University of Al-Mustaqbal
College of Science
Department of Medical Physics

Name of subject : Medical physics 3

Number stage : fourth

Lecture name : Physiological measurements

Lecture number : 4

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Measurement

Physiological measurements have also been used to monitor and measure various physiological parameters. Many physiological measurement techniques are non-invasive and can be used in conjunction with, or as an alternative to, other invasive methods.

Measurements are central to clinical practice and medical and health research. They form the basis of diagnosis, and evaluation of the results of medical interventions. Technical developments and advances in medical knowledge mean that new measurement instruments are still appearing in all fields of medicine. For example recent developments such as functional MRI and DNA microarrays.

*There are many other physical measurements involving the body and time. We can divide them into **two** groups: -*

1- Measurements of **repetitive** processes. It usually involves the number of repetitions per second, minute, hour, and so forth.

For Example: -

- The pulse rate is about 70/min.
- The breathing rate is about 15/min.

2-Measurements of **nonrepetitive** processes, **Nonrepetitive** time processes in the body range from the action potential of a nerve cell (**1msec**) to the lifespan of an individual.

For Example: -

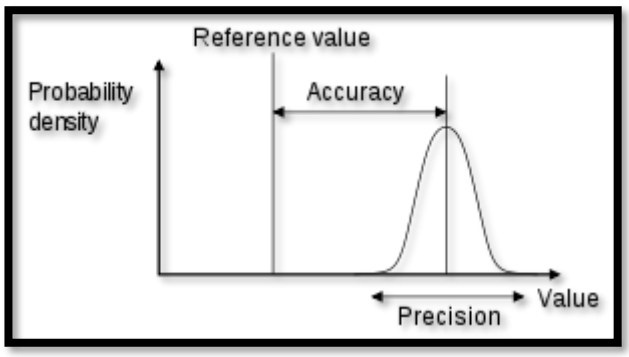
Such as how long it takes the kidneys to remove a foreign substance from the blood

Measurement accuracy: is the closeness of agreement between a measured quantity value and a true quantity value of the measured. A measurement is said to be more accurate when it offers a smaller measurement error.

For example

One may wish to measure a certain chemical's volume in the experiment.

If the actual volume was **60 ml** but the measurement was **75 ml**, it would not be a very accurate value due to the fact that it is not close to the 'true' value of 60 ml.



Measurement precision: is the closeness of agreement between measured quantity values obtained by replicate measurements on the same or similar objects under specified conditions.

Examples of Precision

Example 1 –

When you are measuring the value of resistance using a digital multimeter.
(A multimeter or a multitester, also known as a VOM (volt-ohm-milliammeter))

The value of resistance is actually 35 Ohms, but multimeter is showing 33 Ohms consistently 10 times. **So, Multimeter is Precise but not Accurate.**

Example 2 –

Let's say the temperature of an object is 60-degree celsius. And thermometer is showing 60 degrees for all readings. That means thermometer is **Accurate and precise.**

Measurement trueness: is the closeness of agreement between the average of an infinite number of replicate measured quantity values and the true or a reference quantity value. The concept trueness is a quality and is not given a numerical value.

One of the main characteristics of science is its ability to reproducibly measure quantities of interest.

Reproducibility is a major principle of the scientific method. It means that a result obtained by an experiment or observational study should be achieved again with a high degree of agreement when the study is replicated with the same methodology by different researchers.

The following are the common measurements used in the practice of medicine. Some of these measurements are more reproducible than others:

- Weight.
- Pulse.
- Temperature.
- Blood pressure.
- X-ray.
- Blood analysis.