

# **METHOD OF INVESTIGATING BRAIN: ELECTROPHYSIOLOGICAL PROCEDURES**



**Course: Neuropsychology CC-6 (M.A PSYCHOLOGY SEM II); Unit I**

**By**

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# NEUROPHYSIOLOGICAL METHODS

Neurology has developed special methods for the investigation of disorders of the nervous system, and neuropsychologist is equipped to assist in the solution of neurological problems by carefully investigating the problem. A clinical neurological examination in itself is an extensive, careful **record of the patient's sensation, reflexes movement and muscles tones**. Clinical neuropsychologists need to familiarize themselves with the details of the neurological examination and with the traditional interpretation of neurological sign and symptoms.

Neuroscientists use many **specialized techniques to investigate connections between the brain and behavior**. Among the methods they have depended on most heavily are **electrical recordings, lesioning and electrical Stimulation**. In addition, new brain **imaging techniques** have recently been developed that may eventually revolutionize brain research.

# ELECTROPHYSIOLOGICAL PROCEDURES

## ELECTROENCEPHALOGRAPHY

One of the most widely used investigation techniques in neurology is electroencephalography (EEG). This is a **technique of recording the brain (skull) by means of electrodes placed on the scalp**. The potential differences between two points on the skull are very small and have to be amplified many times before they can be used to drive a recording device such as an open or jet recorder. The mean amplitude of the brain's electrical activity is about one hundredth that of the heart.



**In 1929, a German psychiatrist Hans Berger invented a machine that could record patterns of brain electrical activity. It is called Electroencephalograph which monitor the electrical activity of the brain by means of recording electrodes at the surface of the scalp.**

**Usually, six to ten recording electrodes are attached at various places on the brain. The resulting EEG recordings are translated in tracings, commonly called brain waves. These brain waves recordings provide a useful overview of electrical activity in the brain. Different brain patterns are associated with different states of activity.**

**The EEG is often used in the clinical diagnosis of brain damage and psychological disorders. In research applications the EEG can be used to identify patterns of brain activity that occur when subject engage in specific behavior ranging from daydreaming to working on mathematical problems. The EEG has also been invaluable to researchers exploring the physiology of sleep.**

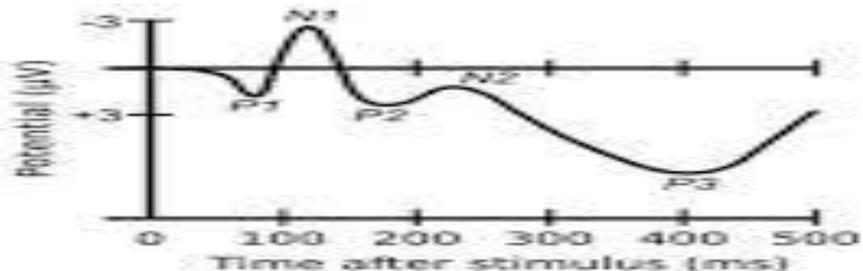
# Event-related potentials or ERPs

Event-related potentials (ERPs) are **scalp-recorded voltage fluctuations that are time-locked to an event**. ERPs as brain potentials are measured by the same amplifiers as EEG, and in this sense the measured parameter in EEG and ERPs is the same: electrical potential generated by the brain. **Event-related potentials or ERPs is the measured brain response that is the direct result of a specific sensory, cognitive, or motor activity**. It is any stereotyped electrophysiological response to a stimulus. The study of the brain in this way provide noninvasive means of evaluating brain functioning in patients with cognitive diseases. ERPs are measured by means of electroencephalography (EEG)



## Electroencephalography (EEG) vs. Event Related Potential (ERP)

> **ERP's** are electrical brain potentials that are related to an event of some sort, usually stimulus perception and evaluation.



# ELECTROCORTICOGRAPHY (ECOG)

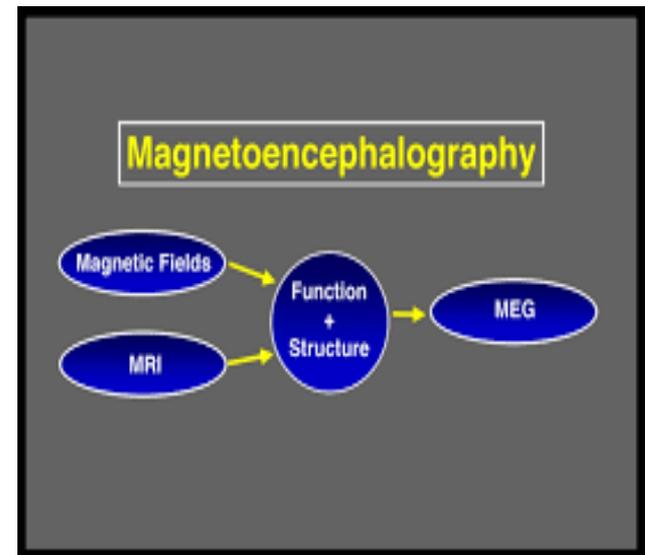
Electrocorticography (ECOG), or intracranial encephalography (iEEG), is a type of electrophysiological (electrical properties of biological cells) that **uses electrodes placed directly on the exposed surface of the brain to record electrical activity** from the cerebral cortex. In contrast, conventional electroencephalography (EEG) electrodes monitor this activity from outside the skull. ECOG may be performed either in the operating room during surgery (intra-operative ECOG). Because a craniotomy (a surgical incision into the skull in which a bone flap is temporarily removed from the skull to access the brain) is required to implant the electrode grid, ECOG is an invasive procedure.

- Invasive- tendency to spread very quickly and undesirably or harmfully.



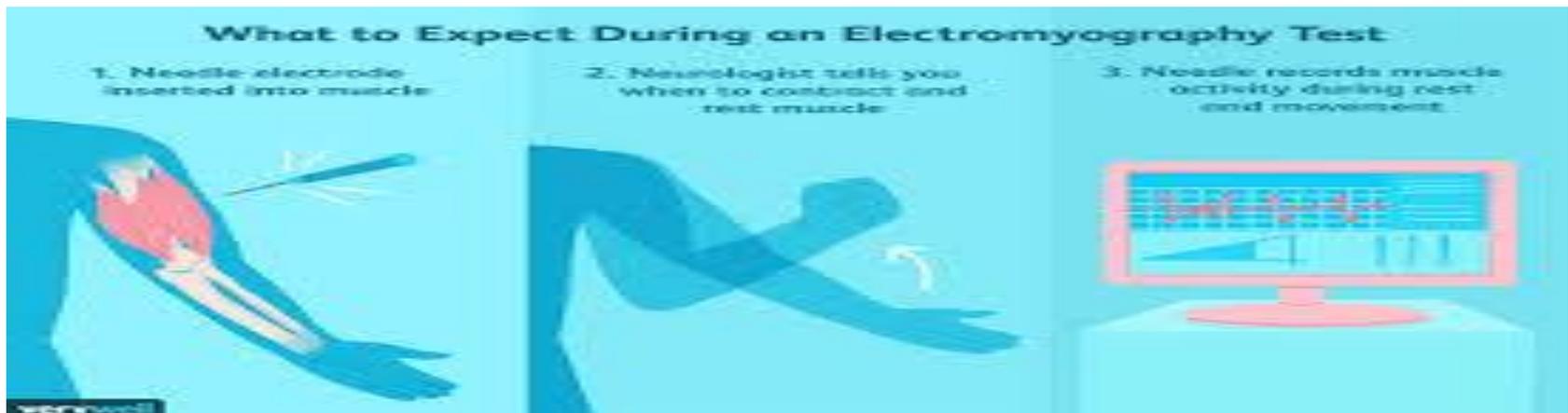
# Magneto encephalography (MEG)

Magneto encephalography (MEG) is a functional neuroimaging technique for **mapping brain activity by recording magnetic fields produced by electrical currents occurring naturally in the brain, using very sensitive magnetometers.**



# Electromyography

Electromyography, or **EMG**, is the analysis of the electrical activity of muscles. The record is made by inserting a needle electrode into the muscle to be tested. When a normal muscle is completely relaxed, no electrical activity can be recorded, but as contraction occurs a characteristic recording, somewhat similar in appearance to an EEG, is produced. EMG recordings are useful for diagnosing damage to or abnormalities in the nerves innervating the muscles from which recordings are being obtained. For example, in disease of the motor neurons of the spinal cord there is a marked reduction in the number of spikes present in the record, because there are fewer normal motor neurons to contract the muscles. By using the EMG the neurologist is able to diagnose the disorder and to evaluate its extent in the spinal cord.

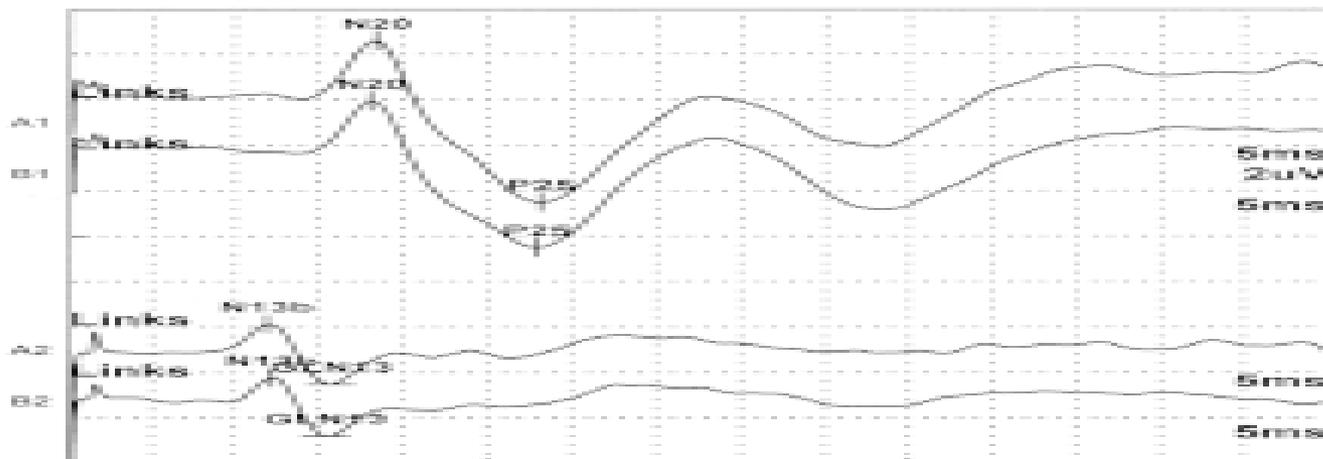


# EVOKED POTENTIAL

Evoked potentials Most EPs cannot be seen **easily on an EEG record** because they are generally of low amplitude relative to the normal background brain wave activity. Thus, it is necessary to average the electrical activity over multiple presentations of the same stimulus.

By measuring EPs to visual, auditory, and tactile stimuli, it is possible to reach conclusions about the functioning of the different sensory pathways.

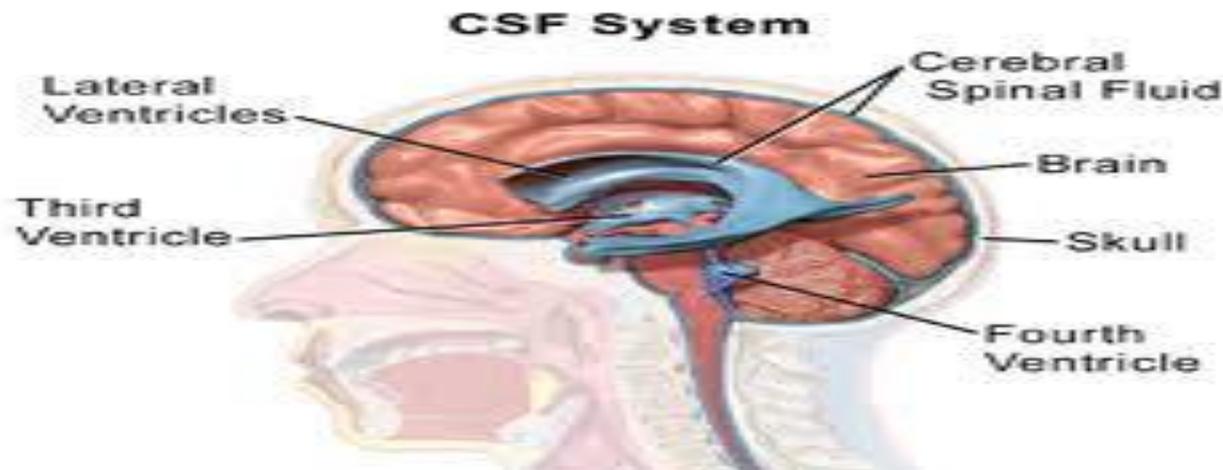
**(EPs) are slow waves that result from some sensory event, such as a click of flash.**



# CEREBROSPINAL FLUID

Analysis of cerebrospinal fluid (CSF) provides the only method of looking at the subarachnoid space without opening the skull. CSF is most easily obtained through a puncture made in the lumbar, or lower, portion of the spinal column. It is removed for a variety of purpose:

1. To relieve intracranial pressure and to remove toxic, inflammatory, or other substances in the fluid, as would be found in disorders such as encephalitis or meningitis,
2. To allow an analysis of the CSF for the presence of blood or a variety of other substances (such as glucose or various proteins) that might indicate a variety of central nervous system dysfunctions,
3. To introduce therapeutic substances into the subarachnoid space, and
4. To introduce air or opaque media for radiographic studies.



# ROENTGENOGRAPHY

Roentgenography, or photography using X rays, has been modified in a number of ways to serve in nervous system diagnosis. Routine X rays are used to scrutinize the skull for evidence of fractures, calcification or erosion of bones. Contrast X rays can be obtained after a special radio-paque dye or air is injected into the ventricles or dye is injected into the arteries. Having a different density from the surrounding areas, these substances can be visualized, along with the outline of the arteries or ventricles, on the X ray negatives. These procedures also make it possible to delineate occlusions or of swellings in the vessels, displacements of vessels or ventricles (indicative of the presence of a tumor), and sometimes **it is actually possible to visualize a tumor.**

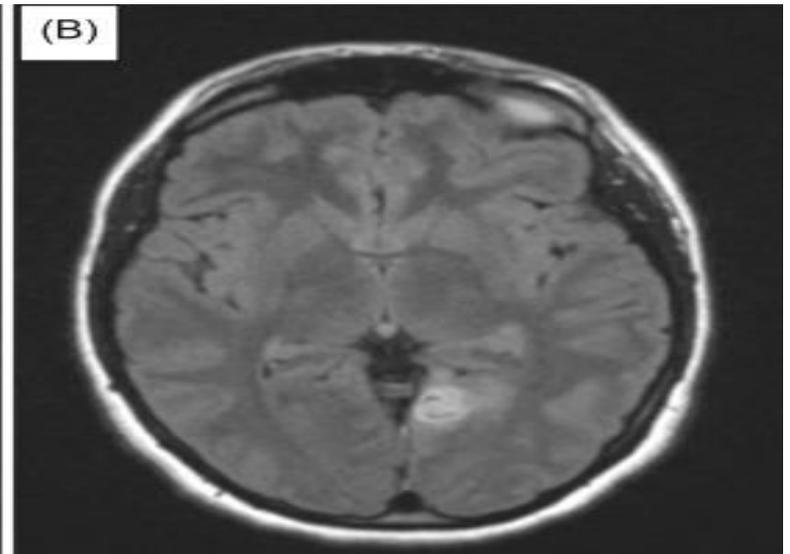
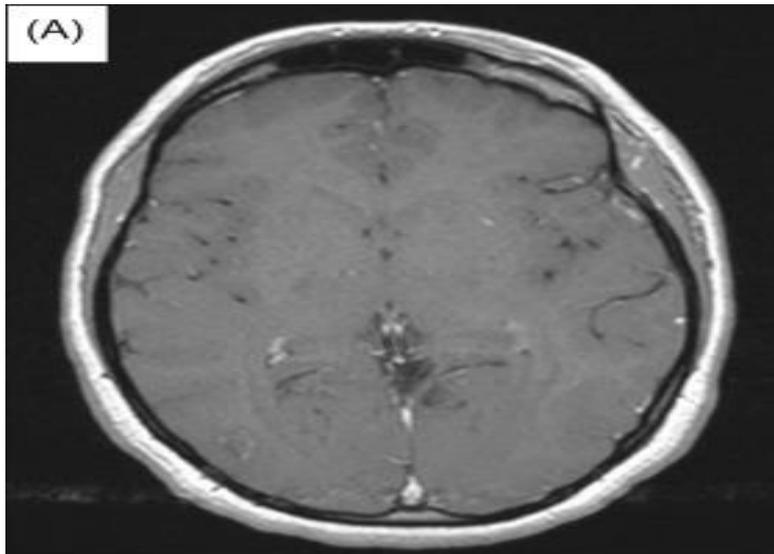
The use of the X-ray technique using a dye injected into the vertebral artery is called angiography.



## PNEUMOENCEPHALOGRAPHY

In pneumoencephalography, X rays are taken after the cerebrospinal fluid is replaced with air introduced through a lumbar puncture. By manipulating the posture of the patient, the radiologist is able to force the air to travel through the ventricular system. Since the air can be seen on an X ray, it is possible to locate blockages in the ventricles, displacements in their position (as might occur in tumor), or enlargements of them as occurs in hydrocephalus.

Ventriculography is a similar technique, except that the air or opaque medium is introduced into the ventricle through a cannula, or tube, inserted through the skull. This technique is chiefly used when there is an increase in intracranial pressure and when other procedures have not proved helpful.



## **REFERENCES**

**Kolb, B., & Whisaw, I.Q. (1990). Fundamentals of human Neuropsychology. New York: Freeman, W.H**

**Singh, A.K. Neuro Manovigyan, Patna: Motilal Banarsidas**

**Google images.**

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