Neurovascular Coupling

Prelims – *Current events for National and International Importance| Science & Technology.*

Why in News?

Recently, a study found that the brain's energy efficiency relies not just on responsive neurons, but also on a hidden vascular network.

- **Concept –** It is the process within the brain, precisely *linking the activity of brain cells (neurons) to the local blood supply*.
- **Role** - This intricate connection ensures that active brain regions receive the necessary resources to function efficiently.
- **Process –** When neurons fire, *nearby blood vessels rapidly widen* to deliver glucose and oxygen, ensuring the brain's energy demands are met instantaneously.
- Messages travel 'upstream' from smaller vessels to larger vessels and the known chemical messengers moved too slowly to account for the brain rapid responses.
- Cells lining the brain's blood vessels are *linked by gap junctions*, that let neighbouring cells exchange ions and small molecules.
- *Gap junctions enable rapid, direct communication* between cells in the blood vessel walls, bypassing the need for slower chemical messengers.
- **Working in blood vessels**
  - **Arteries -** It has *strong gap junction connectivity* involving with connexion proteins allowing for *rapid signals.*
  - **Veins –** It has *weaker networks*, suggesting less involvement in immediate neurovascular response.
  - **Capillaries –** It serves as the local sensors of brain activity.

Arteries *transfer blood from the heart to the tissues.* ***Veins*** *transfers the blood from the different body parts into the heart.* ***Capillaries*** *help in the exchange of nutrients in the tissues and they also connect the veins and arteries.*

Connexin proteins
• It is a group of proteins that *allow cells to communicate directly with their neighbours*. - Example: Cx37 and Cx40 • **In arteries** – Both connexin proteins, were *especially abundant* that may be responsible for the rapid call to action. • Its signals travel along vessel walls to widen upstream arteries, boosting blood flow to active brain areas.

- **Significance of discovery –** Gap junctions acted as a *"scaling mechanism"* that let blood delivery grow to match bursts of brain activity.
- It could *help develop drugs to activate connexins* as well as discover brain's 20-plus connexin protein types combine into mosaic junctions that fine-tune messages from cell to cell.

Reference

The Hindu| Neurovascular Coupling