Intracorporal Nanonetwork

Brief summary

Version 1. Last Update: December 10th, 2021

Mik Andersen

Schematic of the intracorporal nanonetwork

Schematic of the intracorporal nanonetwork

- The nanonetwork is a set of objects and elements with the **ability to interact with each other, by means of signals** in the form of pulses, electromagnetic waves and electric fields, being also capable of operating in the molecular spectrum.

- These components may be **already assembled or pending self-assembly** when the conditions of temperature, magnetism and environment are suitable.

- Within the nanonetwork, two types or strands can be distinguished:

  1. **The one that is fixed in the brain**

  2. **The one that is fixed in the rest of the body**

Schematic of the intracorporal nanonetwork

Brain nanonetwork

- It aims to form a **neuronal interface to interact with the cognitive, physical and electrical processes of brain activity** for neuromodulation, neurostimulation and neurocontrol.
- This requires the introduction of carbon nanotubes that can be used to **link neurons, shortening the natural distance of axons**. This can also be achieved with graphene quantum dots and graphene nanosheets, although the literature makes explicit that single-walled carbon nanotubes SWCNT or multi-walled carbon nanotubes MWCNT are the key element.
- The carbon nanotubes together with the hydrogel in which they are coated, **act as electrodes, picking up the fluctuations of the electrical activity of the neurons**, with sufficient sensitivity to determine the segregation of neurotransmitters.

Schematic of the intracorporal nanonetwork

- The electrical activity can be transmitted through the carbon nanotubes, as **signals triggered by the molecular activity of the brain tissue** that surrounds them, so that a map of the individual's brain activity can be obtained in real time.
- Since the carbon nanotubes are tubular graphene structures, they can propagate the electrical signals to other components of the nanonetwork, these are the nearest nanorouter or nanocontrollers.
- The nanorouters are responsible for **receiving the electrical signal, decoding it, configuring the data packets and the recipient** of the information, providing MAC identification and a destination IP address. Additionally, this information can be encrypted to increase the security of the system and prevent bio-hacking.
- To transmit the signal to the outside of the body, a nanointerface is required, which could have several functions, on the one hand the encryption of the data packets and on the other hand, increase the frequency, so that it can be **propagated outside the body at a sufficient distance**.

Schematic of the intracorporal nanonetwork

Body nanonetwork

- Unlike the brain nanonetwork, it **does not require carbon nanotubes to operate and can be based entirely on the theory of electromagnetic communication**. Recall that the brain nano-network additionally works on molecular communication.

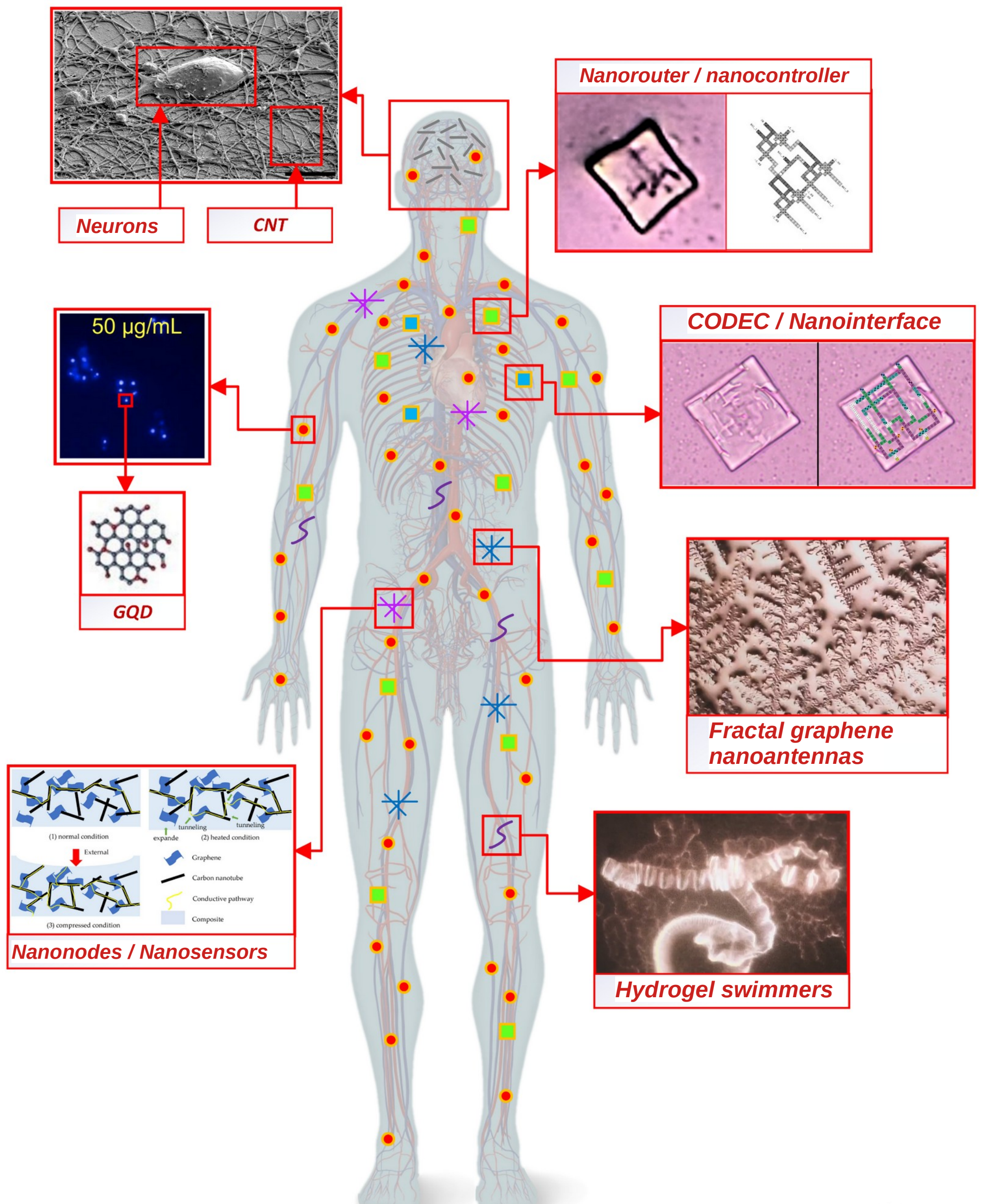
- This network **employs all kinds of nanodevices and nanonodes**, in particular graphene GQD quantum dots, but also nanodevices or nanosensors made of hydrogel, carbon nanotubes and graphene sheets (not necessarily pre-formed).

- All components, whether nanosensors, nanodevices, or GQD graphene quantum dots, **can transmit and repeat signals**, so that they act as nanoantennas, transmitters and receivers, in target organs and tissues.

Schematic of the intracorporal nanonetwork

- The **possible data that can be obtained** are vital signs, cardiac activity, respiratory activity, blood composition, degree of oxygenation, etc. The literature describes a multitude of nanosensors based on graphene and carbon nanotubes, among other components.
- It is obtained thanks to graphene GQD quantum dots, which circulate through the bloodstream, arteries, capillaries... These components are **electrically charged and can transport proteins** due to their adsorptive capacity. When passing near a fixed/attached biosensor in the human body (e.g. a network of carbon nanotubes with graphene nanosheets forming a simple circuit or transistor), it generates a potential differential and thus a signal that can be interpreted and transmitted. Do not forget the ability of the nanomaterial to act as nanoantennas.
- The signals are transmitted to the nearest nanocontroller or nanorouter, reproducing the same **signal propagation process, to the outside of the body**, by means of a component that acts as a nanointerface.

Schematic of the intracorporal nanonetwork



Mik Andersen

This diagram shows all the components that are introduced with each inoculation. Together they act as a network for monitoring the human body.

<u>Intracorporal nanonetwork components</u>

1. Carbon nanotubes and derivatives CNT, SWCNT, MWCNT
2. Graphene quantum dots GQD
3. Hydrogel swimmers
4. Fractal graphene nanoantennas
5. Nanorouter or Nanocontrollers
6. CODEC or Nanointerface

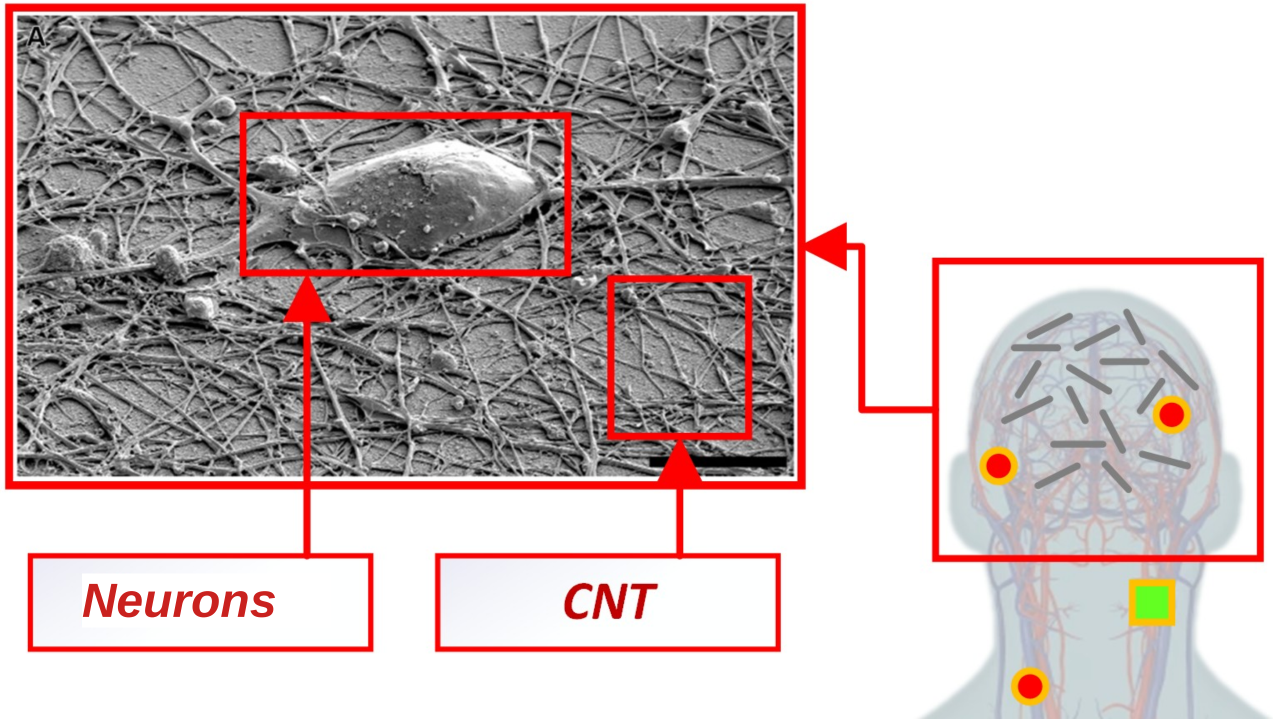
<u>Nanonetwork topology</u>

1. Nanonodes (GQD, Hydrogel swimmers, Nanotubes, Fibers)
2. Nanosensors (Nanotube circuits, graphene nanosheets)
3. Nanocontrollers (QCA nanorouter circuits)
4. Nanointerface (QCA nanoCODEC circuits)
5. => Communication with the outside =>

Analysis of the intracorporal network components

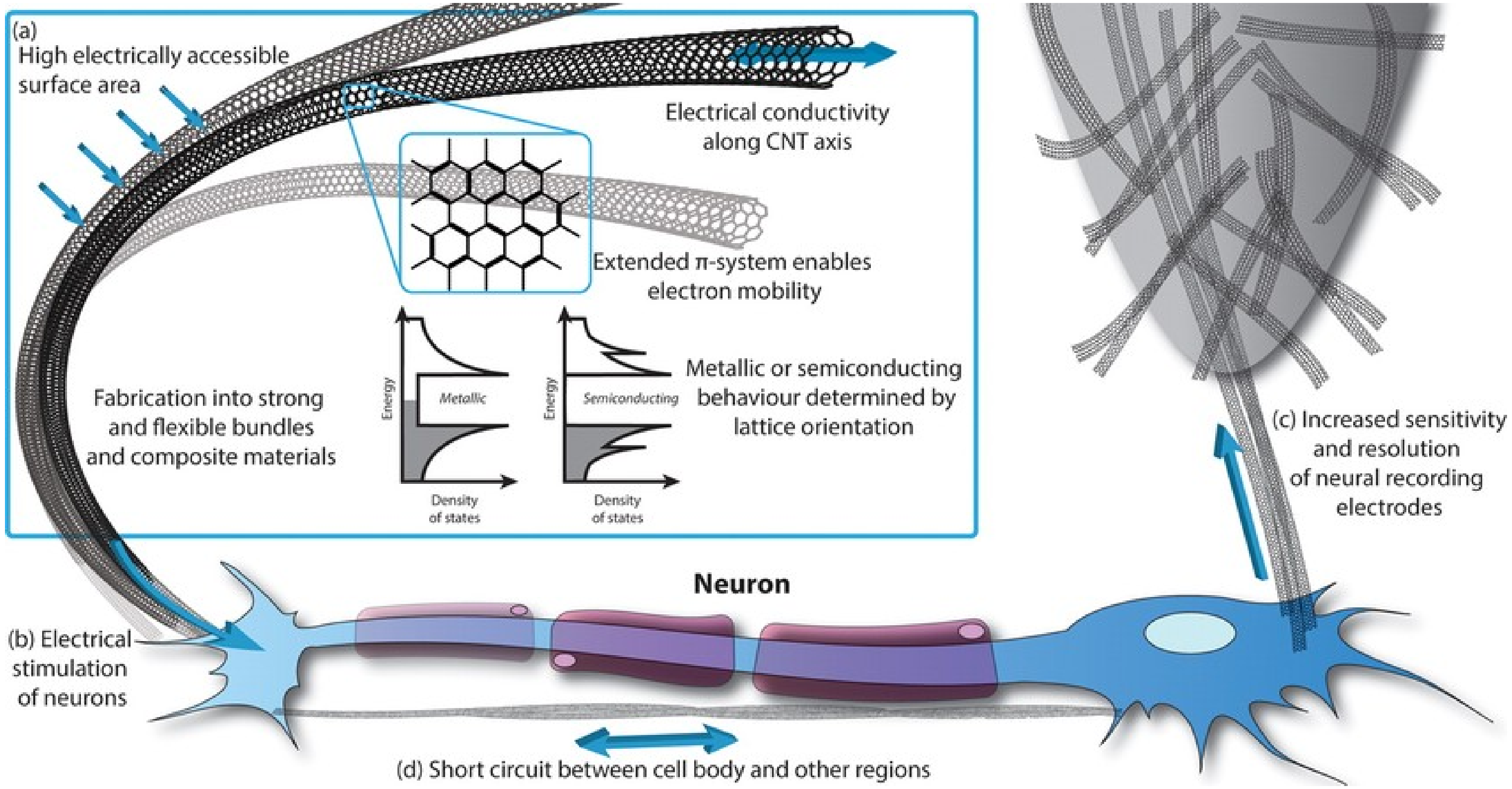
Analysis of the intracorporal network components

Carbon nanotubes in the brain



- The carbon nanotubes generate a mesh over the natural neuronal network, which makes it possible to **infer the synapse and interfere in its functioning**, using the appropriate stimuli.
- New connection routes between neurons are also generated, which **means that the natural networks are no longer used** in favor of the new structure, allowing neuromodulation, neurostimulation and monitoring of the individual's neuronal activity.

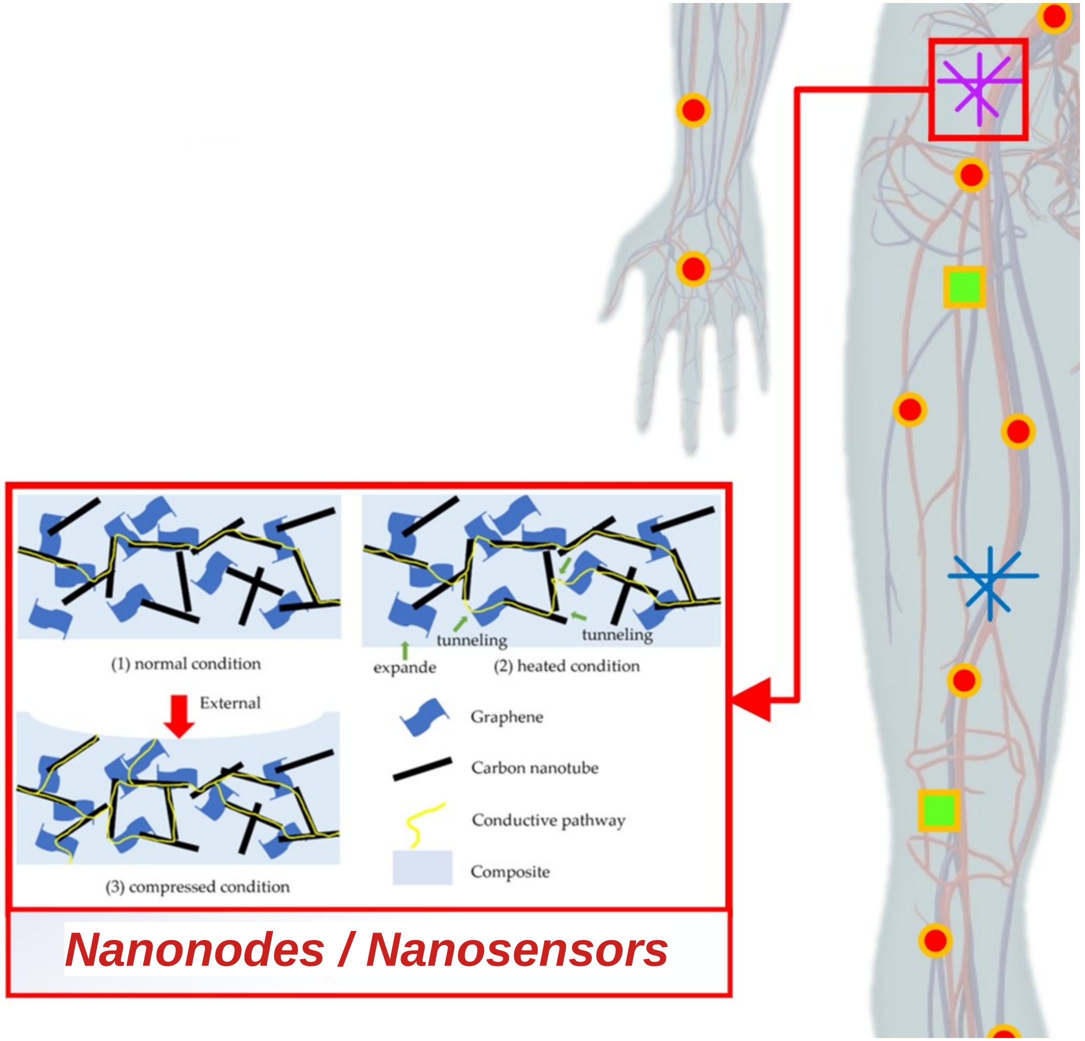
Analysis of the intracorporal network components



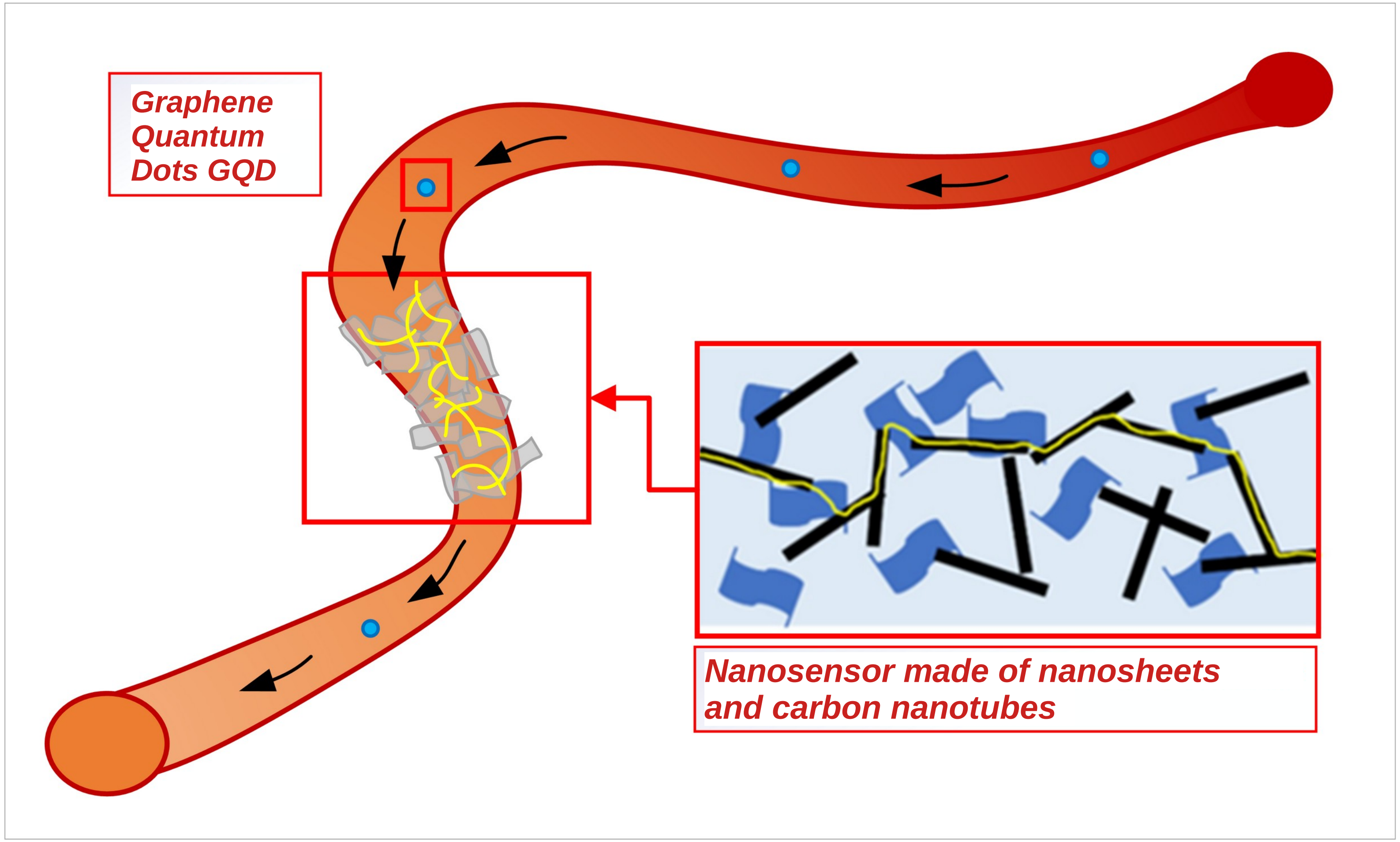
- This diagram shows how the nanotubes **act as electrodes** with which the neurons are stimulated.
- Since the graphene with which the **CNTs are formed is a superconductor**, it serves as an artificial axon.
- It should not be forgotten that the network of CNTs together with hydrogels **can form circuits** with which to obtain and propagate the signal from the neurons.

Analysis of the intracorporal network components

- **Nanosensors can be formed** in any part of the body, not only in the brain. Fundamentally in the endothelium and in the walls of blood vessels.
- These nanosensors do not have a predefined shape, **their organization is chaotic, although they form conductive routes** to transmit electrical signals of potential differential. This happens when a GQD (graphene quantum dot) approaches the nanosensor.
- Since nanosensors **can propagate signals**, they transmit any potential differential as a signal.

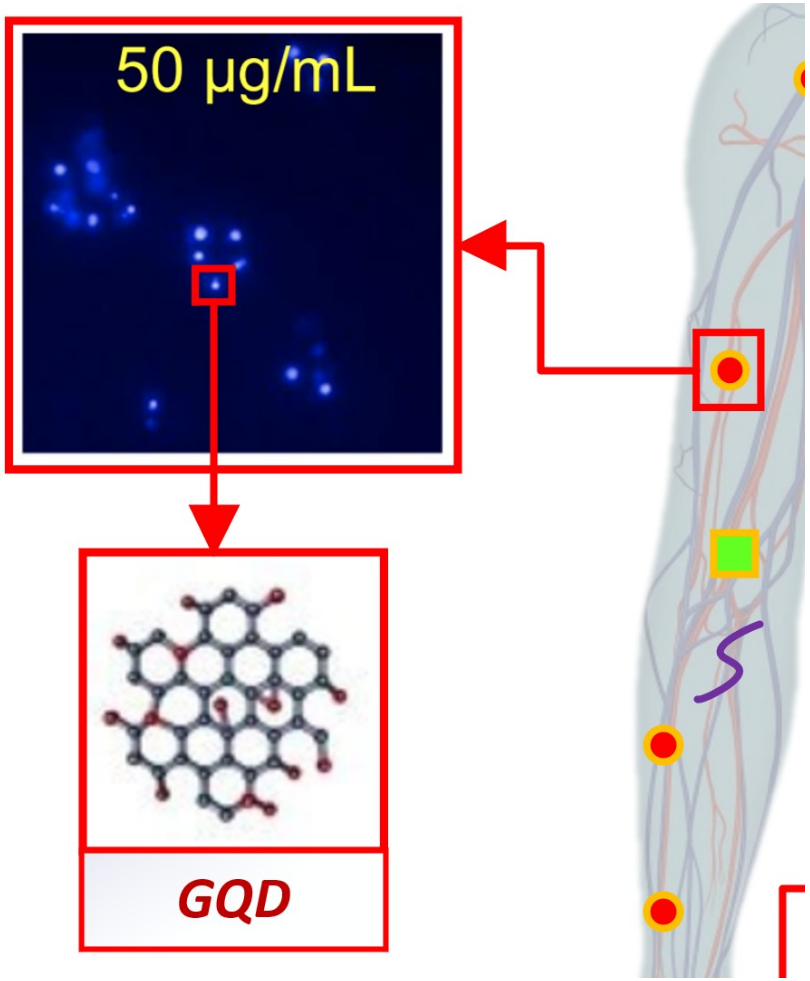


Analysis of the intracorporal network components



- Note how the **nanosensors attach** and conform to the artery wall, and monitor the GQDs crossing it through the bloodstream.
- This model **can be repeated throughout the body**, throughout the circulatory system and probably in the nervous system.

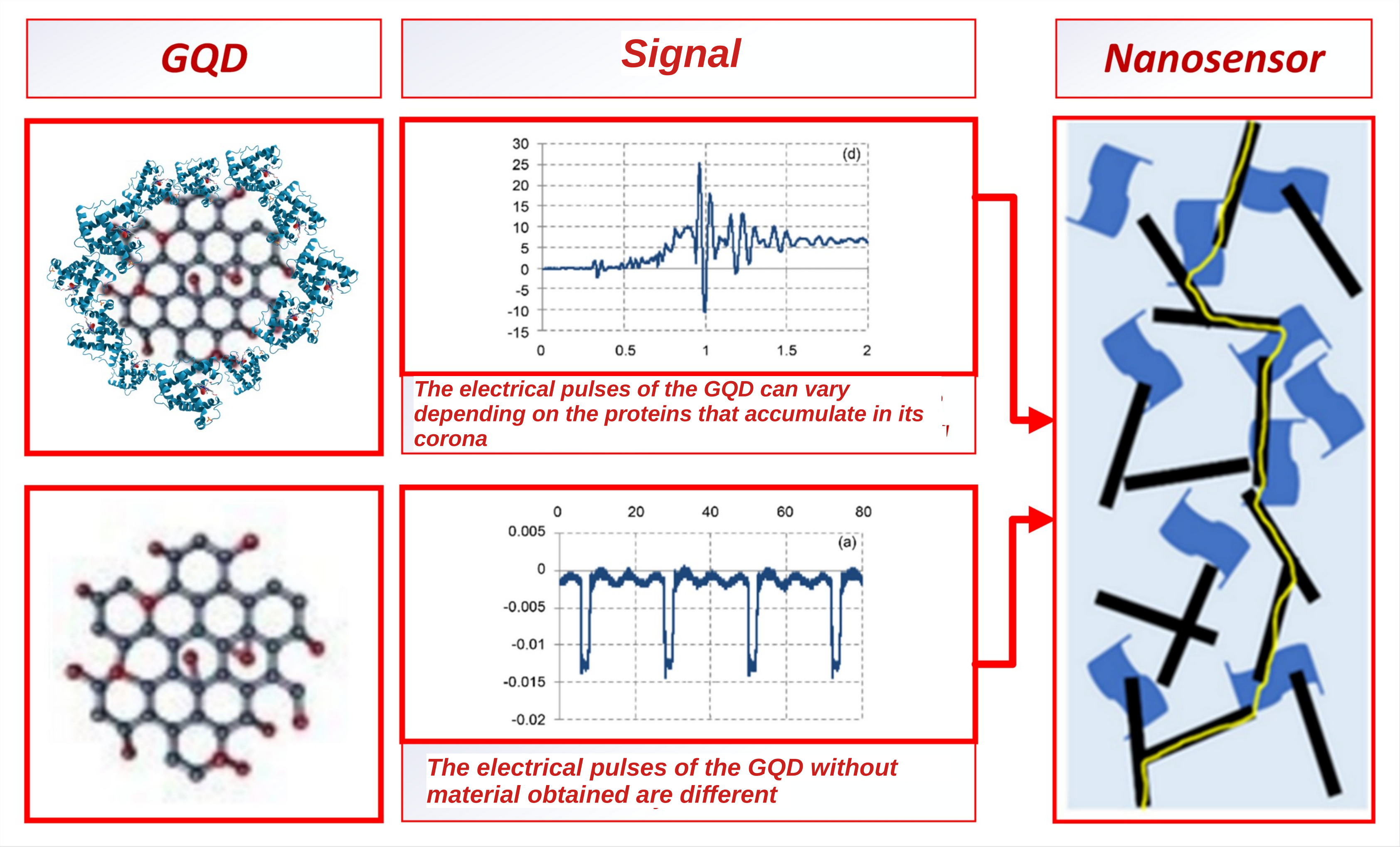
Analysis of the intracorporal network components



Graphene quantum dots GQD

- Graphene quantum dots are micro-nanometer scale pieces of graphene or graphene oxide with circular, hexagonal, triangular... shapes that **result from the decomposition or oxidation of graphene nanosheets**.
- The GQDs, far from being a defect in the network, play a fundamental role, since their size allows them to function or operate as nano-antennas, but they also conduct through the circulatory system, arteries, veins, capillaries, **acting as electrical markers**, but also biological, since they adsorb proteins and other components present in the blood.

Analysis of the intracorporal network components

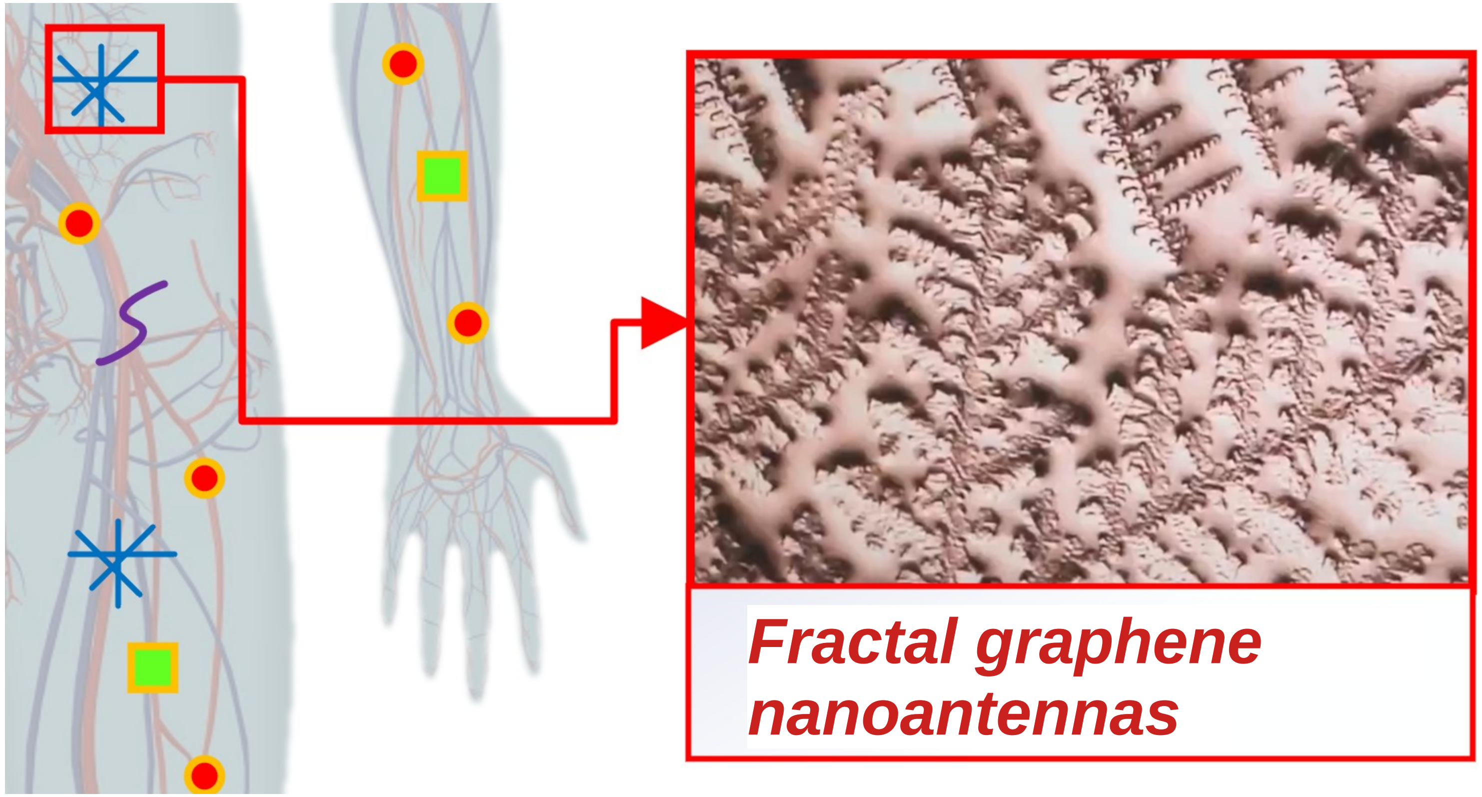


- The electrical pulses emitted by the GQDs **produce variations in the signal**, alterations that are picked up by nanosensors and retransmitted to the rest of the nanonetwork for propagation and emission.
- It must be understood that these signals **can be discerned and interpreted according to predefined mathematical patterns**.

Analysis of the intracorporal network components

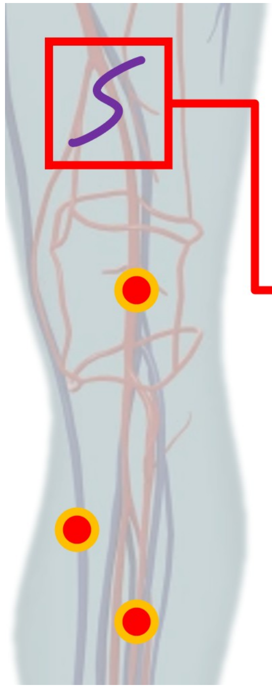
- Under certain conditions of temperature, pressure and blood saturation, **crystallization of graphene nanosheets can occur forming fractals**.
- Graphene fractals are **the best nanoantennas** in terms of capacity, bandwidth, frequency operating capacity, etc….
- When fixed to arterial and capillary walls, they **enhance the propagation effect** of the nanonetwork signals.

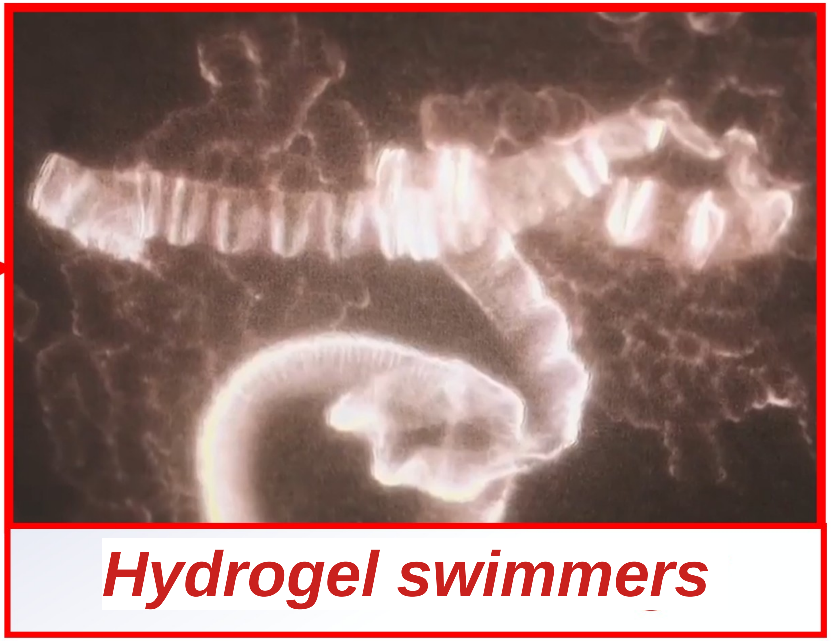
Fractal graphene nanoantennas



Analysis of the intracorporal network components

Hydrogel swimmers / nanoribbons

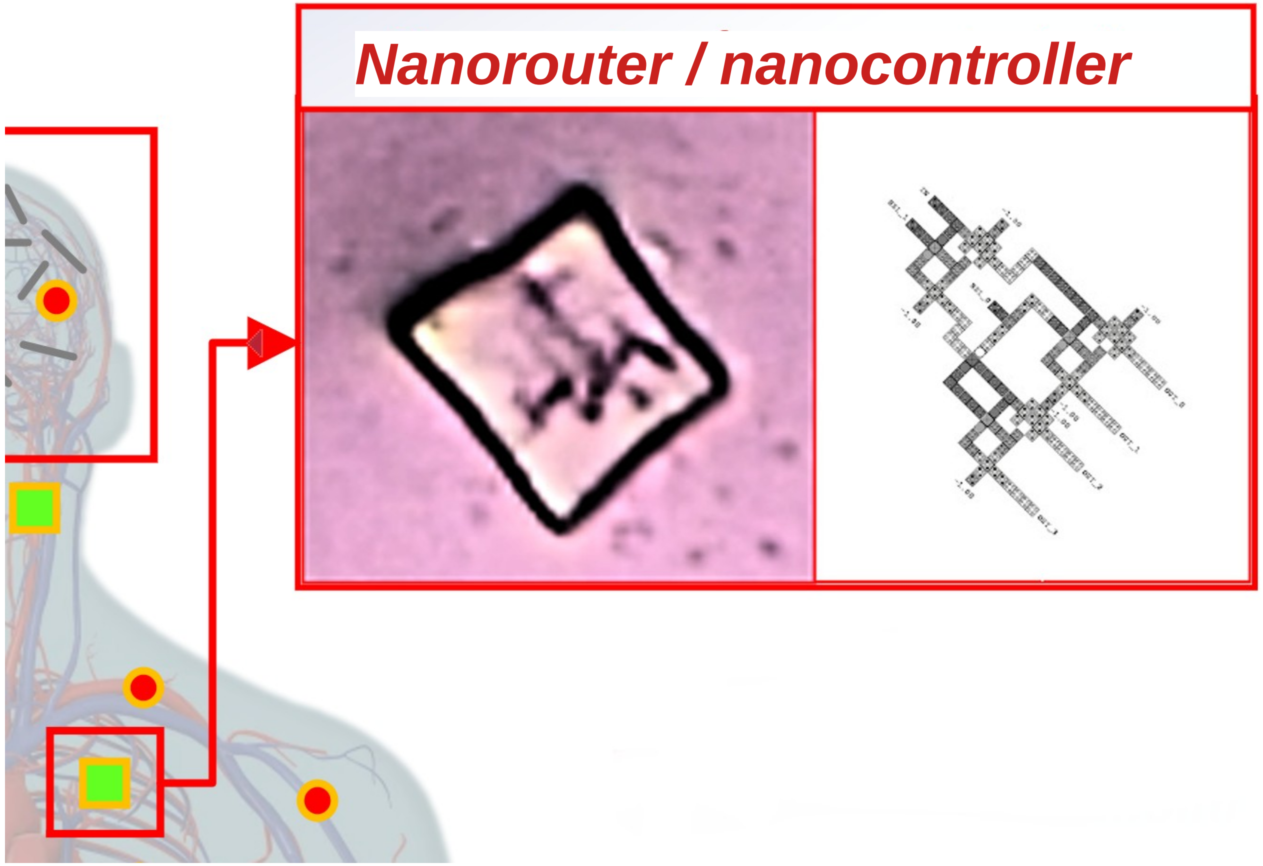




- Hydrogel swimmers are actually **ribbons of hydrogel and graphene**, which can articulate to **produce movement** through the body's circulatory system..
- They can release drugs, but they can also **propagate the nanonetwork signals to hard-to-reach areas** where nanoantennas cannot reach.
- They could play some role as **biosensors**, some publications report this application.

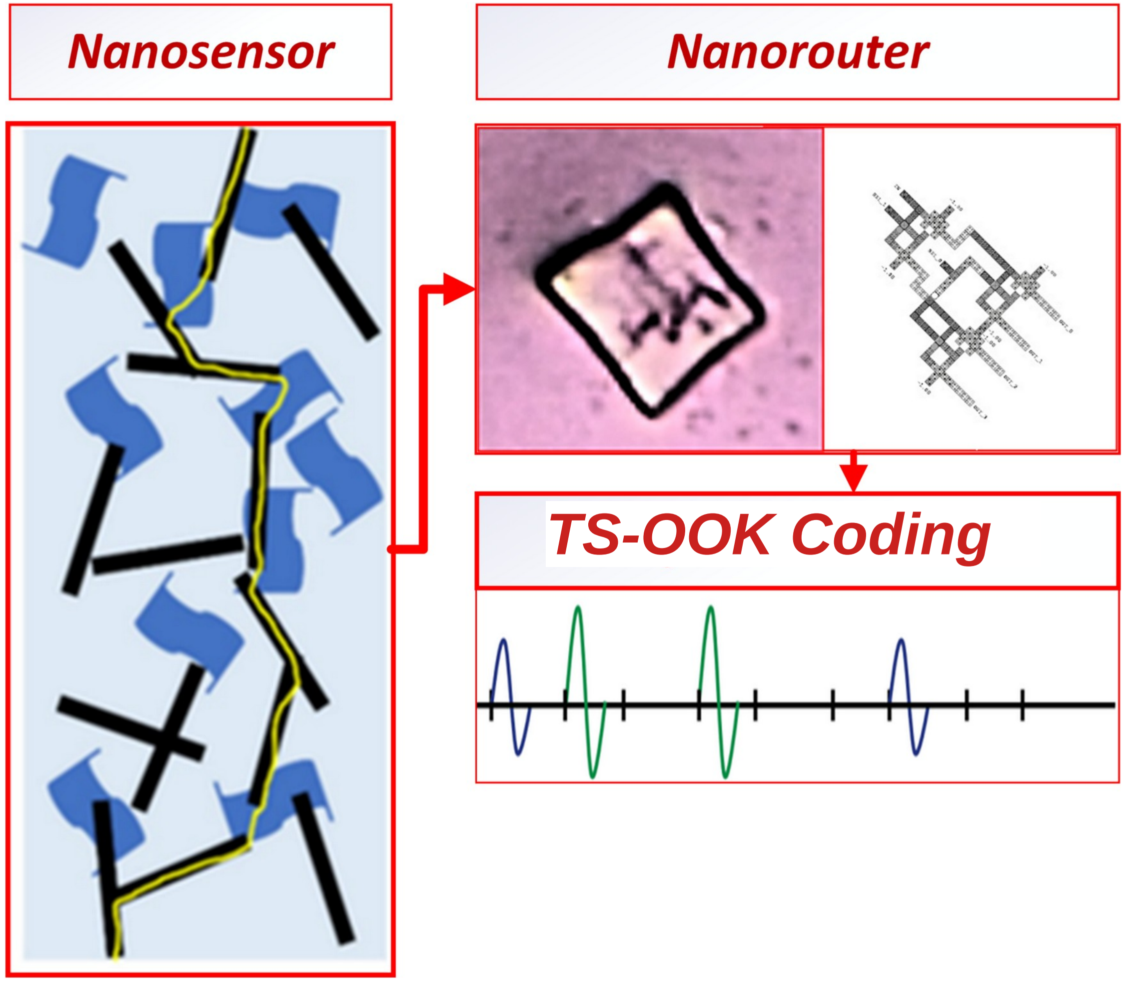
Analysis of the intracorporal network components

Nanorouters



- It is almost certain that the nanonetwork **operates with multiple nanorouters** that are distributed throughout the body, fixing themselves in areas with preferential electrical activity, for example the endothelium, heart, lungs, arteries....
- It is quite likely that **each nanorouter has its own MAC addresses**, stored in memory circuits, which would explain its dynamic operation.
- The ideal concept is for the nanorouters to be located **close to the regions with nanosensors and nanoantennas**, to receive the electrical pulse signals.

Analysis of the intracorporal network components

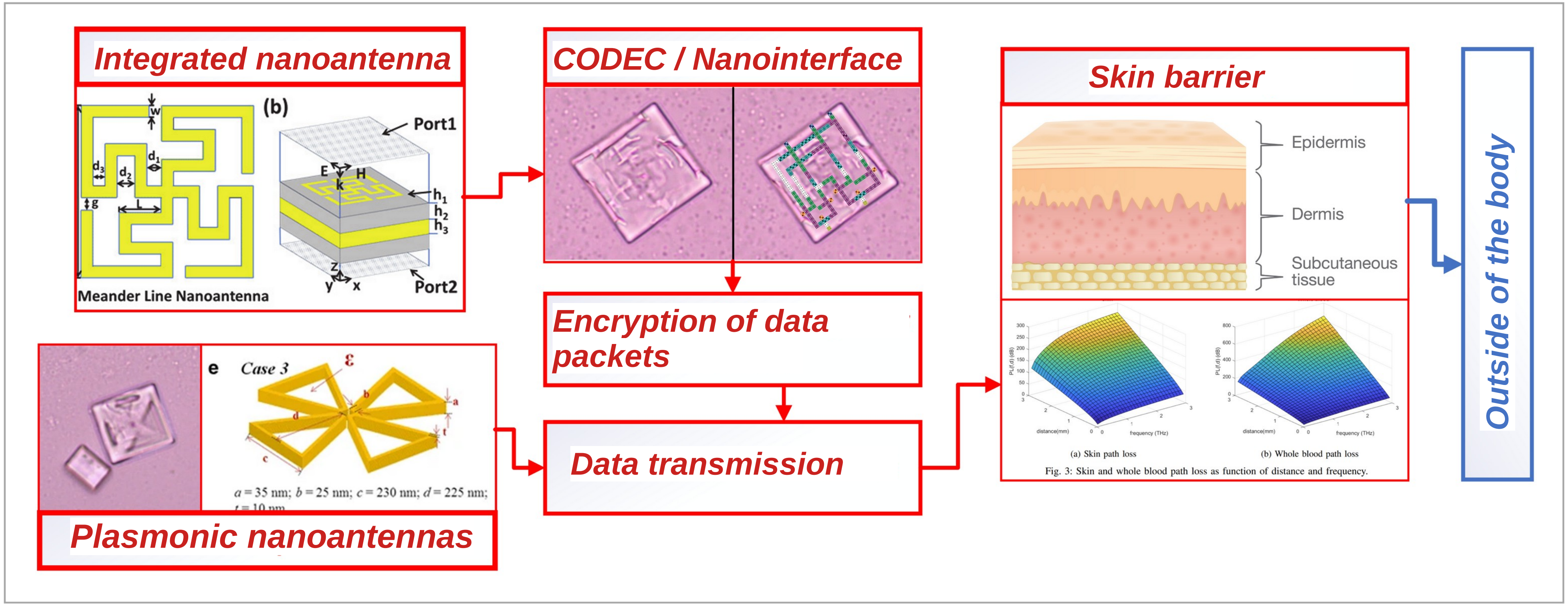


- When the nanorouter receives the signals, it **manages to encode them into TS-OOK** and route them as data packets for transmission. The TS-OOK signals have a binary pattern that is easy to interpret and transmit, which increases the data transmission capacity and the bandwidth that can be supported in the nanonetwork.
- The nanorouter **does not need a processor to operate**, as the QCA (quantum dot) architecture allows it to operate at a clock frequency, just as a computer processor would.
- In this way, **signals are transmitted to the nearest nanorouter** in order to optimize the nanonetwork and avoid signal saturation. For this reason, several of these components are envisaged, seated thanks to the hydrogel.

Analysis of the intracorporal network components

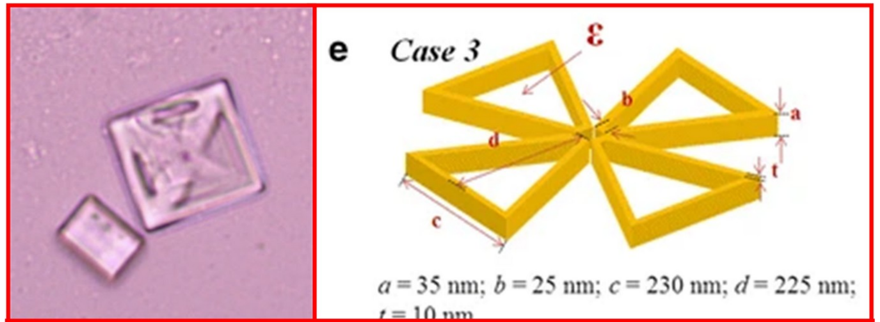
Nanointerface

- The nanointerface is a **more complex QCA circuit**, which contains a nanoantenna for transmitting and receiving TS-OOK signals. With high probability **it has a CODEC to encrypt the data packets** and retransmit them to the outside

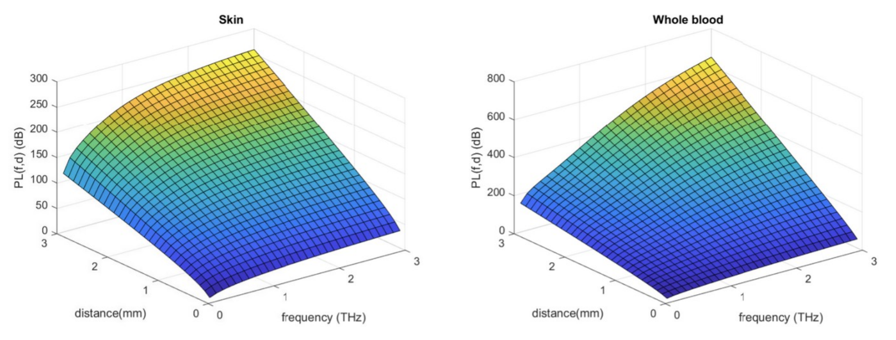


Analysis of the intracorporal network components

- The nanointerface, like the nanorouter, can be made up of **several levels or layers**, of which only the outermost one is visible under the microscope. This does not make it easy to find out its functions.
- The **encryption of the data is understandable**, due to the sensitivity and privacy of the information, in order to add layers of security to prevent bio-hacking.
- JAlong with the CODEC QCA, **plasmonic nanoantennas have been found that serve to boost and repeat the emission of the nanointerface**. This is important for transmitting encrypted data packets outside the body. To do so, the skin barrier (dermis, epidermis...) must be overcome.



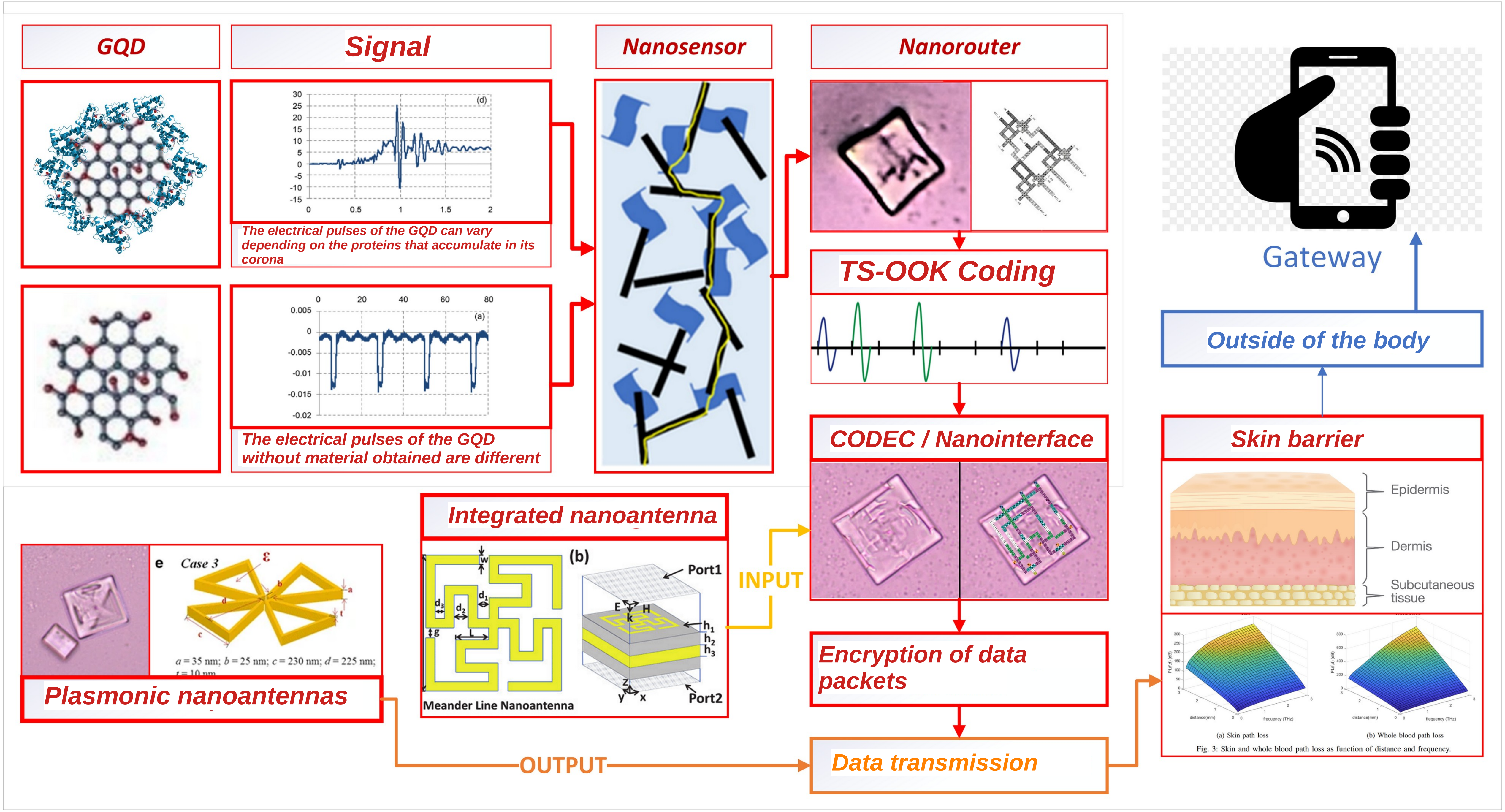
Plasmonic nanoantennas



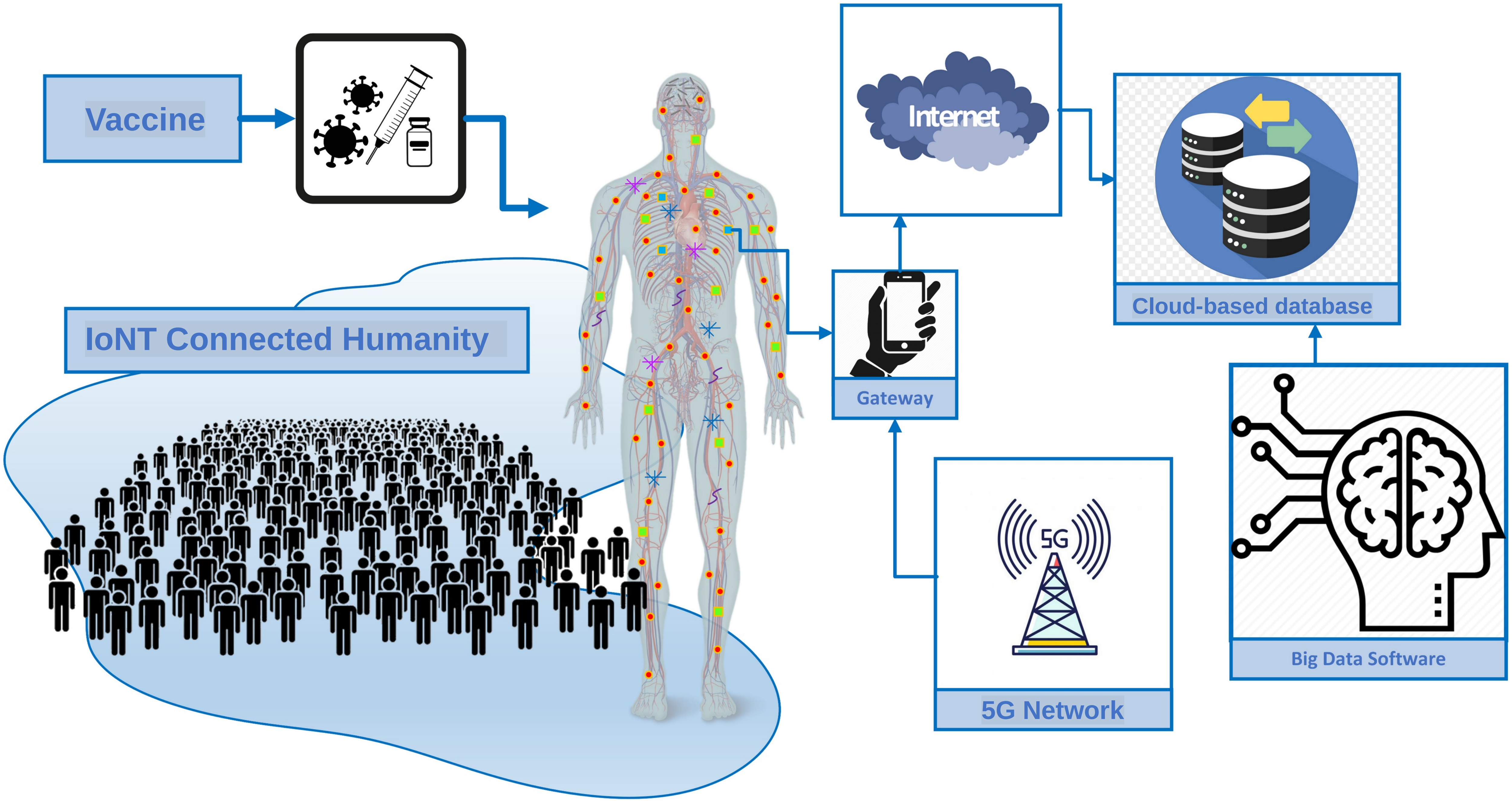
(a) Skin path loss (b) Whole blood path loss

Fig. 3: Skin and whole blood path loss as function of distance and frequency.

Intracorporal nanocommunication process



GQD
Signal
Nanosensor
Nanorouter
Gateway
The electrical pulses of the GQD can vary depending on the proteins that accumulate in its corona
The electrical pulses of the GQD without material obtained are different
TS-OOK Coding
Outside of the body
CODEC / Nanointerface
Skin barrier
Epidermis
Dermis
Subcutaneous tissue
Integrated nanoantenna
INPUT
Meander Line Nanoantenna
Port1
Port2
Case 3
a = 35 nm; b = 25 nm; c = 230 nm; d = 225 nm;
Plasmonic nanoantennas
Encryption of data packets
OUTPUT
Data transmission
(a) Skin path loss
(b) Whole blood path loss
Fig. 3: Skin and whole blood path loss as function of distance and frequency.


Vaccine
IoNT Connected Humanity
Internet
Cloud-based database
Gateway
5G
5G Network
Big Data Software