

**File:EEG-G1C.jpg**

# EEG: Electroencephalogram

Group: G1C

Tamaki Sunai & Wan-chen Lu

## Introduction

Electroencephalogram (EEG) was discovered by a German psychiatrist, Hans Berger, in 1929. He was able to capture Alpha and Beta brain waves, and thus record them for the first time. With his discovery, EEG is capable of being used in the physiological study that measures and records the electrical activity of human brain. Its potential application in epilepsy comes to play a central role in diagnosis and management of patients with seizure disorders.

It is one of the best diagnostic tools for epilepsy today. The tests can detect the presence of a seizure and identify where in the brain it has started.

The technician applies an elastic cap with electrodes embedded to the patient's head. The electrodes are attached to the scalp to record minute electrical activities down to microvolts. Each individual neuron has an electric potential which is too small to be detected by EEG. Therefore, EEG activity represents the summation of millions of neurons that fire together and are of a similar spatial orientation. These activities are recorded by a computer for further analysis.

EEG is a safe and non-invasive way of measuring brain activity. Certain conditions, such as seizures, are detected by observing changes in the normal pattern of the brain's electrical activity.

## Importance in clinical medicine

The main purpose of EEG is in epileptic diagnosis.

In practice, EEG helps determine seizure type and epileptic syndrome of patients along with the clinician's diagnosis based on the account provided by the patient and witness. EEG findings contribute to the multidisciplinary diagnosis of epilepsy, in terms of whether the seizure disorder is focal or generalized, idiopathic or symptomatic, or just part of a specific epileptic syndrome. EEG is an important tool to help evaluate the diagnosis of neurological disorder.

It is also used in diagnosis of tumors, neurodegenerations, and megnetism. Numerous, non-application volumes to make the diagnosis of neurology at dementia for its increasing demands.

As EEG technique places the electrodes in specific areas on patient's head according to the internationally agreed-cortex maps. The names of the electrode sites use alphabetical abbreviations that distinguish from left or right side of the brain which each electrode records with (Fig.1). The EEG records brain waves using equipment called "amplifier" and by looking at the information from the electrodes, we can detect abnormal activities. These combinations of electrodes are called "montages".

In order to locate the origin of electrical activity, the "localization" is critical and therefore able to make the interpretation of the EEG waveings meaningful.

## Literature review

The most signals for noninvasive EEG is from the brain's cortical surface electrode system. Unlike the needs of amplification of the electrical signals from EEG, EEG's electrical signal must developed from the neuronal post-synaptic potentials (PSP) which their action potentials are not strong enough and too short to record. PSPs can be either excitatory (EPSP) or inhibitory (IPSP), the neurons are moved by current flow which are the combination of the potentials resulted from EPSP and IPSP (Figure 1) shows the readable fluctuate-wave volume that is translated from the irregular EEG signal from numerous neuronal activity of cortical neurons.

Fig. 1: Graph showing the change of EEG, showing the rise and fall of potentials and amplification that comprises the normal EEG wave from a single trial.

Here are some advantages of EEG today's EEG below:

- Hardware costs are significantly lower than other techniques.
- EEG provides limited availability of technologies to provide immediate use in high-risk hospitals.
- EEG sensors can be used in more places than other techniques which require bulky and immobile equipments such as MRI, SPECT, and PET etc.
- EEG is also relatively robust of subject movement, and it is possible to minimize or even eliminate movement artifacts in EEG data.
- EEG is silent and could provide better study of the response to auditory stimuli.

EEG does not involve exposure to radiographs and high-intensity (γ) ionizing magnetic fields, which allow the patients to go through the test without the needs to get themselves out of the metal enclosures, such as body-implanted prostheses.

- Relatively poor spatial sensitivity on the scalp, because EEG requires intensive interpretation just to hypothesize what areas are activated by a particular response. Signal-to-noise ratio is low either, therefore sophisticated data analysis and relatively large number of subjects are needed to extract useful information from EEG.
- EEG poorly monitors neural activity that occurs below the brain cortex, and is incapable of identifying specific locations in the brain at which various neurotransmitters or drugs can be found.
- It takes a long time to connect a subject to EEG, as it requires precise placement of numerous electrodes around the head and the use of various gels, saline solutions, and/or pastes to maintain good conductivity, and a use of tape to keep them in fixed status.

Because of the rising number of aged population and the prevalence of polypharmacy, CNS safety issues, neuronal sleeping spindles are more important than ever. EEG is usually used in epileptic diagnosis, though, the application in the field of noninvasive drug testing is increasing as well.

## Medical Devices

EEG is tested mainly in hospitals by EEG technologists. The EEG record is analyzed by a M.D. who is specially trained in diagnosis and treatment disorders affecting the nervous system.

The EEG technologist will attach 16 to 25 (at most) disc electrodes to different places on the patient's head. The electrodes are connected by wires to a machine, that amplify and record the electrical activity inside the brain. The records of the electrical activities are like a series of wavy lines on the computer image.

1) Routine EEG: Routine EEG recording lasts for about 20-40 minutes. During the test, the patient must quietly, open or close his/her eyes from time to time, breathe in and out deeply for a few minutes. At the end of the procedure, a flashing light may be placed nearby to see if this affects brain activities.

2) Sleep EEG or sleep-deprived EEG: A sleep EEG is carried out while the patient is asleep. It may be used if a routine EEG does not give enough information, or to test for sleep disorders. In some cases, the patient may be asked to stay awake the night before for the best result. This is called a sleep-deprived EEG.

3) Ambulatory EEG: An ambulatory EEG is where brain activity is recorded 24 hours day and night over a period of one or more days. The electrodes will be attached to a small portable EEG recorder that can be clipped onto the patient's clothing.

4) Video EEG: Video telemetry, also called video-EEG, is a special type of EEG that the patient is filmed to provide more information about brain activity.

Fig.3: Left: A patient in a hospital EEG with electrodes. Right: Patient wearing EEG device.

Fig. 4: A typical arrangement called the 10-20 system. Each electrode is placed either 10 or 20 cm apart and distance is measured from the back of the head. The electrode on the left side of the head is on the left side of the head. The electrode on the right side of the head is on the right side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on the back of the head. The electrode on the side of the head is on the side of the head. The electrode on the top of the head is on the top of the head. The electrode on the bottom of the head is on the bottom of the head. The electrode on the front of the head is on the front of the head. The electrode on the back of the head is on

Size of this preview: 800 x 563 pixels.

Original file (4,608 × 3,240 pixels, file size: 1.36 MB, MIME type: image/jpeg)

## Summary


## Electroencephalogram

## Licensing

Only for direct use at WikiLectures.eu site.

## File history

Click on a date/time to view the file as it appeared at that time.

	Date/Time	Thumbnail	Dimensions	User	Comment
current	21:31, 21 December 2019		4,608 × 3,240 (1.36 MB)	Luwa (talk   contribs)	Electroencephalogram

You cannot overwrite this file.

## File usage

There are no pages that use this file.