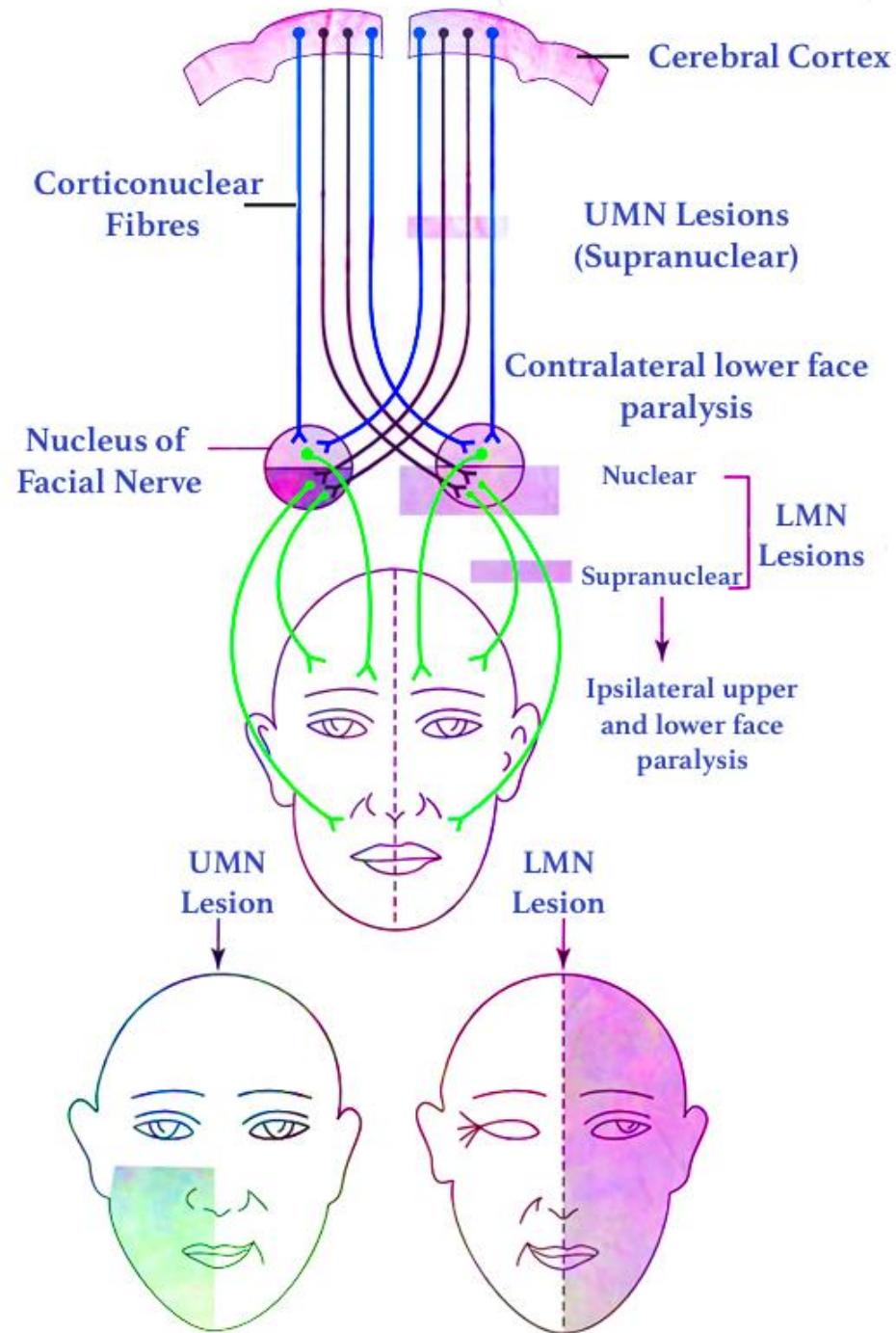
**SPINE**



# Facial weakness

UMN lesion:  
Lower face weakness  
Upper face spared  
Example: stroke

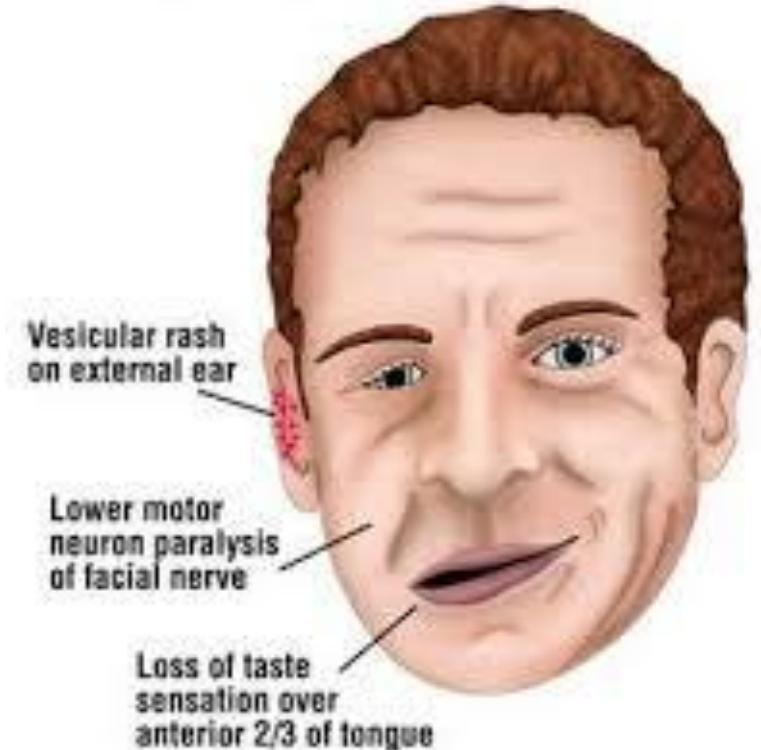
LMN lesion:  
Upper and lower face affected  
Example: Bell's palsy



# Ramsay Hunt syndrome

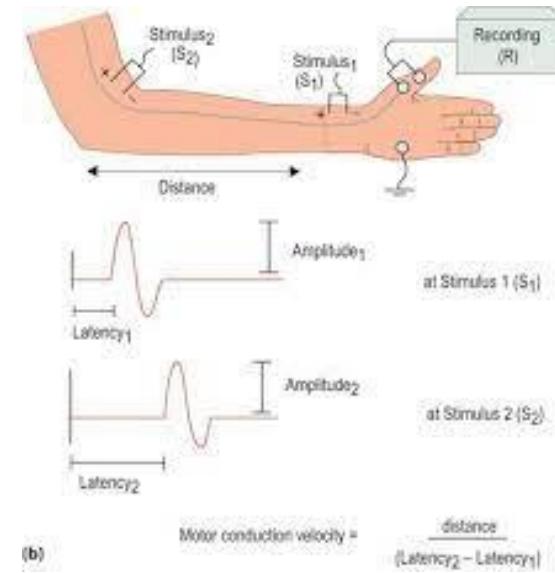
- Facial weakness due to herpes zoster reactivation affecting the geniculate ganglion of the facial nerve

Ramsay-Hunt Syndrome



# Neuropathy: diagnostic tools

- History and physical examination
- Blood tests
- Nerve conduction studies/electromyography
- Imaging: eg. MRI spine



# Mrs. D

- 65-year-old lady
- Tremor of left hand for a few years
- Left shoulder tightness and pain
- Examination:
  - Tremor of the L hand at rest
  - Mild rigidity of LUL
  - Slowed finger taps on the left



# Tremor: classification

- Involuntary, rhythmic, oscillatory movement of a body part
- Rest tremor: occurs at rest
- Action: occurs with voluntary muscle contraction
  - Kinetic
  - Postural
  - Isometric

# Tremor: etiology

- Rest tremor:
  - Parkinson's disease
  - Others: atypical parkinsonian syndromes, Wilson's disease, thalamic/midbrain injury, demyelinating disease
- Action tremor:
  - Enhanced physiologic tremor: drugs, caffeine, thyrotoxicosis, anxiety etc
  - Essential tremor

# Parkinson's disease: Motor symptoms



Rest tremor



Bradykinesia



Rigidity



Postural instability

# Essential tremor

*Recognizing* **Essential Tremor**

The infographic features a purple background with white text and four circular icons. The first icon shows a hand with wavy lines and a speech bubble, labeled 'Shaking of hands, head and voice'. The second icon shows a person walking, labeled 'Worsened by movement'. The third icon shows three people of different ages, labeled 'Affects people of all ages'. The fourth icon shows a family of four, labeled 'Often runs in families'.

- Shaking of hands, head and voice**
- Worsened by movement**
- Affects people of all ages**
- Often runs in families**

 MOVEMENT  
DISORDERS  
POLICY COALITION

# Tremor: diagnosis

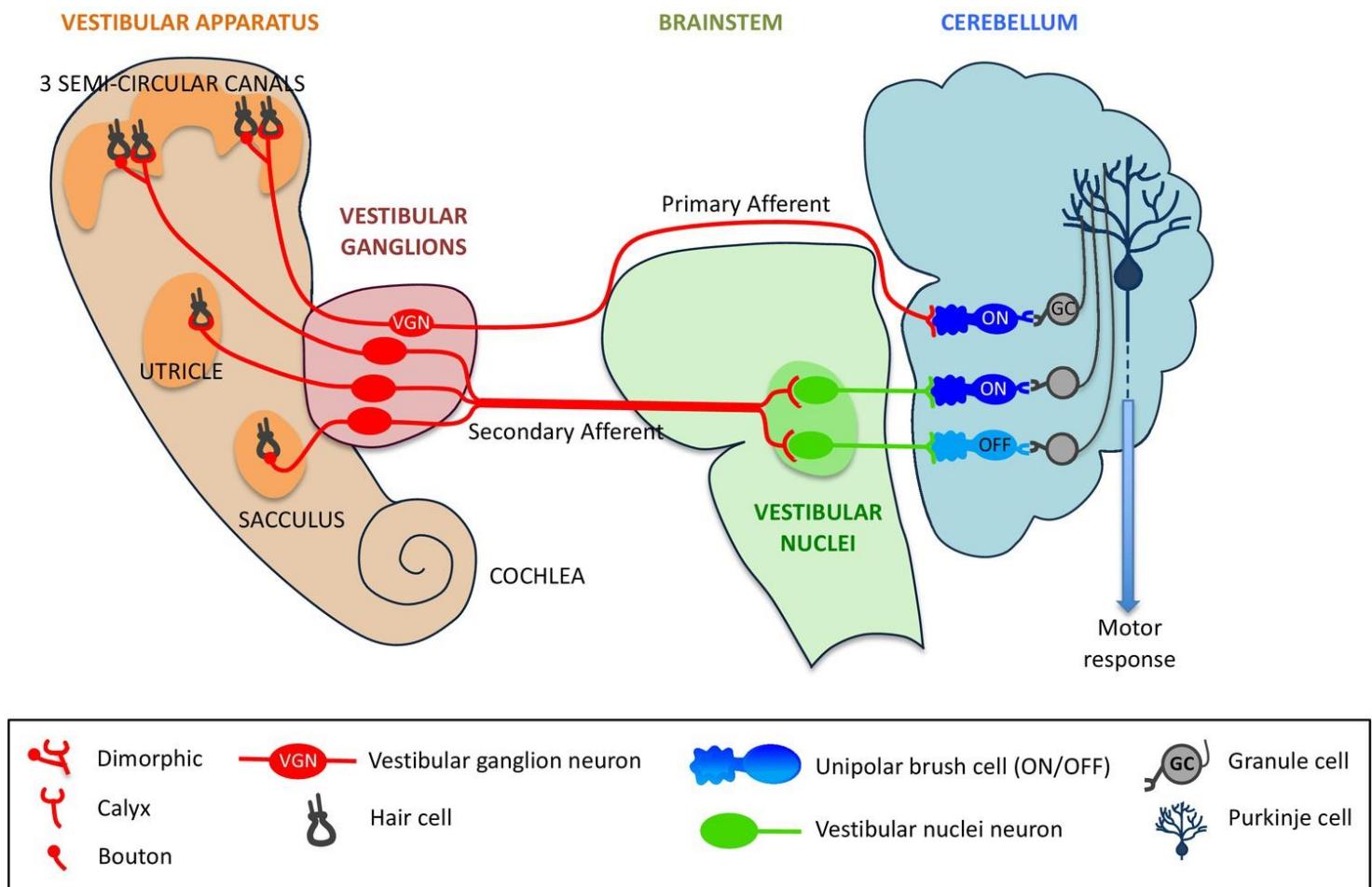
- Clinical diagnosis
- History: other associated symptoms, aggregating factors
- Physical exam: rest vs kinetic tremor; other associated signs
- Blood tests when appropriate

# Mrs. E

- 50-year-old lady
- Diabetes on medications
- Severe dizziness for 1 day with spinning sensation
- Nausea and gait instability
- Hearing and speech normal
- Eye movement, facial sensation normal
- Limbs normal

# Vertigo

- Illusory movement
- Due to dysfunction of the labyrinth, vestibular nerve, or central vestibular structures (brainstem or cerebellum)



# Vertigo: central vs peripheral

## Peripheral causes

Benign paroxysmal positional vertigo

Vestibular neuritis

Meniere disease

## Central causes

Brainstem/cerebellar stroke

Multiple sclerosis

Vestibular migraine

# Vertigo: Diagnosis

- History:
  - Time course: single vs recurrent, brief vs sustained
  - Associated symptoms:
    - Central: other brainstem symptoms
    - Peripheral: tinnitus, hearing impairment

# Vertigo: physical exam

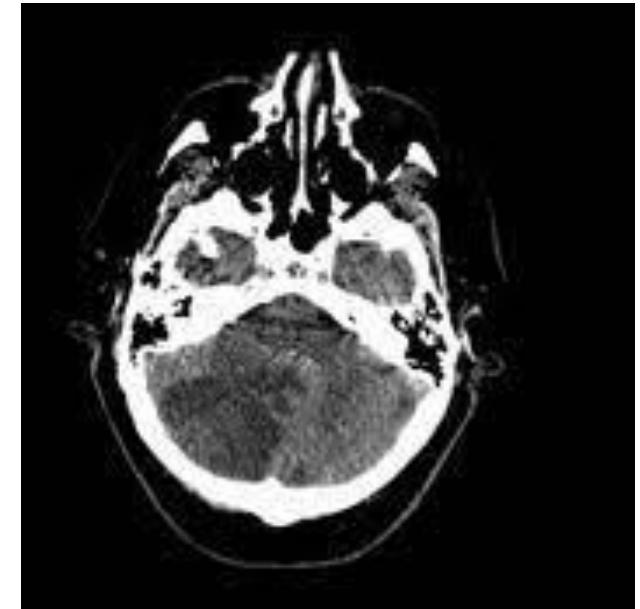
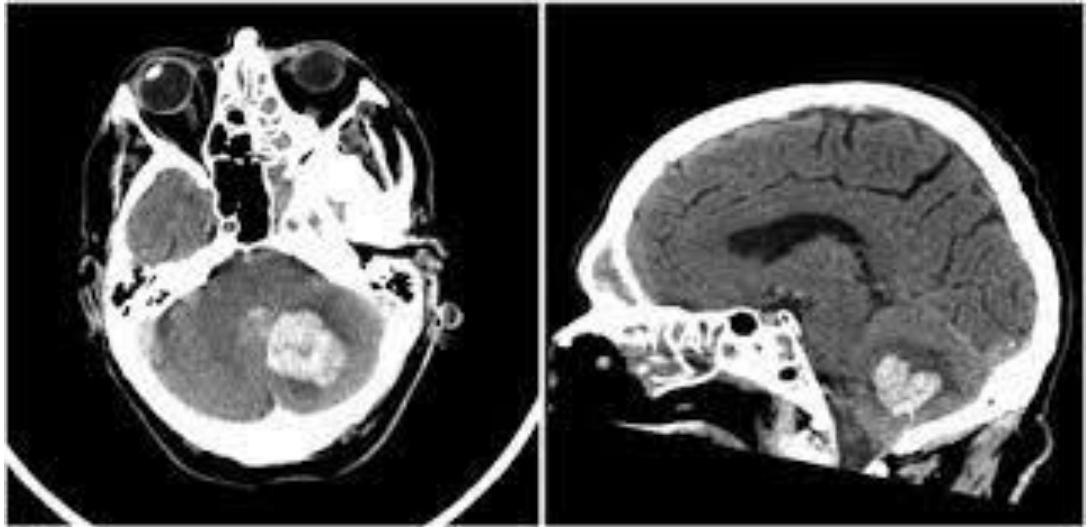
	<b>Peripheral</b>	<b>Central</b>
<b>Nystagmus</b>	<ul style="list-style-type: none"><li>• Unidirectional</li><li>• Mixed component</li><li>• Suppressed by visual fixation</li></ul>	<ul style="list-style-type: none"><li>• Direction-changing</li><li>• Not suppressed by visual fixation</li></ul>
<b>Gait</b>	<ul style="list-style-type: none"><li>• Unstable but able to walk</li></ul>	<ul style="list-style-type: none"><li>• Severe instability</li><li>• Unable to walk</li></ul>
<b>Deafness or tinnitus</b>	<ul style="list-style-type: none"><li>• May be present</li></ul>	<ul style="list-style-type: none"><li>• Usually absent</li></ul>
<b>Other neurologic symptoms and signs</b>	<ul style="list-style-type: none"><li>• Absent</li></ul>	<ul style="list-style-type: none"><li>• Often present</li></ul>

# Back to Mrs. E

- DM with poor control
- Acute onset
- Persistent for 1 day already

→ Vestibular neuritis?

→ Brainstem/cerebellar stroke?



## Mr. F

- 20-year-old university student
- Episode of loss of consciousness
- No preceding symptoms
- Witnessed to have twitching of 4 limbs lasting for 1 minute
- Followed by drowsiness for a few hours
- Sleep deprivation and stress from school exams
- 1<sup>st</sup> episode

## Miss G

- 20-year-old university student
- Episode of loss of consciousness
- Was waiting for a bus on a crowded street
- Preceded by nausea, sweating and light-headedness
- Loss of consciousness for a few seconds
- Has had previous similar episodes

# Loss of consciousness

- Seizure
  - Sudden change in behavior caused by electrical hypersynchronization of neural networks
- Syncope
  - Transient
  - Self-limiting
  - Due to inadequate cerebral blood flow
  - Most often results from abrupt blood pressure drop

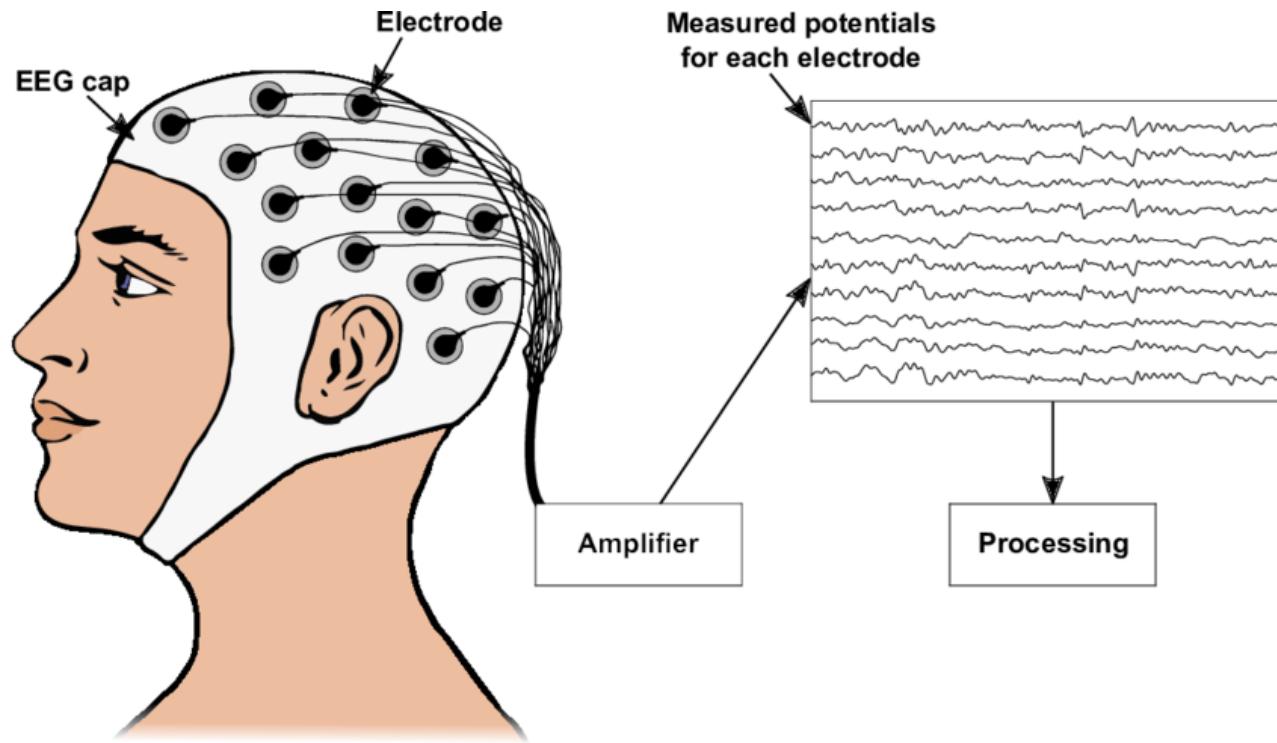
# Seizure

- Acute symptomatic
  - As a result of systemic or brain insult
  - Insults include metabolic derangements, drug or alcohol withdrawal, encephalitis, head injury, stroke
- Unprovoked
  - Unknown etiology
  - Related to a preexisting brain lesion (remote symptomatic seizures)
- Epilepsy
  - At least 2 unprovoked seizures occurring more than 24 hours apart, or
  - 1 unprovoked seizure with an expected increased risk for recurrence e.g. structural lesion such as stroke, history of traumatic brain injury

# **Seizure: types**

- Focal seizures with retained awareness
- Focal seizures with impaired awareness
- Generalized

# Investigations of seizure



EEG



MRI

# Syncope: causes

- Reduced cardiac output
  - Arrhythmia
  - Outflow tract obstruction
- Hypotension
  - Reduced intravascular volume
  - Drugs
  - dysautonomia
- Reflex syncope
  - Neural reflexes modify heart rate and blood pressure inappropriately

# Vasovagal syncope

- The common faint
- Self-limiting systemic hypotension characterized by bradycardia and peripheral vasodilation
- Preceded by pre-syncopal symptoms of fatigue, nausea, weakness, sensation of impending faint
- Precipitated by prolonged standing, heat exposure, sudden painful or traumatic experience, in an upright or sitting position
- Signs of autonomic hyperactivity e.g. pallor, diaphoresis, nausea, sweating
- No post-event confusion but weakness frequently described
- Often recurrent and affects young people

# Syncope and Seizures

Features	Syncope	Seizure
Relation to posture	Common	No
Precipitating factors	Emotion, pain, crowds, specific situations	Sleep loss, alcohol, drugs
Skin color	Pallor	Normal or cyanosis
Aura or premonitory symptoms	Longer duration	Brief
Convulsion	Rare	Common with convulsive seizures
Urinary incontinence	Rare	Common
Post-event confusion	Rare	Common
Focal neurological signs	No	Occasional

# Summary

- Neurological diagnosis requires lesion localization and determination of etiology
- History and physical exam are the most important
- Neurologic diagnostic tools:
  - Neuroimaging
  - Nerve conduction tests
  - Electroencephalography

# The End

Questions?