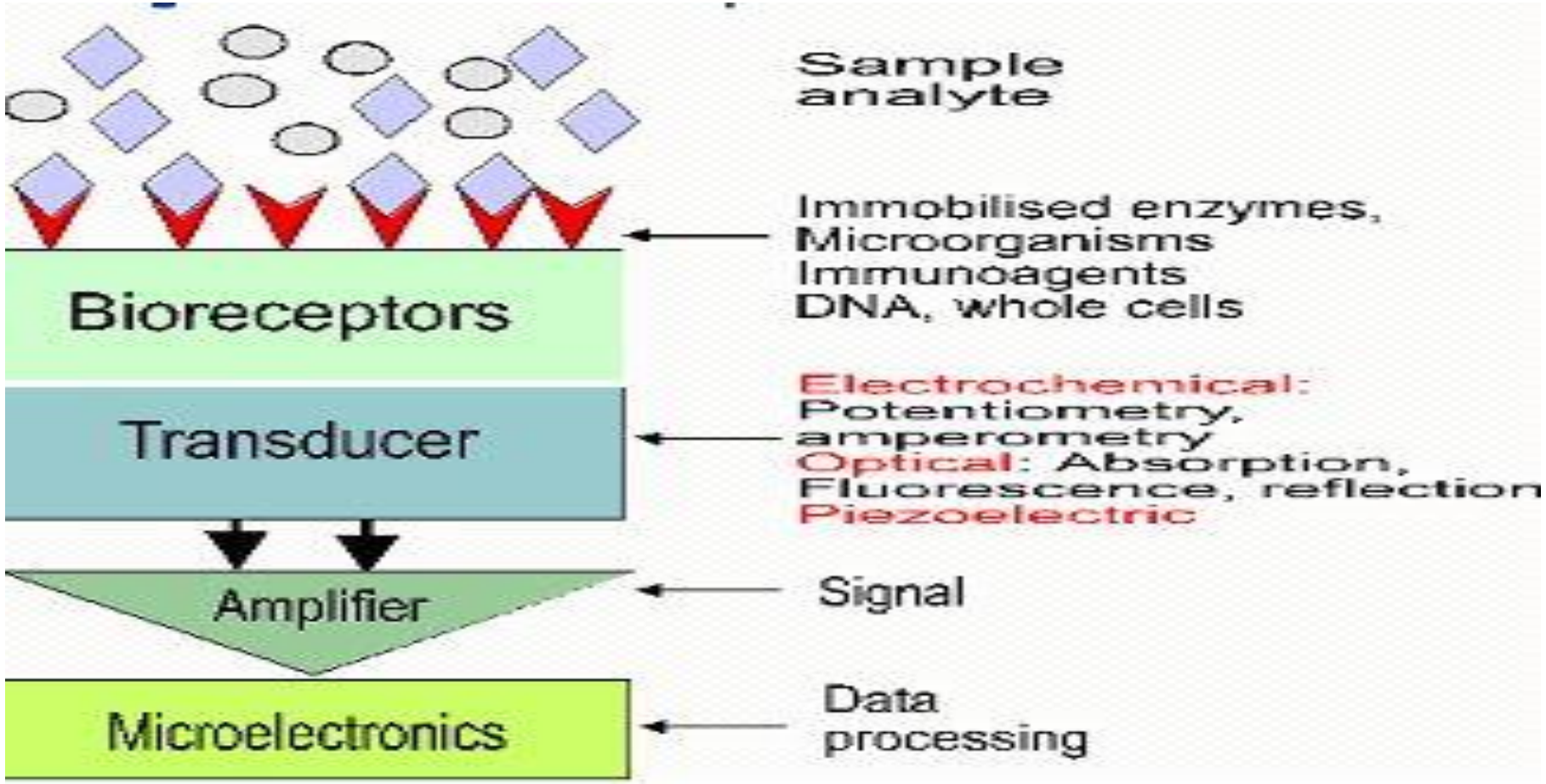
Biosensor

- Definition: A self-contained integrated device that is capable of producing quantitative and semi-quantitative analytic information using a biological recognition element which is in direct special contact with a transduction element.



Basic operation of Biosensor

- First biological recognition element which highly specific towards the biological receptors forms bonding.
- Second transducers detect and transduces signal from biological target - receptor molecule to electrical signal which is due to reaction occur.
- Third after transduction signal from biological to electrical signal where its amplification is necessary and takes place and read out in detector after processing the values are displayed for monitor and controlling the system .

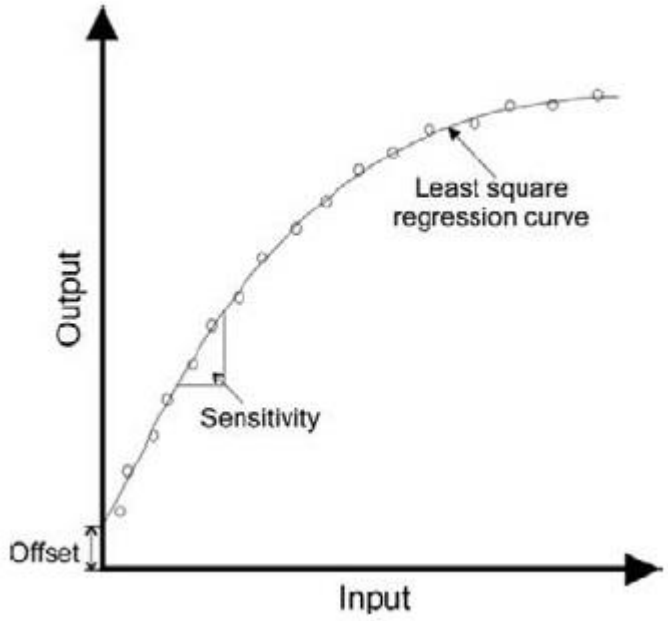
IDEAL SENSOR CHARACTERISTICS

Sensitivity:

❖ Sensitivity is typically defined as the ratio of output change for a given change in input.

❖ A high sensitivity implies that a small change in input quantity causes a large change in its output.

❖ if the calibration line is linear, the sensitivity is constant, whereas the sensitivity will vary with the input when the calibration is nonlinear



❖ It is also defined as the smallest change in the input quantity that will result in a detectable change in sensor output.

❖ For example-a temperature sensor may have a sensitivity of 20 mV/C; that is, the output of this sensor will change by 20 mV for 1 degree change in input temperature.

Range:

- The range of a sensor corresponds to the minimum and maximum operating limits that the sensor is expected to measure accurately.
- For example, a temperature sensor may have a nominal performance over an operating range of -200 to +500 degree Celsius.

Offset:

- Offset refers to the output value when the input is zero

Linearity:

- A Linear response means that if we plot the input signal vs. the output reading then we will get straight line

Accuracy:

- Accuracy refers to the difference between the true value and the actual value measured by the sensor.
- Typically, accuracy is expressed as a ratio between the preceding difference and the true value and is specified as a percent of full-scale reading.

Precision:

- Precision refers to the degree of measurement reproducibility.
- Very reproducible readings indicate a high precision.
- Precision should not be confused with accuracy. For example, measurements may be highly precise but not necessary accurate.

Resolution:

- When the input quantity is increased from some arbitrary nonzero value, the output of a sensor may not change until a certain input increment is exceeded.
- Accordingly, resolution is defined as the smallest distinguishable input change that can be detected with certainty.

Response time:

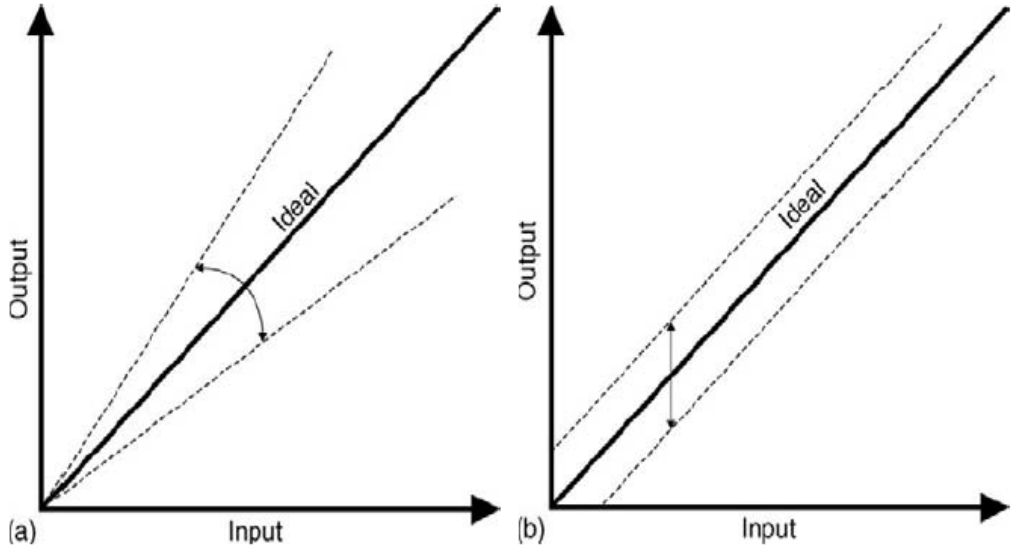
- The response time indicates the time it takes a sensor to reach a certain percent (e.g.,95 percent) of its final steady-state value when the input is changed.
- For example, it may take 20 seconds for a temperature sensor to reach 95 percent of its maximum value when a change in temperature of 1 degree is measured.
- Ideally, a short response time indicates the ability of a sensor to respond quickly to changes in input quantities.

Drift:

❖ Drift refers to the change in sensor reading when the input remains constant.

❖ **Offset drift:** the output of a pressure transducer may depend not only on pressure but also on temperature. Therefore, variations in temperature can produce changes in output readings even if the input pressure remains zero.

❖ **Sensitivity drift:** for a pressure transducer, repeating the measurements over a range of temperatures will reveal how much the slope of the input-output calibration line varies with temperature



Hysteresis:

- In some sensors, the input-output characteristic follows a different nonlinear trend, depending on whether the input quantity increases or decreases
- When the measurement is not perfectly reversible, the sensor is said to exhibit hysteresis.
- If a sensor exhibits hysteresis, the input-output relation is not unique but depends on the direction change in the input quantity.