Electroencephalography (EEG)

Source: TH

Why in News?

Recently, **electroencephalography** has been in the news due to the **centenary year of the first human EEG**, pioneered by German physiologist Hans Berger.

- Vladimir Pravdich-Neminsky achieved the first mammalian EEG in 1912 with a dog's brain, **followed by Hans Berger in 1924** with the first human EEG.

What is EEG?

- **About:**
  - EEG stands for electroencephalography. 'Electro-' pertains to electricity; '-encephalo-' refers to the brain; and '-graphy' is a suffix meaning to show or to represent.
  - The EEG is a remarkable tool in physics and neurobiology, **offering a straightforward glimpse into the human brain's workings**, without invasive procedures.
  - An EEG setup is **simple, cost-effective, non-invasive,** portable, space-efficient, and doesn't emit high-energy radiation or sounds, unlike MRI.
- **Working:**
  - Volume conduction is the interference that **happens between the source of an electrical potential** and the electrode measuring that potential.
    - It occurs when electrical potentials is measured at a distance from their source.
  - Neurons in the **brain constantly exchange ions** with their surroundings, **creating waves of electrical activity** that electrodes on the scalp track to produce an electroencephalogram.
- **Applications:**
  - It is the best test available to diagnose **epilepsy** (a neurological condition involving the brain that makes people more susceptible to having recurrent unprovoked seizures).
  - An EEG test can also reveal the effects of **anaesthesia**, sleeping patterns, neurological activity during a coma, and availability of oxygen.
  - EEG can also help **confirm brain death**.
  - Also used for neuroscience, cognitive psychology, neurolinguistics, and neuromarketing studies and to develop **brain-computer interfaces.**
  - Researchers have linked EEG data to various brain activities, distinguishing effectively between normal and abnormal states.
- **Challenges:**
  - EEG is great at tracking rapid brain activity in milliseconds but is **biased towards signals from the brain's surface** and dendrites, making pinpointing activity origin complex.
  - Researchers use EEG with **MRI** and advanced methods to overcome these challenges.

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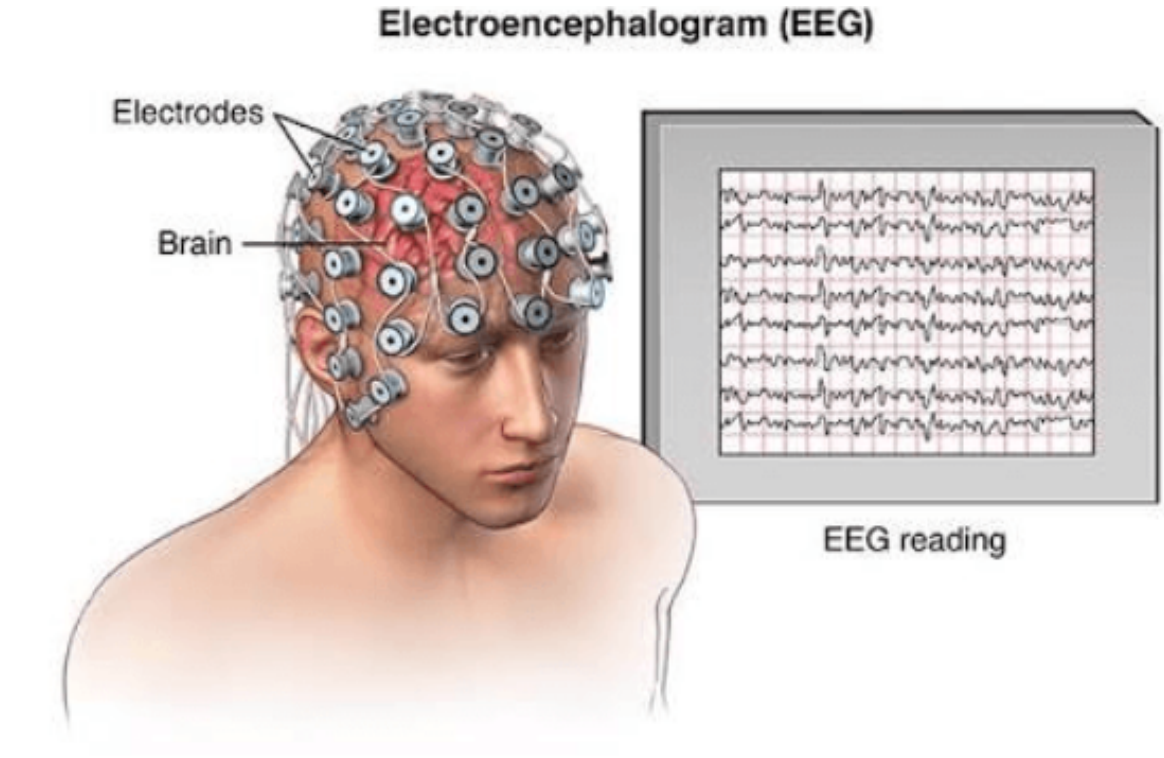

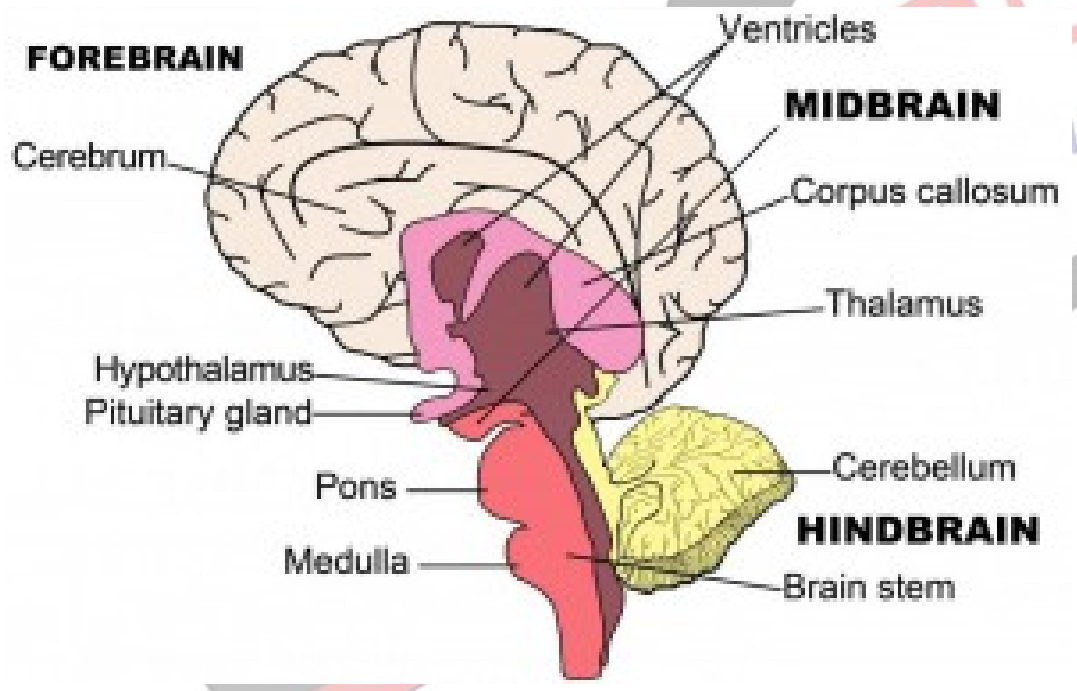

EEG And Other Similar Technologies

Feature	EEG (Electroencephalography)	fMRI (functional Magnetic Resonance Imaging)	PET Scan (Positron Emission Tomography Scan)	MEG (Magnetoencepha
What it measures	Electrical activity of neurons	Blood flow changes in the brain	Metabolic activity of brain cells	Magnetic fields generated electrical currents in the
Safety	Safe, non-invasive	Safe, non-invasive (with	Requires low-dose radiation	Safe, non-invasive

		some limitations)	exposure	
Cost	Relatively inexpensive	Very expensive	Expensive	Expensive
Portability	Portable, can be used in various settings	Not portable, requires a large scanner room	Not portable, requires a specialized scanner	Somewhat portable, requ magnetically shielded roo
Applications	Epilepsy diagnosis, sleep studies, brain function monitoring	Studying brain function during tasks, brain mapping	Identifying metabolic changes associated with diseases, cancer detection	Studying brain function d epilepsy localisation

Read More: MRI

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. With reference to Visible Light Communication (VLC) technology, which of the following statements are correct? (2020)

1. VLC uses electromagnetic spectrum wavelengths 375 to 780 nm.
2. VLC is known as long-range optical wireless communication.
3. VLC can transmit large amounts of data faster than Bluetooth.
4. VLC has no electromagnetic interference.

Select the correct answer using the code given below:

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 1, 3 and 4 only

(d) 2, 3 and 4 only

Ans: (c)

Q. With reference to 'Near Field Communication (NFC) Technology', which of the following statements is/are correct? (2015)

1. It is a contactless communication technology that uses electromagnetic radio fields.
2. NFC is designed for use by devices which can be at a distance of even a metre from each other.
3. NFC can use encryption when sending sensitive information.

Select the correct answer using the code given below:

(a) 1 and 2 only

(b) 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (c)

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