WEARABLE BIOSENSORS

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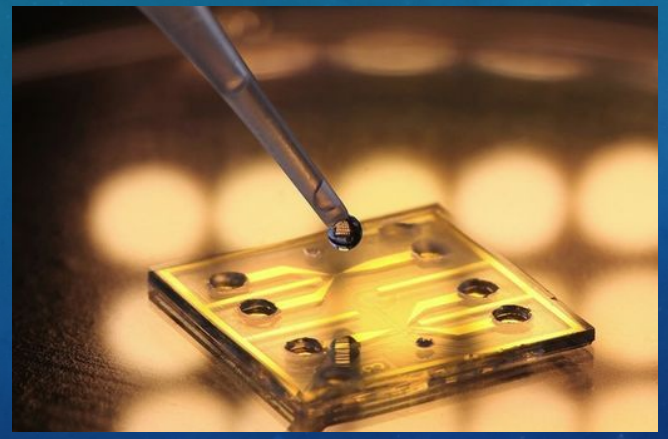
WEARABLE BIOSENSOR

The microbial sensors suit best for the industrial process as they possess the stability for a long time, there are two types of microbial sensors and they are as follows:

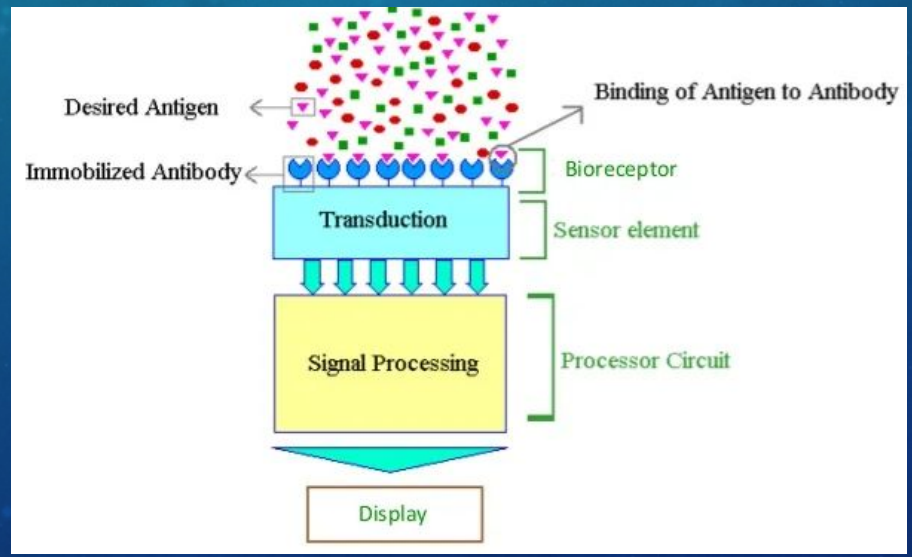
- The microbial sensors which have the immobilized whole cells and an oxygen probe and these are used for the resolution of substances and products.
- The microbial sensors which have the immobilized microorganisms and an electrode and these are used for the resolution of organic compounds.



Bacteria-Detecting Water Sensors
: Aqua sensor

WEARABLE BIOSENSOR

- A biosensor is a machine that consists of a ***bioreceptor and a transducer*** *which* is used for *transforming a biological response into an electrical signal.*
- The biosensor machine empowers one to measure the target analyte by not using the reagents and also to decide the concentration of substances, this machine is also used in the monitoring of the glucose in diabetes patients, detects the pesticides and also the contaminants of the river water, it also detects the poisonous metabolites.
- Example: A conductometric ammonium sensor was prepared by casting an ammonium selective poly (vinylchloride) (PVC) membrane containing nonactin on an interdigitated thin-film electrode surface. *The main drawback of this type of electrochemical transducer is that the sensitivity decreases drastically when the ionic strength of the measuring medium increases.*



HISTORY OF WEARABLE BIOSENSORS:

- In the year of 1956, Professor Lenald C Clack proclaimed a paper about *oxygen electrode* and later in the year of 1962, the Professor came with an advanced idea that includes the enzyme transducers as the membrane enclosed sandwiches.
- The Amperometric biosensor use the movement of electrons produced during redox reactions.
- After this many people did many developments in it and then in the year of 1976, La Roche introduced the Lactate Analyzer LA640.
- In 1987, for *home blood glucose monitoring a pen sized meter* was launched and then in the year of 1996, the sales of this meter reached 175 million dollars.

APPLICATIONS OF THE WEARABLE BIOSENSORS:

The applications of the wearable biosensors are as follows:

- The biosensors are used in *medical care* for both the clinical purpose and the laboratory purpose.
- The biosensors are used in the *resolution of food quality*.
- Calorimetric sensors involve *the measurement of heat* that is generated in an enzymatic reaction
- It is used in *detecting the pollutants* of an environment.
- The biosensors are used in the *industrial process control*.
- In the process control, it will be able to *measure the materials* in the process flow of temperature, acidity regulations and the pressure.
- The advancement of the biosensors in the industries can *develop the manufacturing mechanisms*.
- It plays a vital role in the *production of pharmaceuticals.*
- The biosensors are also used in *the replacement of organs like an artificial pancreas* for the diabetic patient.

NEED FOR BIOSENSORS:

The need for the biosensors is in the following areas:

- In the diagnostic market
- In the clinical testing
- In other materials that include veterinary and agricultural applications
- In specificity, it is used to measure particular analytes
- In the speed Simplicity and continuous monitoring capability

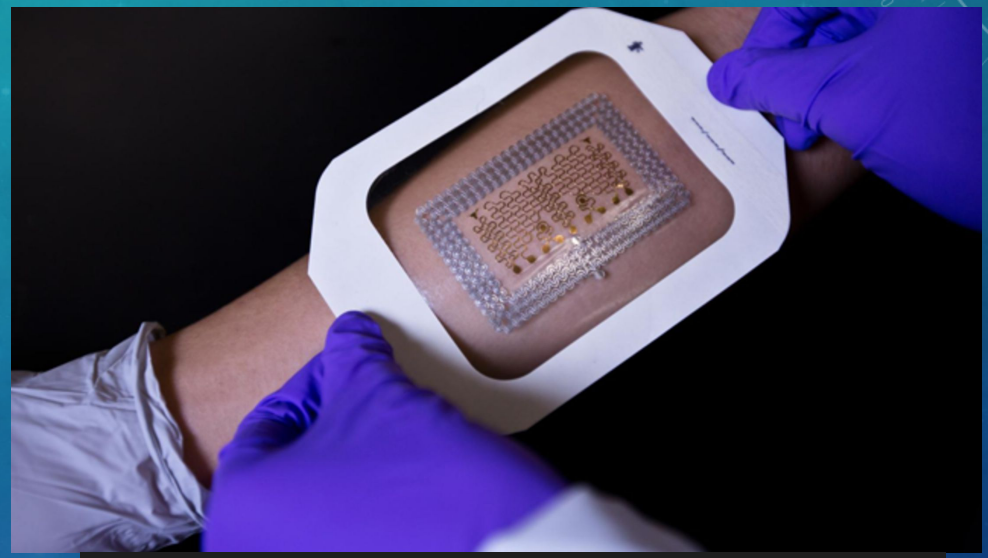
THE SCOPE OF BIOSENSORS:

- The scope of biosensors covers all the aspects of the sensor incorporating to the application areas of biosensors. The sensors incorporating in biosensors are as follows:
- The enzymes
- Antibodies
- Nucleic acids
- Whole cells
- Tissues
- Organelles and
- Other biological components

THE SCOPE OF BIOSENSORS:

All the above biological elements should be continued in spatial contact with the transducers and they include the following:

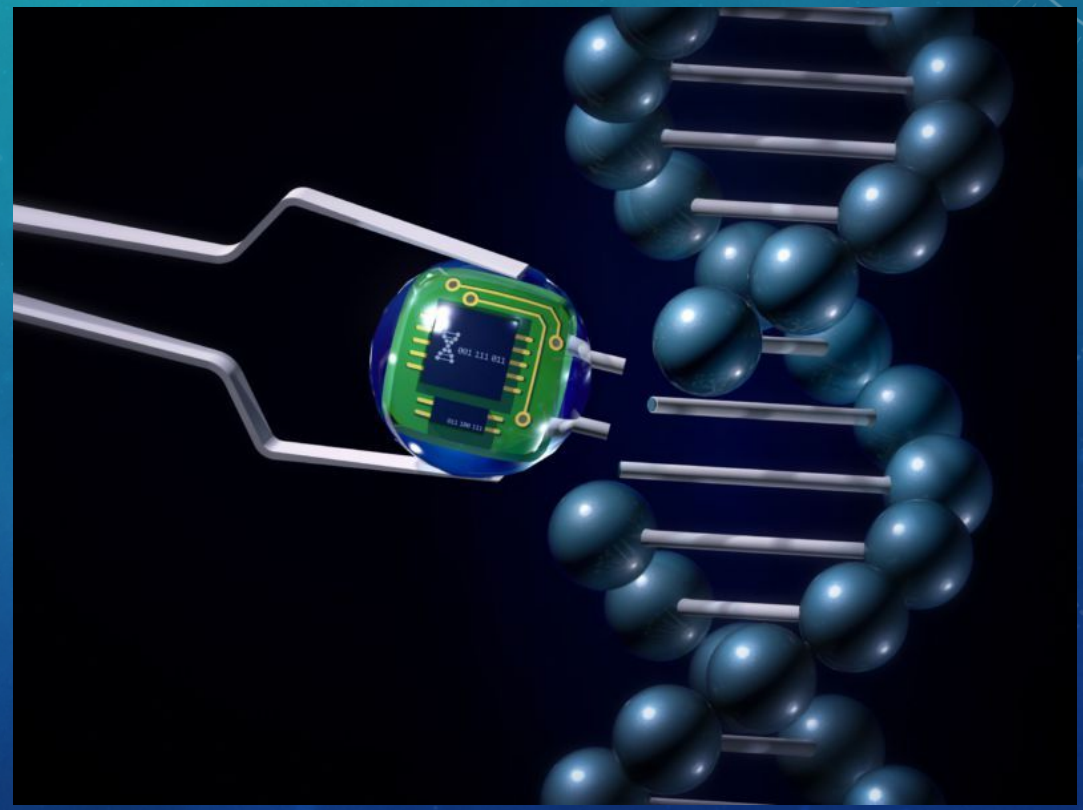
- The electrochemical
- The optical
- The piezoelectric
- The thermal
- The magnetic and
- The micromechanical



THE SCOPE OF BIOSENSORS:

The scope of biosensors includes the different subjects and they are as follows:

- DNA chips
- The lab-on-a-chip applied science
- The micro fluid machines
- The nano-biosensors
- The nanotechnology
- Biosensor fabrication and
- The biomaterials



THE ADVANTAGES AND DISADVANTAGES OF THE WEARABLE BIOSENSORS:

The biosensors have the following advantages:

- The biosensors are used in the medical field and also in the research of the biomedical.
- We have the benefit of protection with the biosensors and these are used in the food industry.
- These are used in the process industry and in the discovery of the drugs.

The disadvantages of the wearable biosensors area as follows:

- The wearable biosensors *cannot be steam sterilized.*
- They react with the products.
- The wearable biosensors are very sensitive.

FUTURE DEVELOPMENTS:

- In the above explanation, we have observed the development of the biosensors and they are still going to develop a lot in the future.
- The biochips are based on the field effect principle of the coupling technique between two domains and this is going to be the future development in the field of wearable biosensors.

CHEMICAL SENSORS

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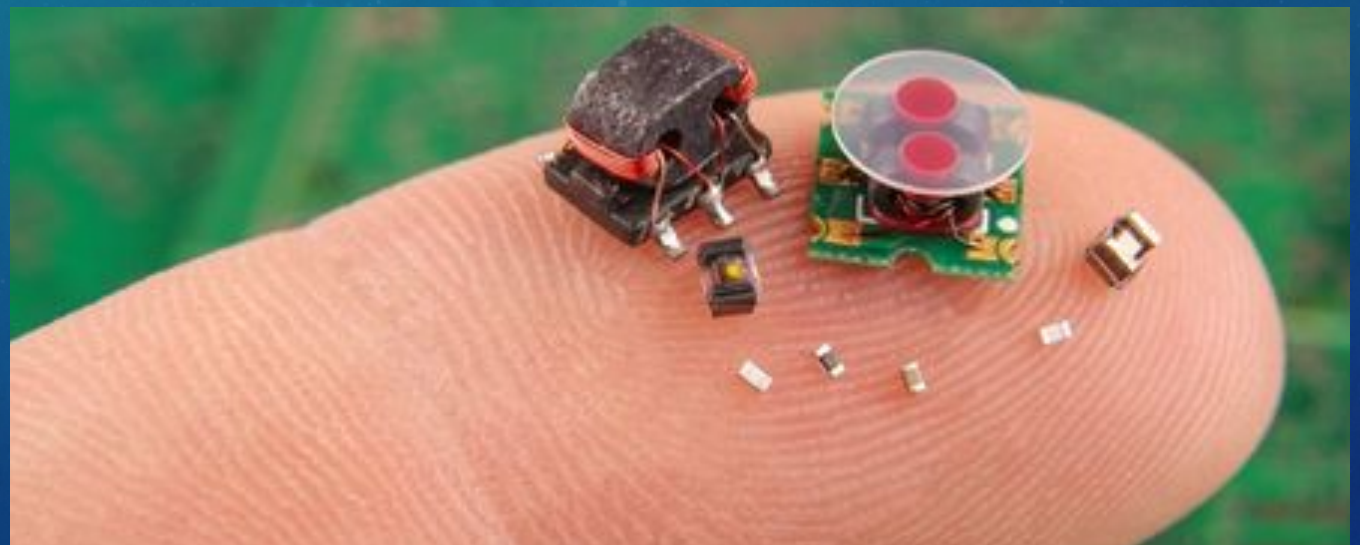
DEFINITIONS

A chemical sensor is a device that transforms chemical information, ranging from the concentration of a specific sample component to total composition analysis, into an analytically useful signal.

The chemical information, mentioned above, may originate from a chemical reaction of the analyte or from a physical property of the system investigated.

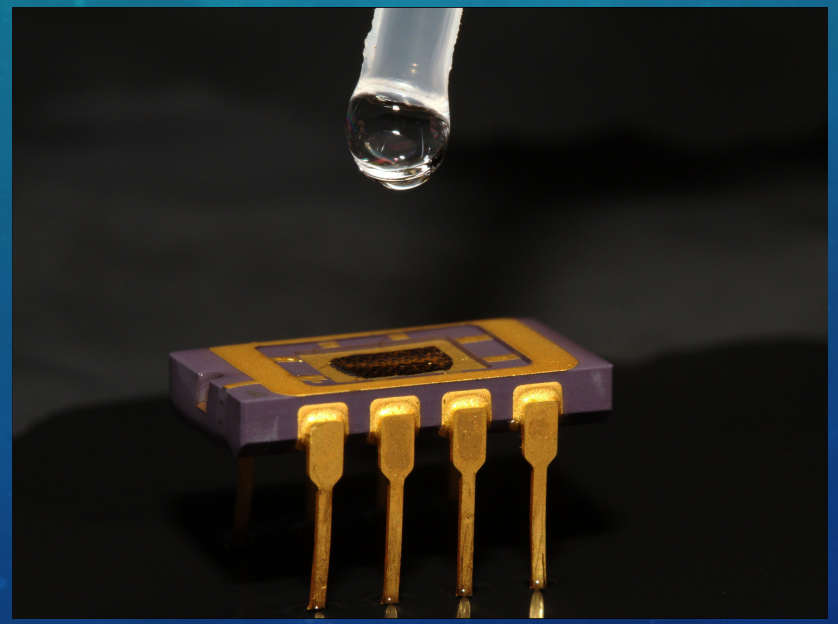
CHEMICAL SENSORS

- A physical sensor is a device that provides information about a physical property of the system. A chemical sensor is an essential component of an analyzer.
- Chemical sensors uses capacitive readout cantilevers and electronics to analyze a transmitted signal.
- In addition to the sensor, the analyzer may contain devices that perform the following functions: sampling, sample transport, signal processing, data processing.
- An analyzer may be an essential part of an automated system. The analyzer working according to a sampling plan as a function of time acts as a monitor.



CHEMICAL SENSORS

- Chemical sensors contain two basic functional units: a receptor part and a transducer part. Some sensors may include a separator which is, for example, a membrane.
- In the receptor part of a sensor the chemical information is transformed into a form of energy which may be measured by the transducer.
- The transducer part is a device capable of transforming the energy carrying the chemical information about the sample into a useful analytical signal. The transducer as such does not show selectivity.



THE RECEPTOR PART OF CHEMICAL SENSORS MAY BE BASED UPON VARIOUS PRINCIPLES:

The physical, where no chemical reaction takes place. Optical examples are those based upon measurement of absorbance, refractive index, conductivity, temperature or mass change.

- Chemical, in which a chemical reaction with participation of the analyte gives rise to the analytical signal.

- Biochemical, in which a biochemical process is the source of the analytical signal. Typical examples are microbial potentiometric sensors or immunosensors. They may be regarded as a subgroup of the chemical ones. Such sensors are called biosensors.

CLASSIFICATION OF SENSORS

- The development of instrumentation, microelectronics and computers makes it possible to design sensors utilizing most of the known *chemical, physical and biological principles* that have been used in chemistry.
- Chemical sensors may be classified according to the operating principle of the transducer.

OPTICAL DEVICES

Optical devices transform changes of optical phenomena, which are the result of an interaction of the analyte with the receptor part. This group may be further subdivided according to the type of optical properties which have been applied in chemical sensors:

a) Absorbance, measured in a transparent medium, caused by the absorptivity of the analyte itself or by a reaction with some suitable indicator.

b) Reflectance is measured in non-transparent media, usually using an immobilized indicator.

c) Luminescence, based on the measurement of the intensity of light emitted by a chemical reaction in the receptor system.

Example: The colorimetric method provides an instrumental measure (eliminating operator influence) of dye adsorption by fly ash.

OPTICAL DEVICES

- d) Fluorescence, measured as the positive emission effect caused by irradiation. Also, selective quenching of fluorescence may be the basis of such devices.
- e) Refractive index, measured as the result of a change in solution composition. This may include also a surface plasmon resonance effect.
- f) Optothermal effect, based on a measurement of the thermal effect caused by light absorption.
- g) Light scattering, based on effects caused by particles of definite size present in the sample.

OPTICAL DEVICES

The application of many of these phenomena in sensors became possible because of the use of optical fibres in various configurations. Such devices have also been called optodes.

It should be emphasized that fiber optics now commonly used are only technical devices applicable in a large group of optical sensors which can be based on various principles.