

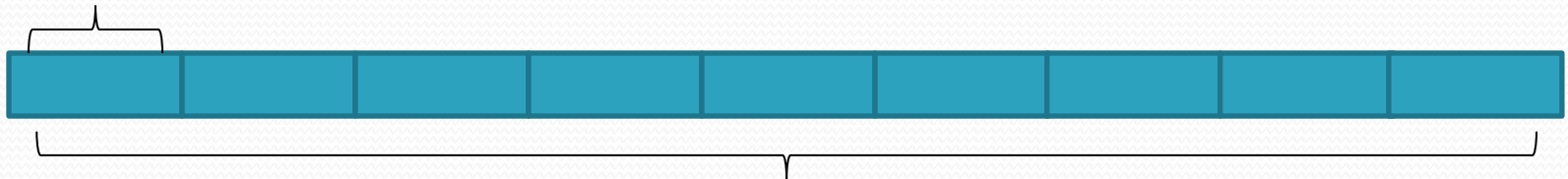


Blood Clots, Polymers and Strokes

Polymers

- **Polymers** are large molecules made of a repeating series of smaller molecule units.
- The small units are called **monomers**.
- **Polymerization** is the process of linking together monomers to form a larger polymer.

monomer



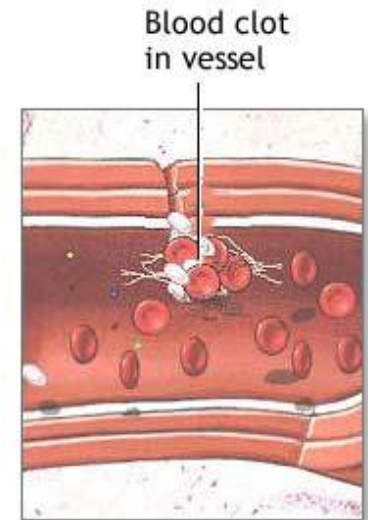
polymer

What is a Blood Clot?

- When damage occurs to a blood vessel, the body creates a blood clot to prevent blood loss. →
- Damaged vessels release proteins causing a cascade leading to **coagulation** and the creation of a clot:
 1. platelets bind to the damaged tissue
 2. fibrinogen (a protein) is recruited to the site and is converted to fibrin
 3. fibrin is **polymerized** and creates a mesh that, when combined with the platelets, creates a blood clot
- When the vessel is healed, the body dissolves the clot.



Blood sample taken

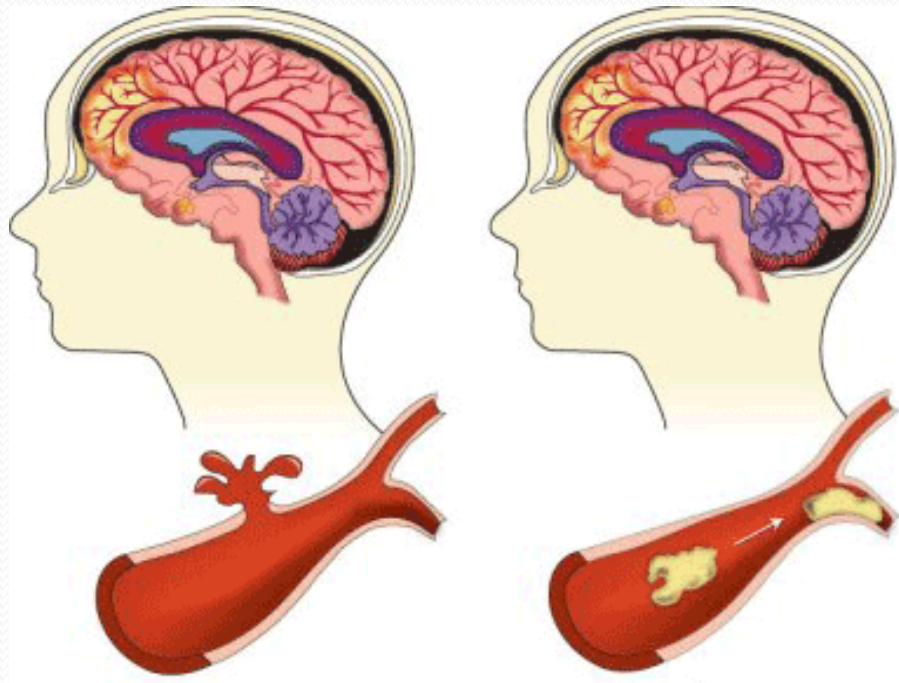


Vessel Blockage

- An **embolism** is an object (blood clot, plaque) that travels through vessels, gets stuck and blocks blood flow. It can be created from:
 - the failure of the body to break-down a clot or a clot that breaks off the vessel wall
 - excessive plaque build-up in vessel walls
- A **thrombosis** is a blood clot that grows abnormally in a vessel and cuts off blood flow.

Stroke

A stroke is a loss of brain function due to an interruption of the blood supply to the brain.

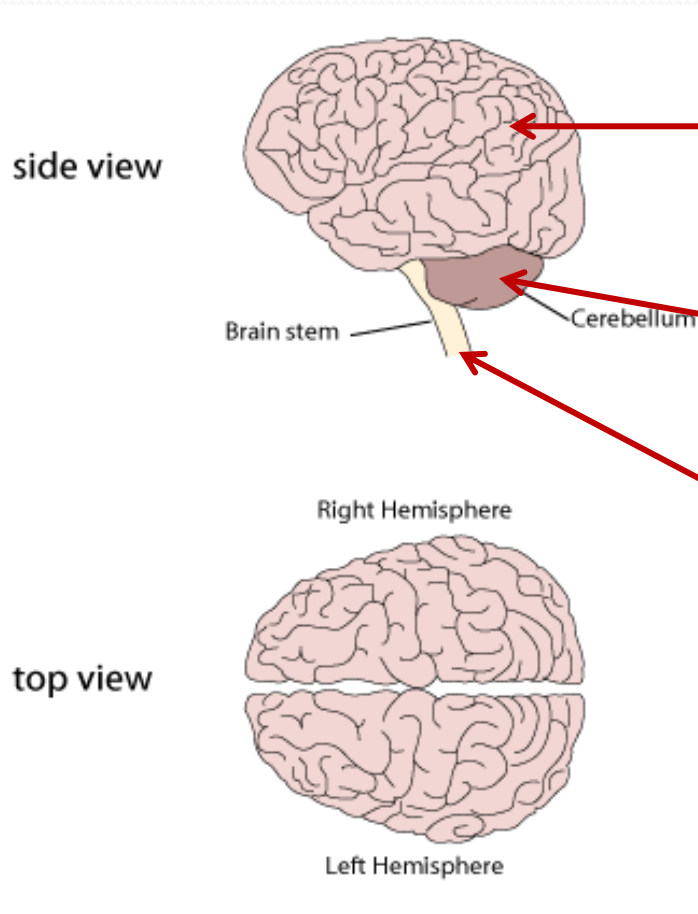


hemorrhagic strokes are caused by a hemorrhages (bleeding) in the brain. →

← **ischemic strokes** are caused by blood clots that block blood flow to areas of the brain.
(87% of strokes)

The Brain

Different parts of the brain have different functions.



cerebrum:

controls higher thought, speech, motion and vision

cerebellum:

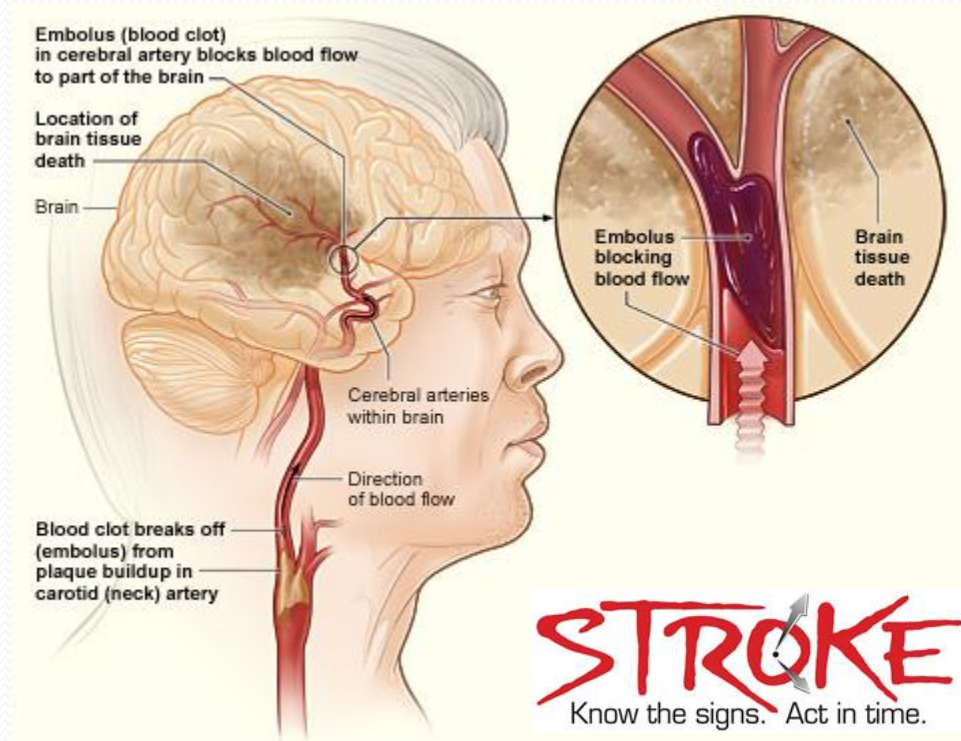
controls balance and fine motor skills

brain stem:

controls vital life functions

Effects of a Stroke

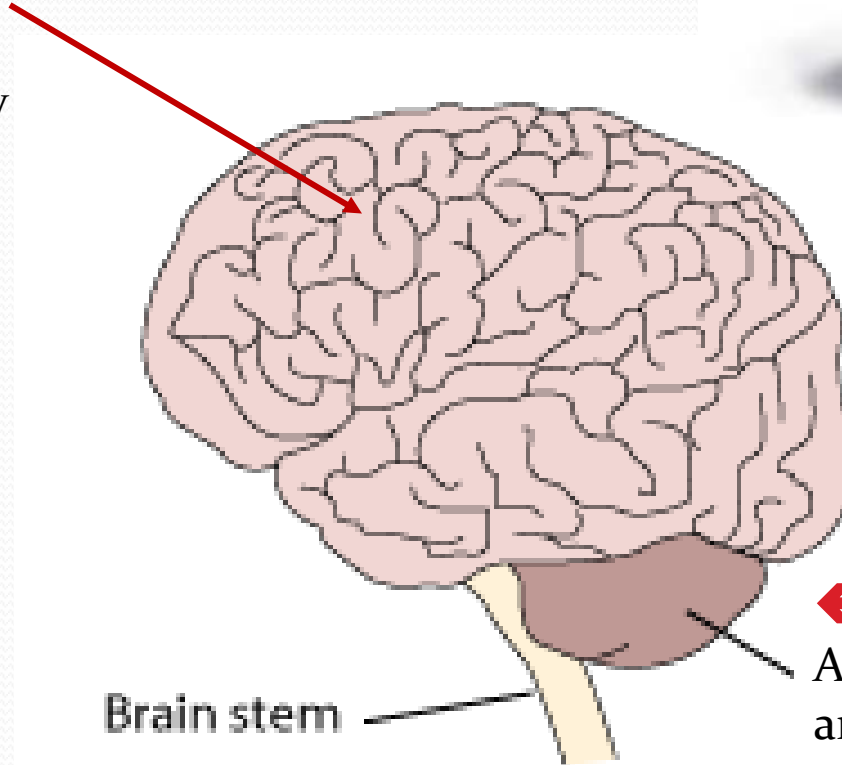
- When a tissue is cut off from its blood supply, it has no oxygen or nutrients and begins to die.
- The effects depend largely on **where** in the brain it occurs, **how large** of an area is affected, and **how long** the tissue is deprived of blood.



Stroke Locations

cerebrum ↘

A stroke here causes difficulty thinking and speaking.



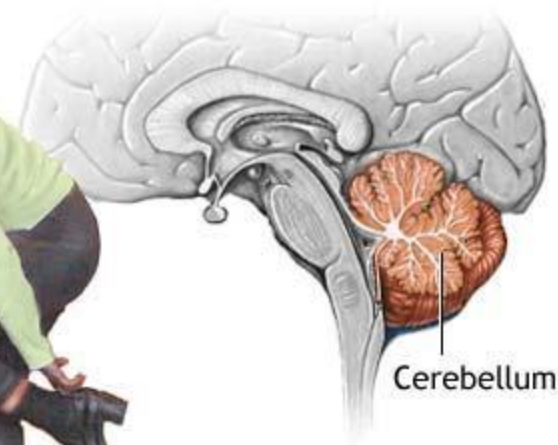
brain stem ↘

A stroke here would likely be lethal.

Brain stem

← **cerebellum**

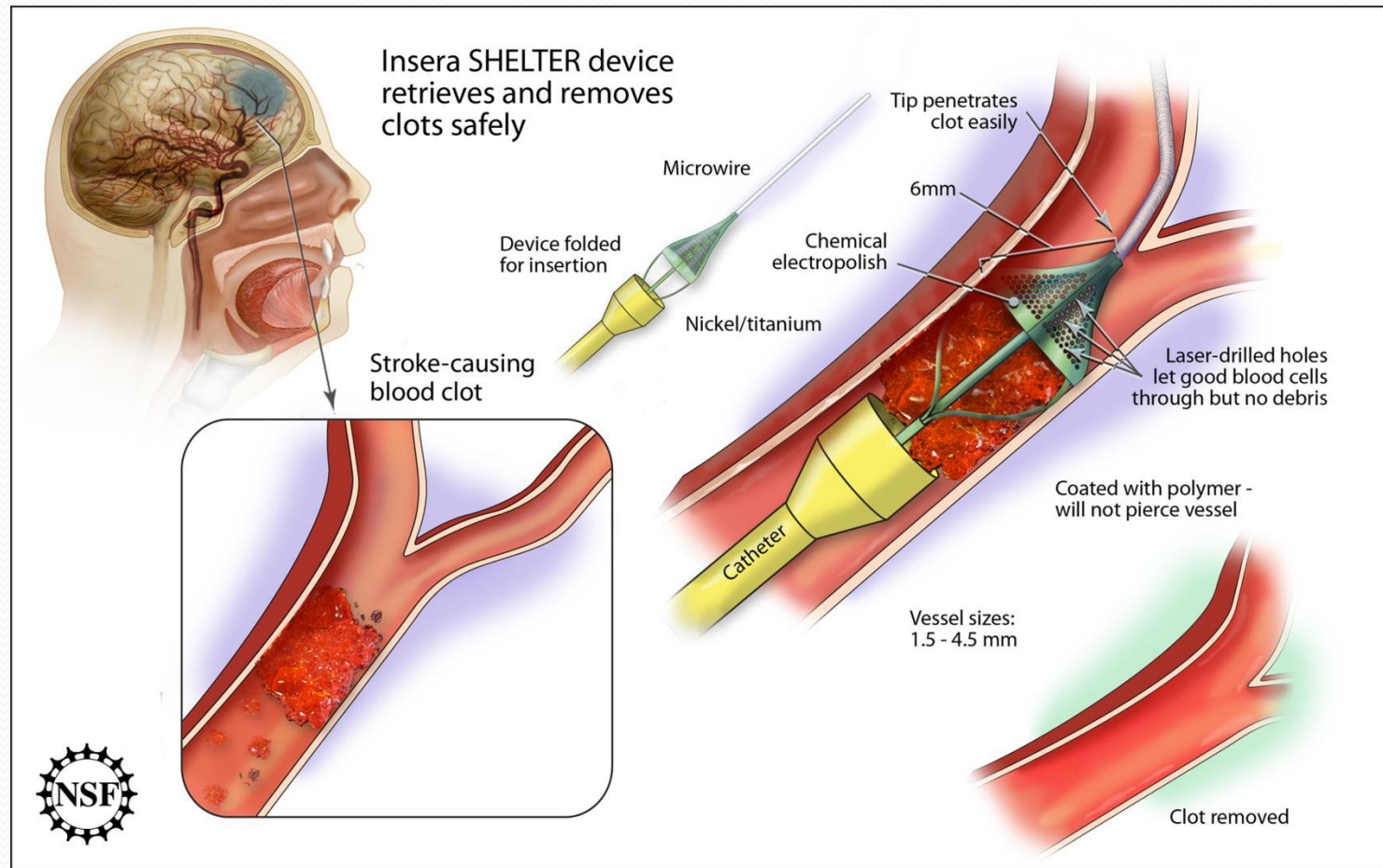
A stroke here causes dizziness and difficulty controlling fine motor skills.



Cerebellum helps provide smooth, coordinated body movement

Restoring Blood Flow

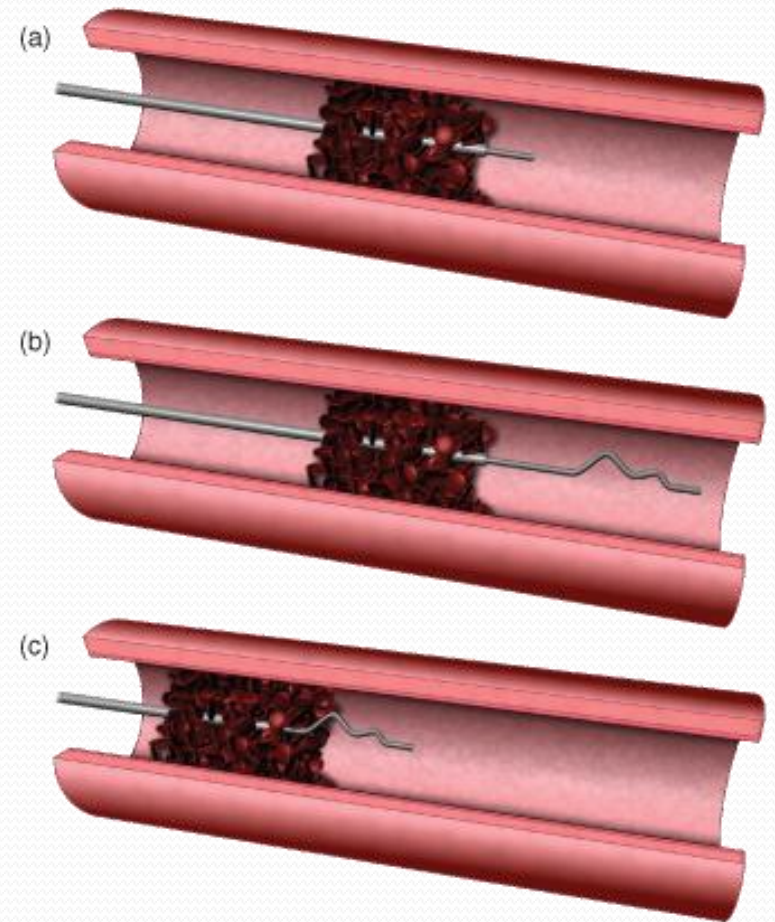
Biomedical engineers design tools to remove blood clots.



Example Biomedical Device

Merci Retrieval System

- A cork-screw device is inserted through the femoral artery in the groin and travels to the site of the blood clot in the brain.
- The tool grabs the clot and pulls it out through the artery.



Example Biomedical Device

Penumbra System

- A thin device is inserted through the femoral artery in the groin area and travels to the site of the clot in the brain.
- The tool sucks up the blood clot to restore blood flow.

Teacher: insert image found at:
stroke.ahajournals.org/content/43/1/280/F2.large.jpg