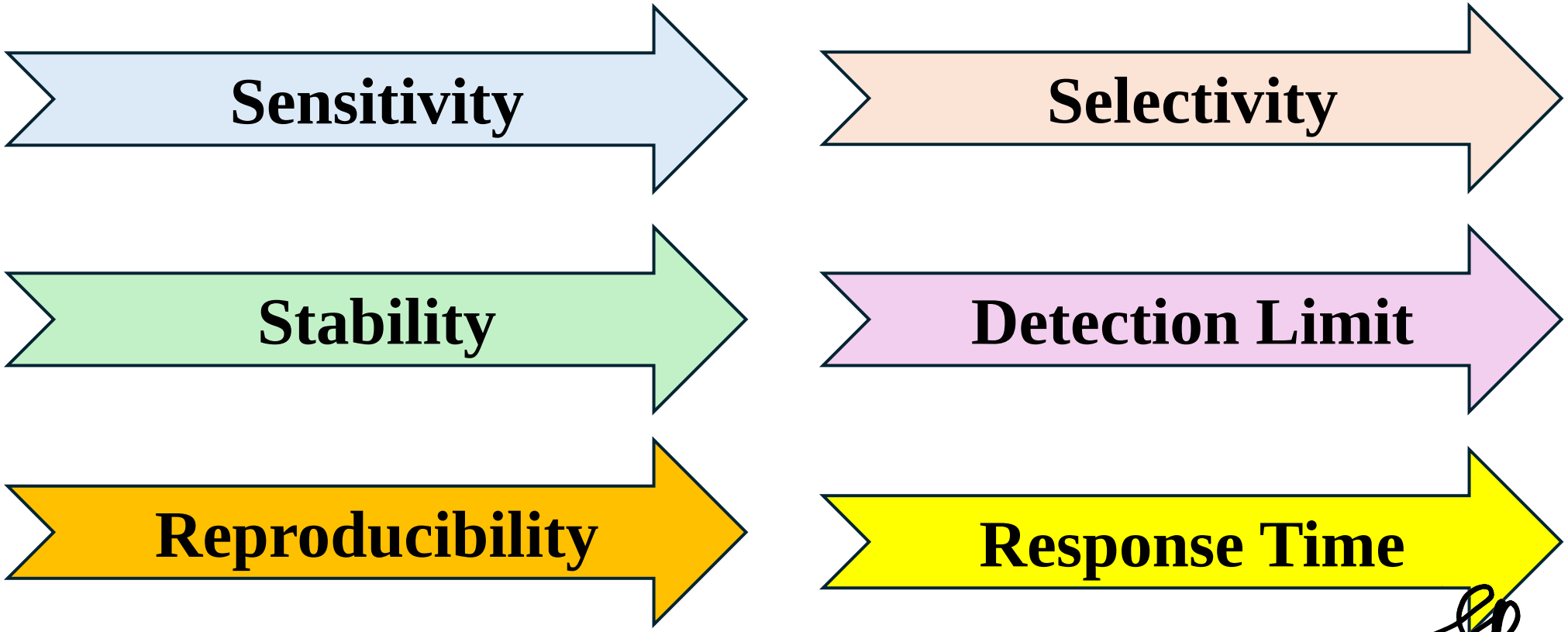
Biosensors EEL3050

Dr. Swati Rajput
Department of Electrical Engineering, IIT Jodhpur

Sensor Key Parameters

Owing to the nature of the applications in which biosensors are used in, several characteristics or parameters have to be met when a biosensor is designed. These characteristics define the performance and usefulness of a biosensor.



Numerical Problems on Biosensor's Key Parameters

Problem 1: A biosensor is designed to detect glucose levels in a solution. The sensor responds with a current that increases linearly with glucose concentration. If the sensor produces a current of 2 µA for a glucose concentration of 0.5 mM and a current of 6 µA for a glucose concentration of 1.5 mM, what is the sensitivity of the biosensor in µA/mM?

Problem 2: A biosensor is calibrated with a series of analyte concentrations and their corresponding currents as follows:

- **0.2 mM: 1 µA**
- **0.6 mM: 3 µA**
- **1.0 mM: 5 µA**

Calculate the sensitivity of the biosensor in µA/mM using the data.

Problem 3: A biosensor is designed to detect glucose but also responds to other substances. The sensor's response to glucose is 5 µA per mM, while its response to a potential interferent (like lactose) is 1 µA per mM. If the sensor is exposed to a 6 mM of solution with having glucose and lactose ratio being 2:1 , what is the sensor's total response, and how much of this response is due to the glucose?

Numerical Problems on Biosensor's Key Parameters

Problem 4: A biosensor has a baseline current (background noise) of 0.5 µA with a standard deviation of 0.02 µA. The sensor detects a significant signal if the response is at least 3 times the standard deviation above the baseline. What is the limit of detection (LOD) in terms of current?

Problem 5: A biosensor designed for detecting a specific analyte (A) has a response of 8 µA/mM. The same sensor has a response of 1 µA/mM to an interferent (B). If the sensor detects 2 mM of analyte A and 0.5 mM of interferent B, calculate the selectivity ratio of the sensor for analyte A over interferent B.

Problem 6: A biosensor provides the following outputs for a 1 mM glucose solution in repeated tests: 100 µA, 102 µA, 98 µA, 101 µA, 99 µA. Calculate the standard deviation of the measurements to evaluate the reproducibility.