



มหาวิทยาลัยราชภัฏนครปฐม



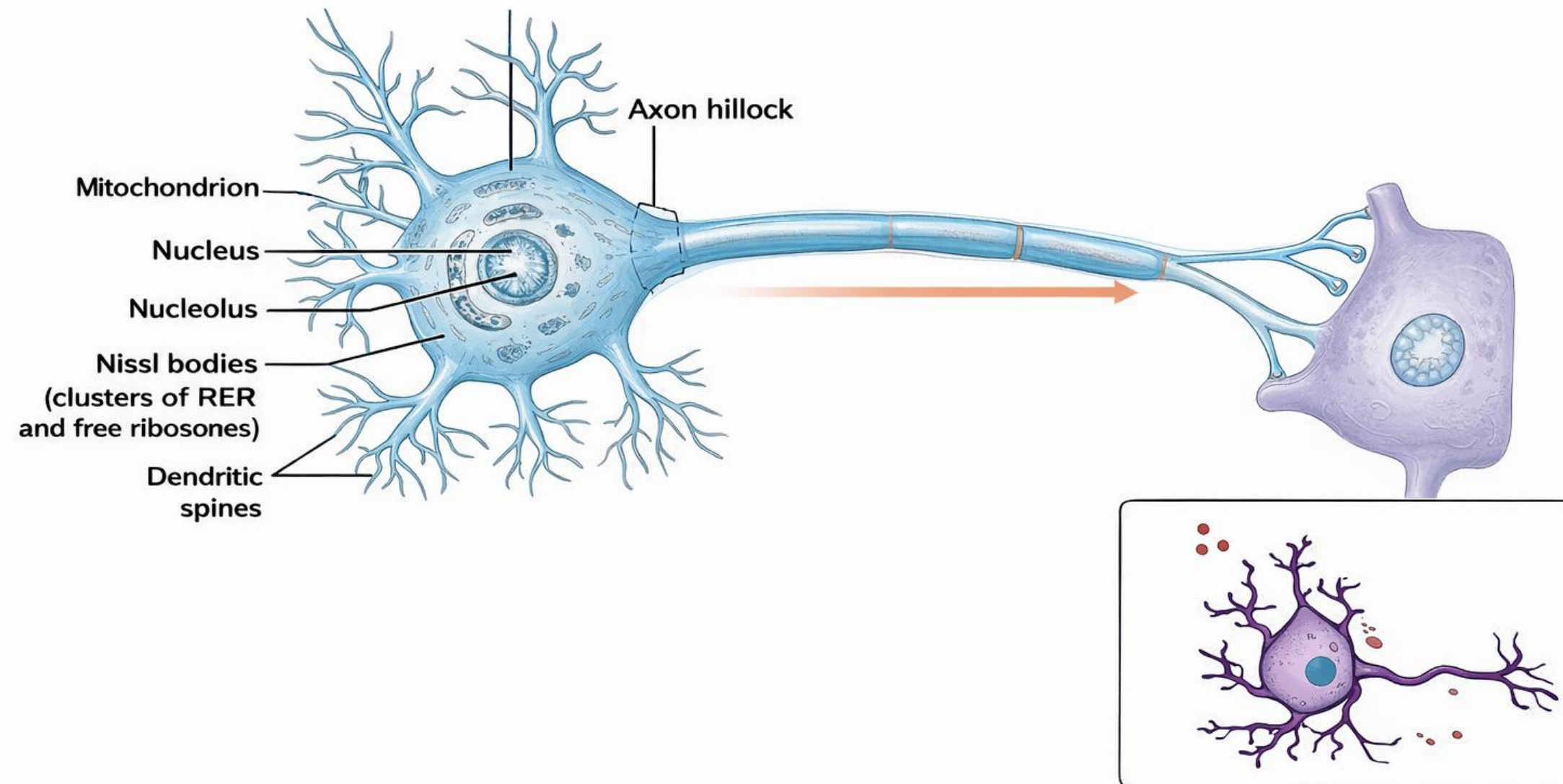
Mechanism and Illness of Human Body 2

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Disorders of the Nervous System (part 1)

Neuronal Changes Following Injury

Neuron or Nerve cell



Disorders of the Nervous System (part 1)

Classification of Nerve Injury

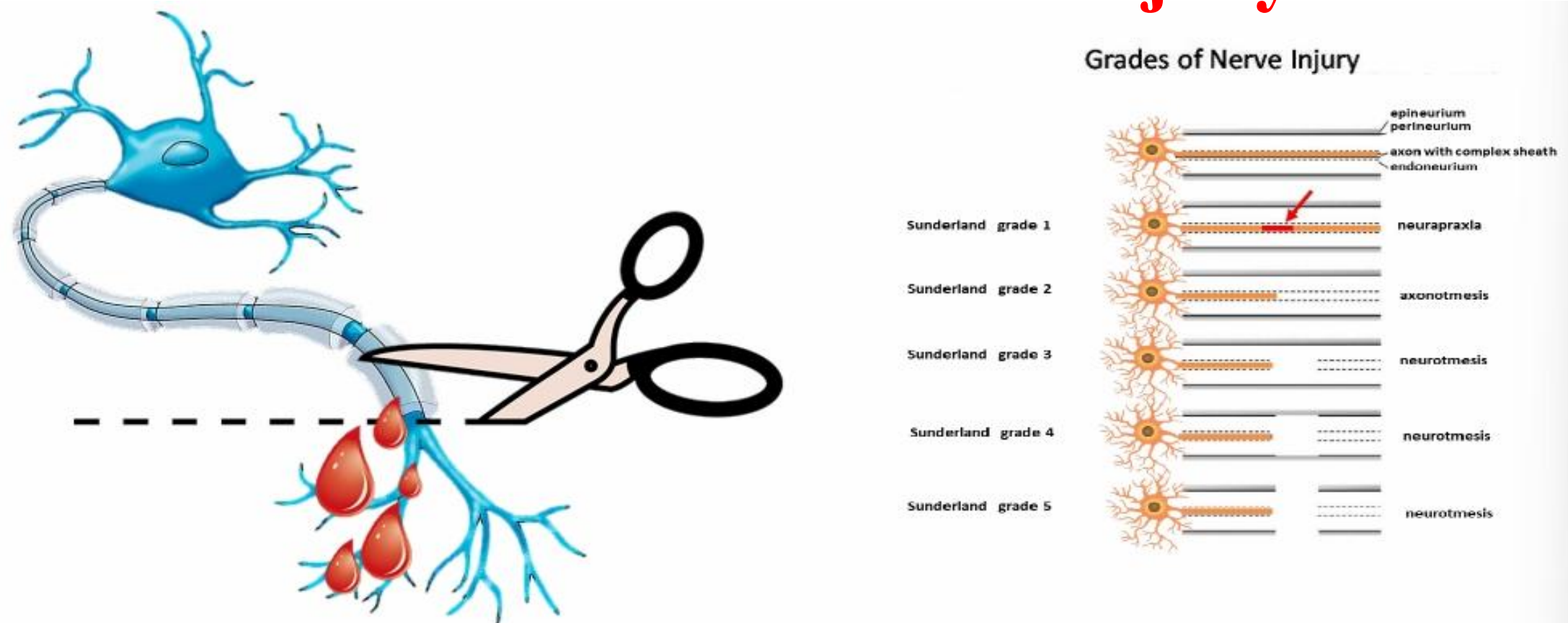


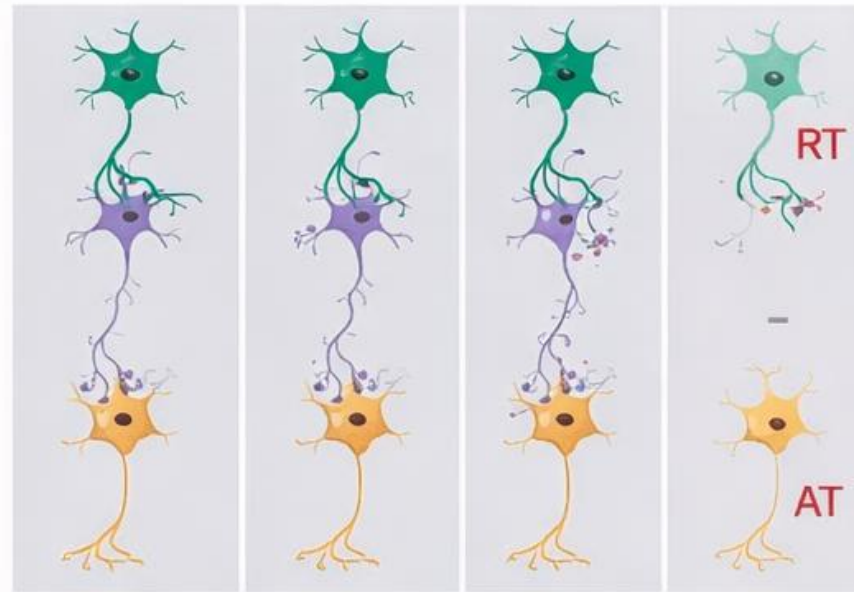
TABLE 1: Neurosensory impairment classification according to Sunderland and Seddon.

Classification of nerve injury			
Seddon	Injury	Neurosensory impairment	Recovery potential
Neuropraxia	Intrafascicular oedema, conduction block	Neuritis, paresthesia	Full (1 day to 1 week)
	Possible segmental demyelination	Neuritis, paresthesia	Full (1 to 2 months)
	Axon severed, endoneurial tube intact	Paresthesia, episodic dysesthesia	Full (2 to 4 months)
Axonotmesis	Endoneurial tube torn	Paresthesia, dysesthesia	Slow, incomplete (12 months)
	Only epineurium intact	Hypoesthesia, dysesthesia, and neuroma formation	Neuroma in continuity
Neurotmesis	Loss of continuity	Anaesthetic, intractable pain, and neuroma formation	None
	Combination of above	Combination of above	Unpredictable

Disorders of the Nervous System (part 1)

Axonal Injury

Axonal injury near the cell body



Damage to the neuron above → Retrograde transneuronal degeneration

Damage to the neuron below → Anterograde transneuronal degeneration

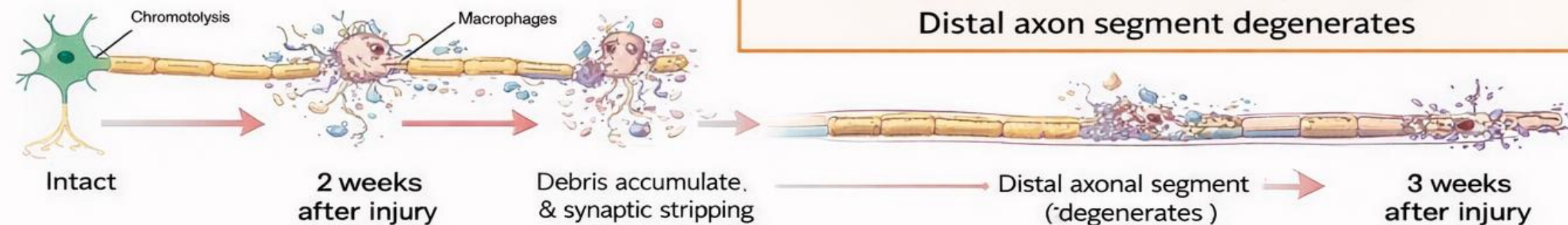
Transneuronal degeneration does not always occur.

Damage along the axon → **Retrograde degeneration:**



Damage along the axon →
Retrograde degeneration:
Proximal axon segment degenerates

Damage along the axon → **Anterograde degeneration:**
Distal axon segment degenerates



Disorders of the Nervous System (part 1)

Neuronal Changes Following Axonal Injury

Cell body reaction

- Chromatolysis : Ribosome dissolution
- Nucleolar eccentricity: Displacement of nucleolus
- Swelling

Changes in the cell body

Retrograde regeneration

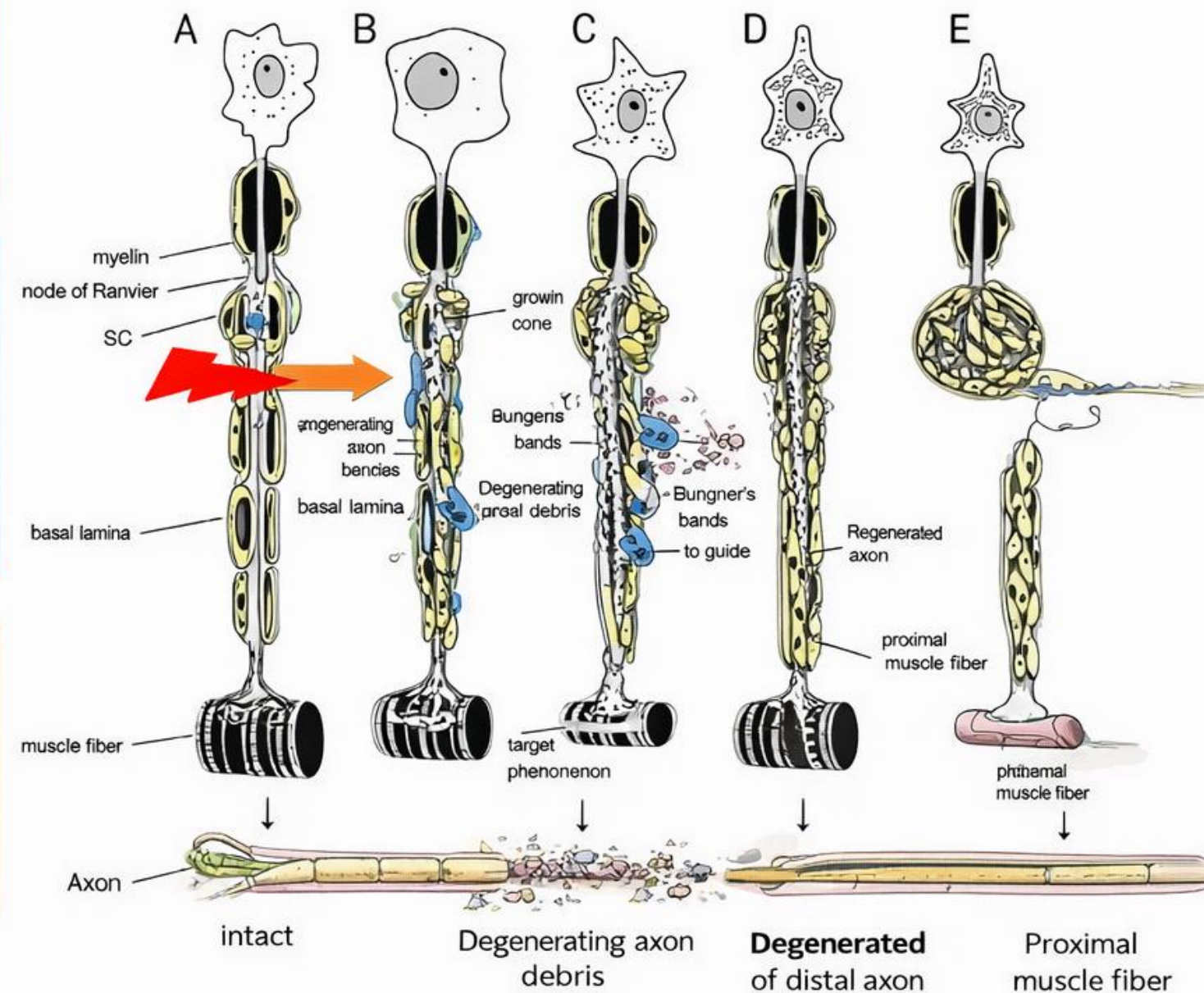
- New axonal tip (growth cone)
- Single axonal sprout grows toward the target
- Schwann cell lay down "Bungner's band" to guide axonal regrowth

Growth toward the target region

Wallerian degeneration

- Organelle break down
- Myelin sheath degenerated/cleared by Schwann cell
- Macrophage

Degeneration of distal axon

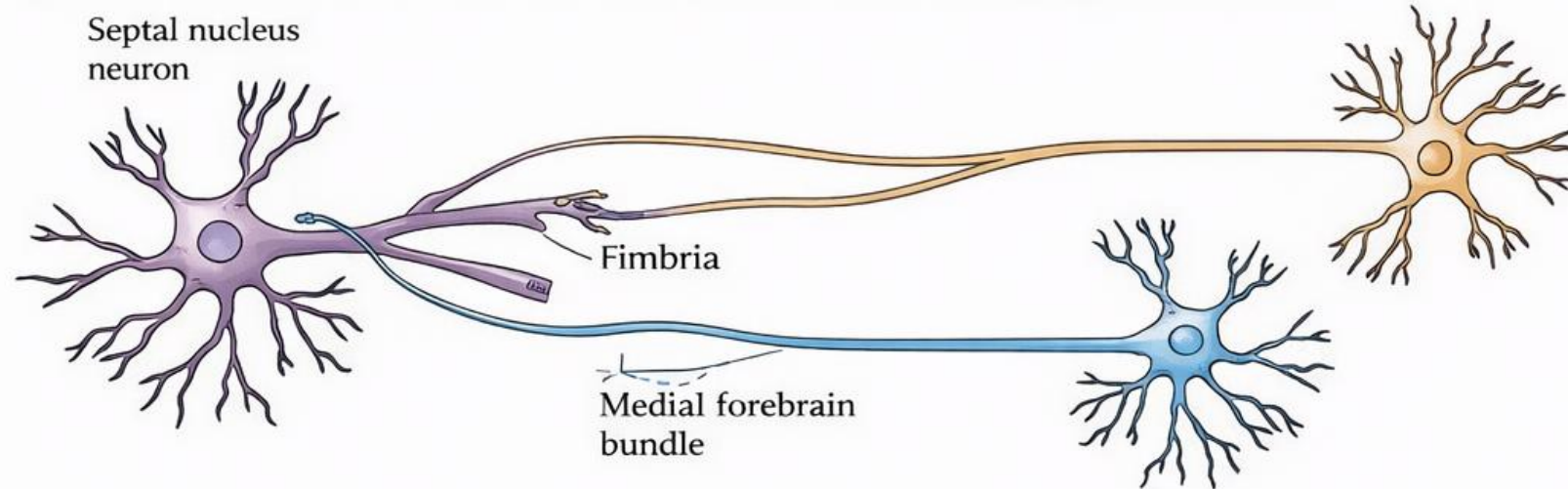


Disorders of the Nervous System (part 1)

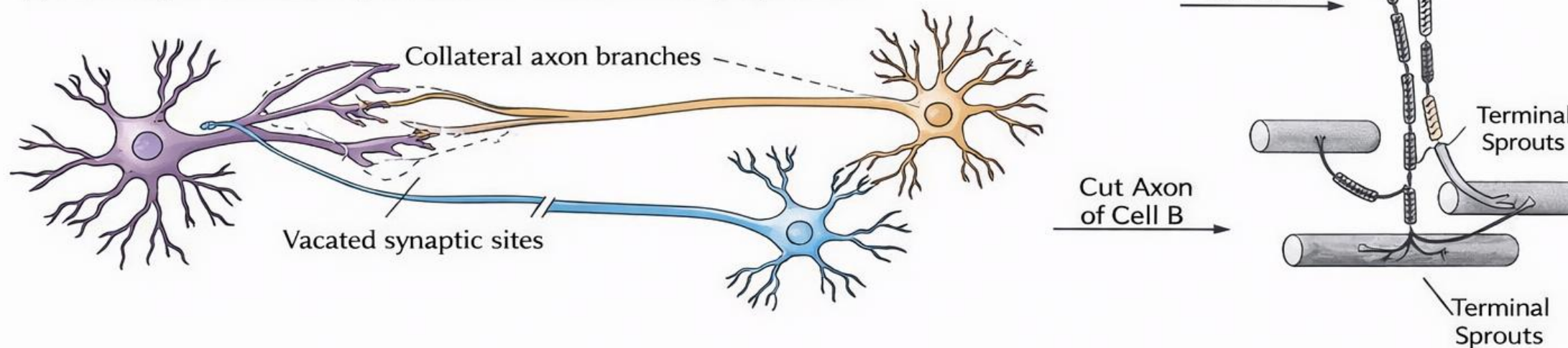
Collateral sprouting of axon

After axonal degeneration, axons from neurons whose proximal axon were not injured sprout collaterals to fill the vacant synaptic sites of an injured neuron neuron.

(a) Normal connections of fimbria and medial forebrain bundle to a septal nucleus cell



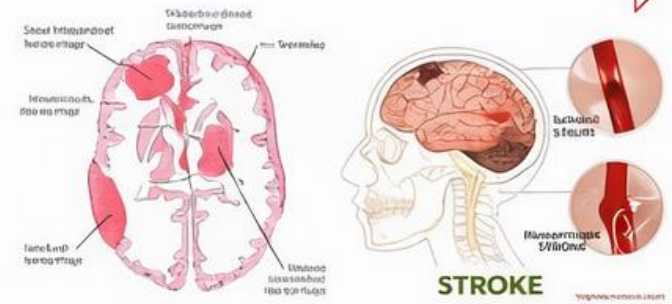
(b) After cut, fimbria axon sprouts to innervate vacated synaptic sites



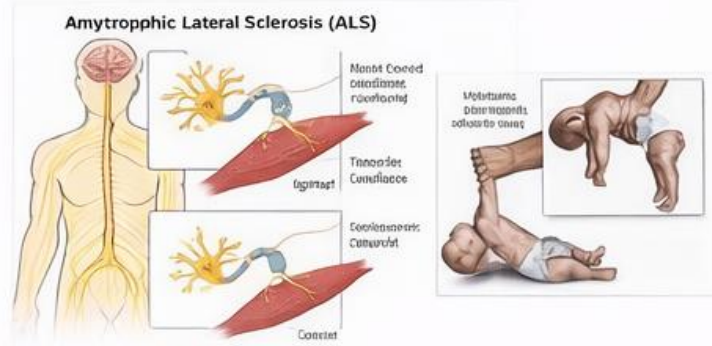
Disorders of the Nervous System (part 1)

Neurological Diseases and Disorders

Vascular disorders (Vascular disorders)

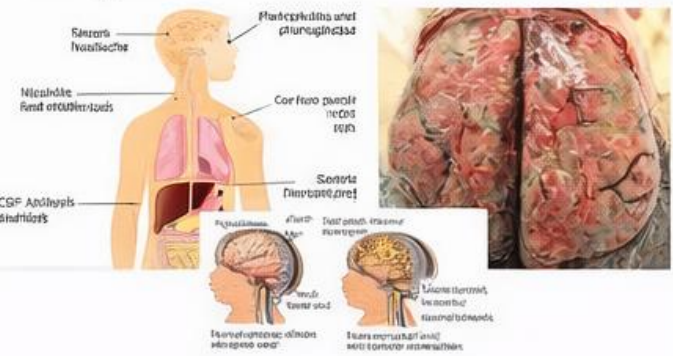


Degeneration



Infections

Meningitis

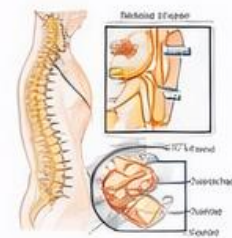


Functional disorders

TRIGEMINAL NEURALGIA

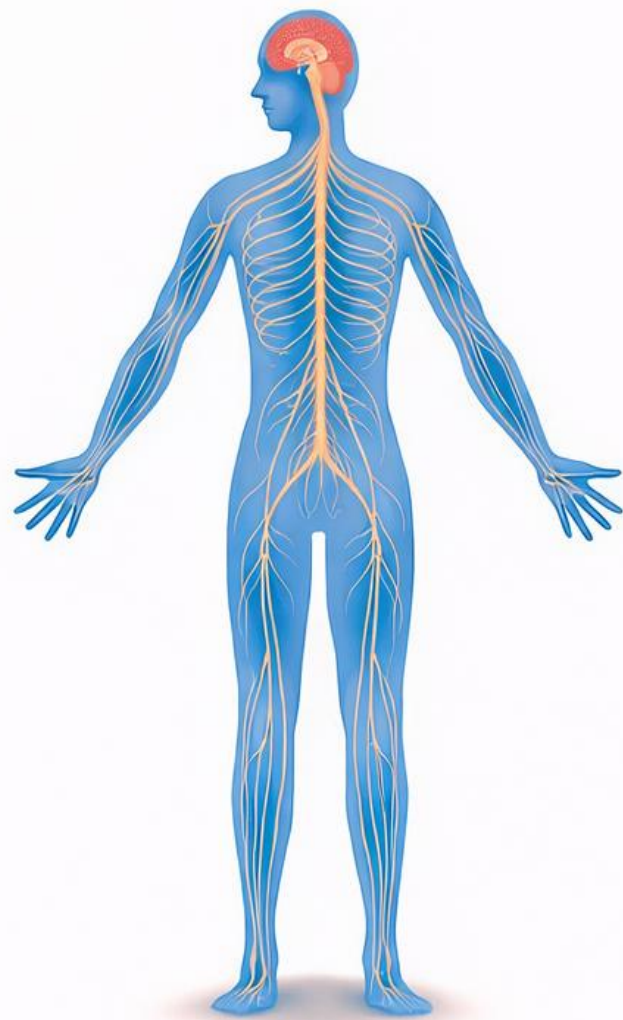


Structural disorders



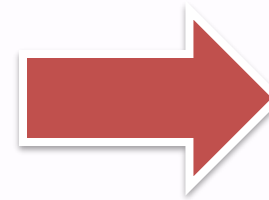
Disorders of the Nervous System (part 1)

Signs and Symptoms of Neurological Disorders



Signs and Symptoms:

- Sensory disturbances such as numbness or tingling
- Weakness or paralysis in a limb, one-sided face or limb weakness, or clumsiness
- Poor coordination or balance problems
- Sudden or severe headaches
- Seizures or loss of consciousness
- Cognitive impairment or confusion
- Vision problems like blurred or double vision
- Memory loss, difficulty concentrating
- Speech problems such as slurred speech/ difficulty speaking
- Altered movement ability including abnormal gait, tremors, involuntary muscle spasms
- Dizziness or unsteadiness
- Lack of bladder or bowel control
- Unexpected mood or behaviour changes, such as difficulty controlling emotions, depression, apathy, personality changes



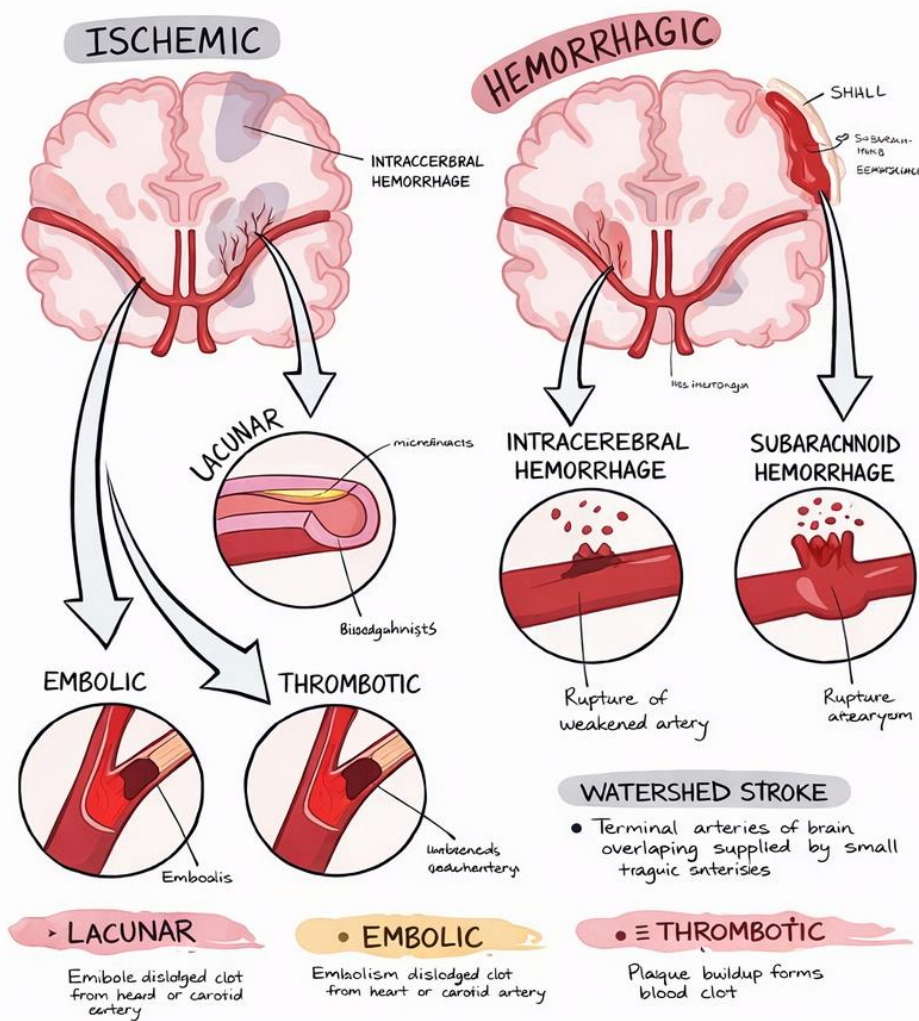
Overlap with other conditions

Vary for each individual

Disorders of the Nervous System (part 1)



Stroke



B E F A S STROKE SYMPTOMS

B BALANCE **E** EYES **F** FACE **A** ARM **S** SPEECH

F Has their **FACE** dropped?

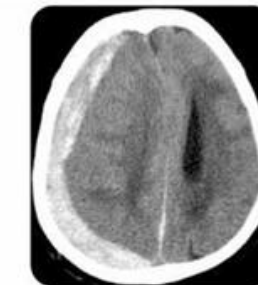
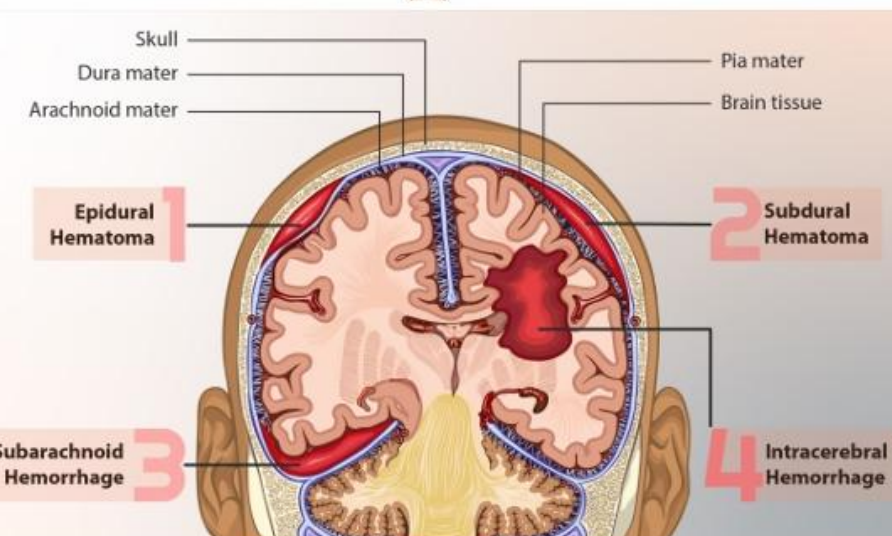
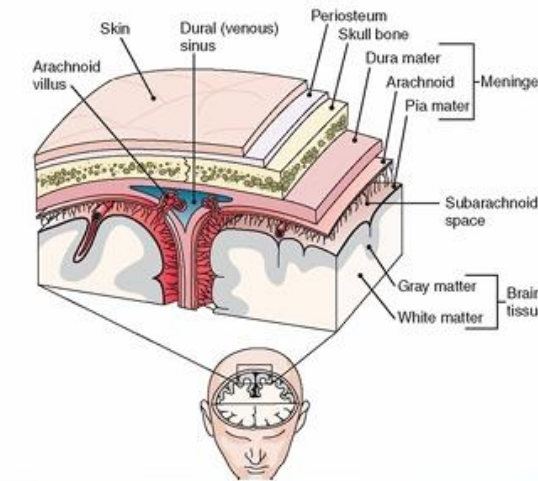
A Can they lift both **ARMS**?

S Is their **SPEECH** slurred and do they understand you?

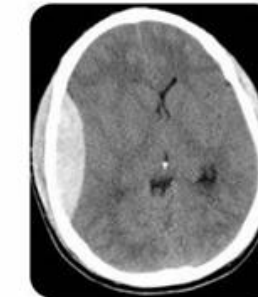
T Call 911, **TIME** is critical

Call 911, **TIME** is critical

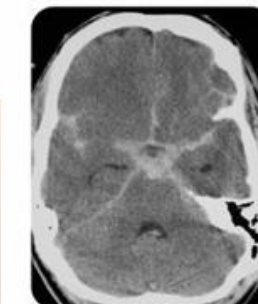
Cerebral hemorrhage



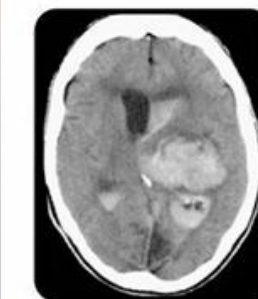
- C Subdural hematoma**
- Crescent-shaped
 - Blood collection between dura and arachnoid matter
 - Tear in **bridging veins**
 - Alcoholics and elderly are prone



- Epidural hematoma**
- Biconvex (lens) shaped
 - Blood between dura and skull
 - Tearing of **middle meningeal artery**
 - Adolescents and young adults (trauma)



- Subarachnoid hemorrhage**
- Blood in circle of Willis, cisterns, and fissures
 - Rupture of **berry aneurysm**
 - Polycystic kidney disease (risk factor)



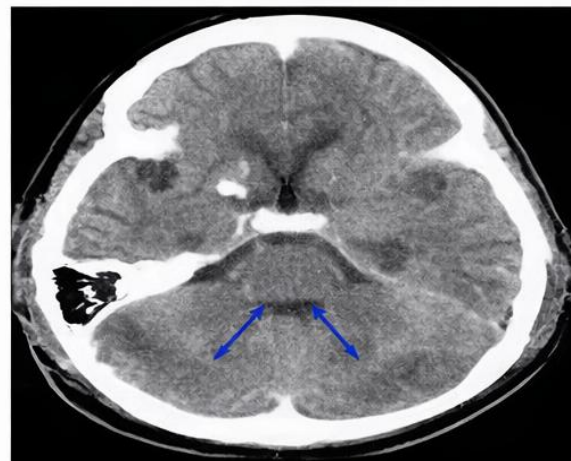
- Intracerebral hemorrhage**
- Blood in parenchyma and ventricles
 - Hypertensive vasculopathy
 - Territory of **penetrator arteries**

Disturbances of Brain Homeostasis, Cerebral Edema, and Increased Intracranial Pressure (ICP)

Brain Edema (Cerebral Edema)

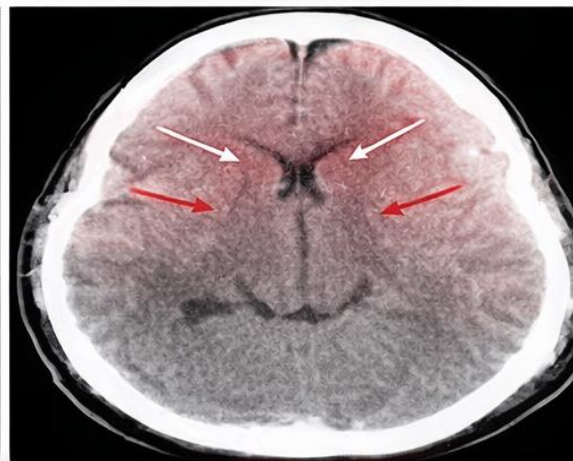
- ✓ Excess accumulation of fluid in brain tissue
- ✓ Seen in neurological disorders: stroke, meningitis, traumatic brain injury
- ✓ Caused by disruption of blood-brain barrier function

Normal Brain

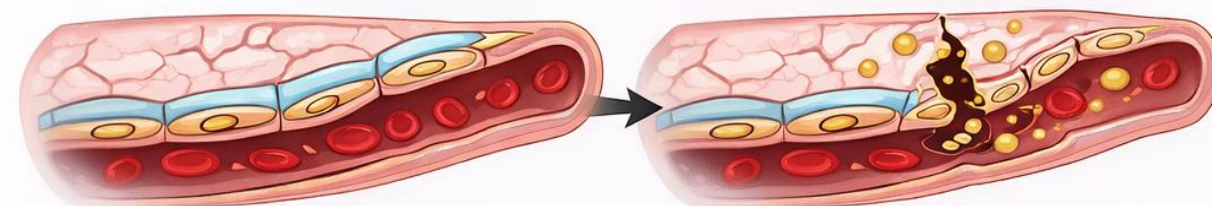


Normal Pressure

Brain Edema



Increased Pressure



Normal Blood-Brain Barrier

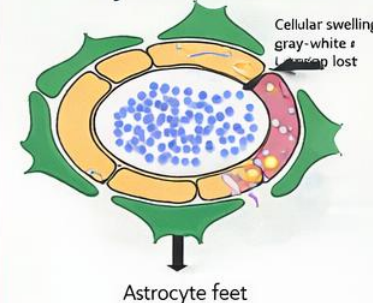
Disrupted Blood-Brain Barrier

Types of Brain Edema

Cytotoxic Edema

- ✓ **Cytotoxic Edema**
Cellular swelling, gray-white margin lost
- ✓ Caused by disruption of cellular metabolism leading to intracellular fluid accumulation and swelling of brain cells
- ✓ Seen in stroke and traumatic brain injury (TBI)

Cytotoxic edema



Vasogenic Edema

- ✓ **Vasogenic Edema**
Leaky capillaries, gray matter is spared
- ✓ Caused by disruption of the blood-brain barrier leading to excess extracellular fluid accumulation
- ✓ Seen in brain tumors and head injury

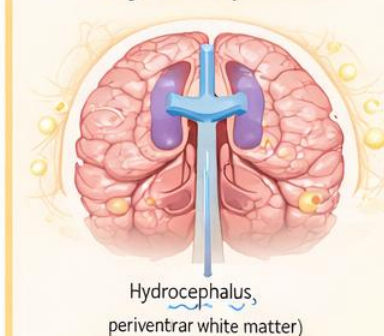
Vasogenic edema



Interstitial Edema

- ✓ **Hydrocephalus**
Hydrocephalus, periventricular matter affected
- ✓ Caused by increased cerebrospinal fluid (CSF) in ventricles and interstitial space
- ✓ Seen in hydrocephalus or conditions blocking CSF flow: subarachnoid hemorrhage

Hydrocephalus

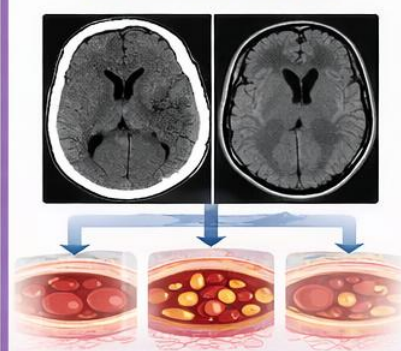


Combined Edema

- ✓ **Combined Edema**
 - Multiple pathological mechanisms lead to mixed types of brain swelling
 - ✓ Seen in severe brain injuries and various causes



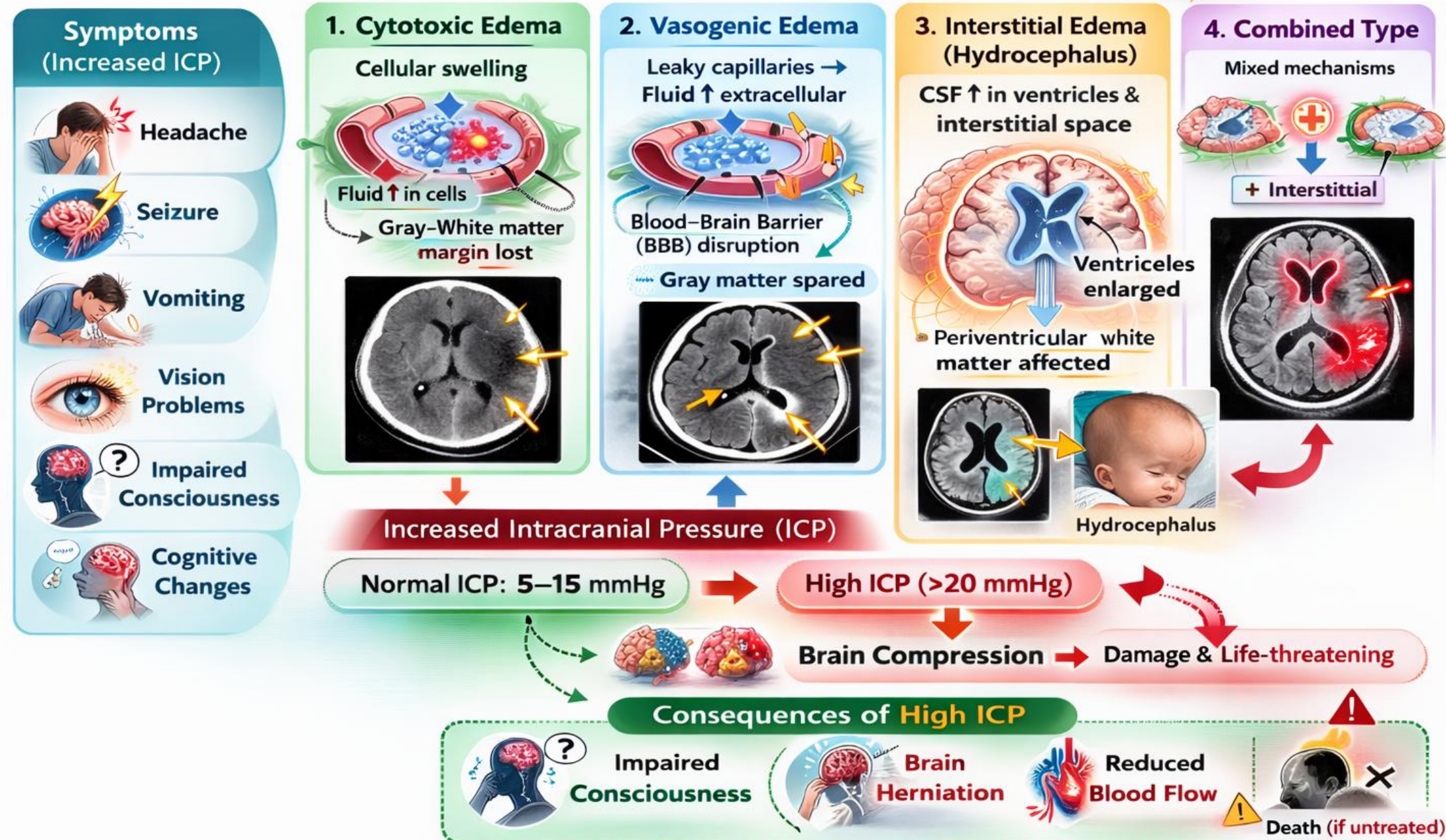
Combined Edema



Disturbances of Brain Homeostasis, Cerebral Edema, and Increased Intracranial Pressure (ICP)

Brain Edema (Cerebral Edema)

Location: Inside the brain → **Increased volume & pressure** → **Brain swelling**



Disturbances of Brain Homeostasis, Cerebral Edema, and Increased Intracranial Pressure (ICP)



Brain Edema Overview

Type	Cytotoxic	Vasogenic	Interstitial
Cause	Neuronal & Glia cell damage	Disrupted BBB (Blood–Brain Barrier)	Transependymal flow of CSF (Cerebrospinal Fluid)
Edema Location	Gray > White matter	White matter	Periventricular white matter
Fluid Accumulation	↑ In cells	↓ Extracellular	↓ Ventricles, beside cells
Associated Diseases	Stroke, Traumatic brain injury (TBI)	• Brain tumors • Venous sinus thrombosis	Hydrocephalus
Steroid Response	Stroke, Traumatic brain injury (TBI)	↑ Improves	Hydrocephalus
Treatment	● Treat underlying cause	• Focus on cause, ↑ BBB repair	● CSF diversion ● VP shunt - Ventriculostomy



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