

BIOSIGNAL CHARACTERISTICS

A bio signal can be defined as a physiological phenomenon, a body variable that can be measured and monitored. Since the number of physiological mechanisms is nearly unlimited, the diversity of bio signals is huge.

Types of Bio signals:

1. Intrinsic/Extrinsic to body:

This first method takes the existence of bio signals as a way to classify them, dividing the bio signals into

- Permanent Bio signals: This kind of bio signals exist without any excitation from outside body and are always present in the human body because source is inside the body.
- Induced Bio signals: This group of bio signals includes bio signals that are artificially induced. In contrast with the permanent bio signals this one's exist only during the excitation. It means that, when the artificial induction is over the induced bio signal decays with a time constant determined by the body properties.

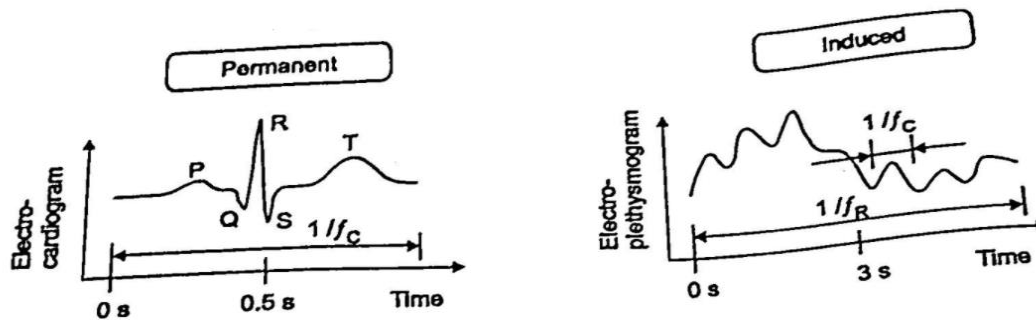


Fig: Permanent and Induced Bio Signals

2. Static/Dynamic:

The second method takes in consideration the dynamic nature of the bio signal according to:

- Static bio signal: Static bio signals carry information during their steady-state level which may show slow changes over the time.
- Dynamic bio signal: Dynamic bio signal shows big changes during time.

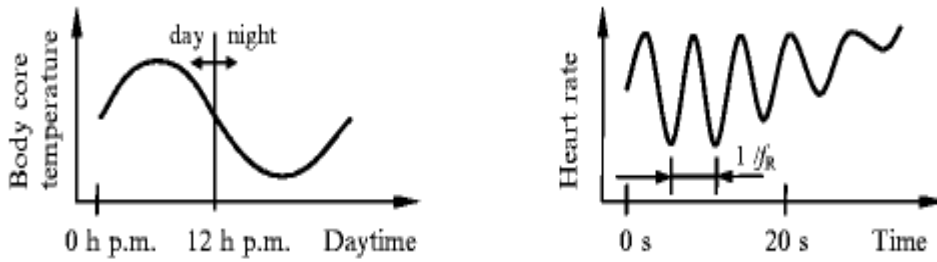


Fig: Static and Dynamic bio signals

3. Origin:

The last method is using the origin of the bio signal as a basis for their classification, here are some examples

- Electric bio signals
- Magnetic bio signals
- Mechanic bio signals
- Optic bio signals
- Acoustic bio signals
- Chemical bio signals
- Thermal bio signals

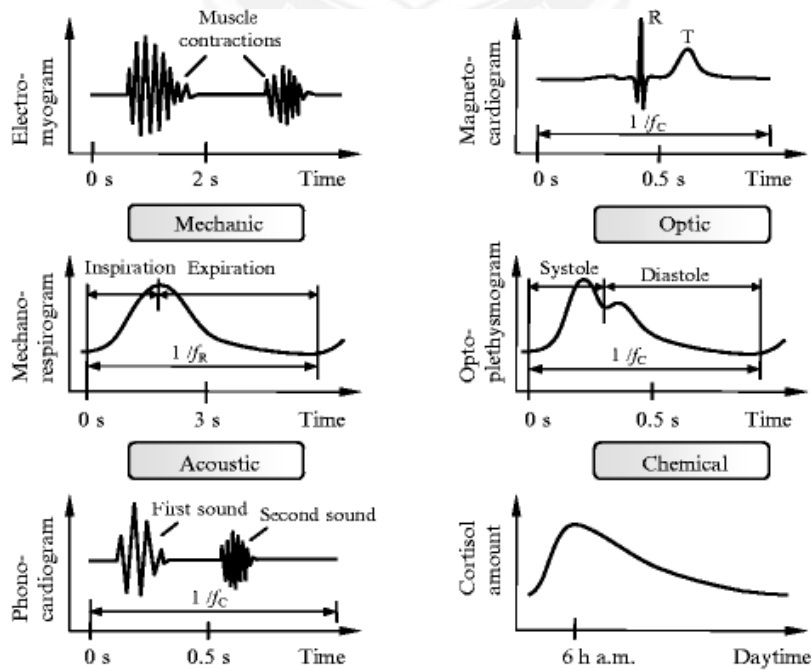


Fig: Origin of bio signals

Frequency and Amplitude Ranges

ECG Waveform:

The electrocardiograph (ECG) is an instrument, which records the electrical activity of the heart. Electrical signals from the heart characteristically precede the normal mechanical function and monitoring of these signals has great clinical significance. ECG are used in catheterization laboratories, coronary care units and for routine diagnostic applications in cardiology.

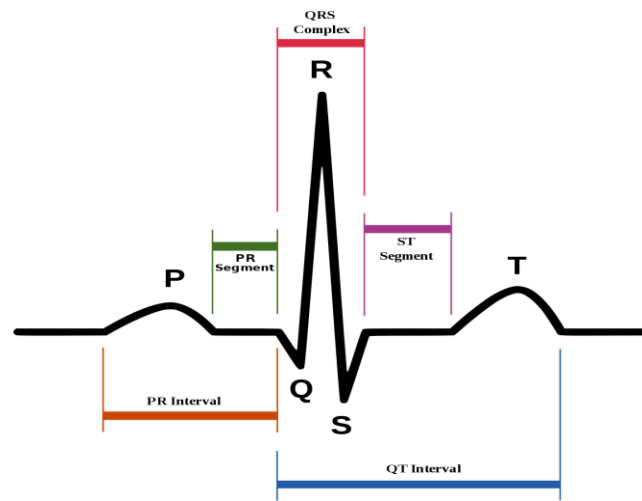


Fig: ECG waveform

Depolarization:

When electrical activity occurs, heart muscle fibres are contracted and produce a movement. This condition is referred as depolarization. When blood is pumped around the body, it results in contraction. When chambers are contracted, it is called systolic.

Repolarization

The relaxation of heart muscles is called electrical repolarisation. Relaxed heart chambers are called diastolic.

S. No	Wave	Origin	Amplitude (mv)	Duration (seconds)
1	P wave	Due to depolarization of atria	0.25	0.12 to 0.22 (PR interval)

2	R wave (QRS complex)	Due to repolarization of atria and ventricle contraction	1.60	0.07 to 0.1
3	T wave	Due to relaxation of myocardium	0.1 to 0.5	0.05 to 0.15 ST interval
4	ST interval	Contraction of ventricles	-	-
5	U wave	Due to slow expansion of purkinje fibers		0.2 (T-U interval)

EEG waveforms:

The continuous electrical activity of the brain is recorded from the outer surface of the brain. The excitation level of the brain decides the intensity and pattern of this electrical activity. In the recorded electrical potentials, we find some variations, which are brain waves. We have four major type of brain waves given as alpha, beta, theta, and delta waves. At most of the instance our brain waves will be irregular and does not have regular pattern.

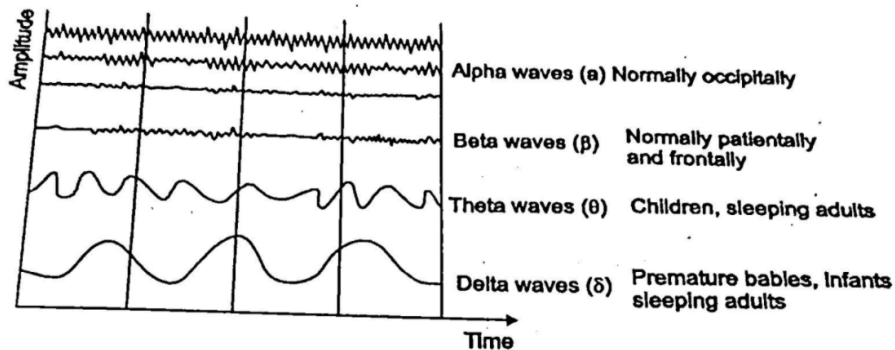


Fig: Brain wave

EMG waveform:

Electromyograph is an instrument used for recording the electrical activity of the muscles to determine whether the muscle is contracting or not, or for displaying on the CRO and loudspeaker the action potentials spontaneously present in a muscle or those induced by voluntary contractions as a means of detecting the nature and location of motor unit lesions, or for recording the electrical activity evoked in a muscle by the stimulation of its nerve.

The amplitude of the signal can range from 0 to 10 mV (peak-to-peak) or 0 to 1.5 mV(rms). The usable energy of the signal is limited to the 0 to 500Hz frequency range, with the dominant energy being in the 50-150 Hz range.

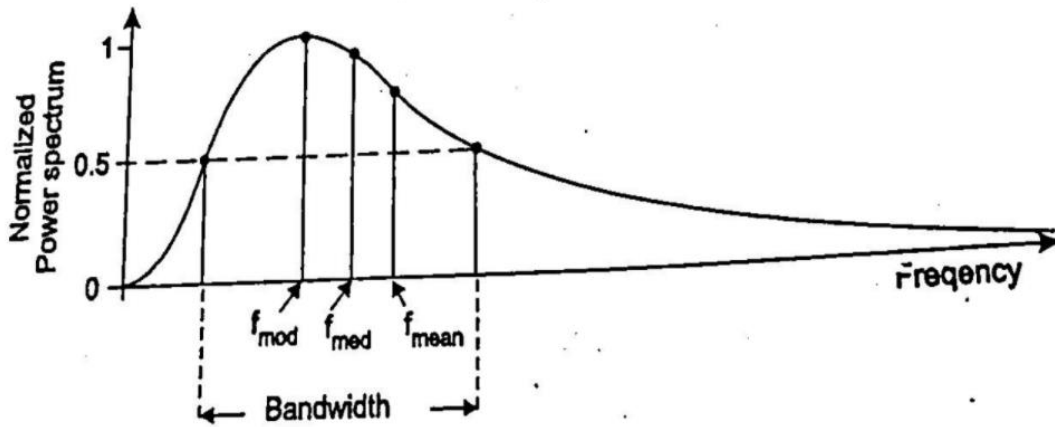


Fig: EMG waveform

