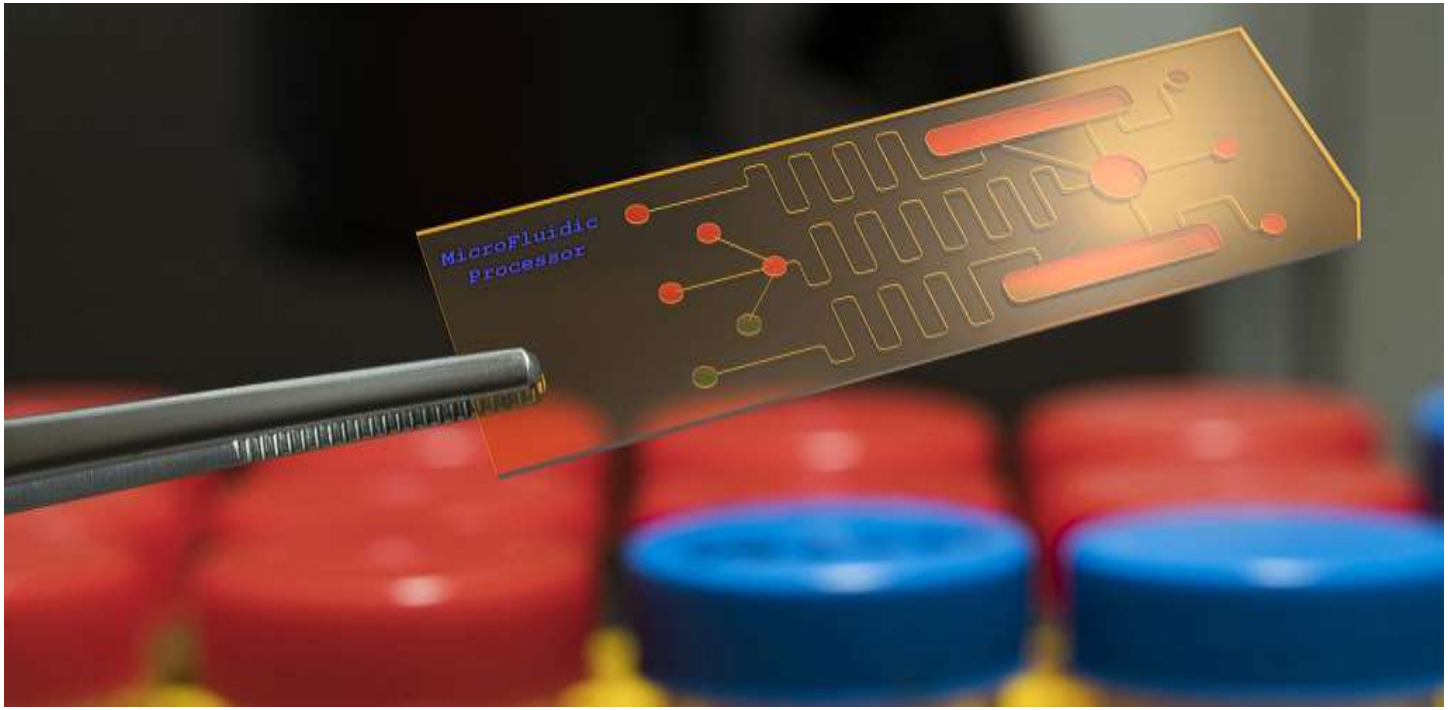
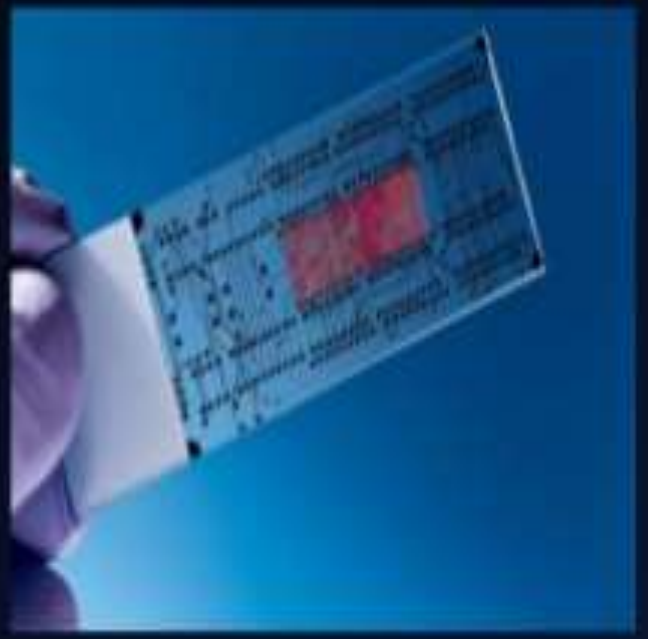
Biosensors



Ms. Pratiksha Jayaswal
Assistant Professor
Faculty of Pharmaceutical Sciences,
Rama University, KANPUR (U.P.)

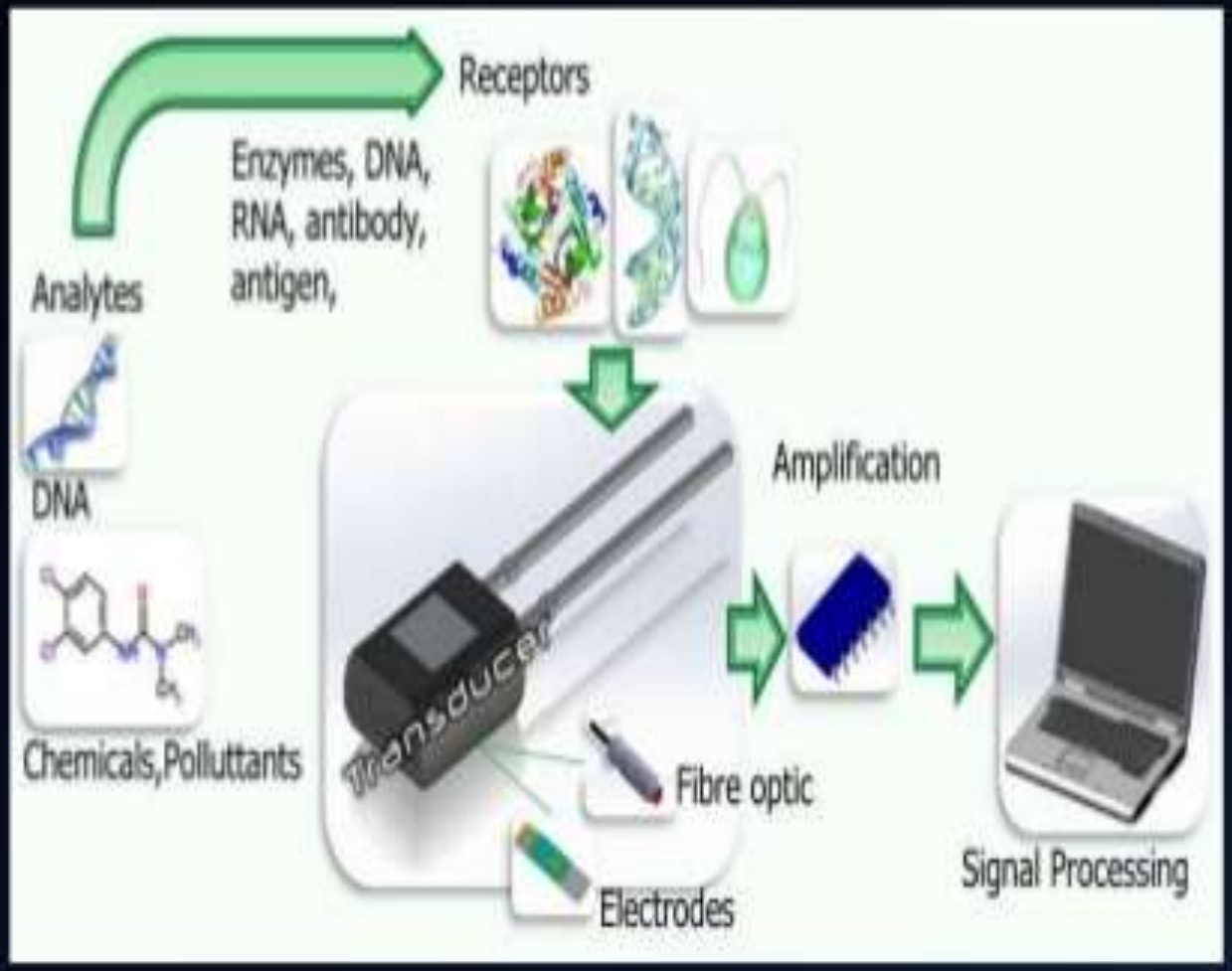
INTRODUCTION

- A **biosensor** is an analytical device containing an **immobilized biological material** (enzyme, antibody, nucleic acid, hormone, organelle or whole cell) which can specifically interact with an **analyte** and produce physical, chemical or electrical signals that can be measured. An analyte is a compound (e.g. glucose, urea, drug, pesticide) whose concentration has to be measured.



MAIN COMPONENTS OF A BIOSENSOR

- Sensor
- Transducer
- Amplifier
- Processor
- Display unit



WORKING PRINCIPLE

- Biosensors are operated based on the principle of **signal transduction.**
- Bioreceptor, is allowed to interact with a specific analyte. The transducer measures this interaction and outputs a signal. The intensity of the signal output is proportional to the concentration of the analyte. The signal is then amplified and processed by the electronic system.

FEATURES OF A BIOSENSOR

a) It should be highly specific for the analyte.

b) The reaction used should be independent of manageable factors like pH, temperature, stirring, etc.

c) The response should be linear over a useful range of analyte concentrations.

d) The device should be tiny and bio-compatible.

e) The device should be cheap, small, easy to use and capable of repeated use.

APPLICATIONS OF BIOSENSOR

- Food analysis
- Study of Biomolecules and their interactions
- Drug development
- Crime detection
- Medical diagnosis
- Environmental field monitoring

- Industrial process control
- Manufacturing of pharmaceuticals and replacement of organs
- Monitoring glucose level in diabetes patients
- Protein engineering
- Wastewater treatment
- Agriculture industry

- **Biosensors in Food Industry**

Biosensors are used for the detection of pathogens in food. Presence of *Escherichia coli* in vegetables, is a bioindicator of faecal contamination in food. *E. coli* has been measured by detecting variation in pH caused by ammonia (produced by urease–*E. coli* antibody conjugate) using potentiometric alternating biosensing systems.

Enzymatic biosensors are also employed in the dairy industry.

- **Biosensors in Medical field**

Glucose biosensors are widely used in clinical applications for diagnosis of diabetes mellitus.

A novel biosensor, based on hafnium oxide (HfO_2), has been used for early stage detection of human interleukin.

These are also used for detection of cardiovascular diseases.

- **Biosensors in Drug Discovery and Drug Analysis**

Enzyme-based biosensors can be applied in the pharmaceutical industry for monitoring chemical parameters in the production process (in bioreactors).

Affinity biosensors are suitable for high-throughput screening of bioprocess-produced antibodies and for drug screening.

Oligonucleotide-immobilized biosensors for interactions studies between a surface linked DNA and the target drug or for hybridisation studies.

- **Role of Biosensors in Environmental Monitoring**

The biosensors find wide application for measurement, estimation and control of water, air and soil contaminants.

Determination of the pesticides can be made by potentiometric biosensor.

Amperometric basic sensor can be used for analyses of water pollution from herbicide.

Concentration of ammonia can be defined with microbe biosensor with cells of type Nitrosomonas sp.

- **Epigenetics**

Photonic biosensors have been developed, which can detect tumor cell in a urine sample to an ultra-sensitivity level .

Epigenetic modifications are detected after exploitation of integrated optical resonators (e.g., post-translational modifications in histone and DNA methylation) using body fluids of patients suffering from cancer or other ailments.