BHARATHIDASAN UNIVERSITY

Program: M.Sc., Biomedical Science

Course Title : Neurobiology

Central pontine myelinolysis

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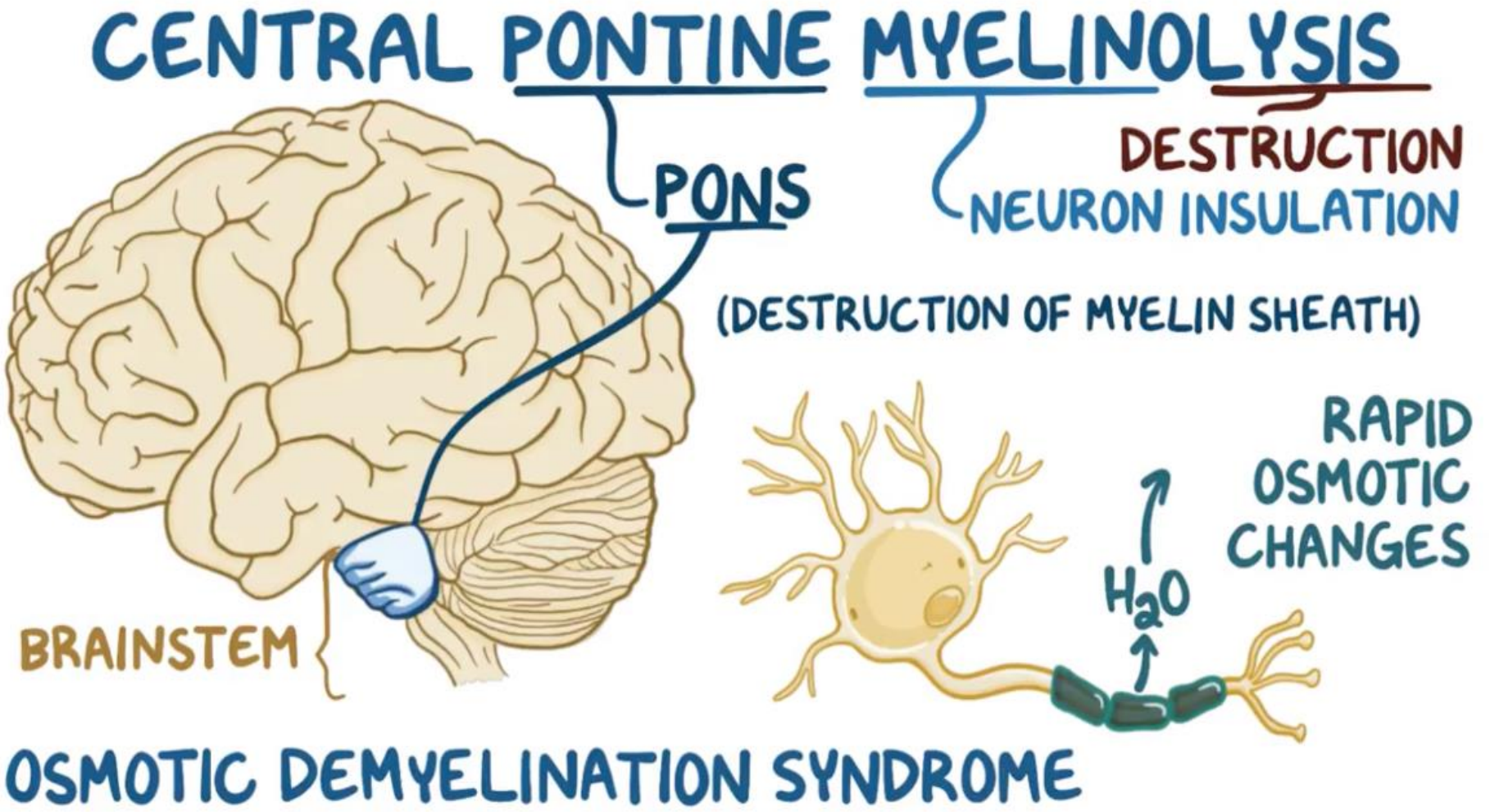
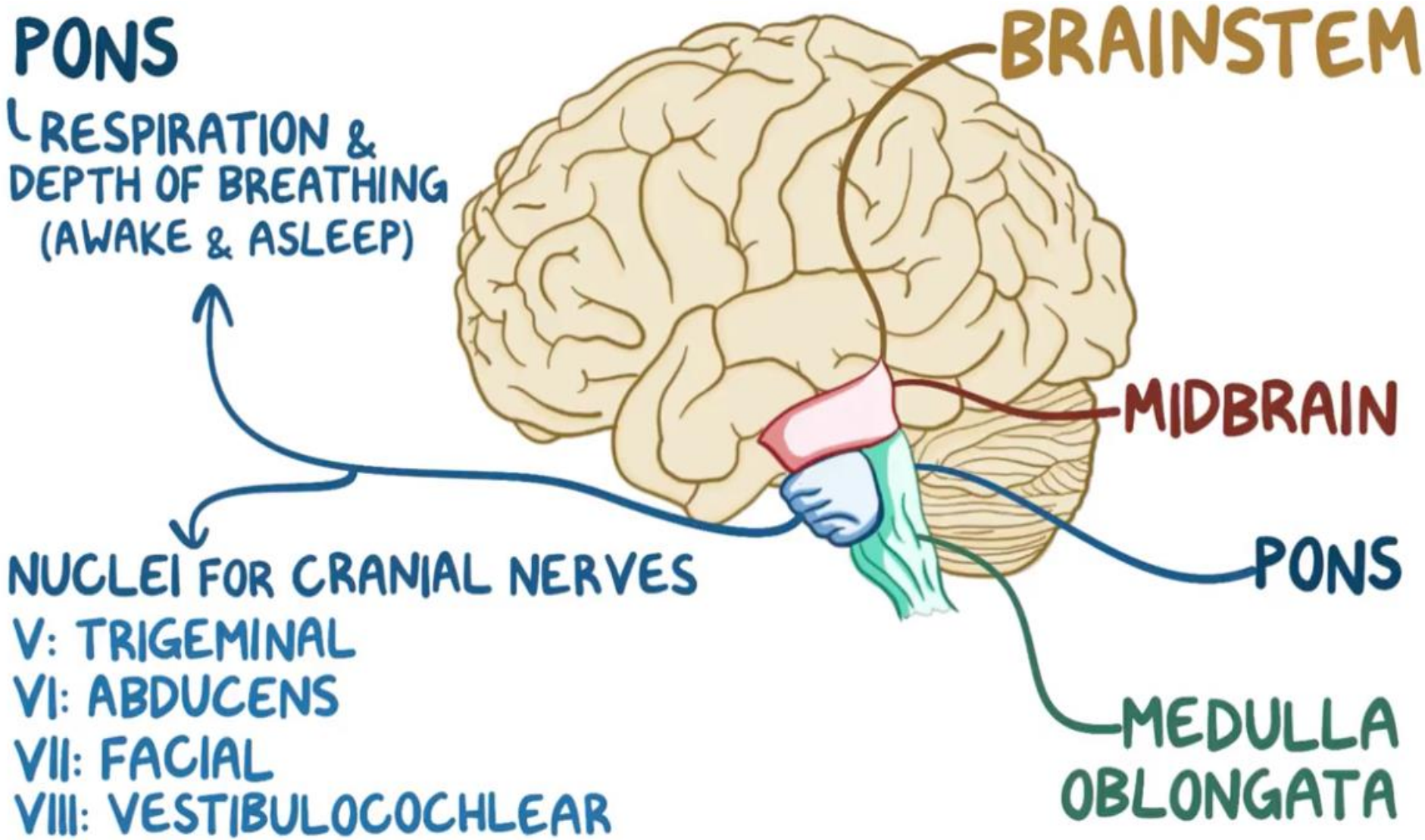
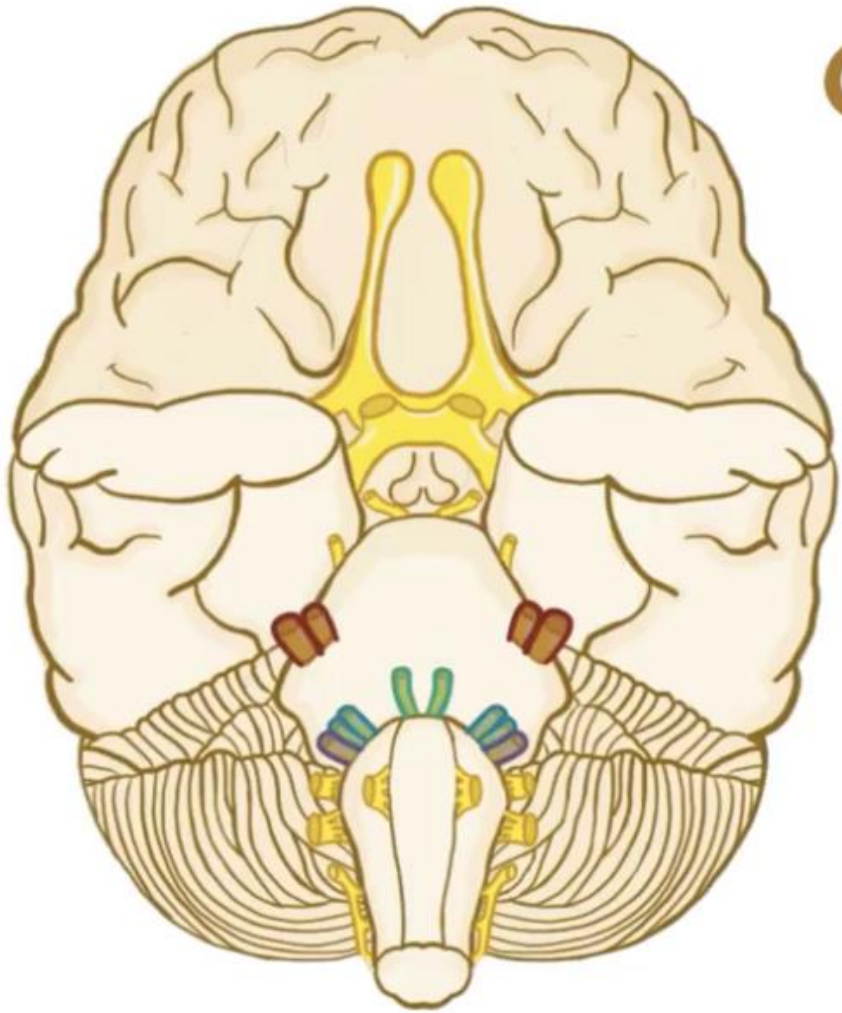
Central pontine myelinolysis

- results in massive axonal demyelination in the center of the pons of the brainstem.
- can occur in a variety of clinical settings, including alcoholism and severe electrolyte/ osmolar imbalance.
- Patients often present with
  - Quadriplegia (total or partial paralysis of all four limbs)
  - speech impairments
  - diplopia, (simultaneous perception of two images of a single object)

Water imbalance causes disease




PONS
RESPIRATION & DEPTH OF BREATHING (AWAKE & ASLEEP)
NUCLEI FOR CRANIAL NERVES
V: TRIGEMINAL
VI: ABDUCENS
VII: FACIAL
VIII: VESTIBULOCOCHLEAR
BRAINSTEM
MIDBRAIN
PONS
MEDULLA OBLONGATA



CRANIAL NERVES

V ~ SENSORY (FACE), CHEW, BITE & SWALLOW

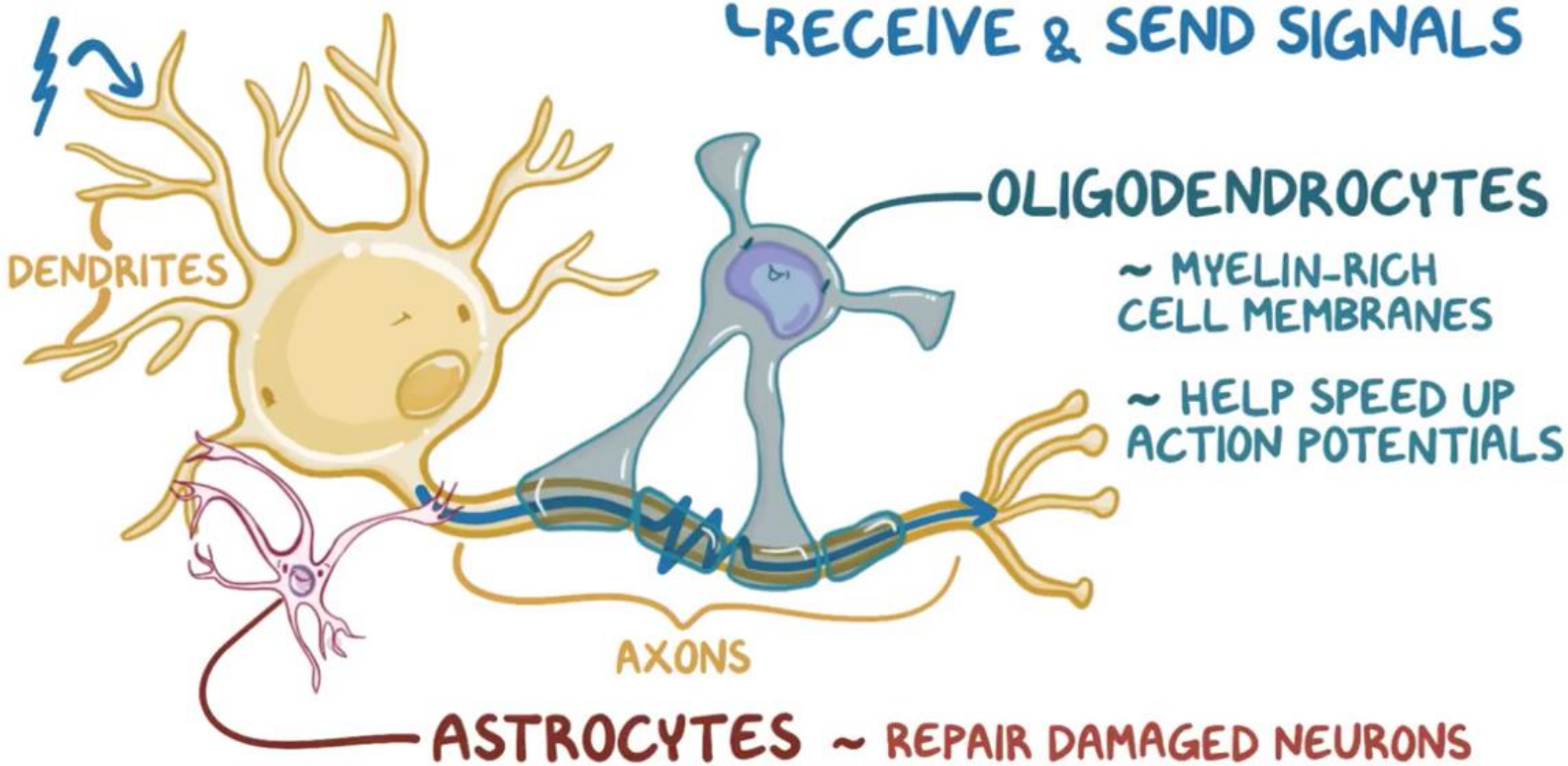
VI ~ EYE MOTION (SIDEWAYS)

VII ~ FACIAL EXPRESSIONS

VIII ~ HEARING

NERVES ~ MANY NEURONS

└RECEIVE & SEND SIGNALS



NEURONS & OLIGODENDROCYTES

- SENSITIVE TO CHANGES IN H_2O / ELECTROLYTES (INTRA/EXTRACELLULAR COMPARTMENT)

PONS

- CELL MEMBRANE ~ H_2O PERMEABLE
- OSMOLYTES ~ SEMI-PERMEABLE
  - ELECTROLYTES (POTASSIUM, SODIUM & CHLORIDE)
  - ORGANIC SUBSTANCES (PHOSPHORYLATED GLUCOSE)

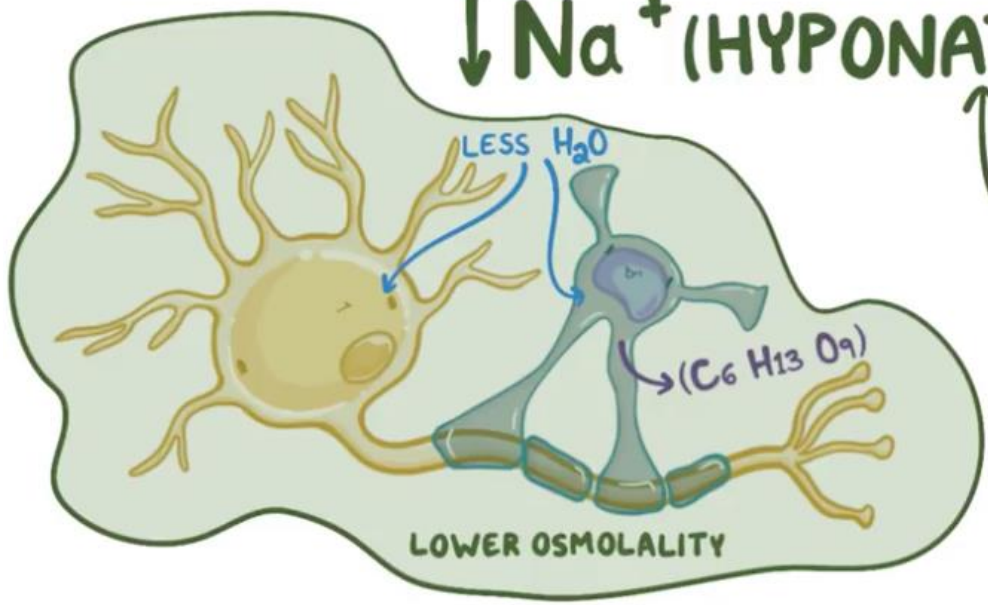
} POLARIZES MOLECULE

OSMOLALITY NORMALLY MATCHES

INTRACELLULAR ($\uparrow K^+ \downarrow Na^+$) ← OSMOLALITY NORMALLY MATCHES → **EXTRACELLULAR** ($\uparrow Na^+ \downarrow K^+$)

→ **OSMOSIS!**

↓ Na^+ (HYPONATREMIA)



NEURONS & OLIGODENDROCYTES

* SENSE ↓ IN EXTRACELLULAR OSMOLALITY
* ↓ OSMOLYTES
* PROTEIN KINASES INHIBITED
* ↓ OSMOTIC GRADIENT, CELL IS IN EQUILIBRIUM

TAKES 24 HR TO RESTORE TO NORMAL

H_2O → CELLS

SYNDROME OF INAPPROPRIATE DIURETIC HORMONE (SIADH)

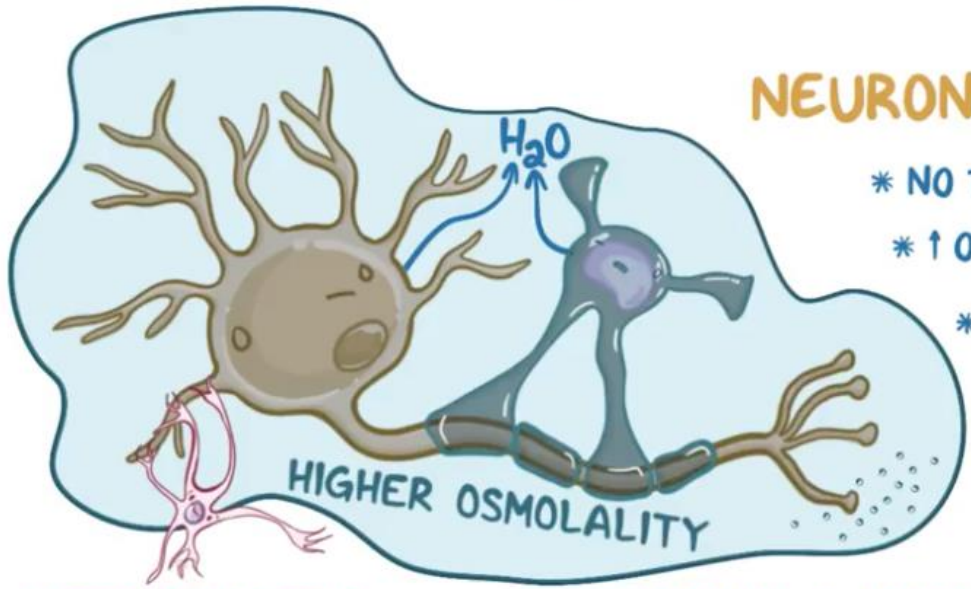
RETAIN TOO MUCH H_2O

SIGNIFICANT SWELLING

TISSUE GETS COMPRESSED

HYPONATREMIA RESOLVES

$+ = \uparrow Na^+$



NEURONS & OLIGODENDROCYTES

* NO TIME TO REESTABLISH BALANCE
* ↑ OSMOLYTES, H_2O MOVES OUT
* CELLS DEHYDRATE

PONS DAMAGE =

↓ FUNCTION OF CRANIAL NERVES

ASTROCYTES → SIGNALS TISSUES TO SECRETE PROTEINS

~ FORM SCAR TISSUE, MADE OF GLYCOPROTEINS (ASTROGLIOSIS)

└(LAMININ, FIBRONECTIN & PROTEOGLYCANS)

└INHIBIT TISSUE REGENERATION

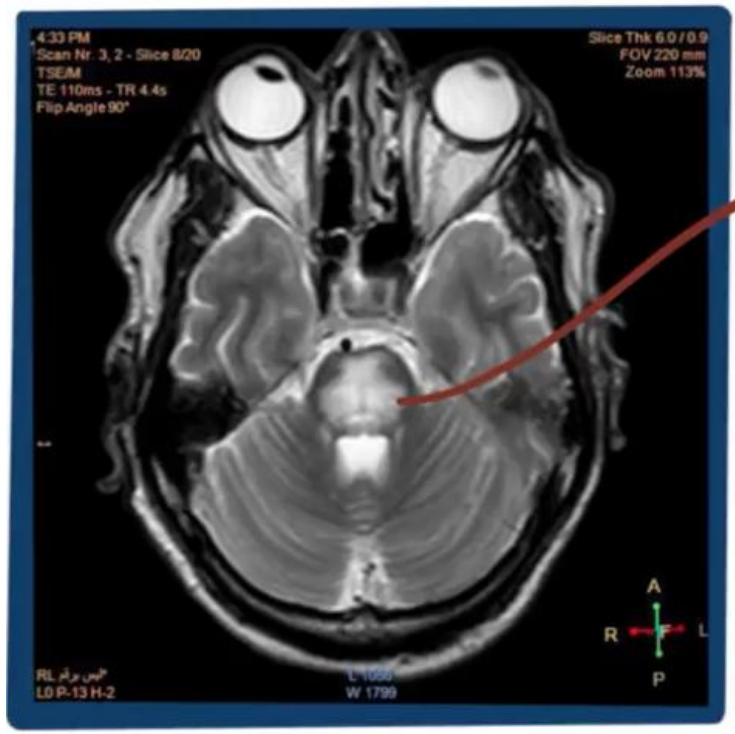
CENTRAL PONTINE MYELINOLYSIS

└IMPAIRED MUSCLE MOVEMENTS (HEAD & NECK)

DYSARTHRIA ~ INABILITY TO SPEAK NORMALLY
DYSPHAGIA ~ DIFFICULTY SWALLOWING
DIPLOPIA ~ DOUBLE VISION

LOCKED-IN SYNDROME
(COMPLETE PARALYSIS OF VOLUNTARY MUSCLES)

DIAGNOSIS



MRI → DAMAGE TO PONS

* NO WAY TO REVERSE
* ONGOING DAMAGE CAN BE STOPPED

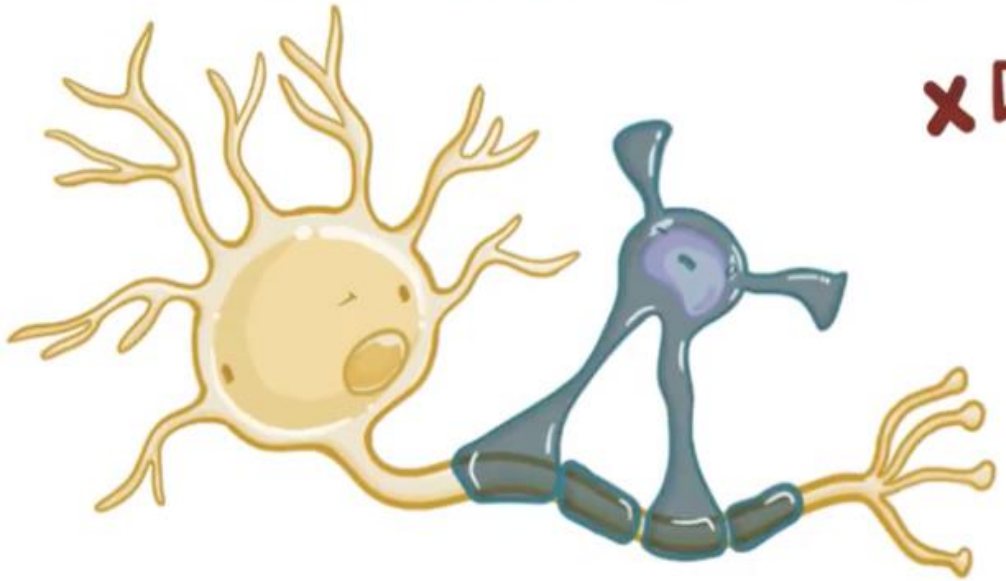
↓

CORRECT ELECTROLYTE ABNORMALITIES

Summary

CENTRAL PONTINE MYELINOLYSIS

(OSMOTIC DEMYELINATION SYNDROME)



- DESTRUCTION OF MYELIN (IN THE PONS)
- RAPID CORRECTION OF HYPONATREMIA
- CAN CAUSE LOCKED-IN SYNDROME (CONSCIOUS BUT PARALYZED)