Brain Resource Creation Workshop:
Chapter 14 - Injury and Illness

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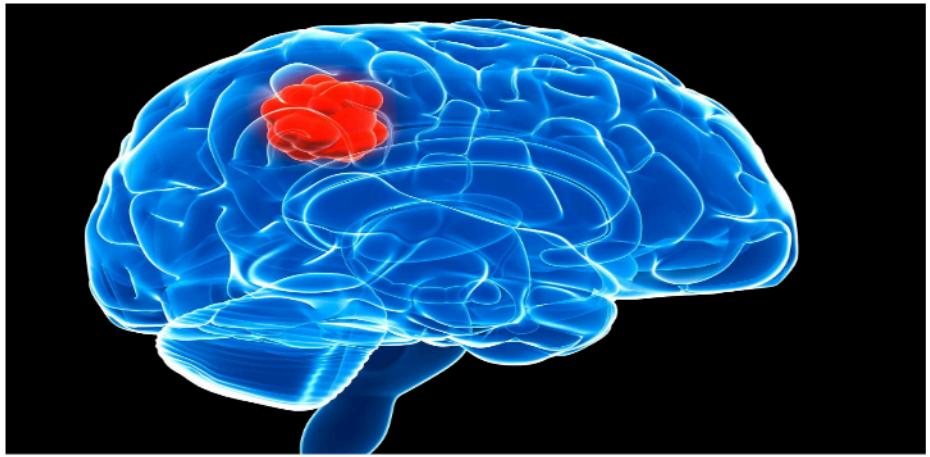
PRIMARY BRAIN TUMORS

- Tumors that originate in the brain.

METASTATIC BRAIN TUMORS

- Cancers that typically spread from tumors of the lung, breast, skin,or kidney.



metastatic vs primary

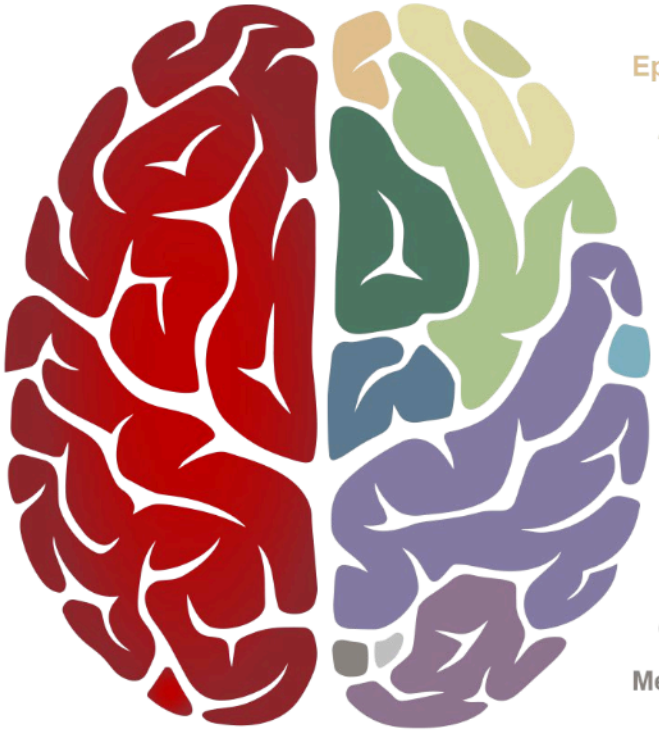
BRAIN CANCER

INCIDENCE

Higher than any primary brain cancer

50% Accounts for half of all CNS tumors

Lung and breast cancer are the most frequent metastasis origin



Ependymomas

Astrocytomas

Lymphoma

Glioblastoma

All Other

Oligodendrogliomas

Pituitary

Meningioma

Nerve Sheath

Craniopharyngioma

Medulloblastoma

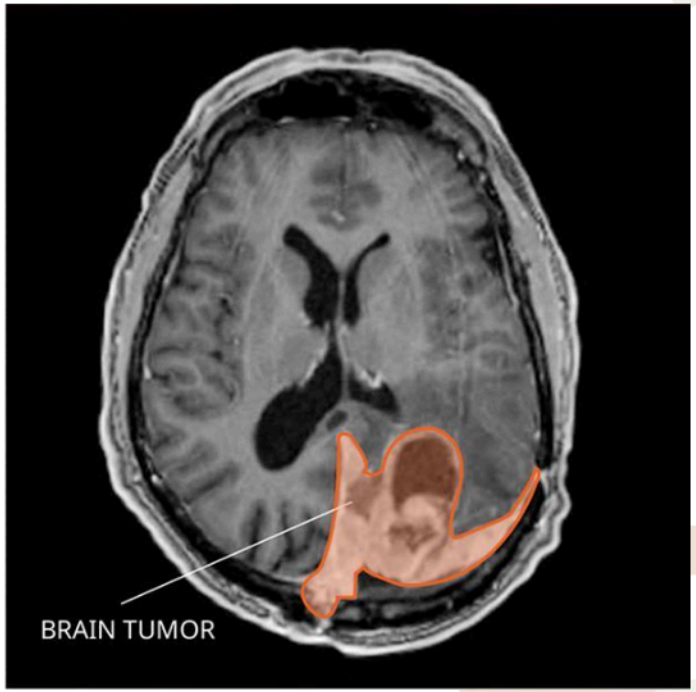
Overview

- Lethal—surgical removal needed for survival.

- Types are named after the cell/brain area where they develop:

    - **GLIOMAS:** from glial cells (supports and protects brain neurons).

    - **MENINGIOMA**: most common type of primary brain tumor, benign, from meninges (thin tissue layers covering the brain).

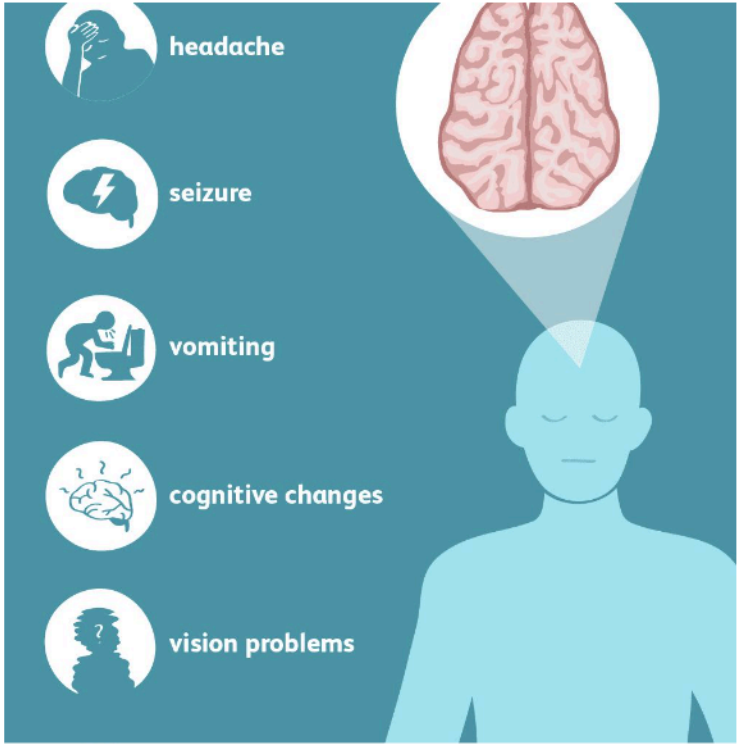


Statistics

- **More than 79,000 people** in the U.S. will be diagnosed with a primary brain tumor:
  - **~26,000** = malignant (cancerous) & **~53,000** = benign (noncancerous).

- **More than 200,000 people** will be diagnosed with brain tumors that develop when cancer cells travel from the bloodstream to the brain.

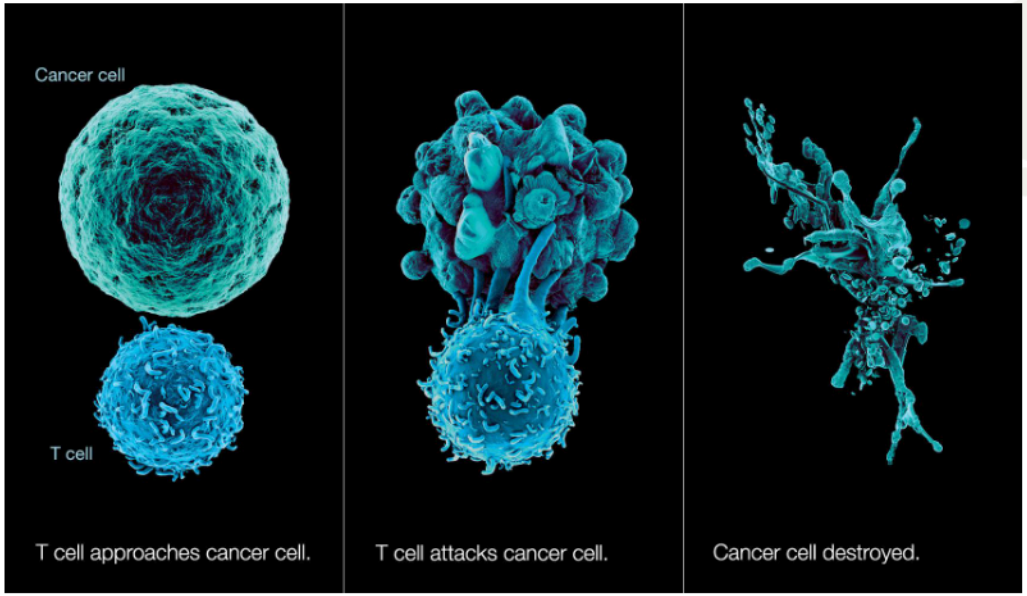
- **Most common brain cancer type: GLIOBLASTOMA:** proliferation of immature glial cells.



Symptoms

- Headache
- Difficulties with sight
- Seizures
- Memory loss
- Confusion

Treatments

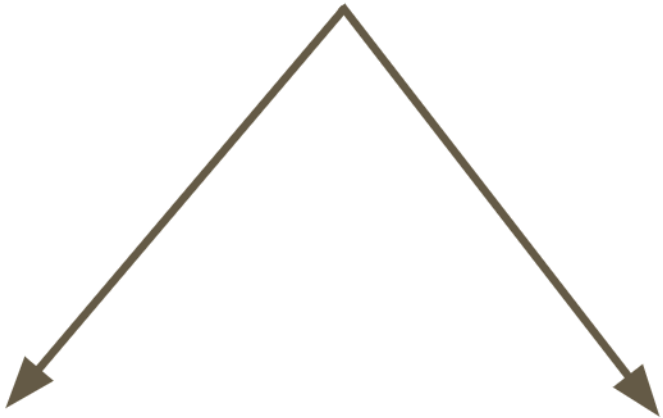


- Surgery
- Radiation
- Gene therapy
- Chemotherapy
- Ultrasound beams
- Targeted treatments
- Steroid medication (reduces brain swelling)
- **Stereotactic radiosurgery** (radiation aimed at the tumor)
- **Craniotomy** (skull is opened and tumor removed as much as possible)
- **Immunotherapy** (stimulation of immune system to prevent tumor growth)

NEUROLOGICAL TRAUMA

Leading cause: falls

275,000 hospitalized & 52,000 deaths from TBI every year.



Leading cause: vehicle crashes

282,000 people currently live with spinal cord injuries!

Traumatic Brain Injury (TBI)

Spinal Cord Injury (SCI)

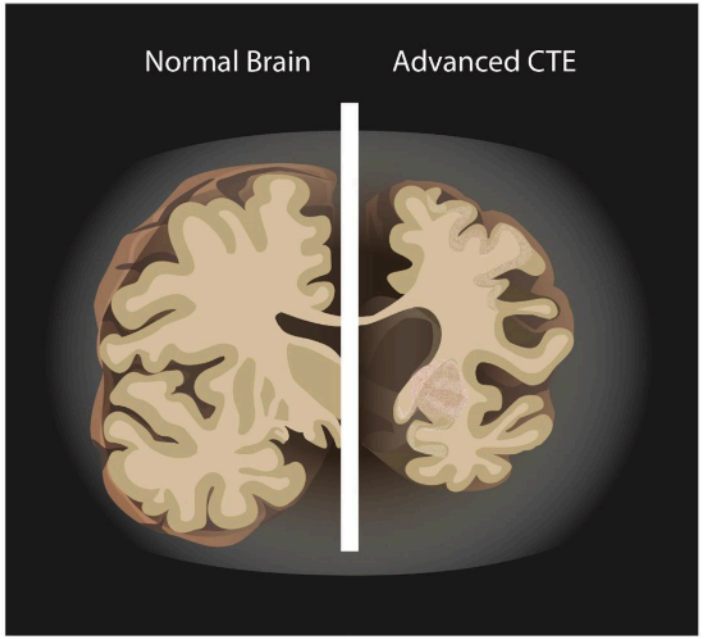
Traumatic Brain Injury

- Causes:
  Bumps, blows, or jolts to the head → multiple minuscule bleeds.
  Penetrating head injuries → destruction of brain tissue.

- **Mild** TBIs (e.g. concussions) are recoverable within a short period.

- **Severe** TBIs (e.g. massive bleeding, neuron damage) can cause internal bruising, as well as contact of blood with brain tissue (toxic to cells!) → reduced blood flow to affected tissues.

Chronic Traumatic Encephalopathy (CTE)



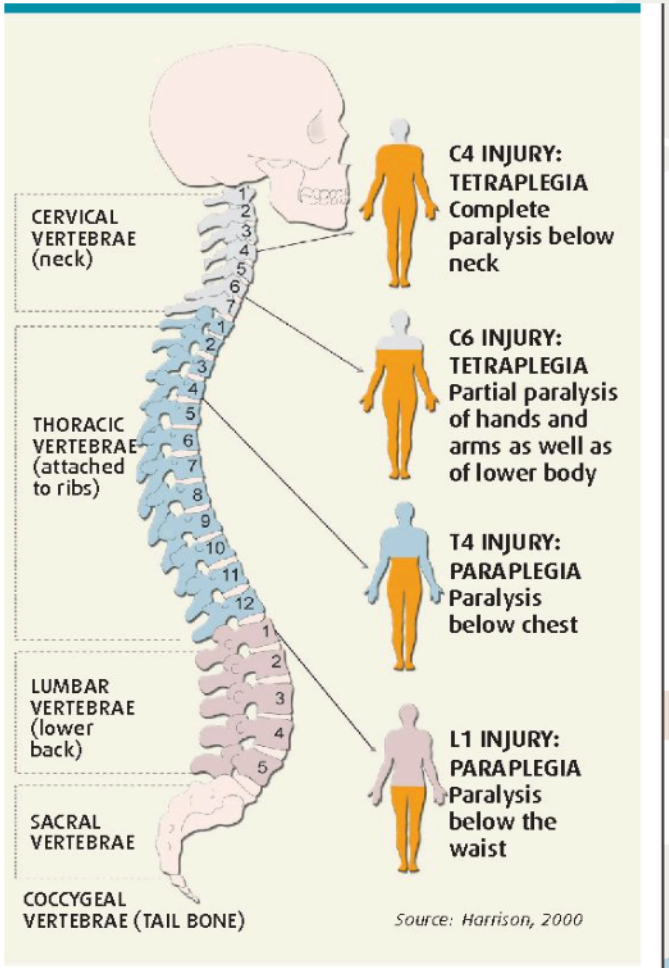
- Induced by repetitive Concussions or head trauma
  → **Degeneration of brain tissue.**

- Buildup of abnormal proteins.

- Symptoms:
  - Memory loss
  - Confusion
  - Impaired judgment
  - Impulse control problems
  - Aggression
  - **Progressive dementia**
  - Depression

Spinal Cord Injury (SCI)

- Can lead to **permanent nerve damage** and/or various degrees of **paralysis**.
- **Incurable**, but Methylprednisolone (a corticosteroid) reduces damage and inflammation at the affected site.
- Physical/occupational therapy and electrical stimulation are both considered possible ways for rehabilitating SCI patients.

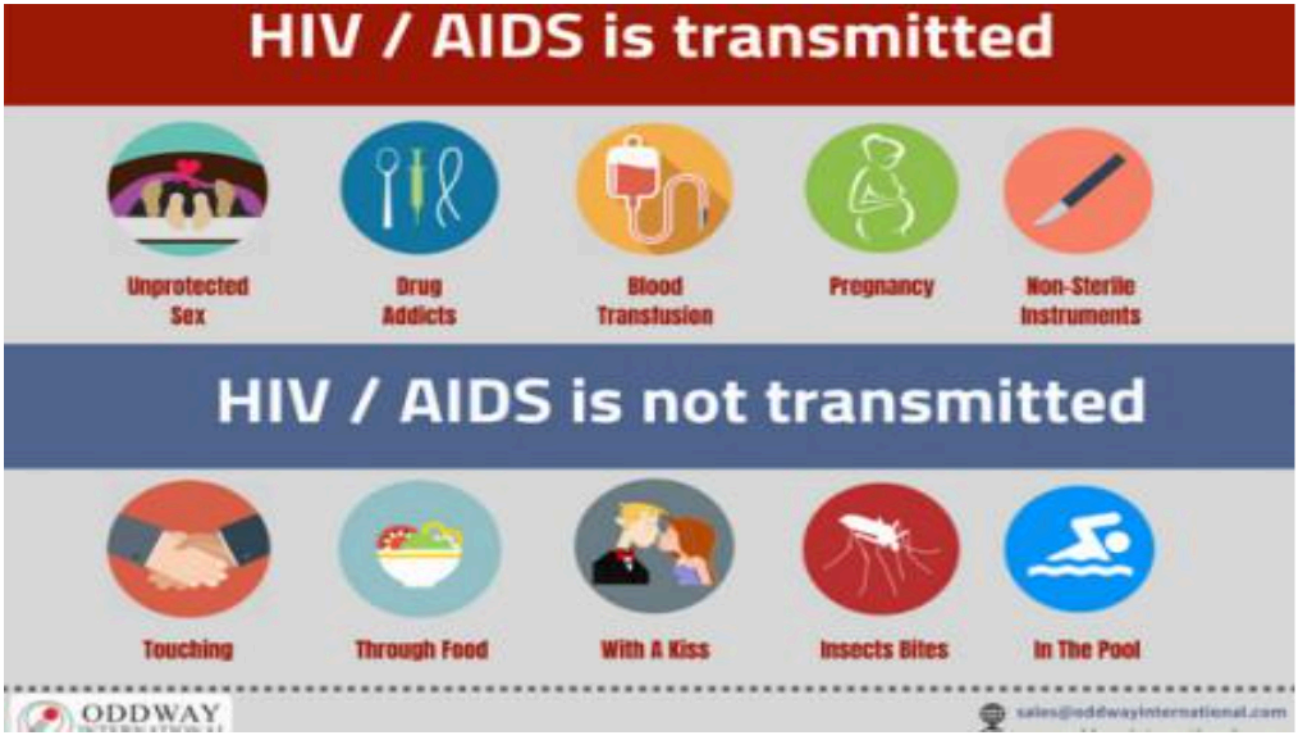


NEUROLOGICALLY-ACQUIRED IMMUNODEFICIENCY SYNDROME

- HIV targets both the **immune** and **nervous** systems.
  - HIV-associated neurocognitive disorders (HAND) leads to **difficulties with coordination, memory, decision-making,** and **progressive/AIDS dementia**. Complications can be treated and reversed by antiretroviral (ARV) drugs.

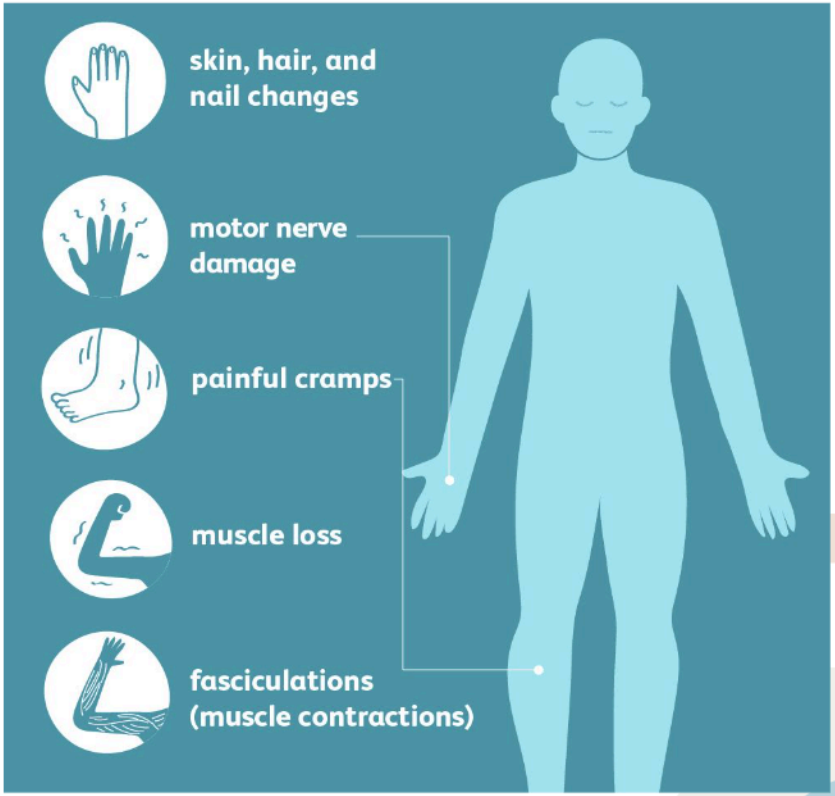
- HAND and AIDS cause loss of balance, leg weakness, and brain shrinkage. *HIV increases vulnerability to cancers and infections.*

- **Incurable**, but ARVs can reduce the incidence of anomalies.


HIV / AIDS is transmitted
Unprotected Sex
Drug Addicts
Blood Transfusion
Pregnancy
Non-Sterile Instruments
HIV / AIDS is not transmitted
Touching
Through Food
With A Kiss
Insects Bites
In The Pool
ODDWAY

Peripheral Neuropathy

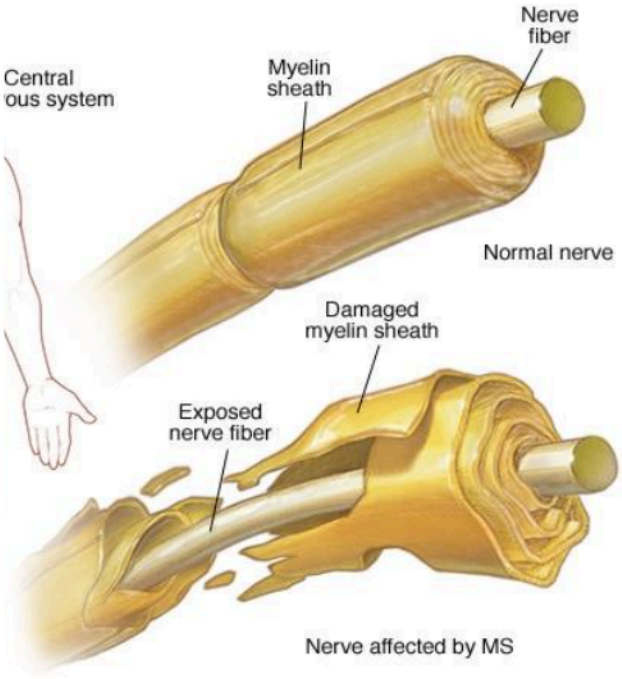
- Neurological problem developed
and **triggered by HIV.**
- ARVs can make neuropathies more frequent and serious.
- Nerve injuries of extremities.
- **Discomfort**: tingling, burning, and severe pain.



MULTIPLE SCLEROSIS

- Inflammatory disease of the **central nervous system**.

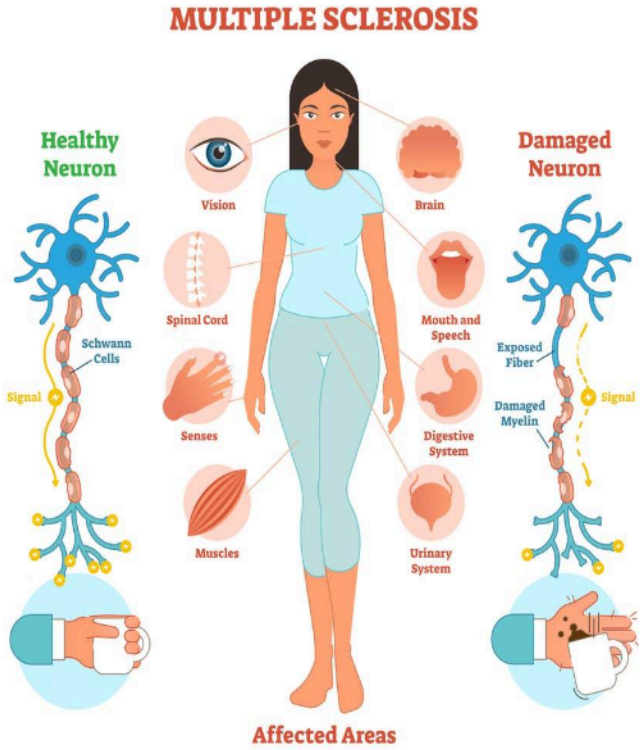
- The immune system attacks the brain, spinal cord, and optic nerves, causing the **myelin sheath** *(fatty, protective nerve coating)* to form lesions (scar tissue).
  - Interferes with nerve impulse transmission & communication.
  - Comparable to the loss of insulation around electric wires & wire damage.



MULTIPLE SCLEROSIS

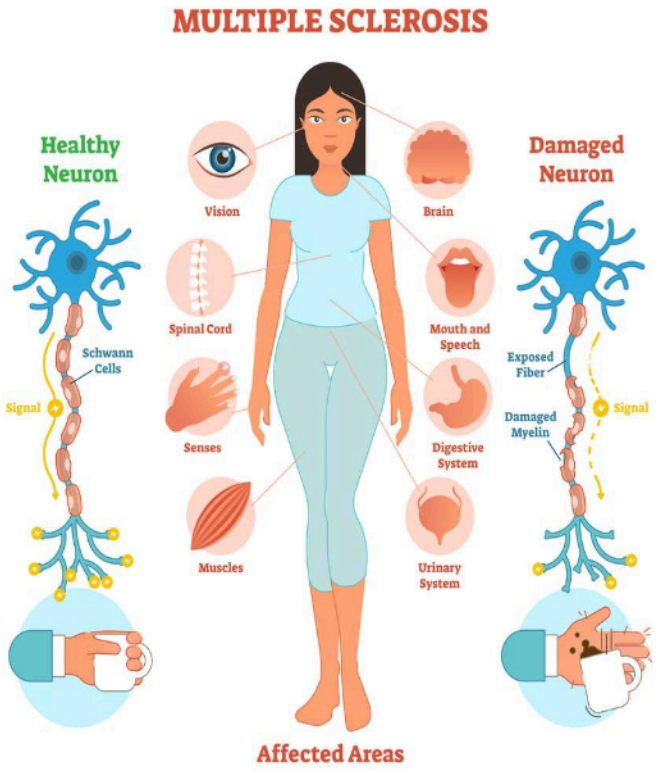
- **Unknown causes**; possibly **genetic** and **geographical** factors.

- Symptoms:
  - Numbness
  - Blurred vision
  - Weakness
  - Depression
  - Memory loss
  - Loss of coordination
  - Uncontrollable tremors
  - Loss of bladder control
  - Clumsiness
  - Slurred speech
  - Pain
  - Fatigue



MULTIPLE SCLEROSIS

- **Incurable**, but more medications are becoming available:
  - **Steroid drugs** (glucocorticoids) reduce inflammation and acute attacks.
  - Medications to control symptoms (muscle stiffness, pain, fatigue, mood swings, bladder/bowel/ sexual dysfunction.



Types

1) **Relapsing-remitting MS**
   - Flare-ups of new or worsening symptoms → complete or partial remission of symptoms.

2) **Primary-progressive MS**
   - Progressive worsening of symptoms after disease onset.

3) **Secondary-progressive MS**
   - Relapsing-remitting MS transitions into a progressively worsening form of the disease.

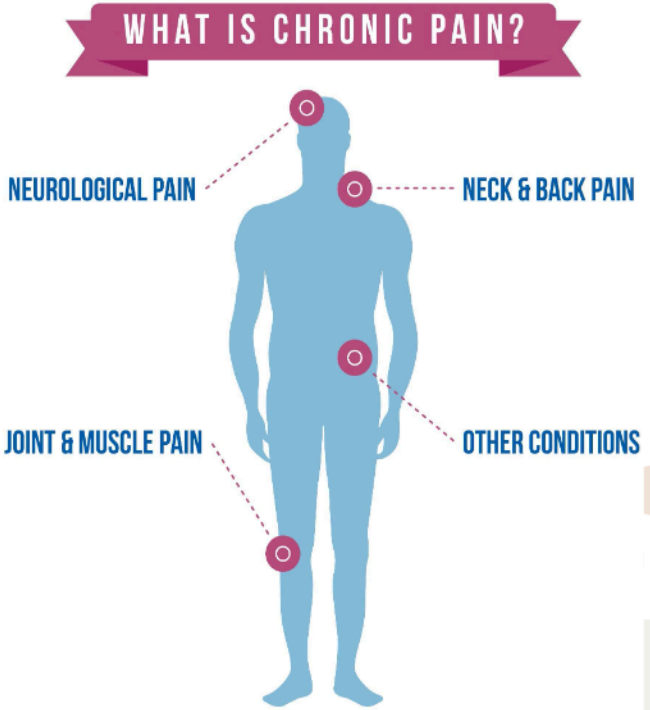
CHRONIC PAIN

- **Persists for weeks, months, or years.**

- Most commonly back pain, severe headaches, migraine pain, and facial ache.

- Can lead to changes in
  - Perception
  - Attention
  - Mood
  - Motivation
  - Learning
  - Memory

- Combination of medical, behavioral, and physical therapy treatments can help manage chronic pain.



Treating Pain

- **Anaesthesia**—procaine (Novocalin) and lidocaine.

- **4 main types of painkillers**
  - **Aspirin** and Nonsteroidal anti-inflammatory drugs (**NSAIDs**), such as ibuprofen and naproxen → postoperative pain, arthritis pain, headaches.
  - **Opioids** (morphine, codeine) → reduce pain and produce euphoric feelings; highly addictive.
  - **Antiepileptic agents** (gabapentin) → nerve pain and damage.
  - **Antidepressants** (amitriptyline) → nerve pain and damage.

- **Psychological therapies** (cognitive behavioral therapy, biofeedback) can simulate relaxation, release muscle tension, manage changes caused by chronic pain.

The Body's Pain Control System

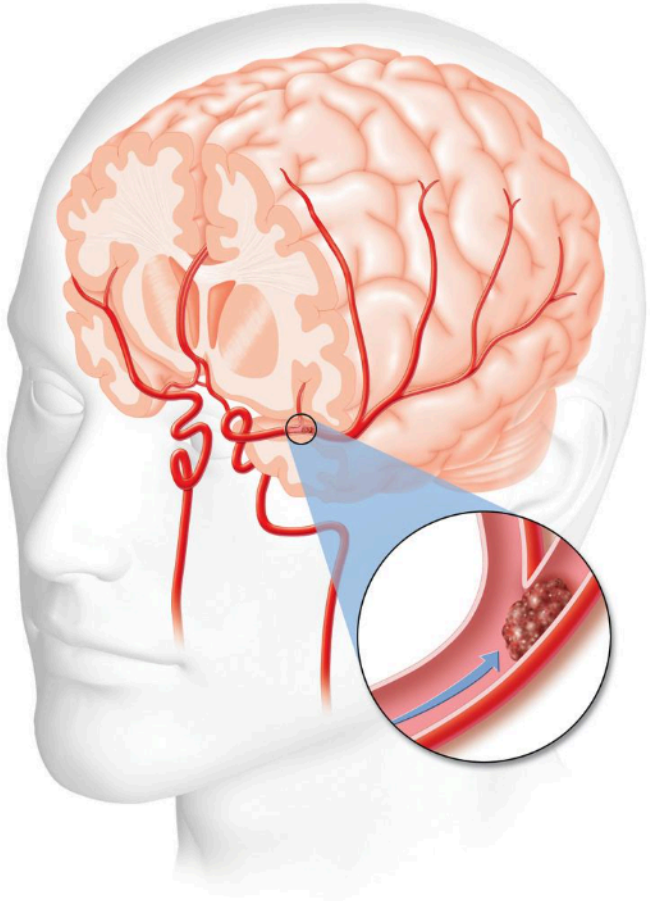
- **Endorphins:** body's opioids, concentrated in the cerebrospinal fluid surrounding the spinal cord.

- Morphine injections into CSF (treats pain post-surgery)
  → profound pain control (no paralysis, numbness, or other side effects).

STROKE

- **Interruption of blood flow to the brain** due to ruptured blood vessel or blood clot.

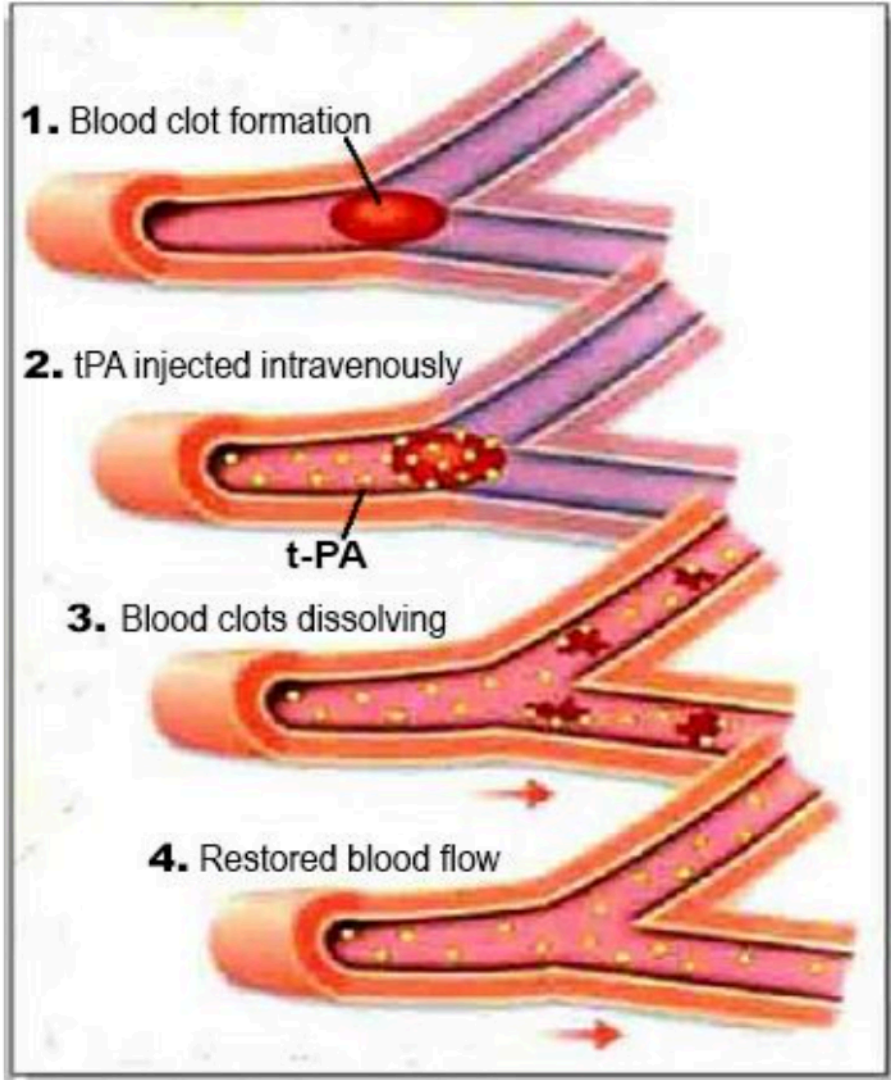
- **Risk factors**: obesity, physical inactivity, heart disease, genetics
  - Controlled by maintaining a healthy weight, exercising, avoiding alcohol, taking medications for high blood pressure.



Treatment

- **Clot-dissolving medications** (e.g. Tissue Plasminogen Activator, or tPA) restore circulation before oxygen loss causes permanent brain damage.

- **Anticoagulant drugs** reduce the probability of clot formation.



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We hope you enjoyed the workshop!

Any questions?

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