DE VINCI INNOVATION CENTER

WEARABLE BIOSENSORS COURSE

Vivien PERRELLE
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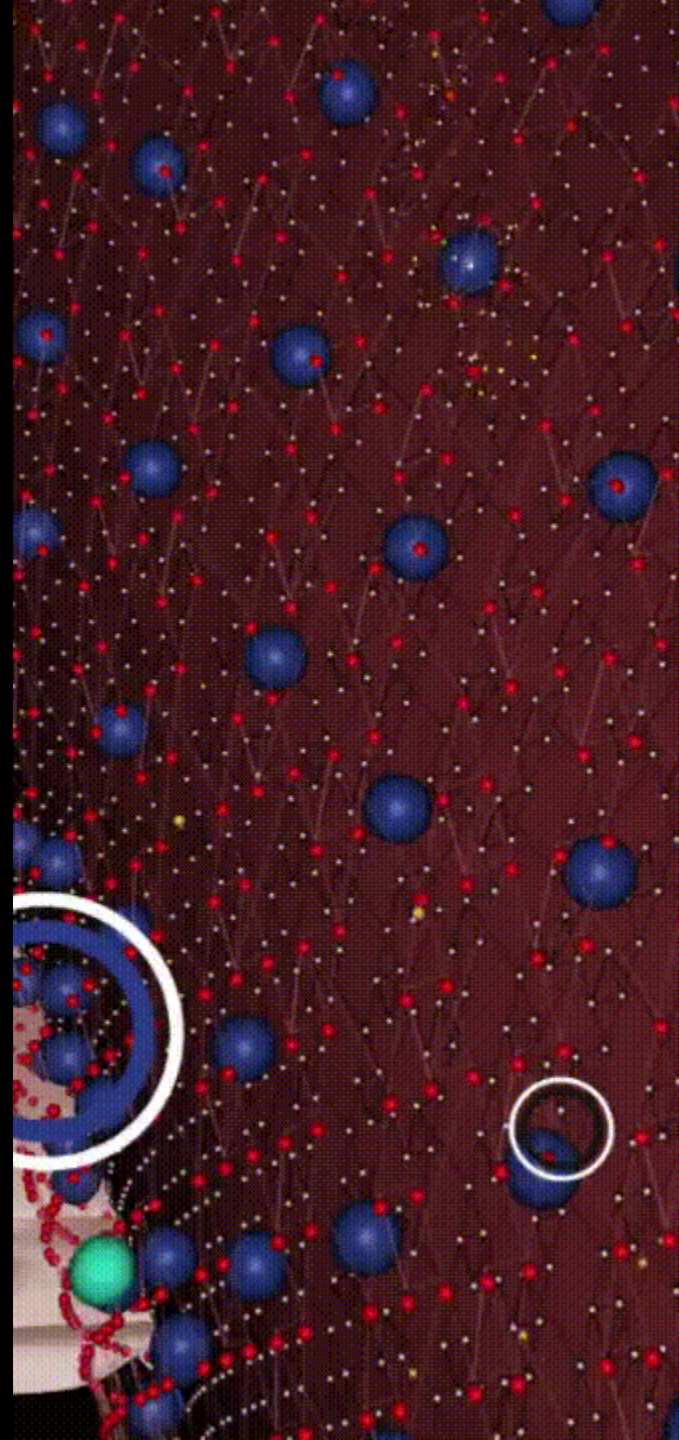
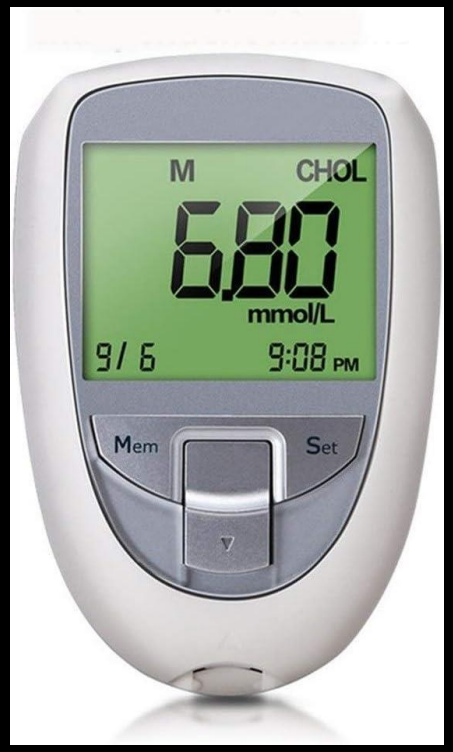
Entrepreneur

vivienperrelle.com



01| BIOSENSORS - DEFINITION

Blood glucose meter



Cholesterol test kit

Pregnancy test

human Chorionic Gonadotropin (hCG)

01| BIOSENSORS - DEFINITION

RT-PCR & Antigen
COVID-19 Tests

Alcohol Breathalyzers

Food Safety Testing

01| BIOSENSORS - DEFINITION

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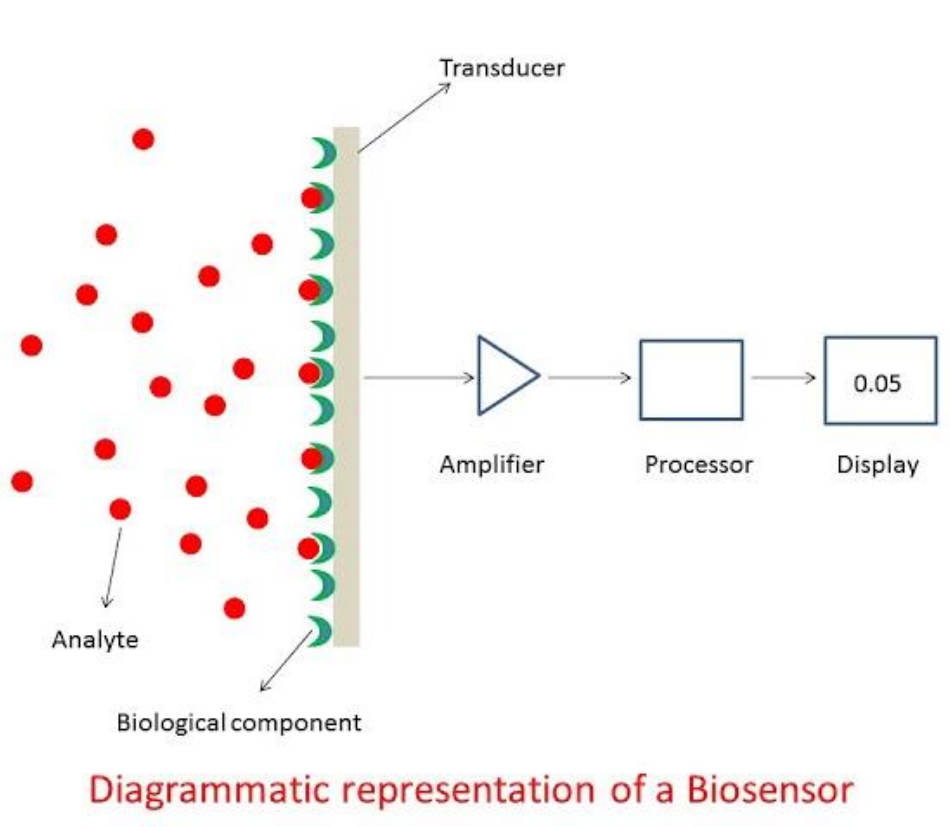
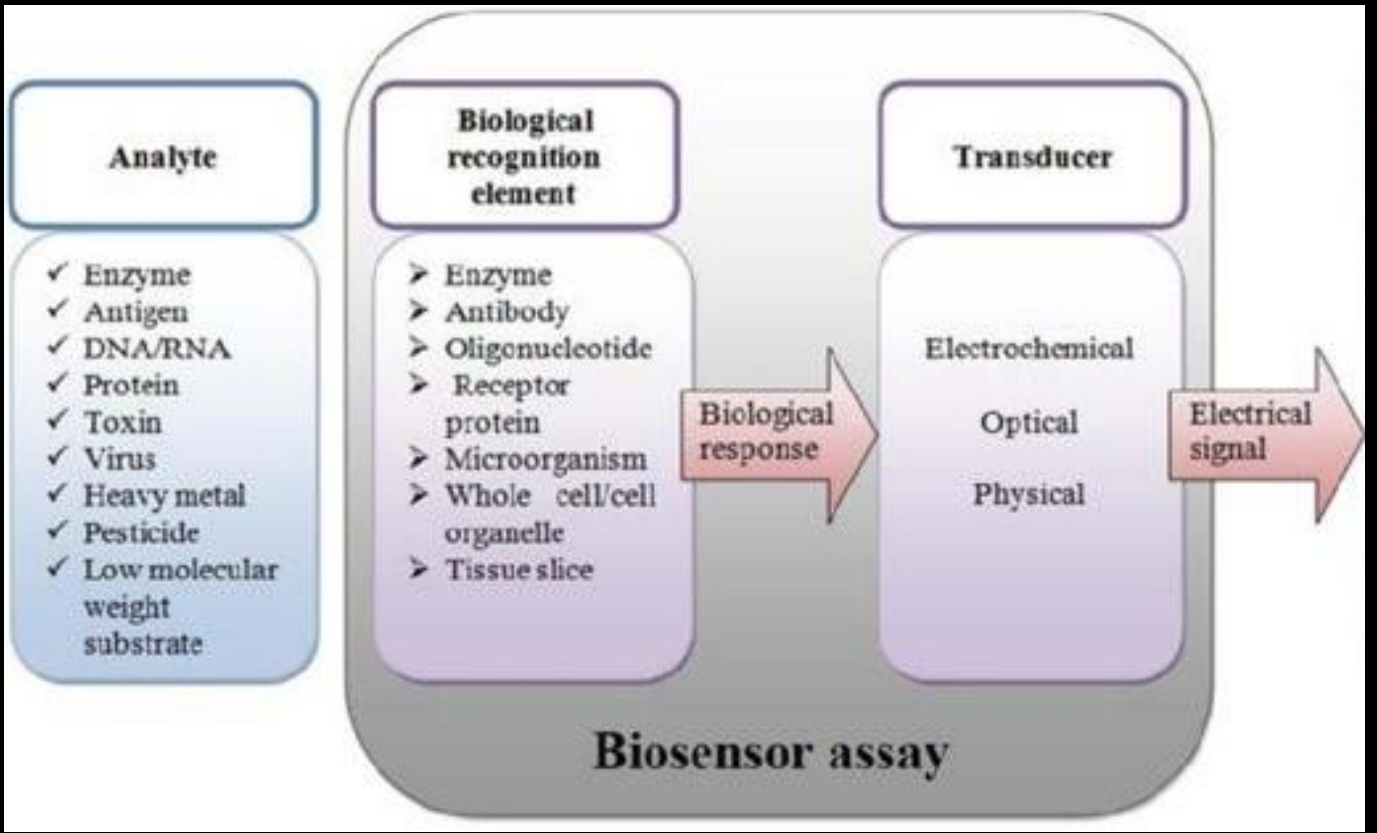
- Biosensors are analytical devices used to detect **chemical substances** by combining a **biological component** with a **physicochemical detector**.



Diagrammatic representation of a Biosensor



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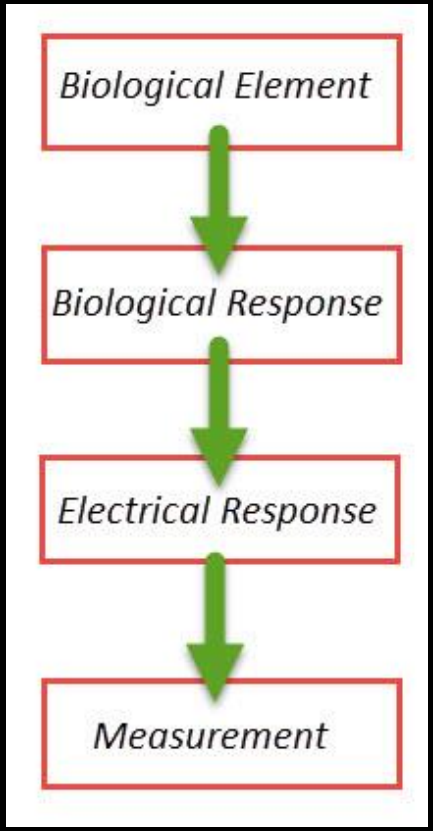

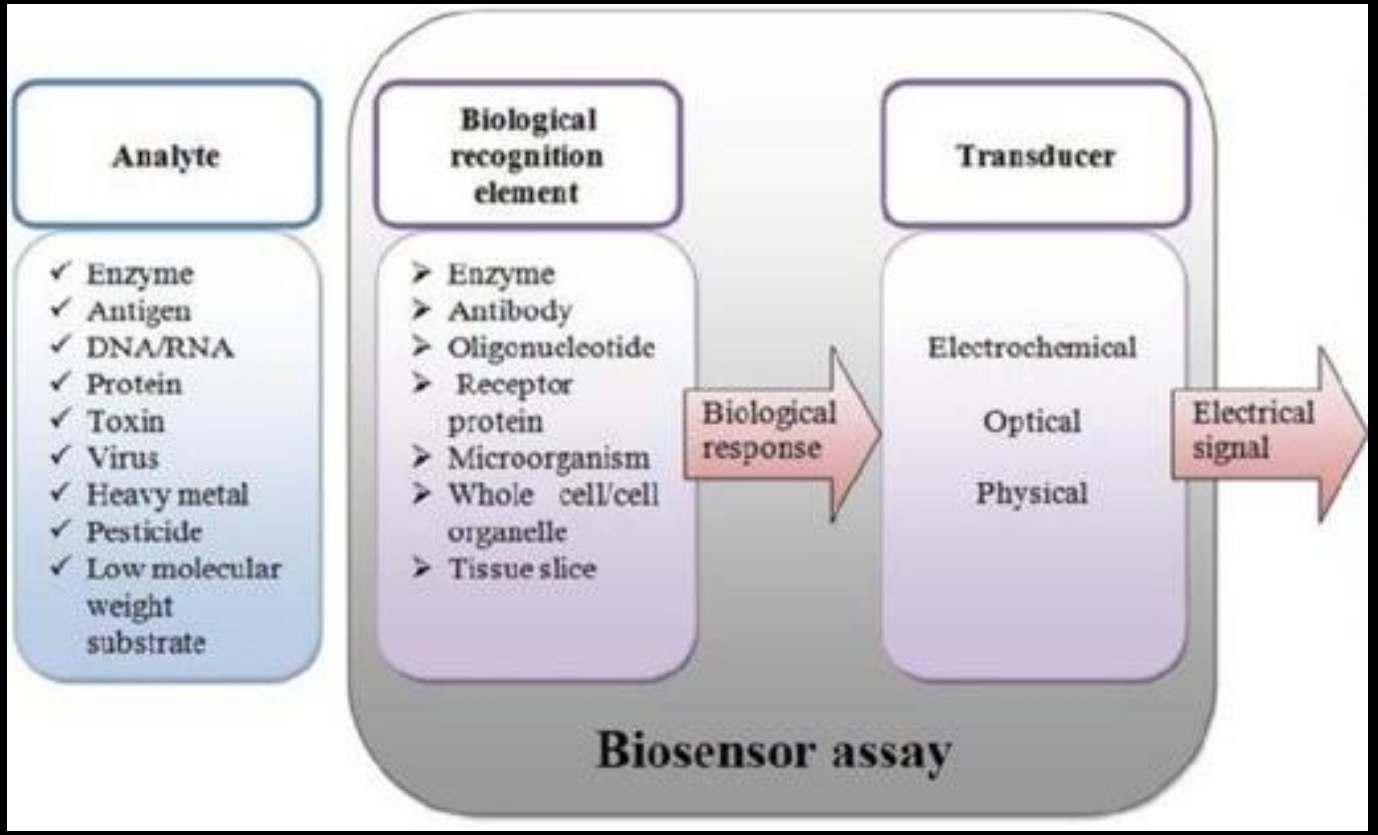

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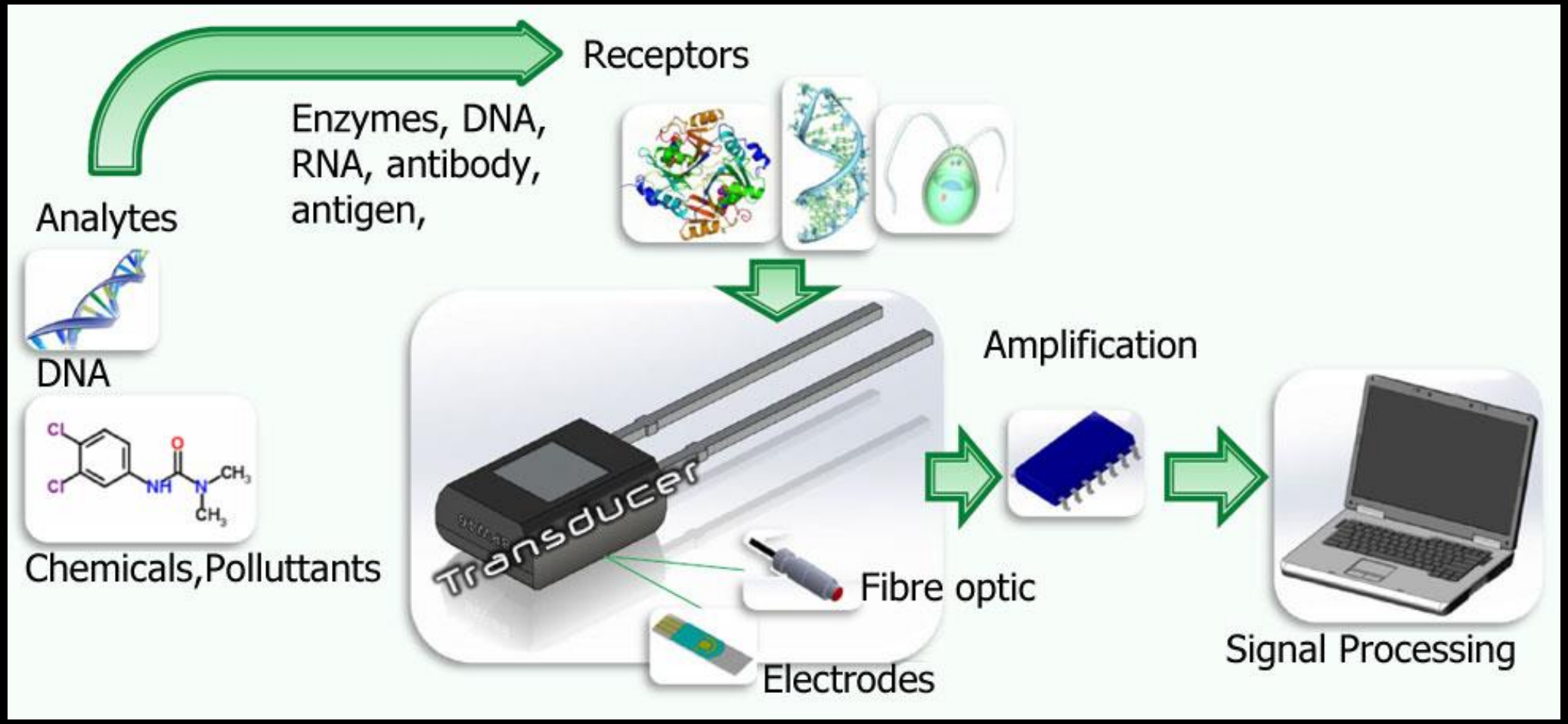
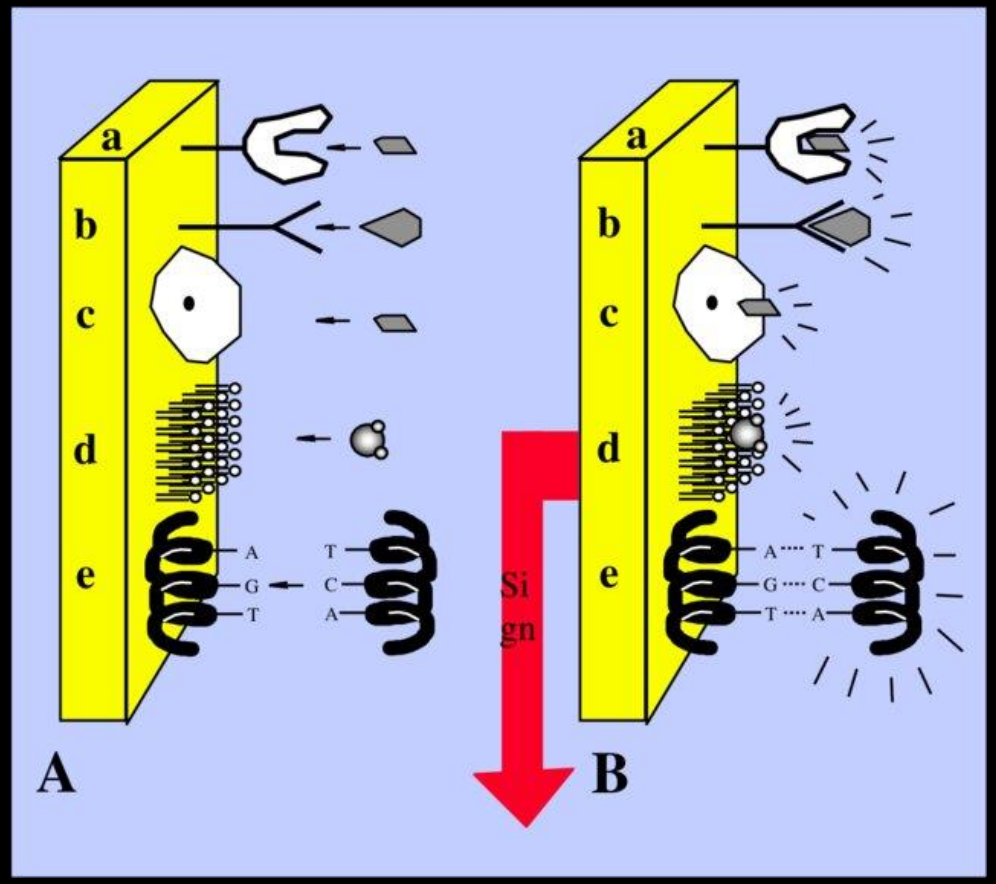
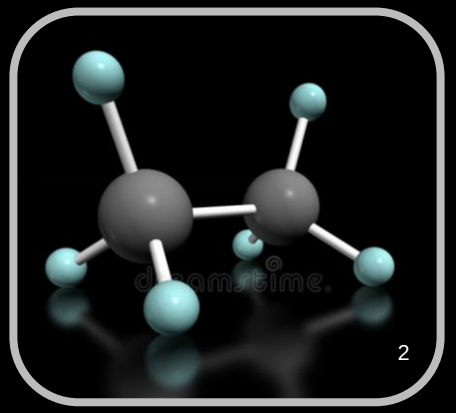


01| BIOSENSORS - DEFINITION



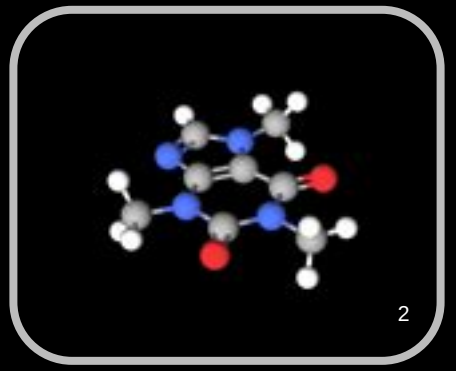
Biosensor

1



Biomarker

2

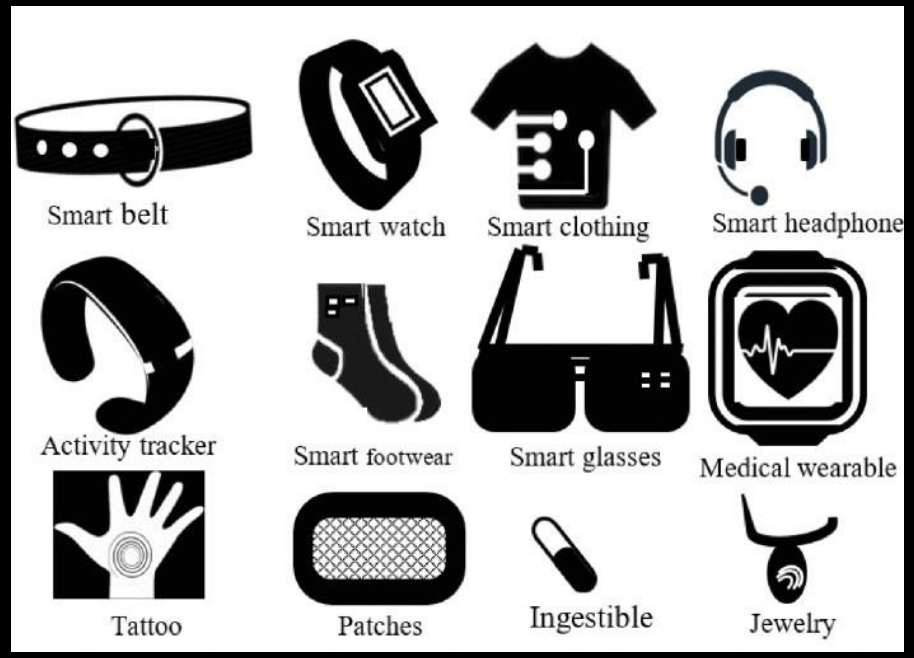


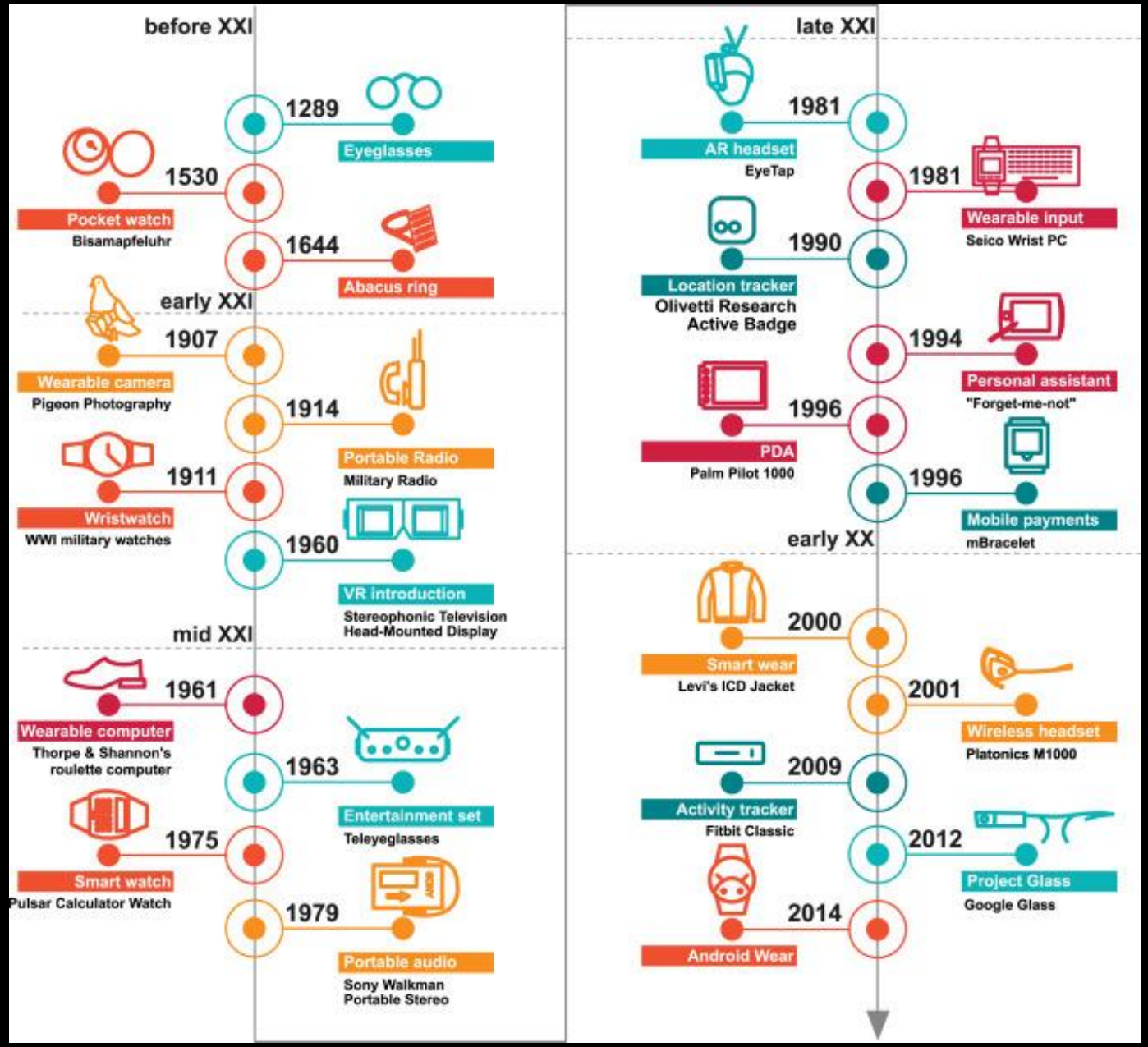
Bioreceptor

2

1. Illustration from Zeammer&Peacock YouTube Channel : https://www.youtube.com/watch?v=9lVmGDgVFdQ&t=9s
2. Representation suggestions of a molecule. Free images from pixabay.com

02| WEARABLE IOT DEVICES





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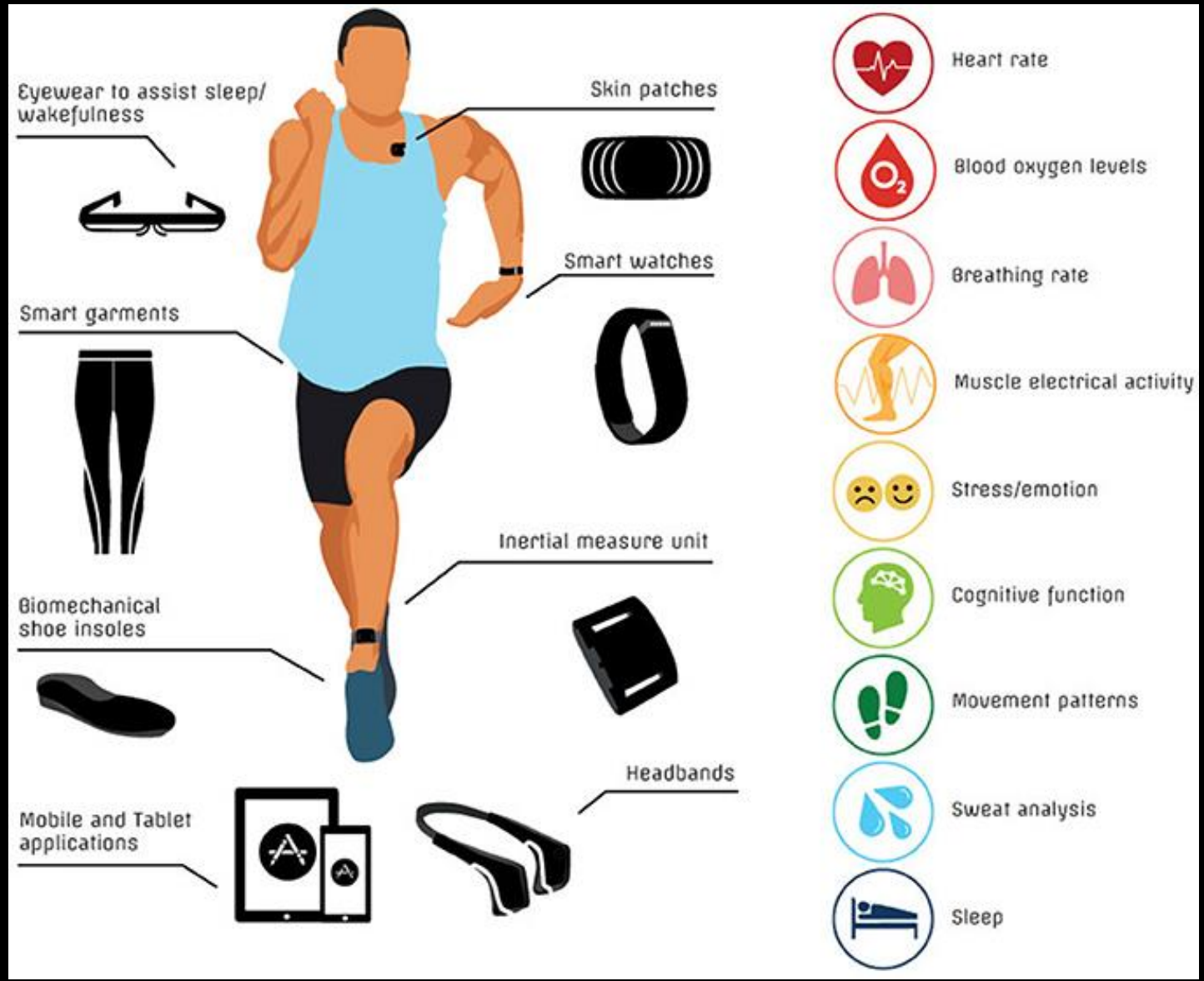
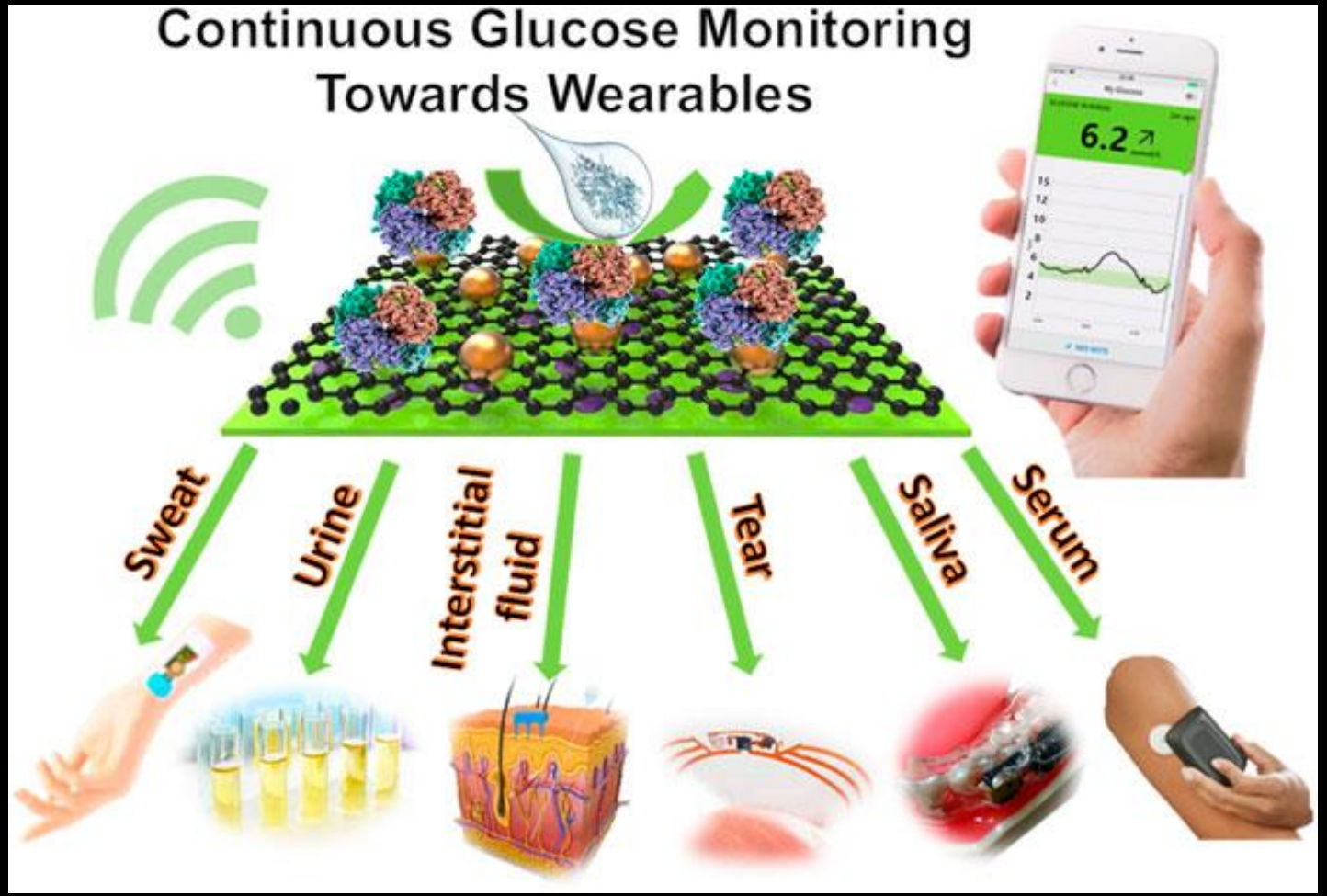
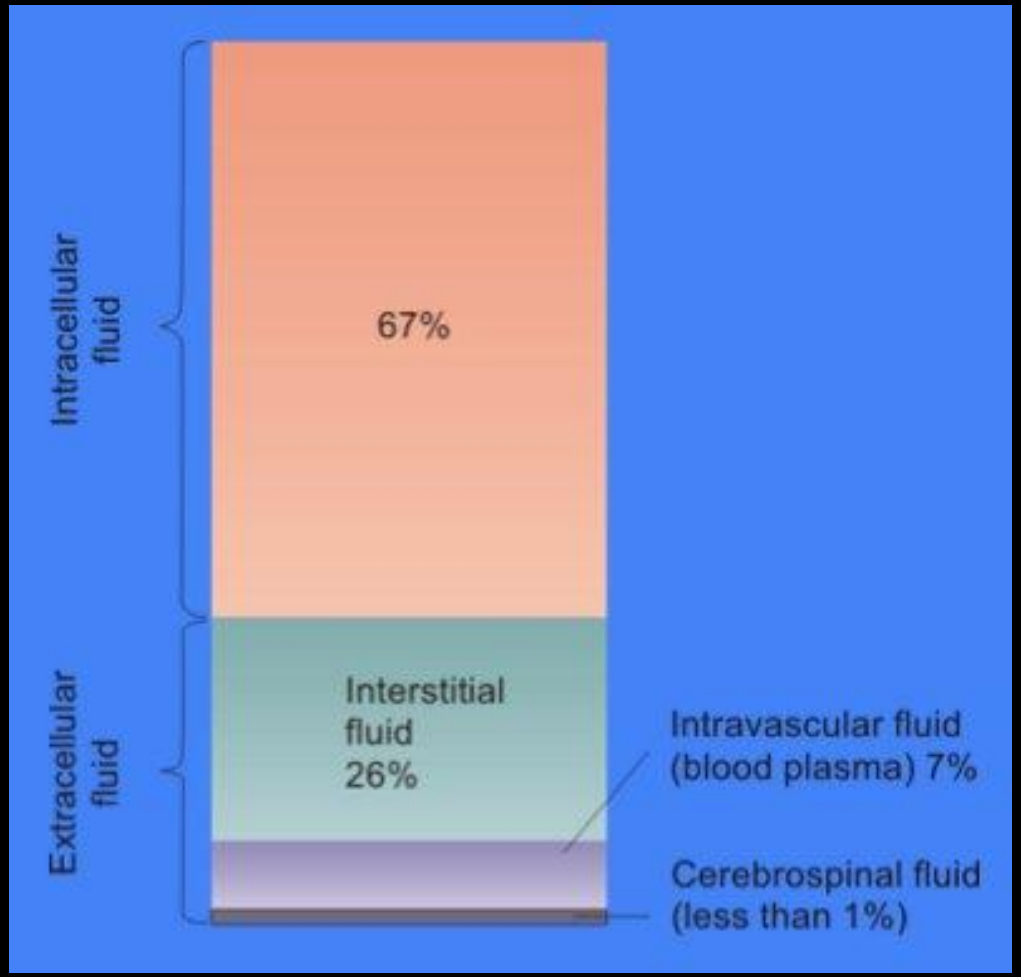


02| WEARABLES BIOSENSORS – BODY FLUIDS





02| WEARABLES BIOSENSORS

Continuous Glucose Monitoring (CGM)

MiniMed

GlucoWatch

02| COMERCIAL CGMs

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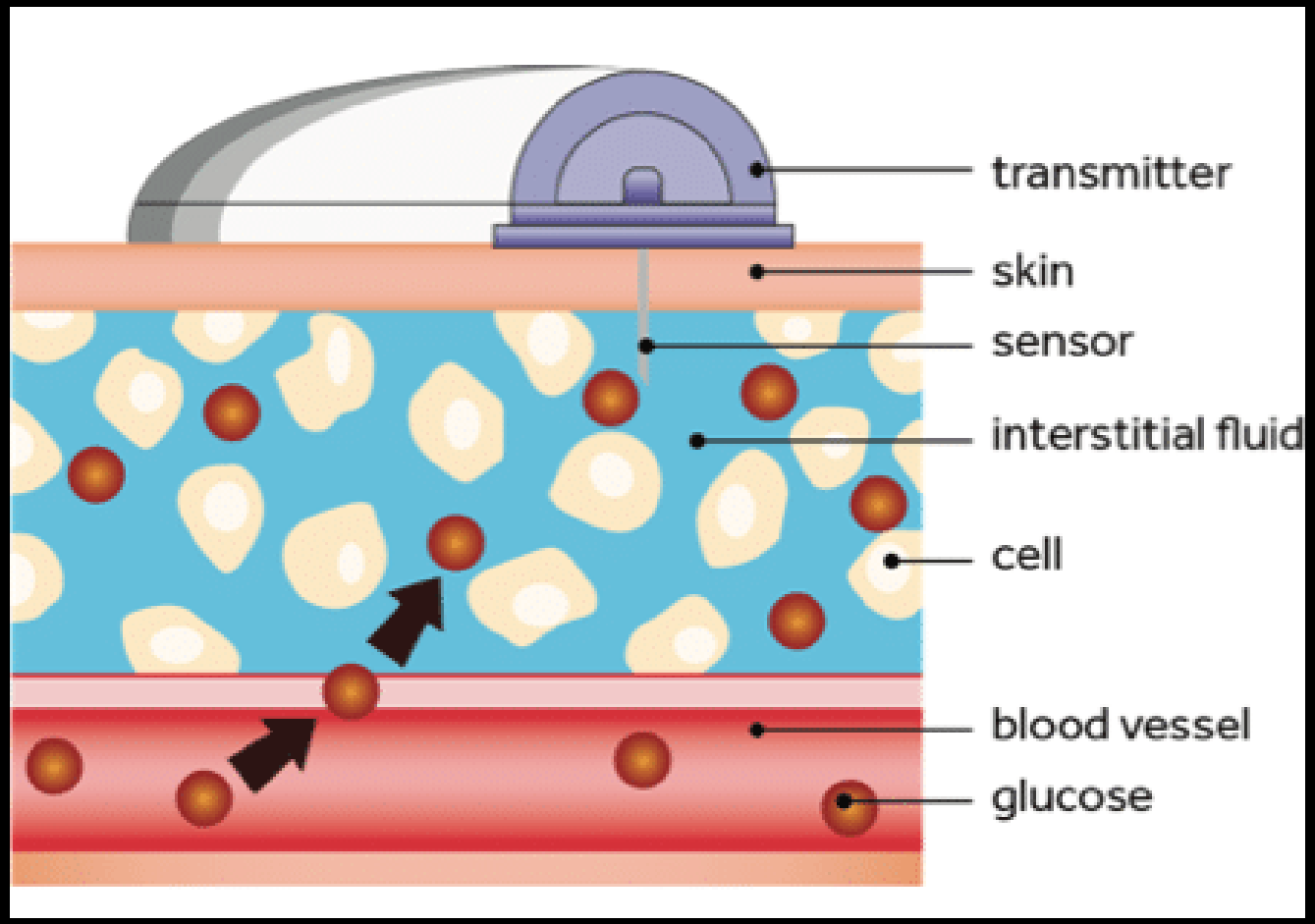
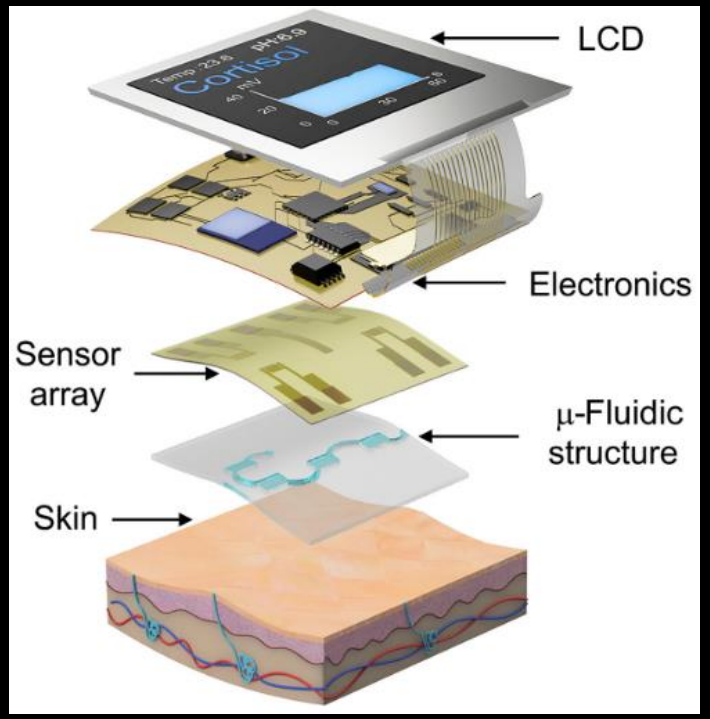


03| RELATED WORKS – NON-INVASIVE BIOSENSORS

Kim, J. et al. [1]

University of California

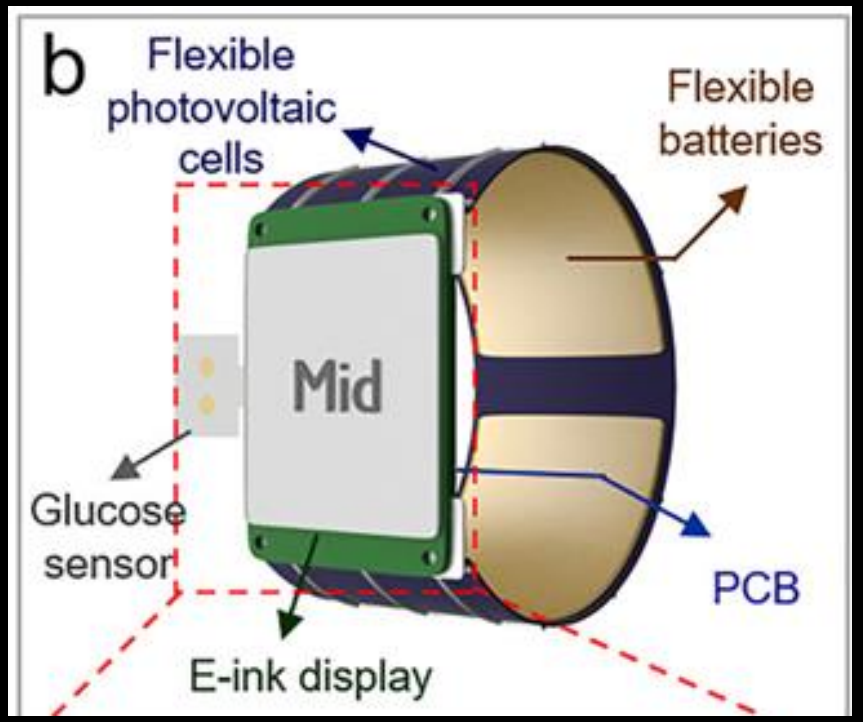
2018



Wang, B. et al. [2]

University of California

2022



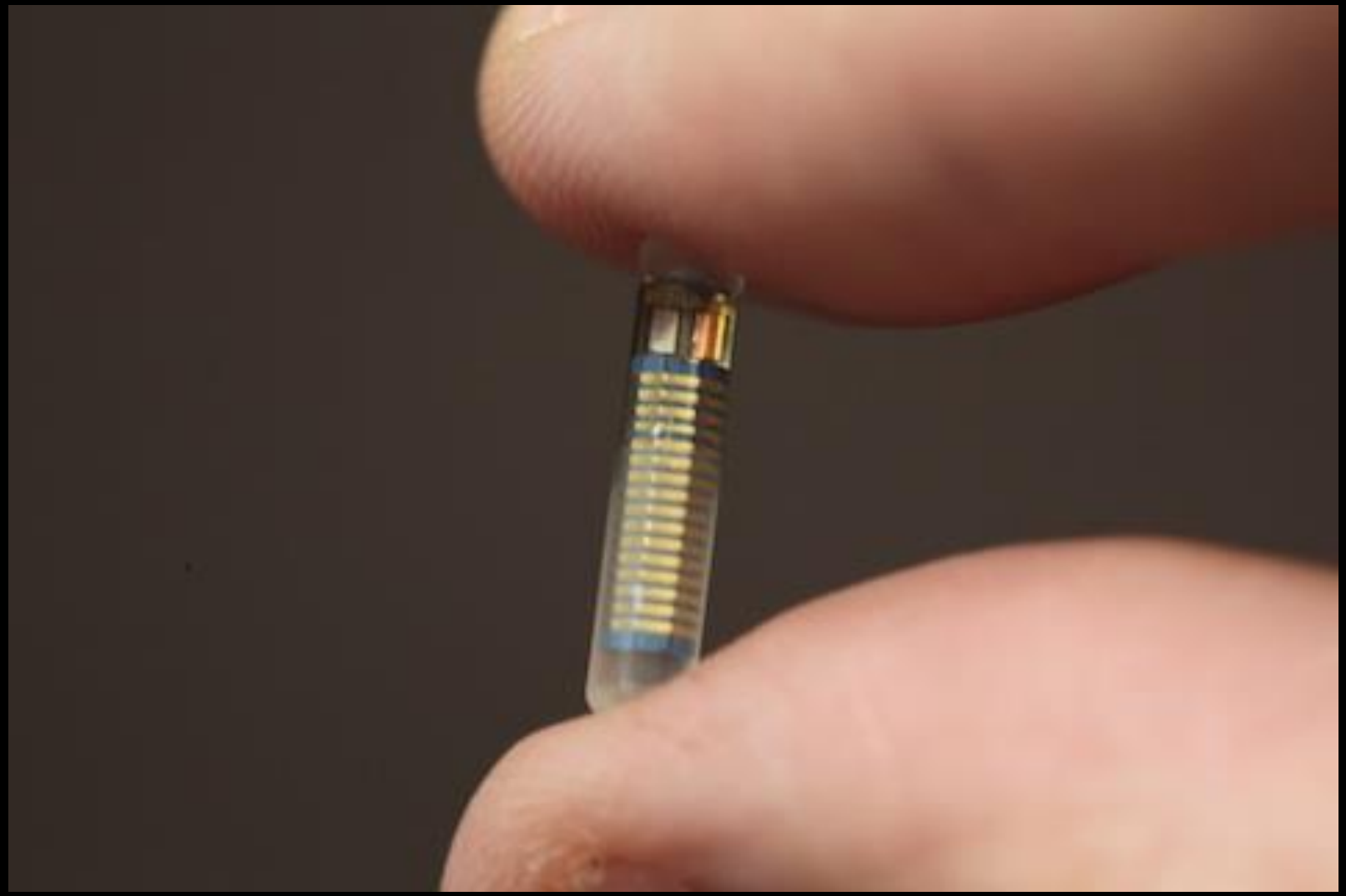
Zhao, J. et al. [3]

2019

1. Jayoung Kim et al. Simultaneous monitoring of sweat and interstitial fluid using a single wearable biosensor platform, 2018
2. Wang, B. et al. Wearable aptamer-field-effect transistor sensing system for noninvasive cortisol monitoring. Science advances, 2022
3. https://pubs.acs.org/doi/full/10.1021/acssensors.9b00891

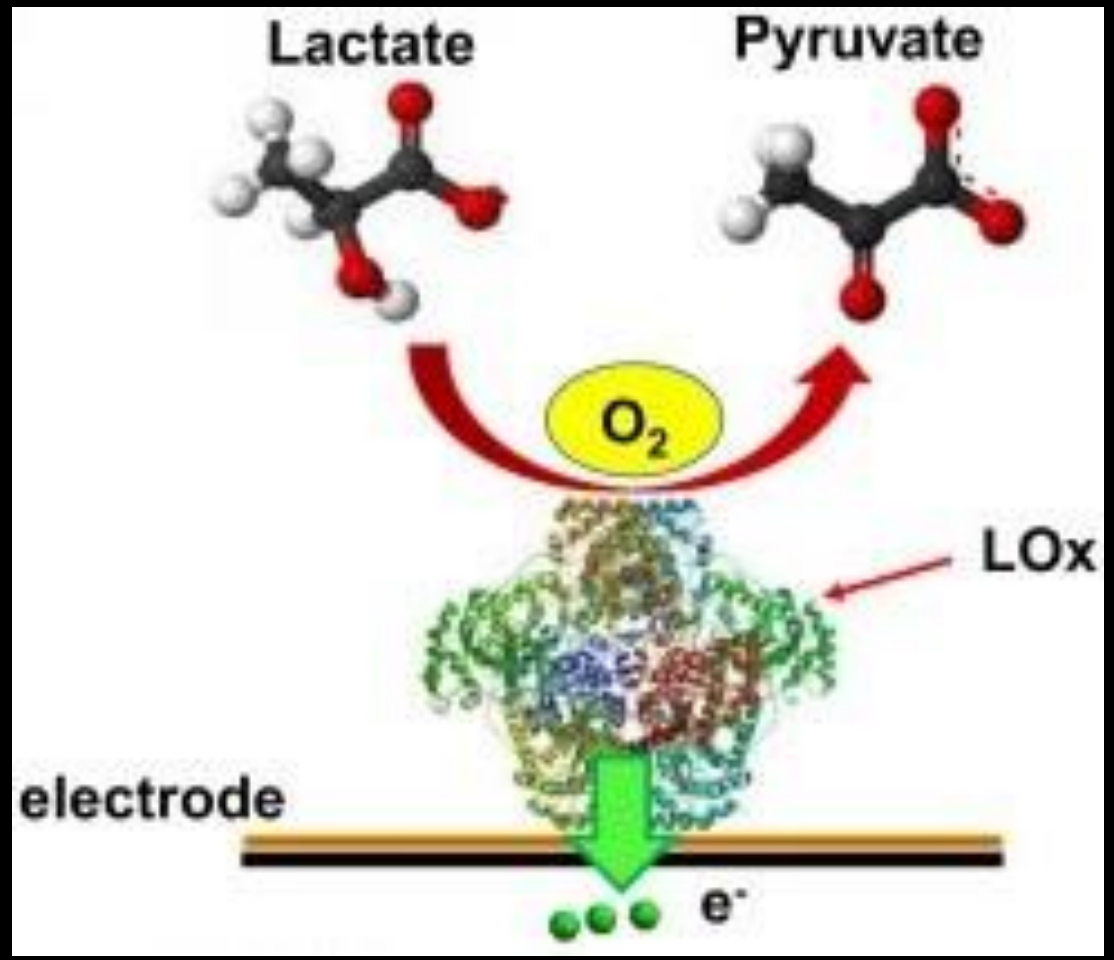
03| RELATED WORKS Thesis

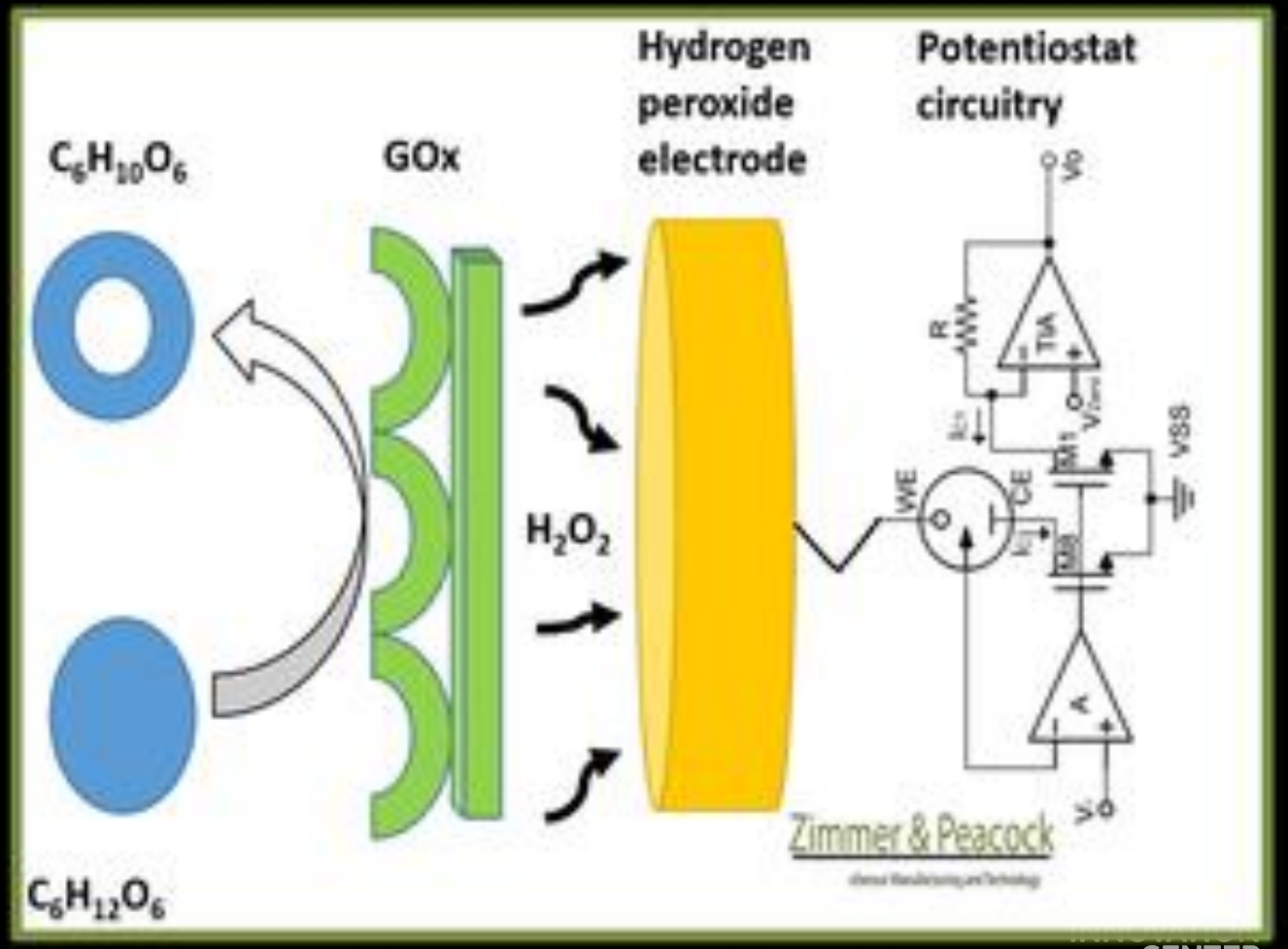
03| IMPLANTED CGM (SENSEONICS)



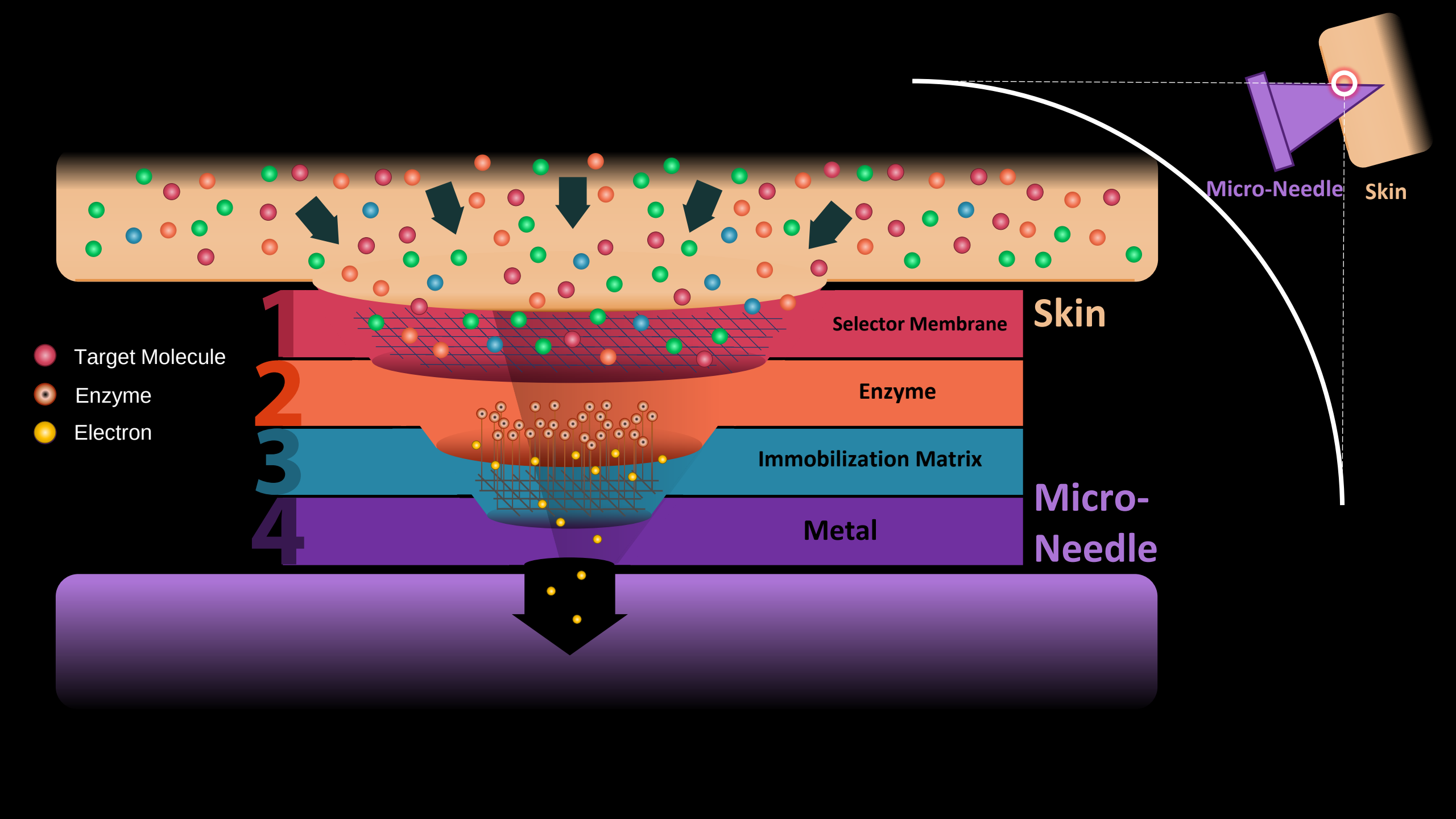
03| RELATED WORKS – K'WATCH, PKVITALITY

03| ENZYMATIC BIOSENSORS





CENTER

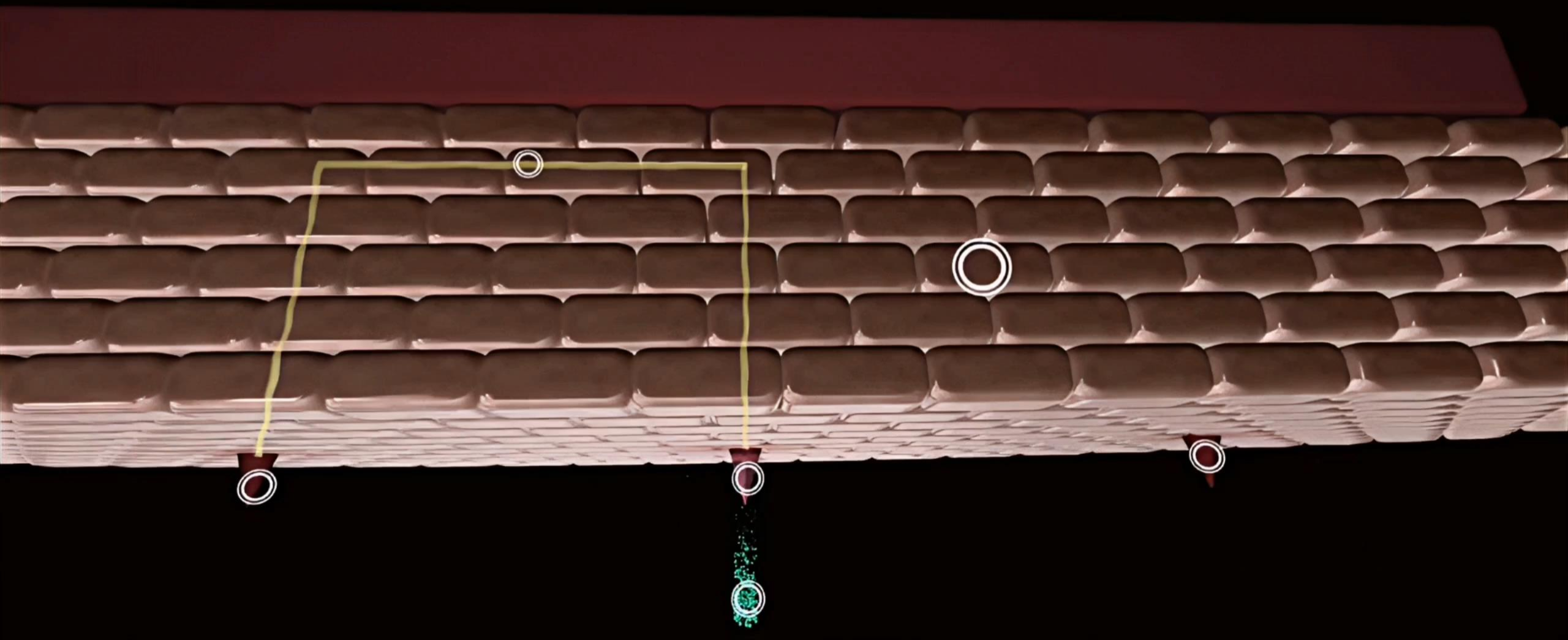

Micro-Needle
Skin
Target Molecule
Enzyme
Electron
1
2
3
4
Selector Membrane
Enzyme
Immobilization Matrix
Metal
Skin
Micro-
Needle

A biosensor is a device that combines a biological component with a physicochemical detector to recognize and measure specific molecules or substances in a sample. A microneedle-based biosensor can penetrate the skin to perform real-time biological measurements. The micro-needles typically range from 0.1 to 1 millimeter, making them less invasive and more comfortable than traditional needle-based devices.

SIDEBAR

Glucose Concentration 130 mg/dL

Initial View



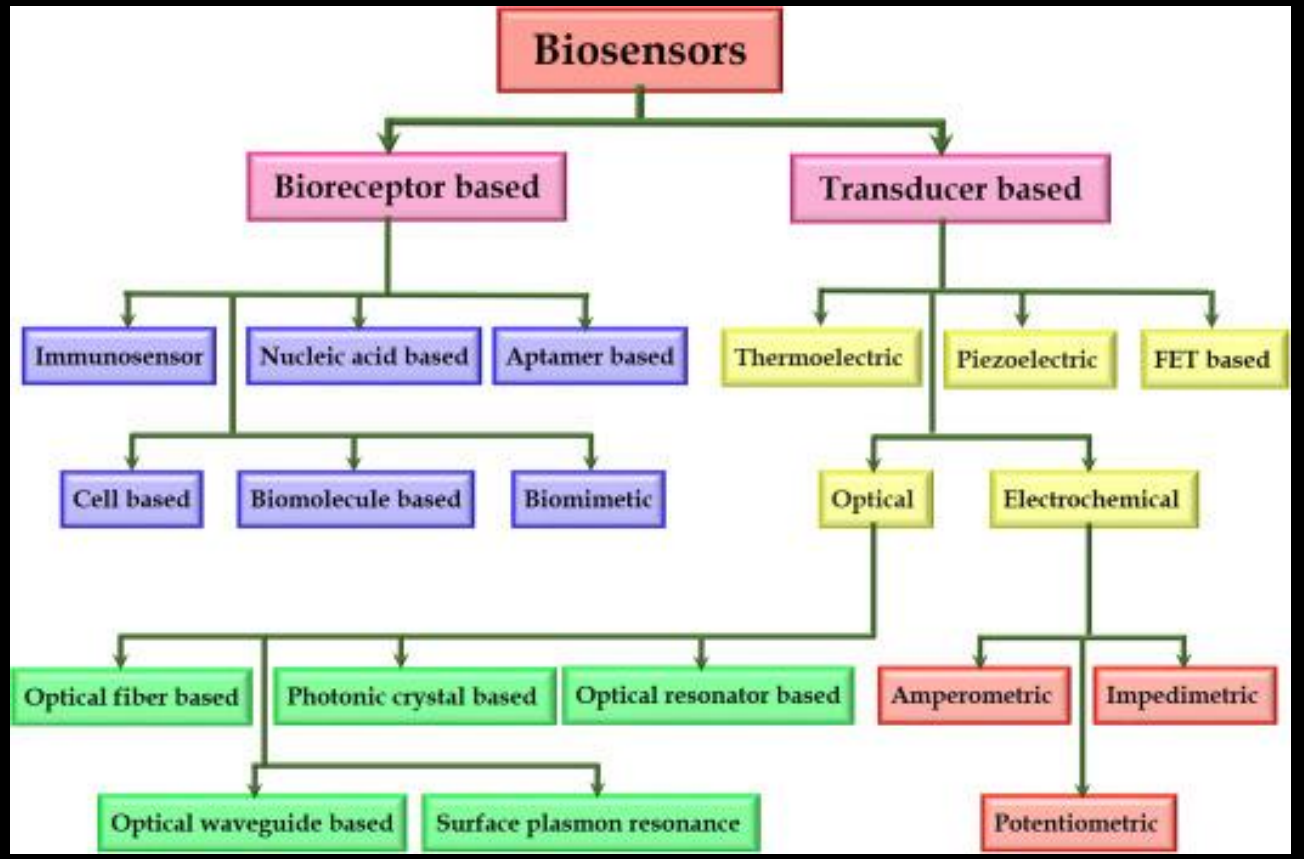
04| BIOSENSORS CLASSIFICATIONS

Based on **Biological Element**:

1. Enzyme-based biosensors
2. Tissue-based biosensors
3. Immunosensors
4. DNA biosensors
5. Other biological elements such as microorganisms, cells, and acids.

Based on **Method of Transduction**:

1. Electrochemical biosensors
2. Optical biosensors
3. Mass-based biosensors
4. Thermal and piezoelectric biosensors.



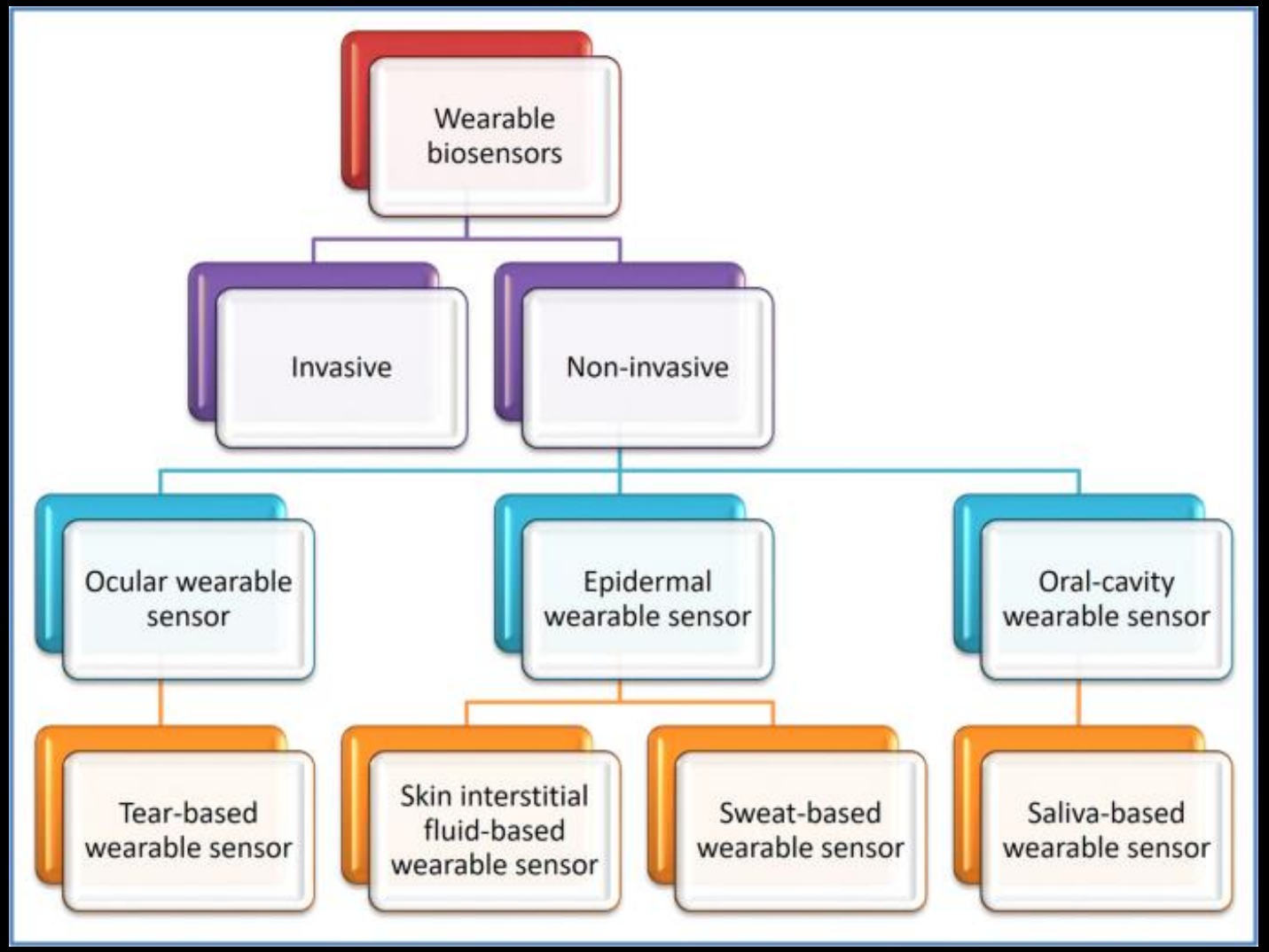
04| WEARABLE BIOSENSORS CLASSIFICATIONS

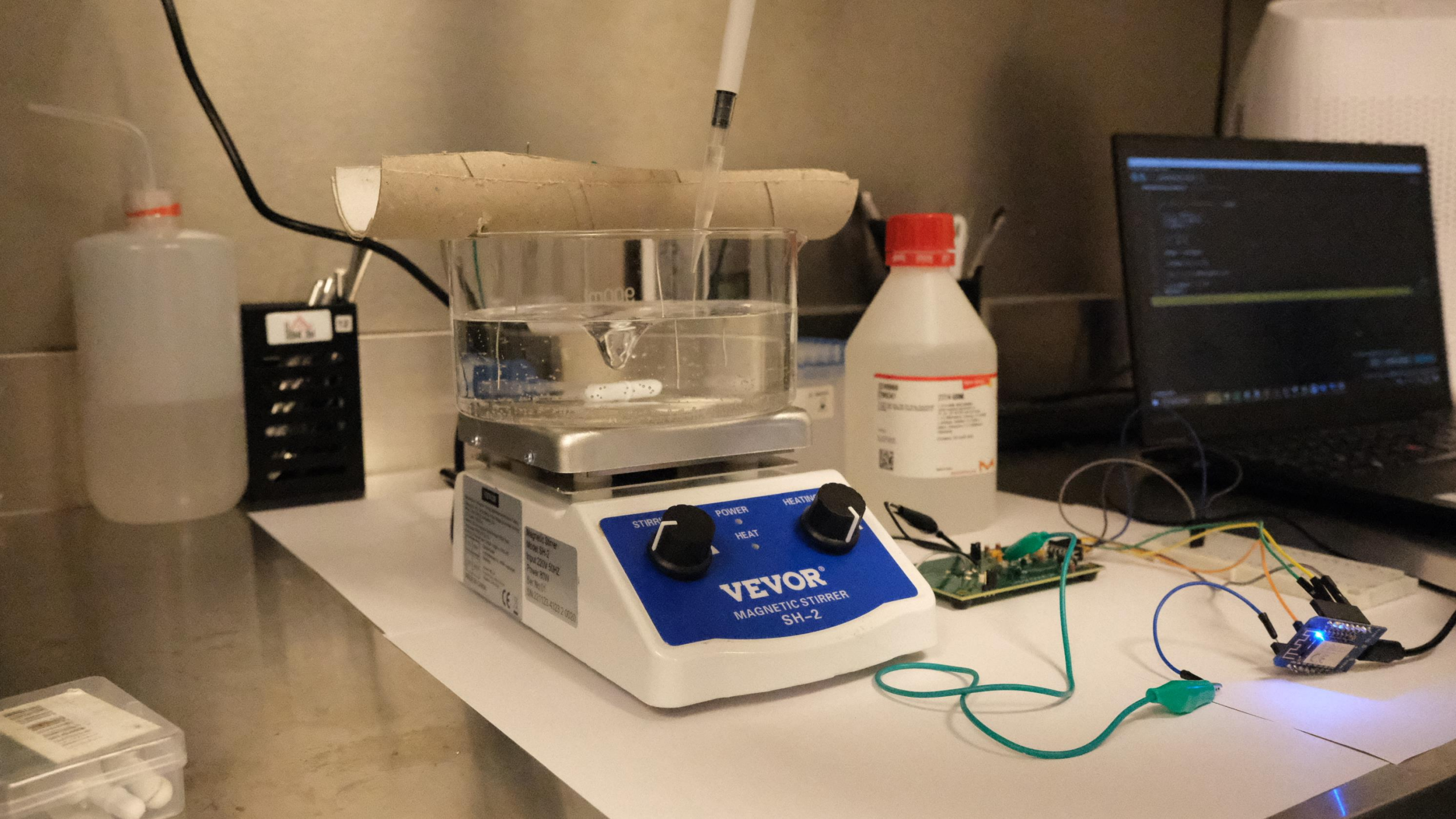
Based on **Body fluid**:

1. Enzyme-based biosensors
2. Tissue-based biosensors
3. Immunosensors
4. DNA biosensors
5. Other biological elements such as microorganisms, cells, and acids.

Based on **invasiveness**:

1. Implantable biosensors
2. Invasive biosensors
3. Minimally-invasive biosensors
4. No-invasive biosensors

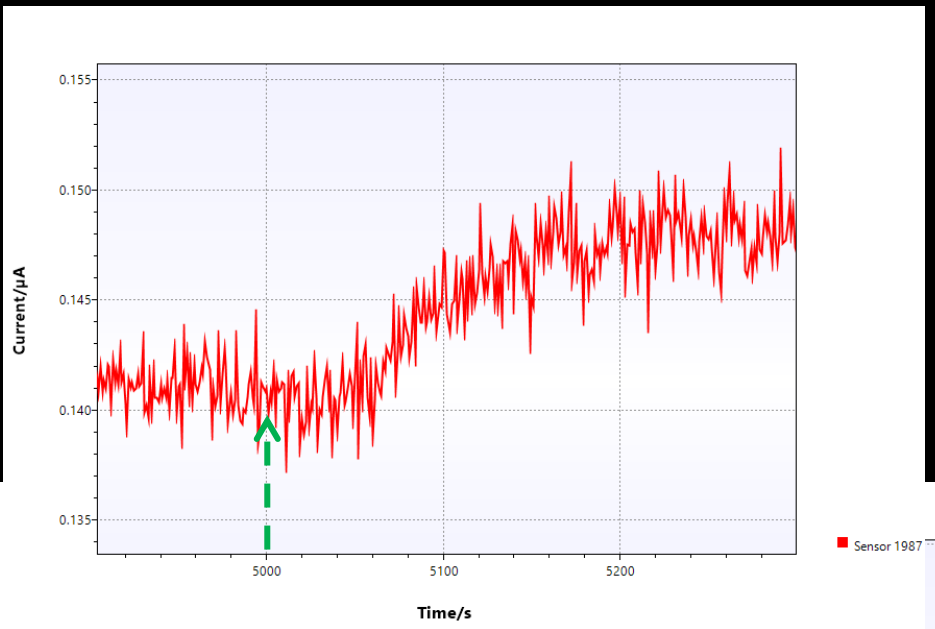



POWER
HEAT
VEVOR
MAGNETIC STIRRER
SH-2

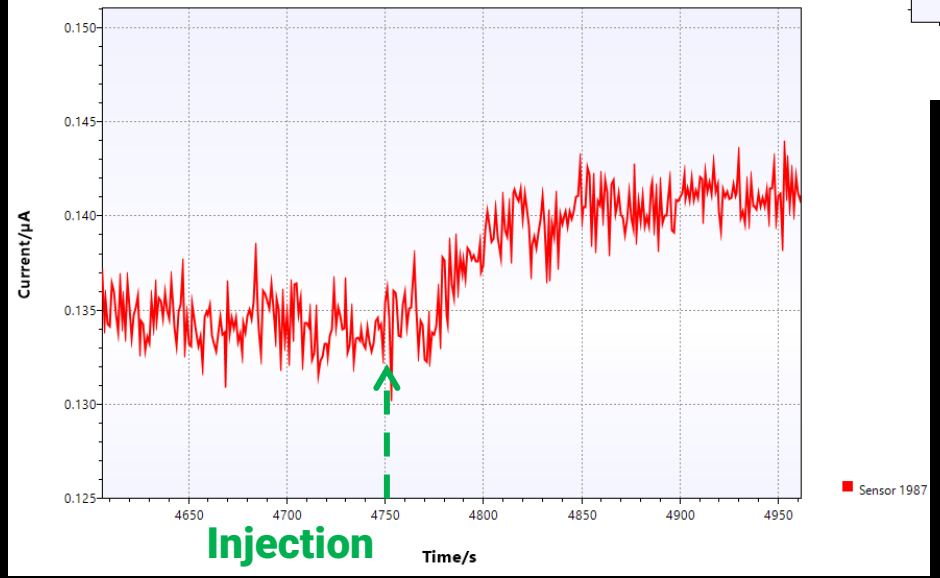
05| SENSOR CHARACTERIZATION – IN VITRO TESTING

Sensitivity: 1.8 µA / mM
Linearity: NA
LOD: 5mM
SNR: Low

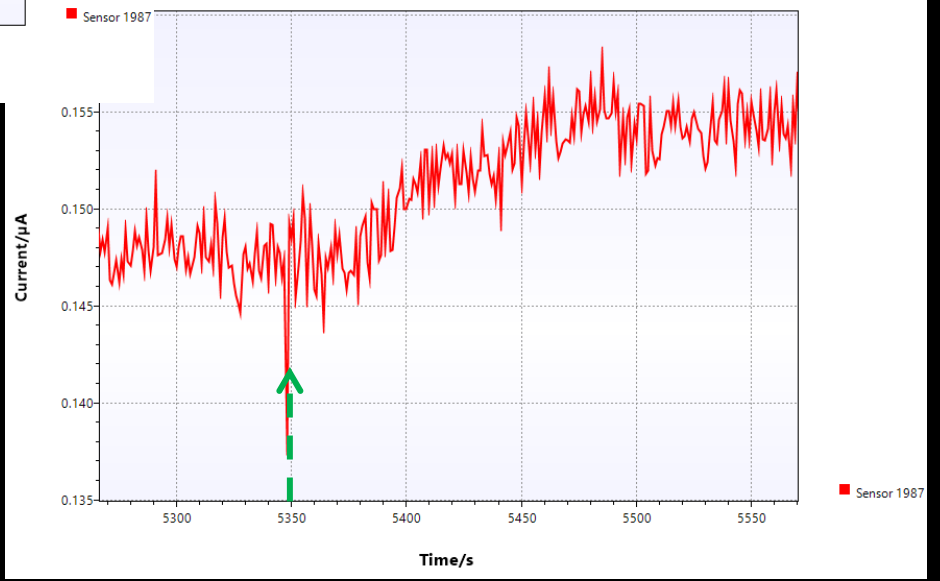
5 mM → 10 mM
7 nA



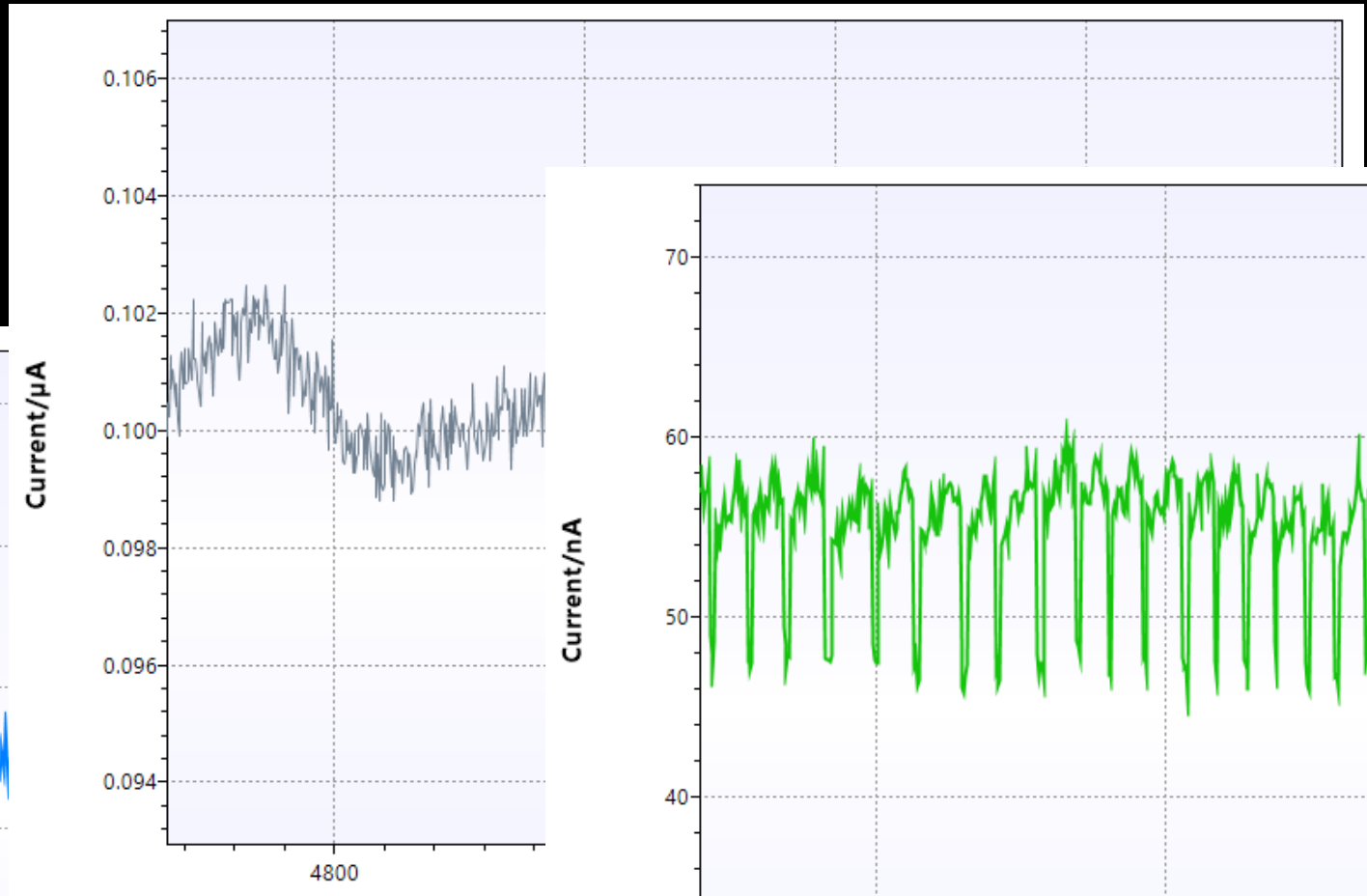
15 mM → 20 mM
12 nA

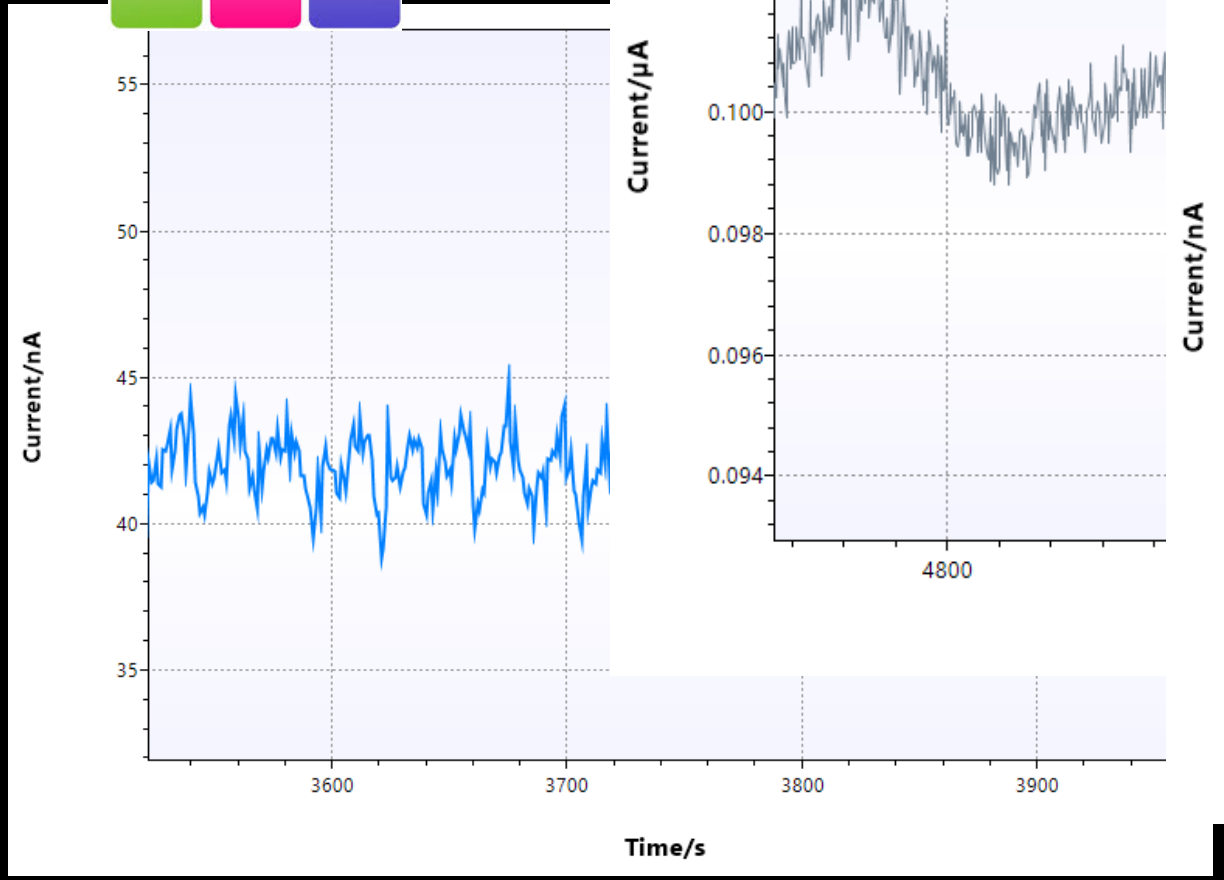


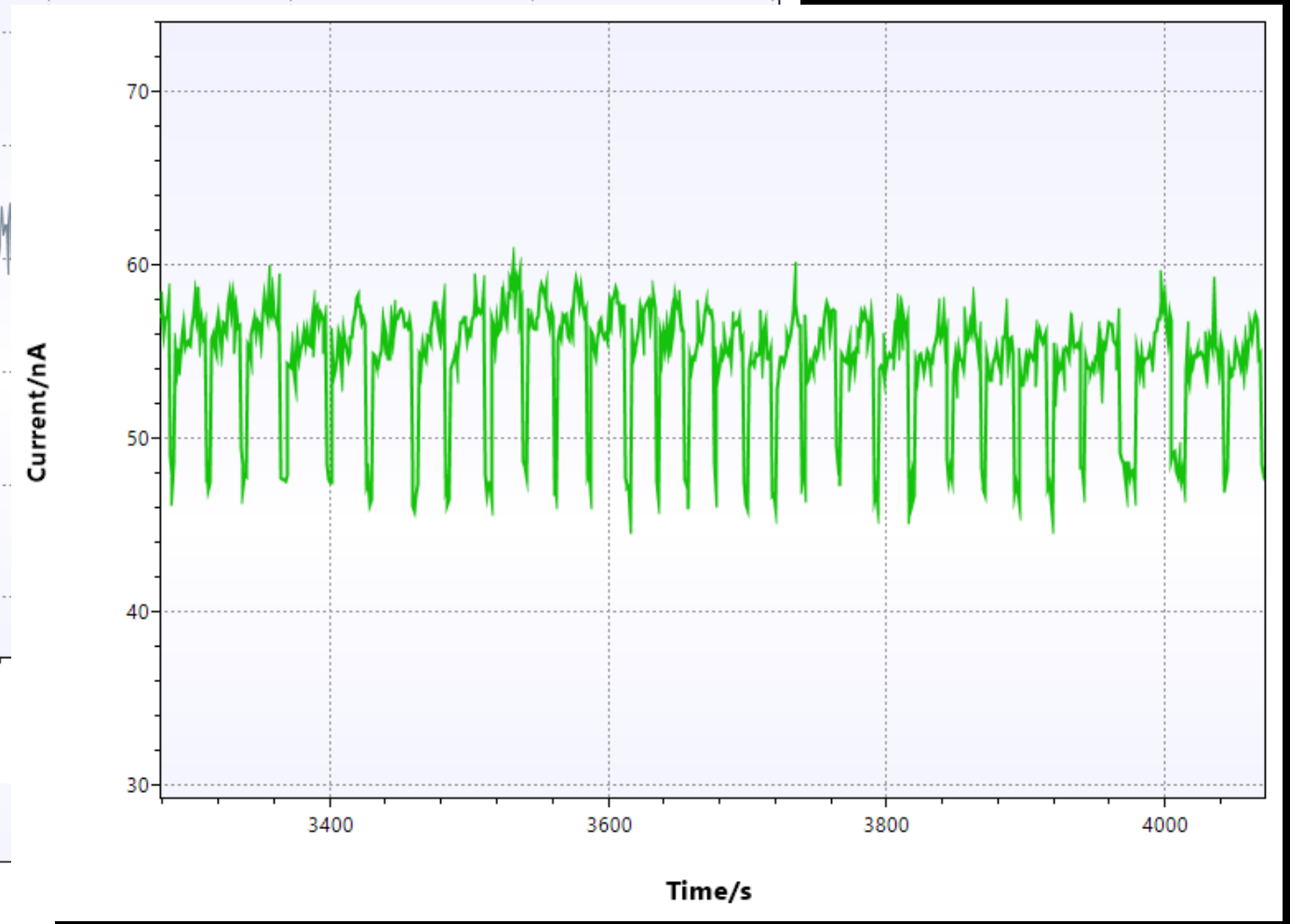
10 mM → 15 mM
8 nA



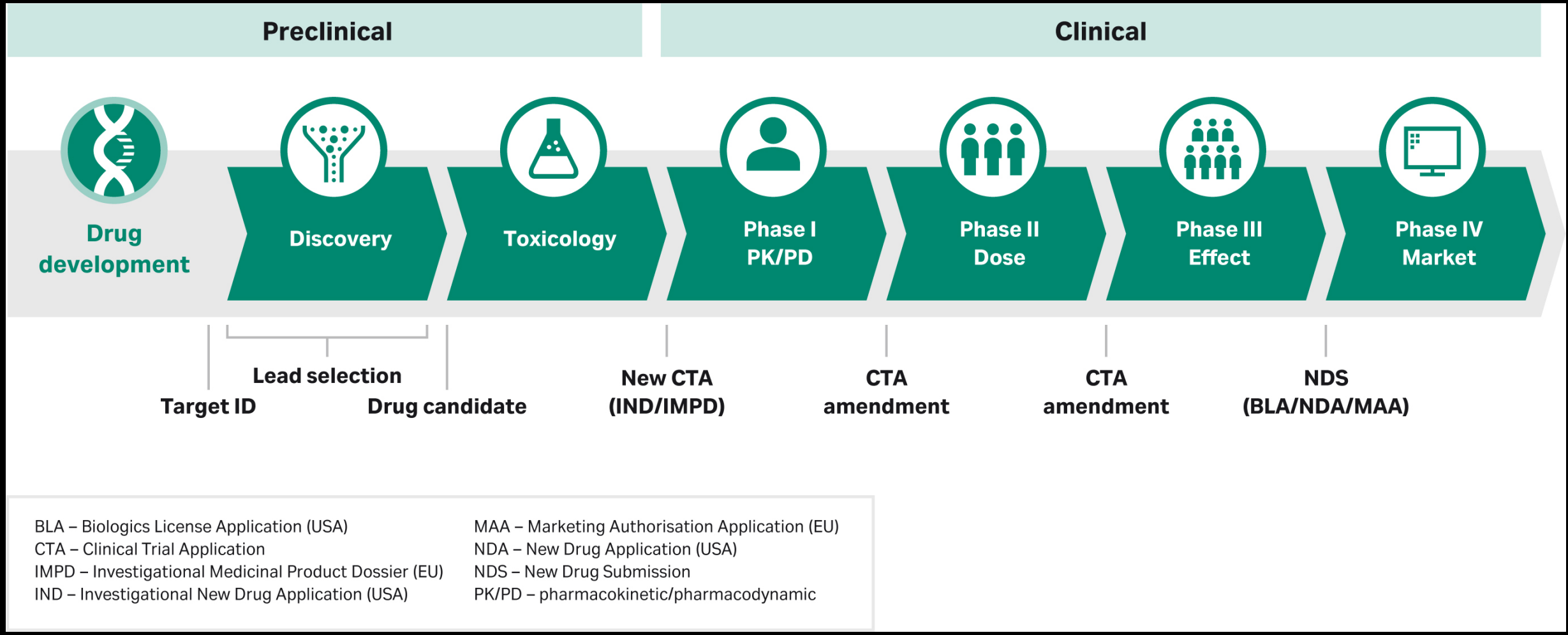
05| SENSOR CHARACTERIZATION – IN VITRO TESTING







06| CLINICAL PRODUCT DEVELOPMENT STAGE



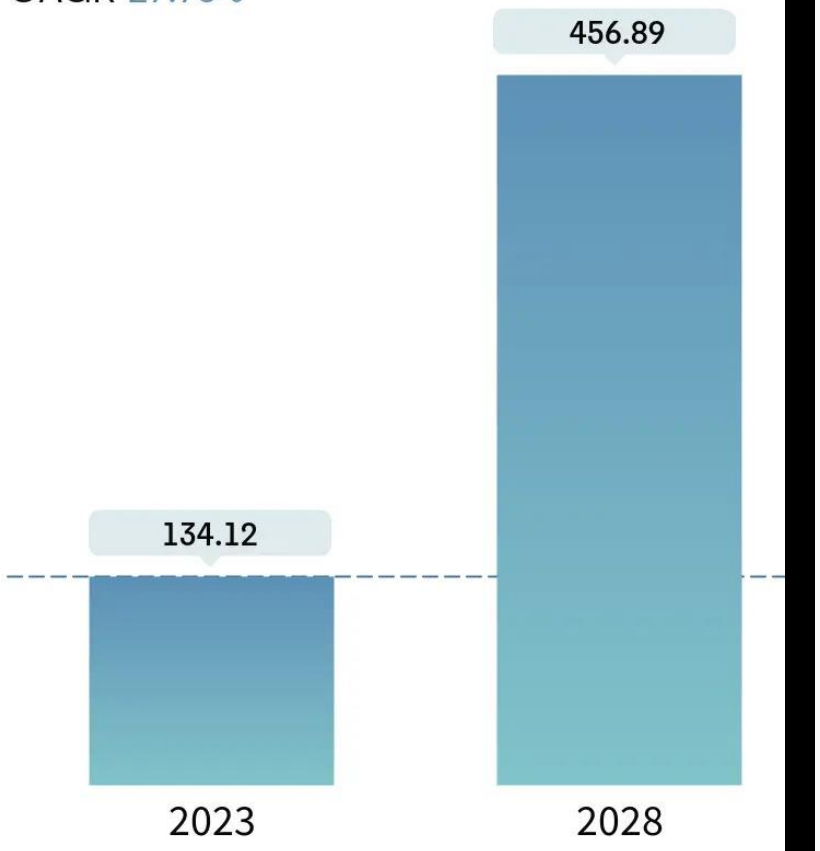
BLA – Biologics License Application (USA)
CTA – Clinical Trial Application
IMPD – Investigational Medicinal Product Dossier (EU)
IND – Investigational New Drug Application (USA)
MAA – Marketing Authorisation Application (EU)
NDA – New Drug Application (USA)
NDS – New Drug Submission
PK/PD – pharmacokinetic/pharmacodynamic

Why SmartWatches?

Smartwatch Market

Shipment Volume in Million Units

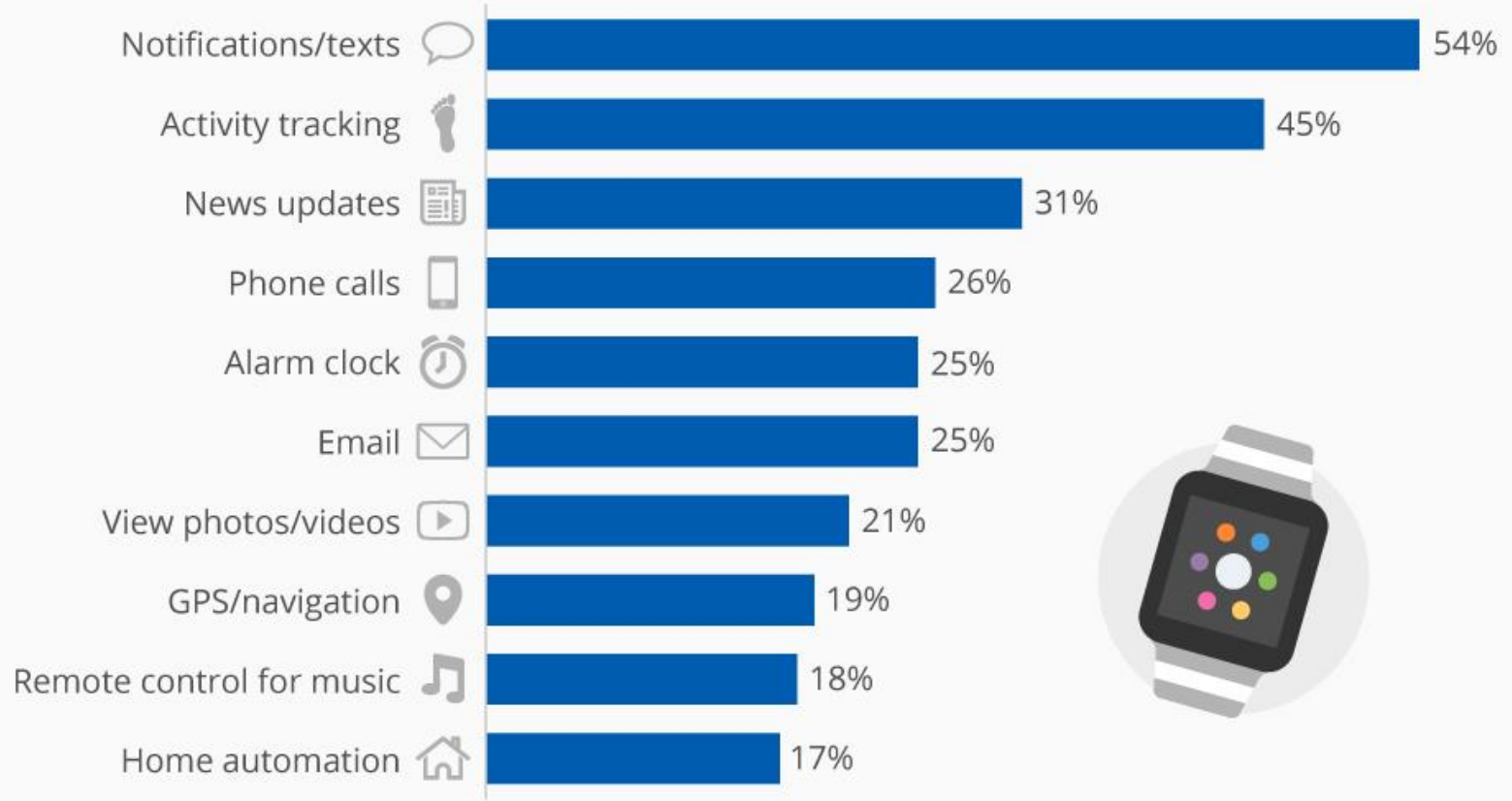
CAGR 27.78%



Source : Mordor Intelligence

What Smartwatches Are Actually Used For

Percentage of smartwatch owners that use each function daily



Based on a June 2017 survey of 5,000+ U.S. consumers aged 18+ of which 9% owned a smartwatch

@StatistaCharts

Source: NPD Connected Intelligence/WEAR

statista

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QUESTIONS

Contact
vivienperrelle@gmail.com