

Lec10\ Biosensor

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What is a Biosensor?

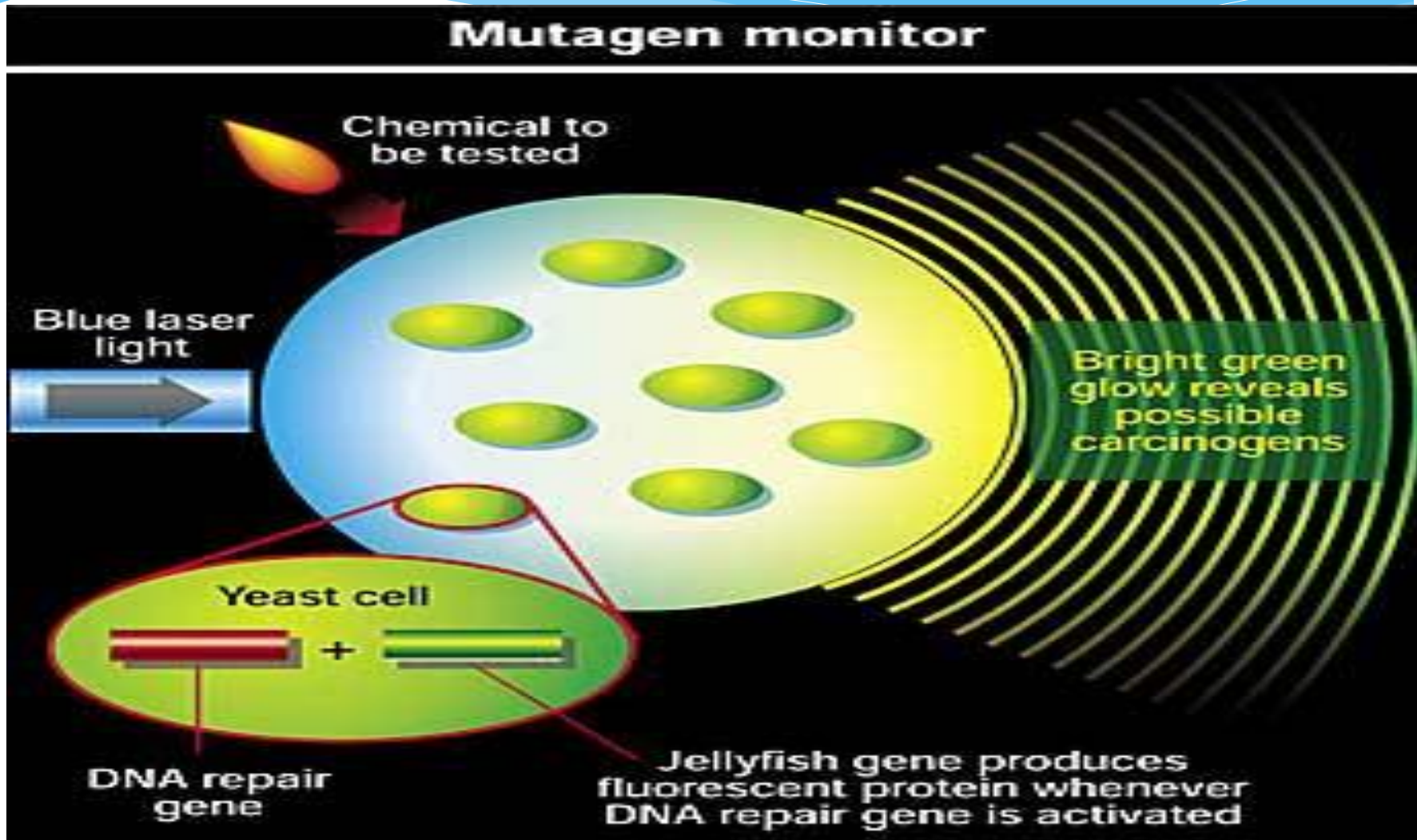
A biosensor is a self-contained integrated device that is capable of providing specific quantitative or semi-quantitative analytical information using a biological recognition element which is in direct spatial contact with a transduction element (IUPAC, 1996) .



1) Biosensor $\neq$ Bioanalytical system

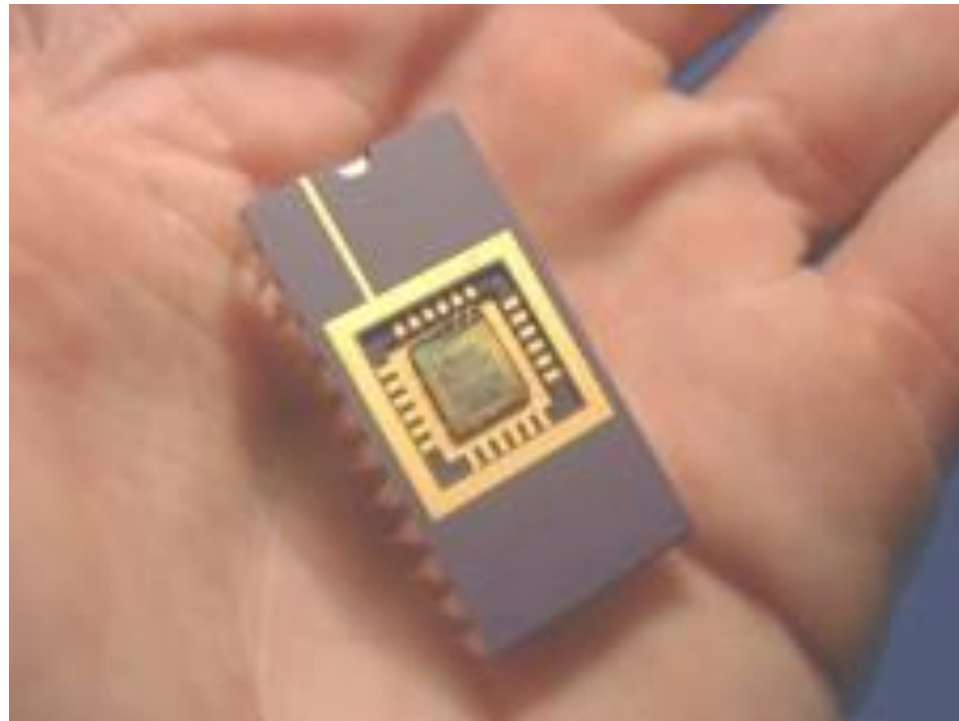
2) An enzyme electrode is a biosensor

“Biosensor” – Any device that uses specific biochemical reactions to detect chemical compounds in biological samples.

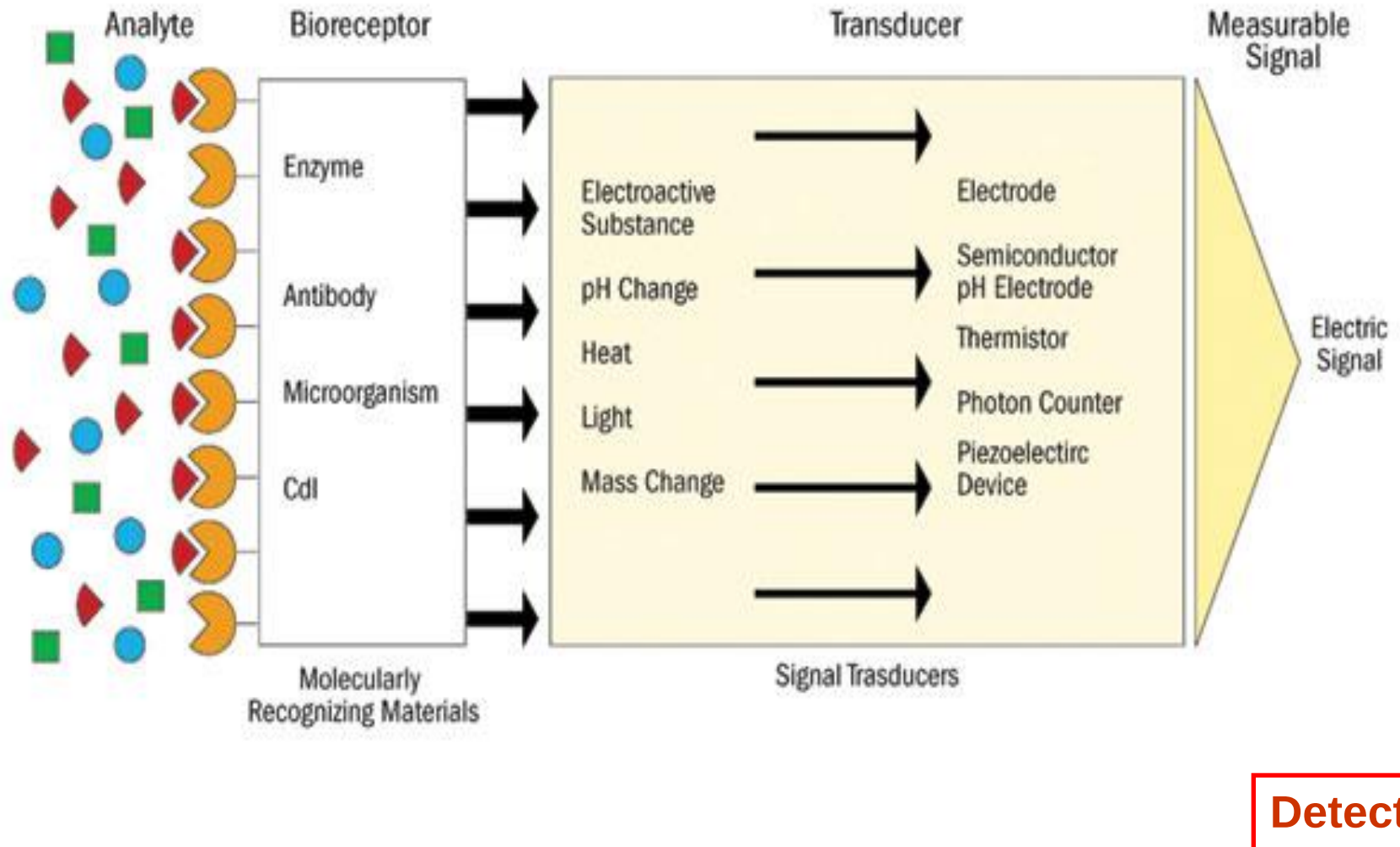


Current Definition

A sensor that integrates a biological element with a physiochemical transducer to produce an electronic signal proportional to a single analyte which is then conveyed to a detector.



Components of a Biosensor

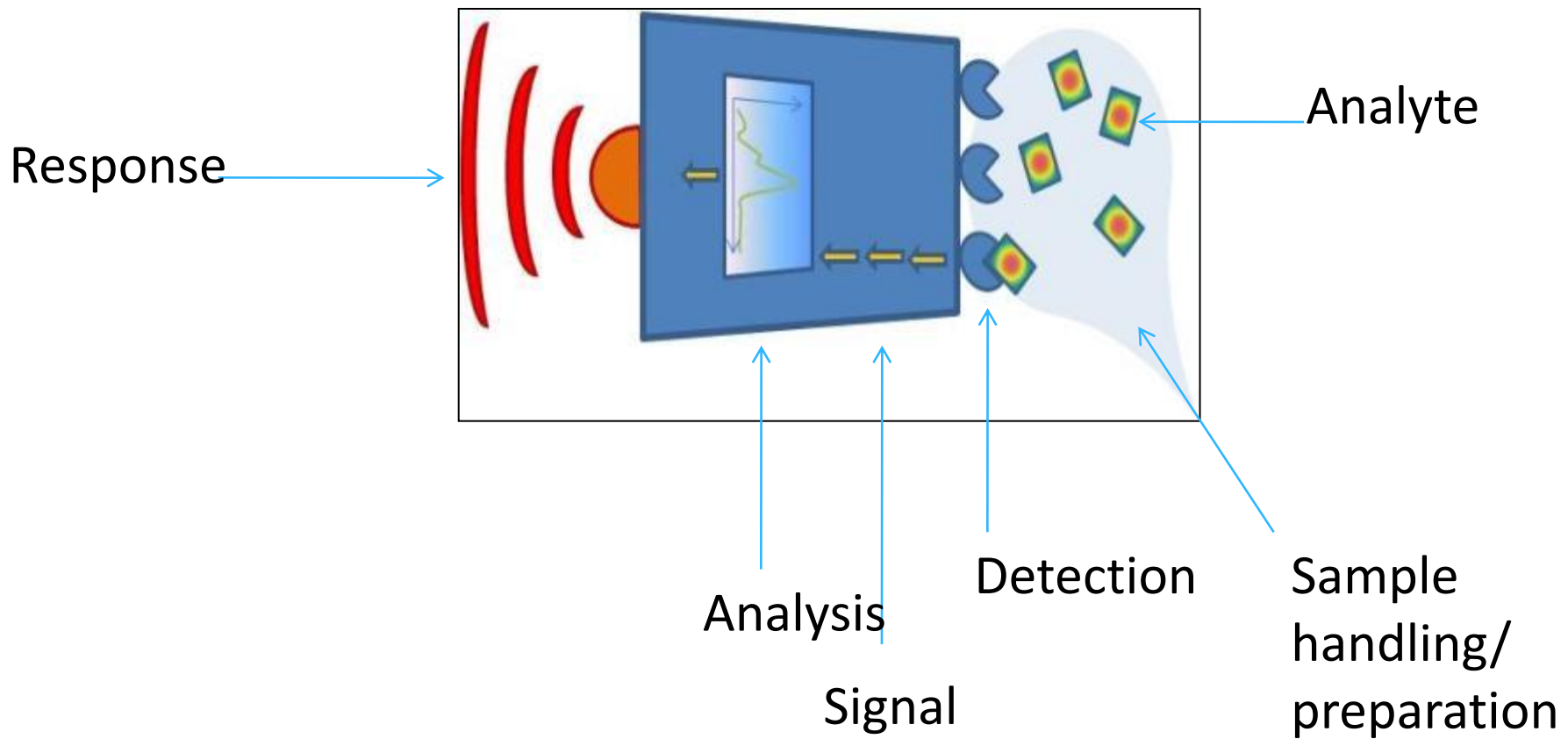


Father of the Biosensor



**Professor Leland C Clark Jr
1918–2005**

Biosensor



Biosensor

1. The Analyte (What do you want to detect)

Molecule - Protein, toxin, peptide, vitamin, sugar, metal ion

2. Sample handling (How to deliver the analyte to the sensitive region?)

(Micro) fluidics - Concentration increase/decrease),
Filtration/selection

Biosensor

❖3. Detection/Recognition

(How do you specifically recognize the analyte?)

4. Signal

(How do you know there was a detection)

Example of biosensors

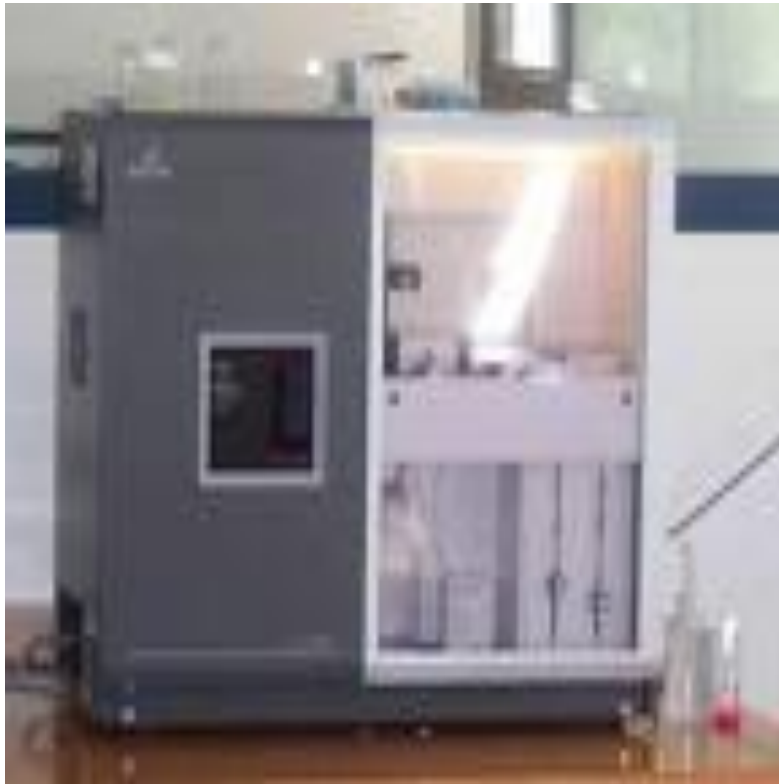


Infectious disease biosensor
from RBS



Old time coal miners' biosensor

Research Biosensors



Biacore Biosensor platform

Types of Biosensors

- 1. Calorimetric Biosensor**
- 2. Potentiometric Biosensor**
- 3. Amperometric Biosensor**
- 4. Optical Biosensor**
- 5. Piezo-electric Biosensor**

Piezo-Electric Biosensors

Piezo-electric devices use gold to detect the specific angle at which electron waves are emitted when the substance is exposed to laser light or crystals, such as quartz, which vibrate under the influence of an electric field.

The change in frequency is proportional to the mass of absorbed material.

Electrochemical Biosensors

- For applied current: Movement of e^- in redox reactions detected when a potential is applied between two electrodes.

Potentiometric Biosensor

For voltage: Change in distribution of charge is * detected using ion-selective electrodes, such as pH-meters.

Optical Biosensors

- Colorimetric for color

Measure change in light adsorption

- Photometric for light intensity

Photon output for a luminescent or fluorescent process can be detected with photomultiplier tubes or photodiode systems.

Calorimetric Biosensors

If the enzyme catalyzed reaction is exothermic, two thermistors may be used to measure the difference in resistance between reactant and product and, hence, the analyte concentration.

Electrochemical DNA Biosensor

- Steps involved in electrochemical DNA hybridization biosensors:
 - Formation of the DNA recognition layer
 - Actual hybridization event
 - Transformation of the hybridization

DNA biosensor

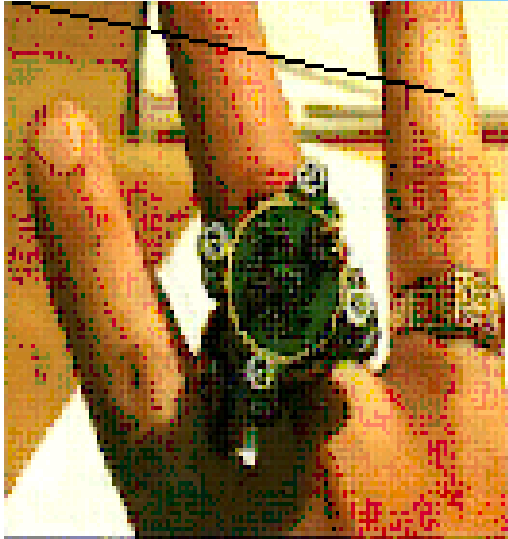
the application to clinical diagnosis and genome
mutation detection

Electrodes

Chips

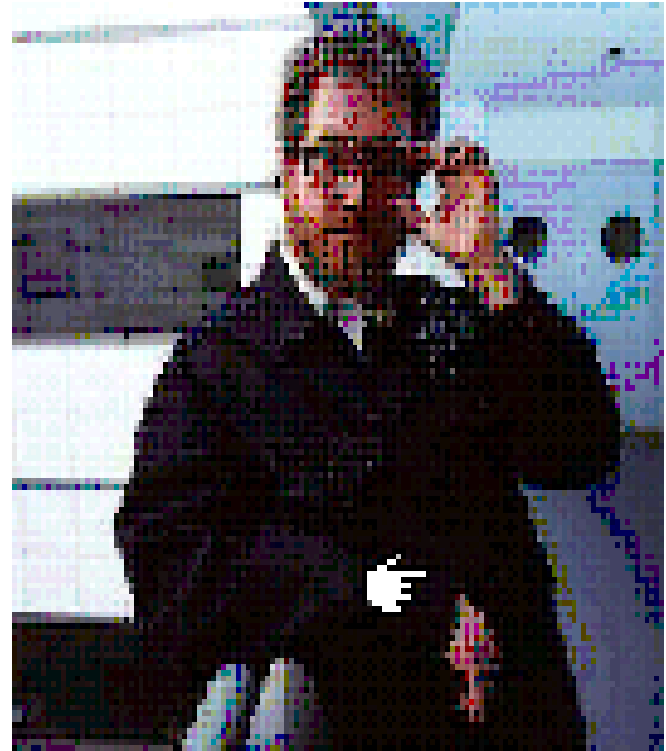
Crystals

Wearable Biosensors



Ring Sensor

Smart Shirt



Potential Applications

- Clinical diagnostics
- Food and agricultural processes
- Environmental (air, soil, and water) monitoring
- Detection of warfare agents.