सत्यमेव जयते

‘Biosensors in Food Industry’

A Status Paper Presentation

By-

Sonika Singh (FTM),

414014

Dated : May 7th 2015

Food Quality Checks

- Involves making sure the agricultural produce is microbe/pathogen free.
- Making sure that raw material is being handled safely.
- The processing operation is pathogen free.
- Food testing in laboratories.
- GHP and GMP

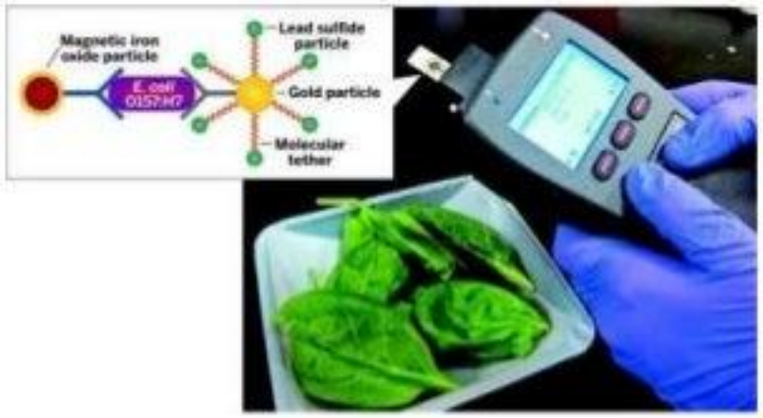
Problems with Food Analysis

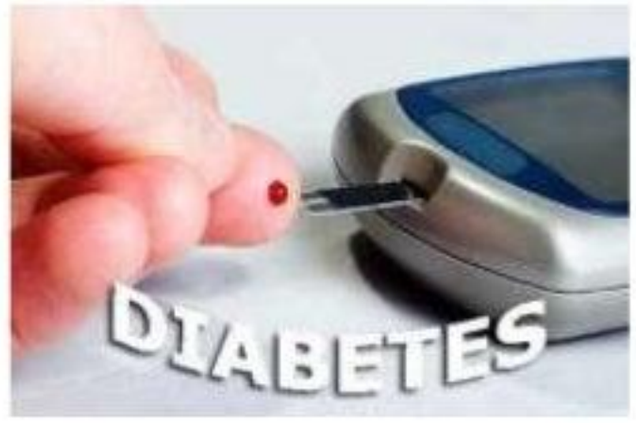
- Sample preparation is tedious job.

- Results may not be reproducible.

- Results may be inaccurate.

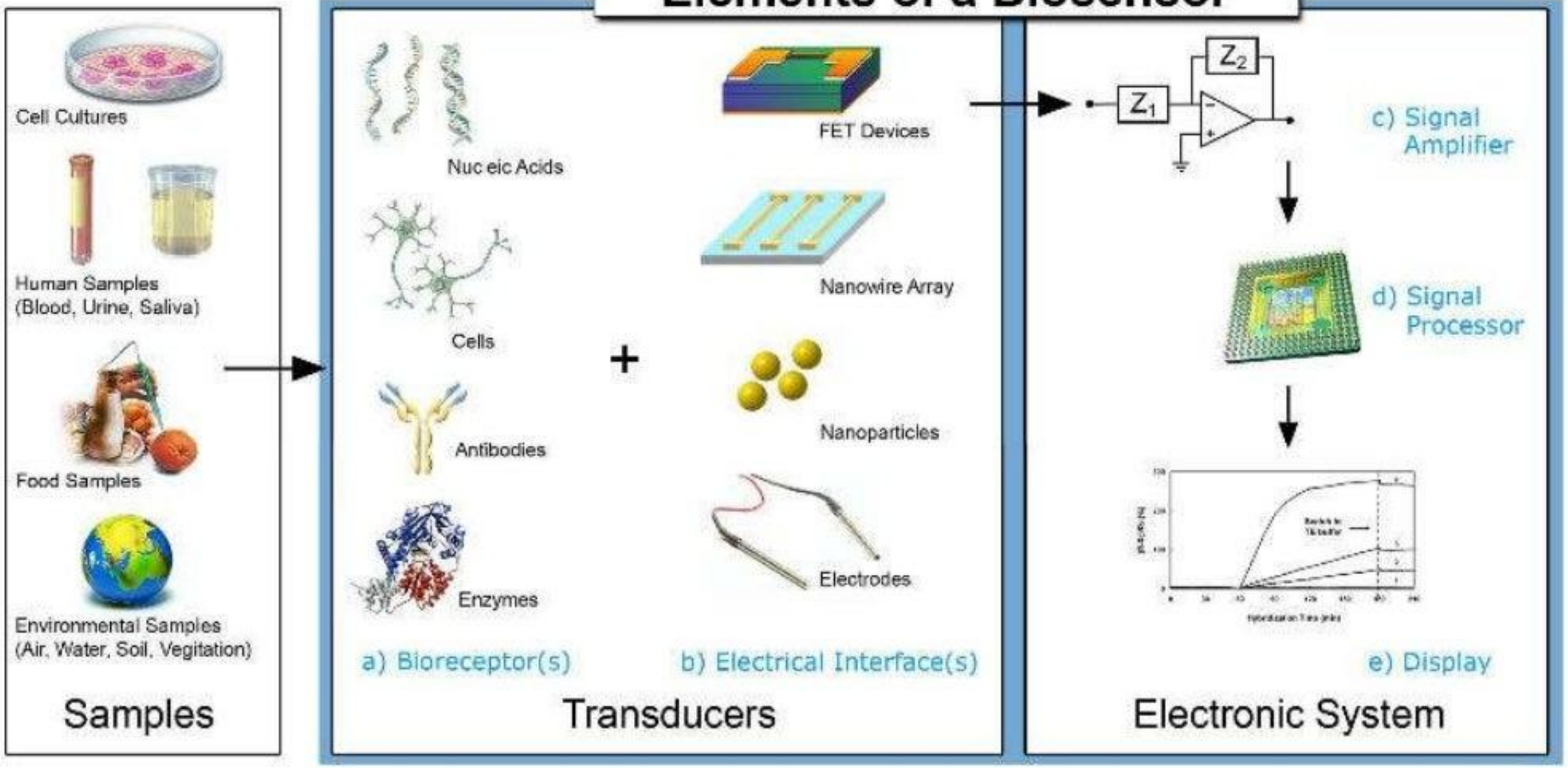
What are Biosensors?





- **Biological Entity**
- **Electronic Entity**
- **Chemical Entity**

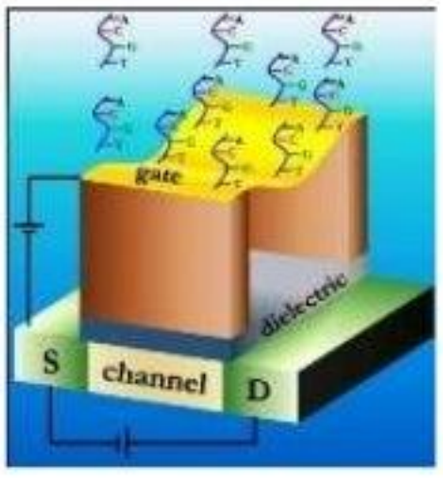
WORKING AND ELEMENTS OF A BIOSENSOR



Classification of Biosensors

Biological Recognition

- Enzymes
- Proteins
- Antibodies
- DNA
- Organelles
- Microbial Cells



Transducer and Measured Property

- Electrochemical
- Electrical
- Optical
- Mass Sensitive
- Thermal

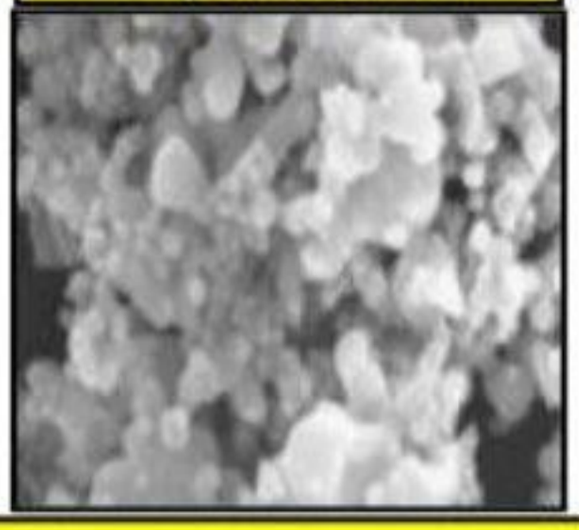
Conventional modes of food analysis and their disadvantages-

- Expensive
- Time Consuming
- Changes the morphology of the food

CASE STUDY- How sampling destroys the real analysis of a food product.

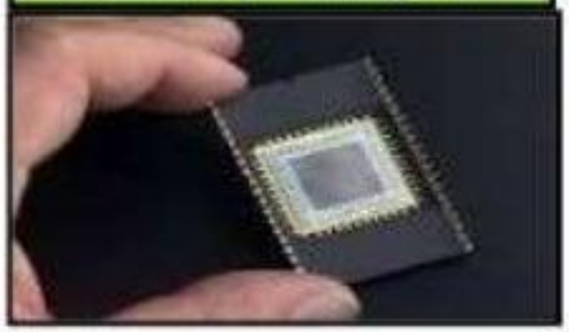
Uses of Biosensors

Agrochemical
Ex: Nanoparticles in pesticides



In food industry

Sensing
Ex: Detect chemicals or food borne pathogen

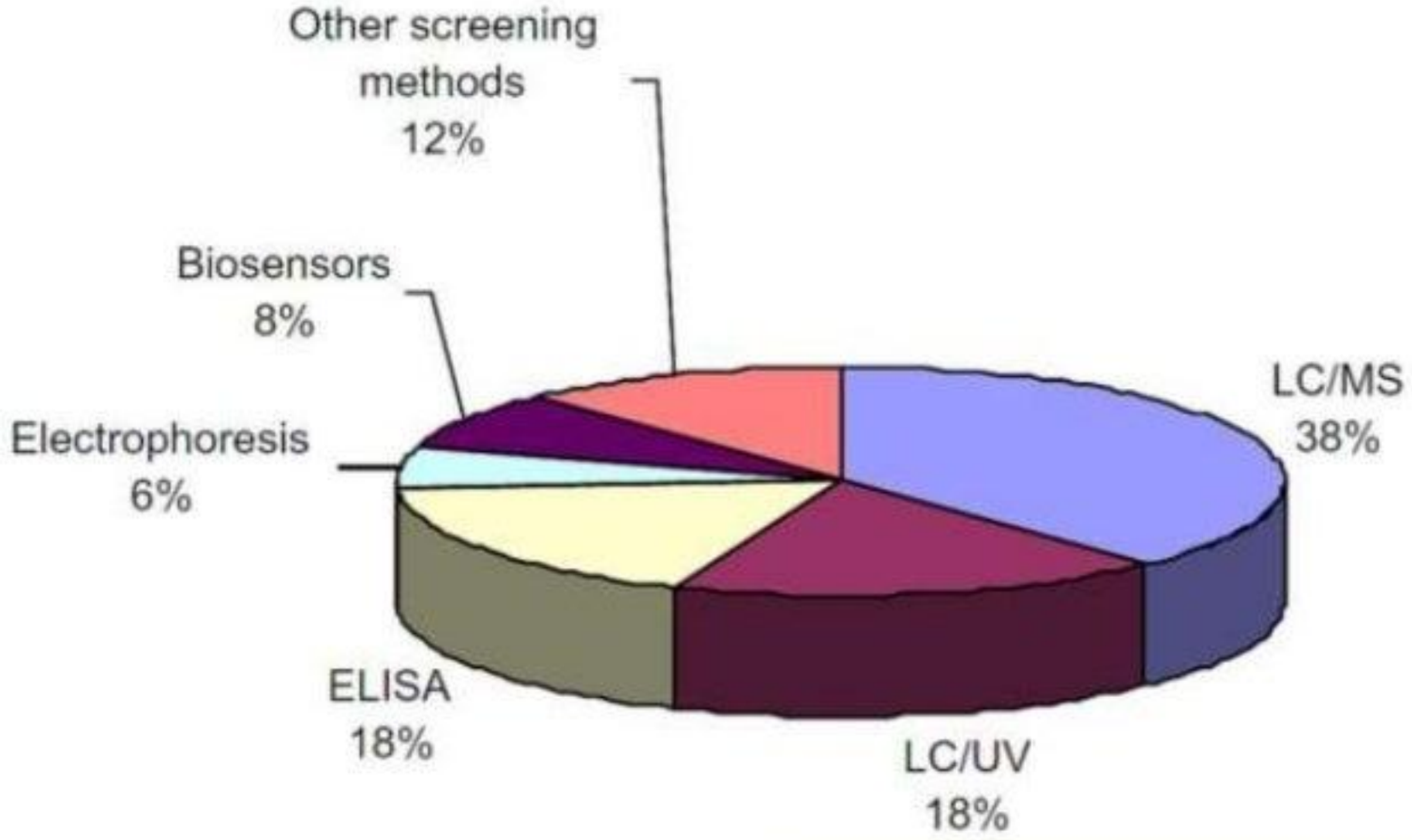


Convergence Nano-Geo-(Bio)-Info technology

Packaging
Ex: Prevent or respond to

Safety

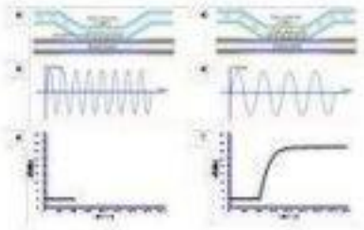
Usage of Biosensors in Food Industry



- PH
- DNA Testing
- Alcohol Testing
- Sugar Content Testing
- Contamination in packed Food

Electronic component design

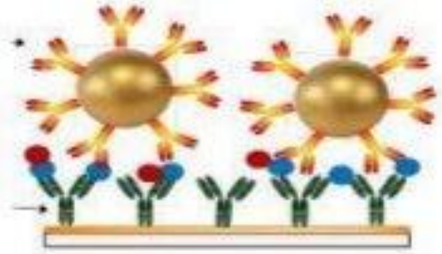
Device control software; data collection, analysis and secure transfer



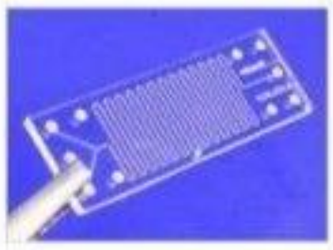
Design of the detection unit

Biosensor Prototype (system integration)

[www.yildizuludag.wordpress.com]



Assay development



MEMs and microfluidics

Sensor chip design

Sensor surface chemistry

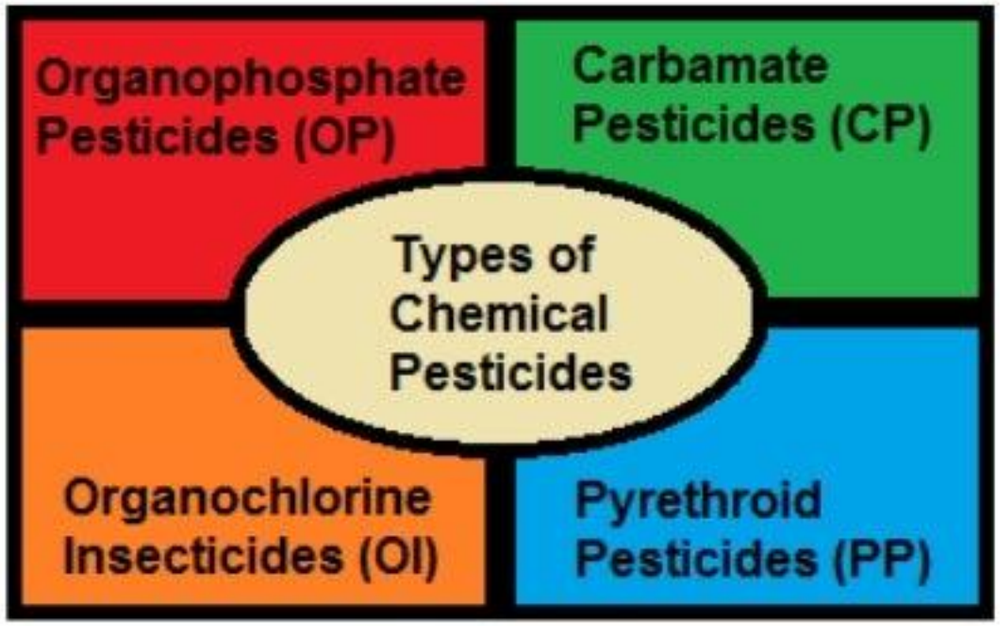
A Typical Biosensor

Biosensors in Dairy Technology

- DNA testing of the cows
- Pathogen Testing in the milk
- Milk bacterial Load
- Micro-organism Identification in the milk
- Test for preservation and pasteurization

Biosensors in Agriculture

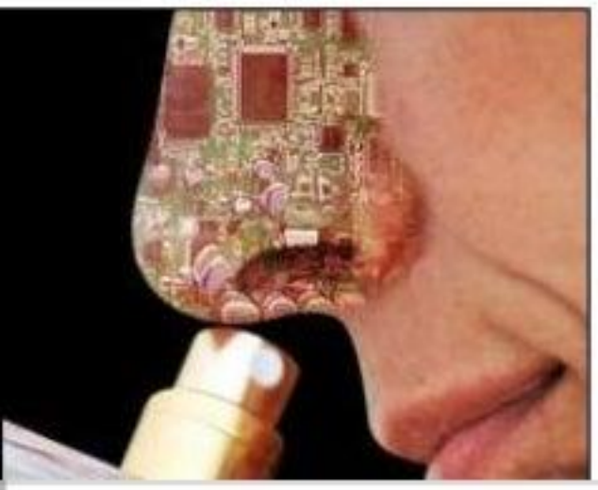
- Testing for pesticides in the crop.
- Soil ph testing
- Crop deterioration test
- Crop respiration detectors
- Gases detectors
- Environmental pollutants



Durrieu and Tran-Minh developed an optical biosensor to detect lead and cadmium by inhibition of alkaline phosphatase present on the external membrane of *Chlorella vulgaris* microalgae, used as biological recognition element.

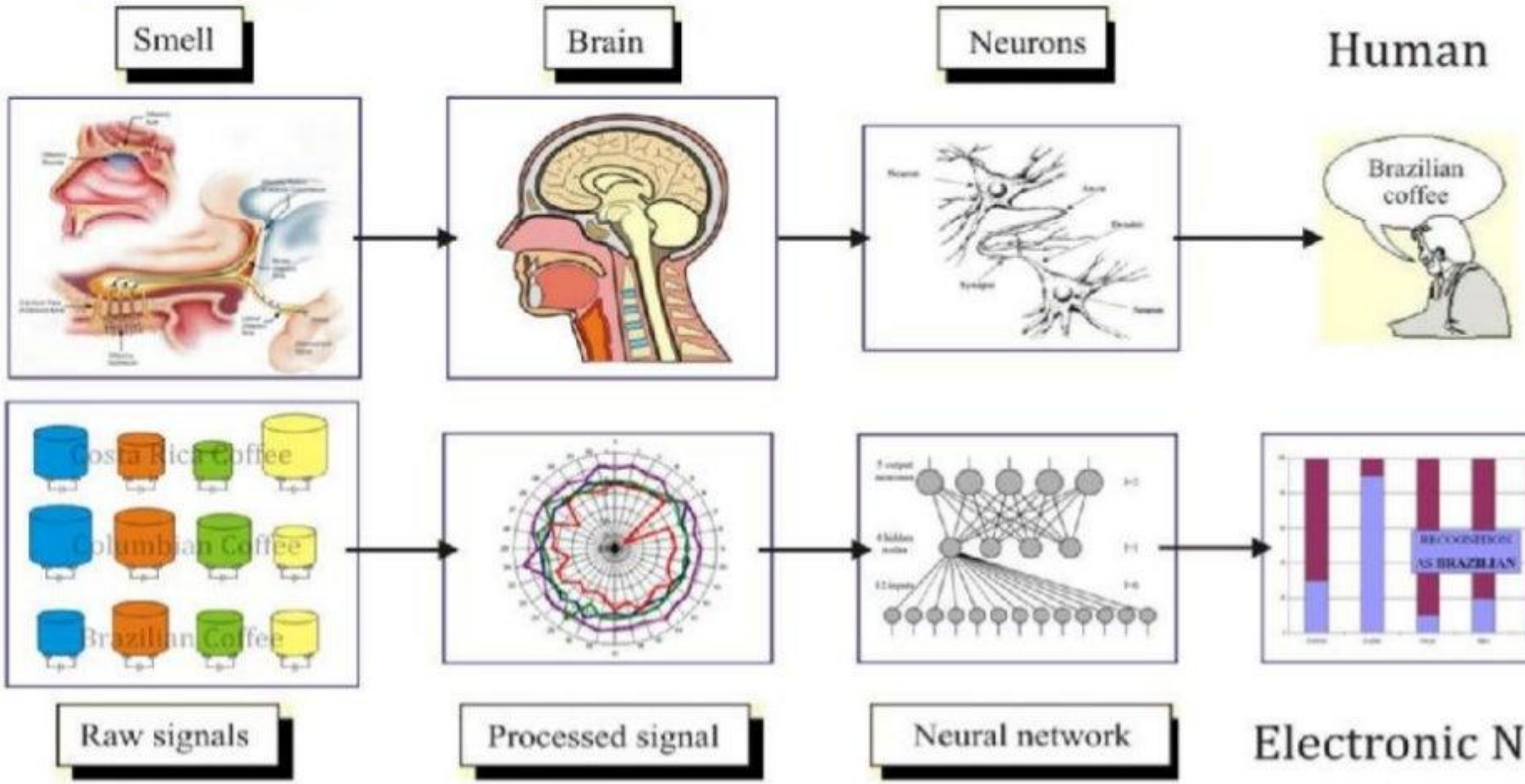
Also, a biosensor with microalgae *Tetraselmis chui* was developed for the voltammetric measurement of Cu+2 by **Alpat et al.**

Trending Biosensors

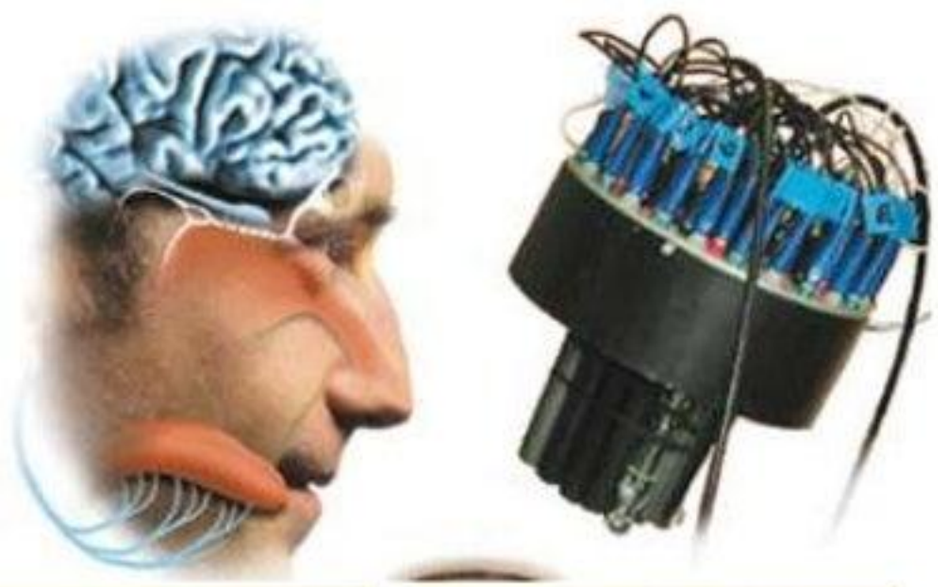


E- nose

- Sensory Analysis Software (accuracy)
- Detection of odd volatile compounds
- Application in Tea, Wine, Coffee, Spices Industry

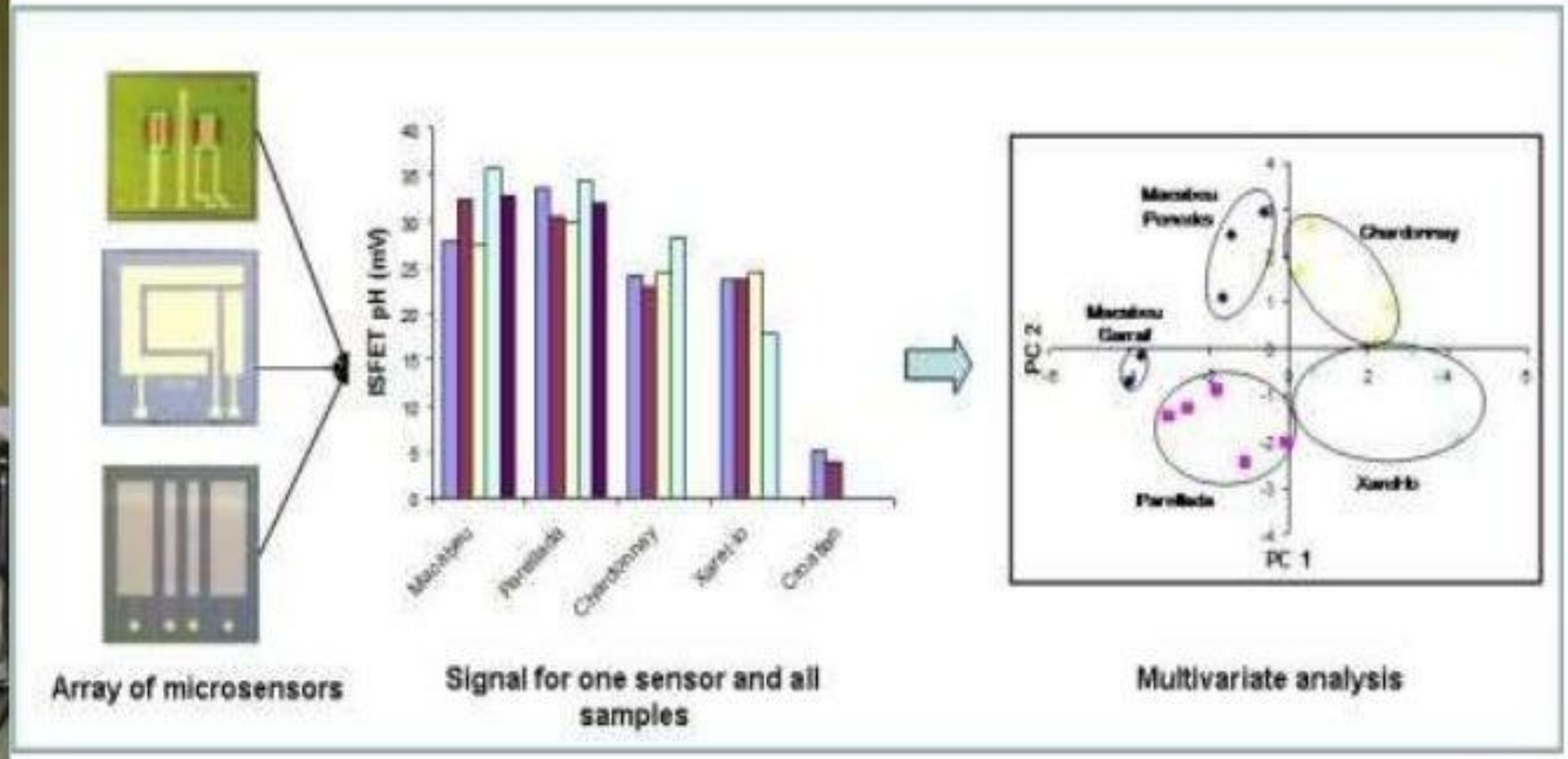


Trending Biosensors



E- Tongue

- Used when a combination of volatiles and their effect on sensory is to be analyzed.
- Applications in Tea, Coffee, Beverage (liquid food industry).



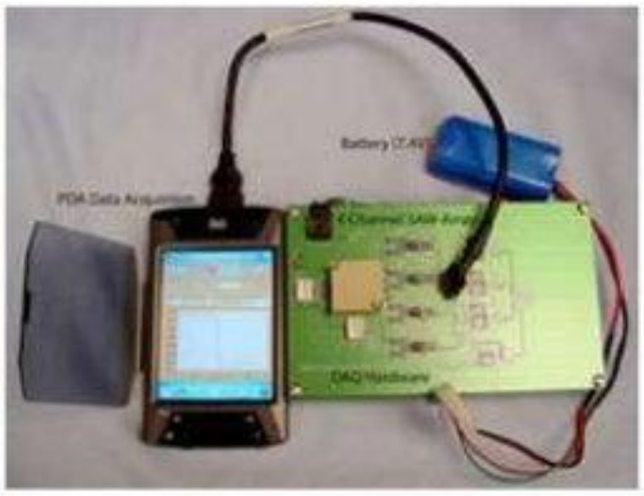
Indian scenario in usage of Biosensors

Research and Development is less; companies depends more on usage of conventional systems

Usage of Biosensors are limited to medical field.

Not manufactured in India. Custom made are expensive.

Global scenario in usage of biosensors



Pathogen Detector

Toxin detector using Smartphone app

E-Tongue (Handy)

Calorie Counter

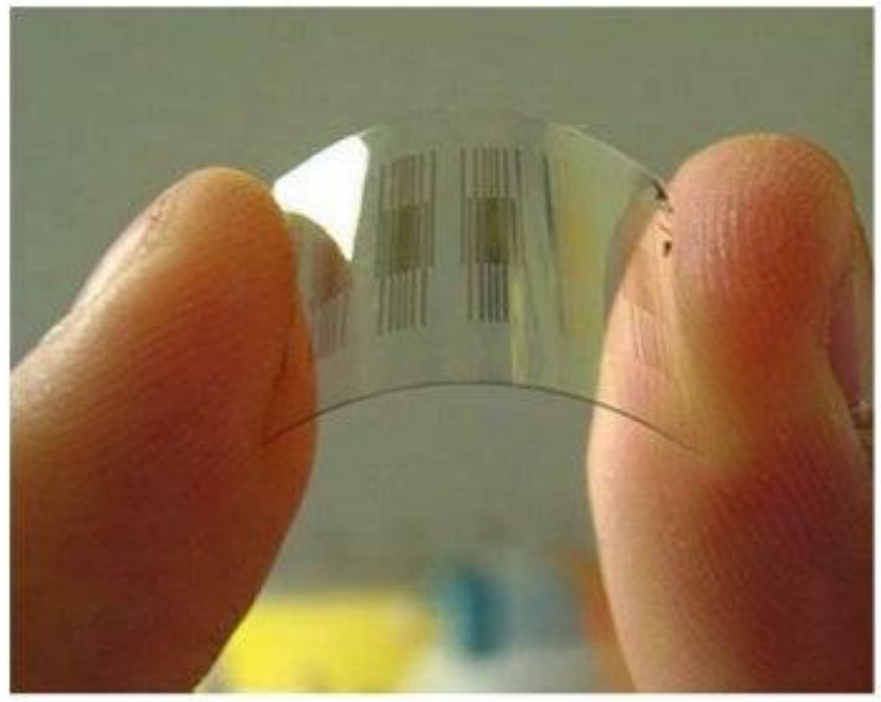
Nano-sensors in Food Packaging

Nanotechnology offers 3 distinct advantages to food packaging-

- Barrier resistance
- Incorporation of active components to provide functional performance
- Sensing of relevant information

Application in this area already support development of improved-

- Taste, colour, flavour, texture and consistency of foodstuffs, increased absorption and bioavailability of nutrients and health supplements.
- New food packaging materials with improved mechanical, barrier and antimicrobial properties



Nano-sensors for Food Safety

- ***Nanostructured films and packaging materials*** can prevent the invasion of pathogens and other microorganisms and ensure food safety.

- ***Nanosensors embedded in food packages*** will allow the determination of whether food has gone bad or show its nutrient content.

- By ***adding certain nanoparticles into packaging material*** and bottles, food packages can be made more light- and fire-resistant, with stronger mechanical and thermal performance and controlled gas absorption.

Companies manufacturing Food Biosensors

COMPANIES	ACTIVITY
Biometra, Germany	HPLC + biosensor: glucose, ethanol
Colora Messtechnik GmbH, Germany	on-line fermentation control: glucose, lactate, ethanol
Cranfield Institute of Technology, UK	Glucose, microbial contamination, methanol
Fuji Electric Co, Japan	Gluco 20: glucose
GeneScan Europe AG/Scil Diagnostic GmbH, Germany	NutriChip, DNA detection with array technology
IBA GmbH, Go¨ttingen	On-LineGeneralAnalyzer (Olga): sucrose, glucose, alcohol
Integrated Genetics, USA	DNA probes for detection of microbial contamination: (*Salmonella)*
Molecular Devices Corporation, USA	Threshold-System (based on light-addressablepotentiometric sensor): assay for DNA traces
NEC, Japan	NEC, JapanFET biosensors: glucose, alcohol, L-lactate, glycerine
Oriental Electric Co., Japan	KV-101 freshness meter: degradation products of ATP
Pegasus Biotechnology, Canada	Microfresh: degradation products of ATP
Provesta Corporation, USA	Multipurpose Bioanalyzer: glucose, latate, lactose, alcohol
Pru¨fgera¨te-Werk Medingen GmbH	Industrial Module: glucose, L-lactate, lysine: lactose, glutamate, ascorbate in preparation
TOA Electronics Ltd., Japan	Glu-11: glucose
Toyo Jozo, Japan	Biosensors for glucose, lactate, lipids
Yellow Springs Inc., YSI, USA	YSI 2700 Select: Glucose (Dextrose), L-lactate, glucose, ethanol, sucrose, lactose, starch, galactose, L-glutamate, L-glutamine, choline, hydrogen peroxide