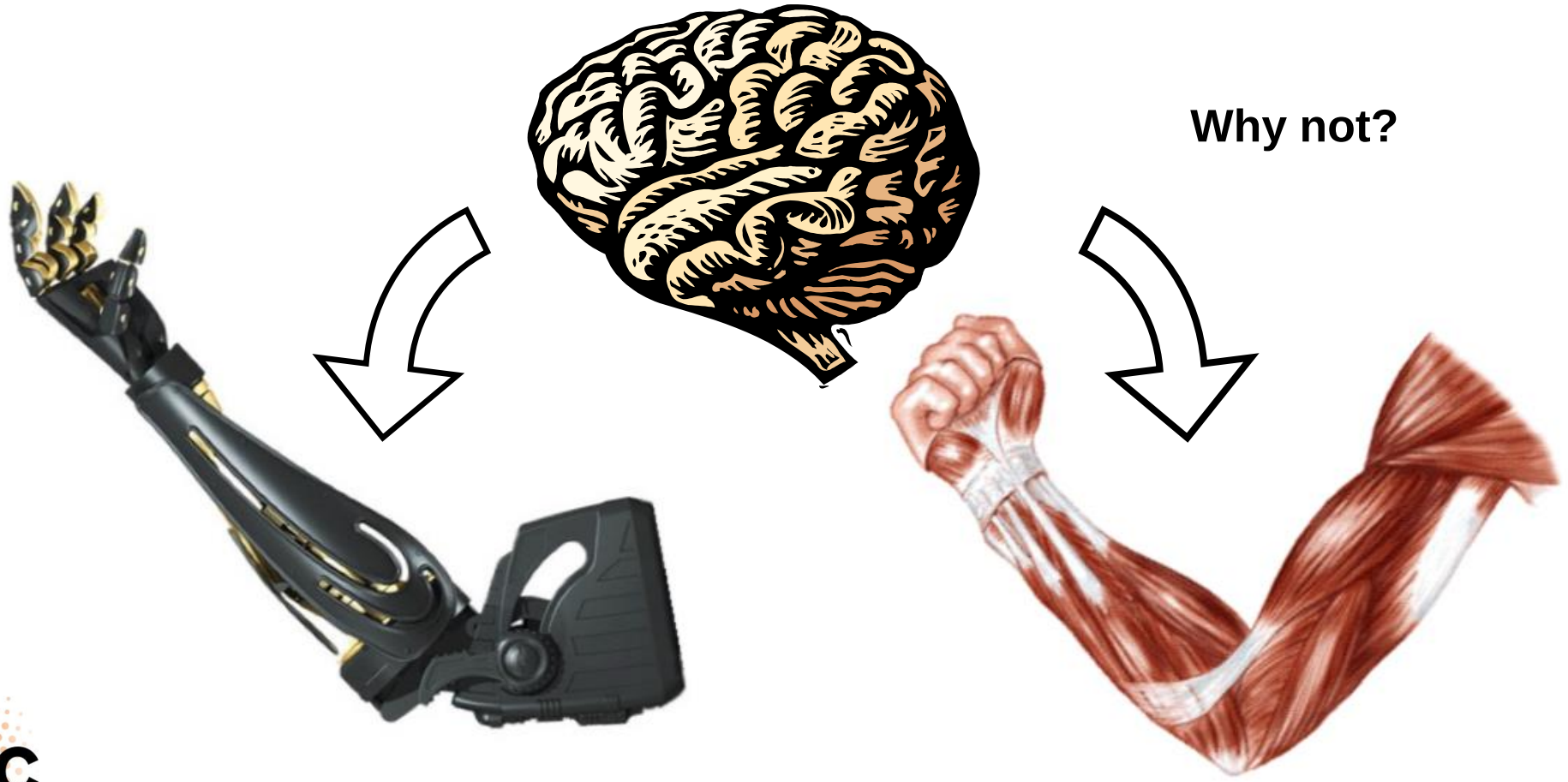
The experience of a ERC-2020-PoC SENSO-eAXON + EIC-2023-TRANSITION FORESEE

Antoni Ivorra

Department of Engineering
Universitat Pompeu Fabra, Barcelona, Spain

Webinar ERC PoC 2025
Fundación Española para la Ciencia y la Tecnología (FECYT)
January 31st, 2025

Motivation of my ERC CoG (eAXON project)



Why not?

(full **neuroprosthetic** approach)

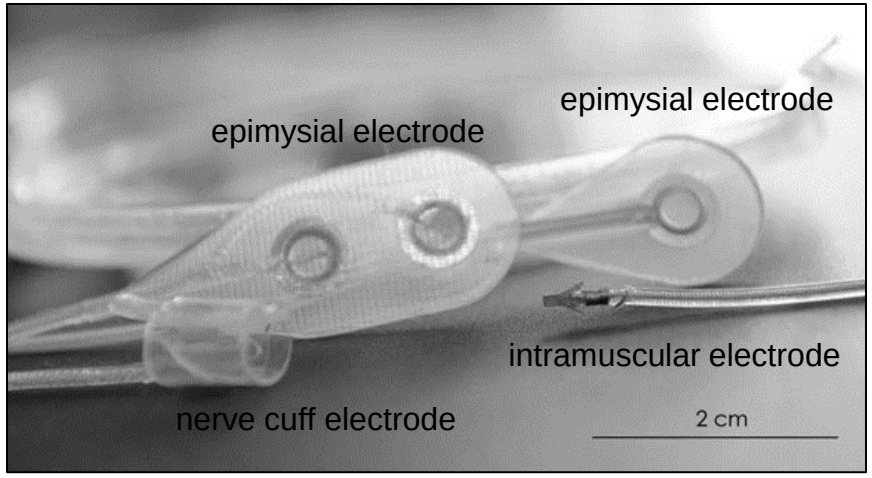
European Research Council

Established by the European Commission

Pulse generator

Wires
(leads)

Electrode



(Image source: http://fescenter.org/)

Electrode

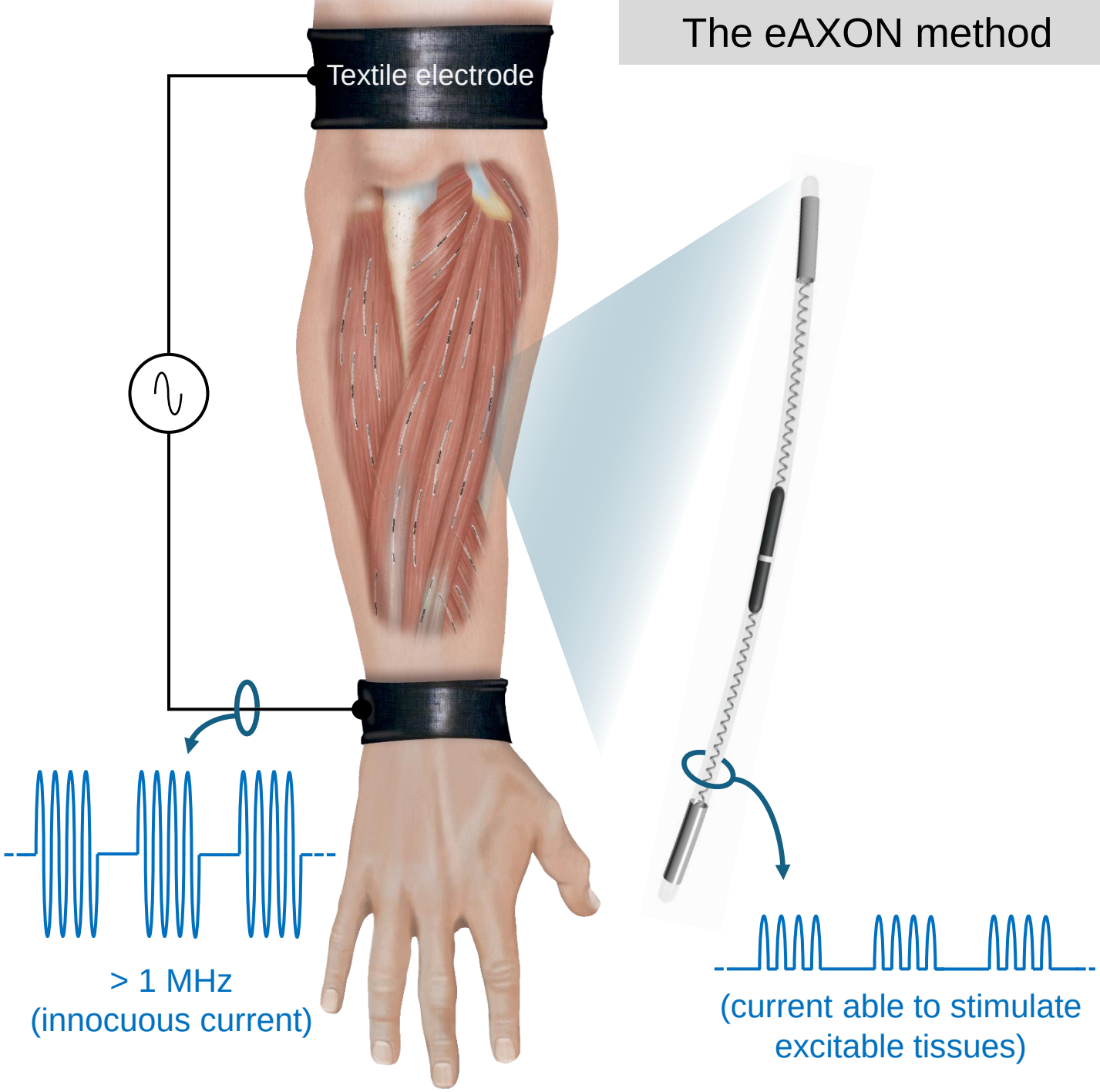
Electronics

Energy system
(e.g. battery or
coil)

Electrode

Leadless injectable
microstimulators

The eAXON method



digital

local rectification of HF current bursts

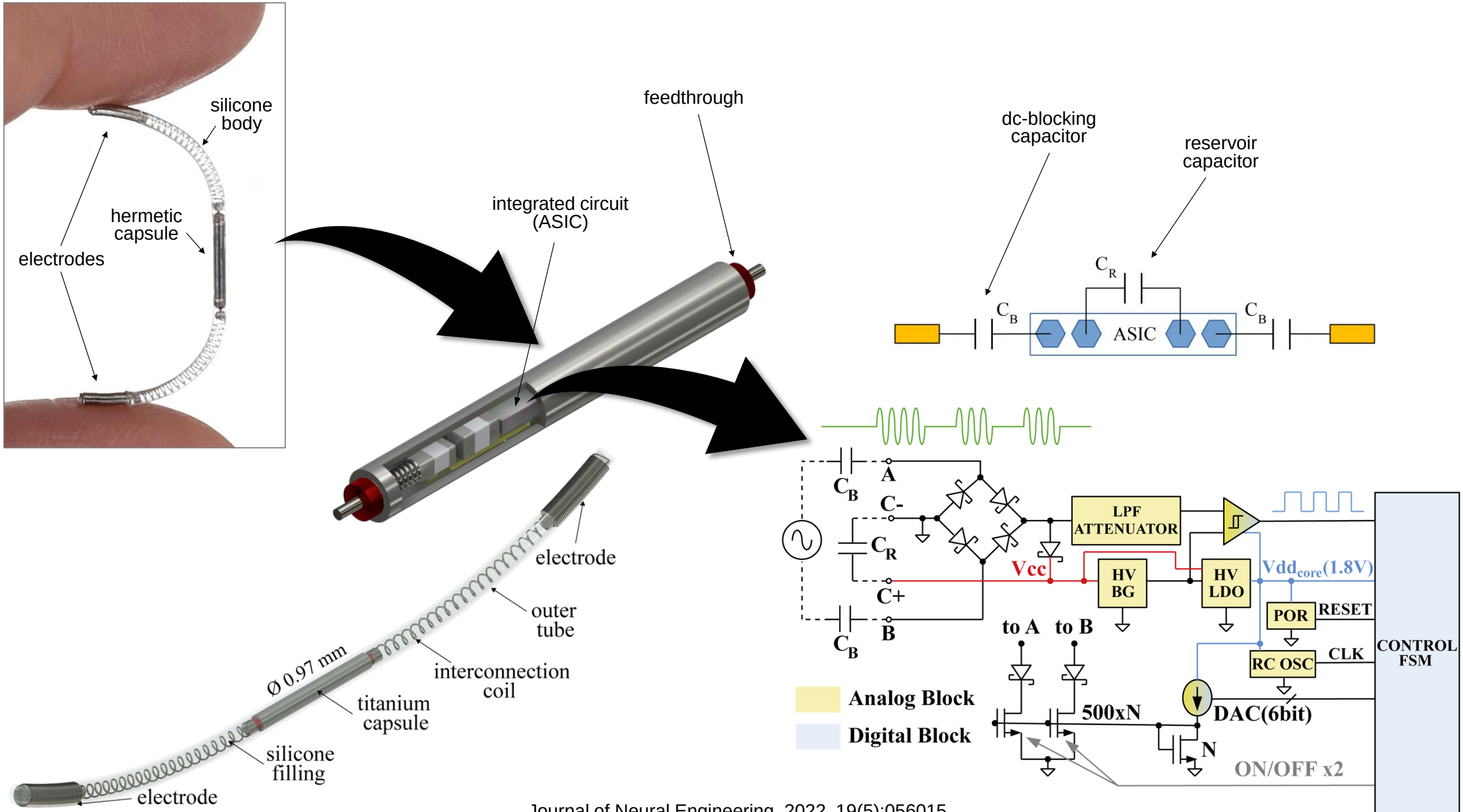
local LF currents

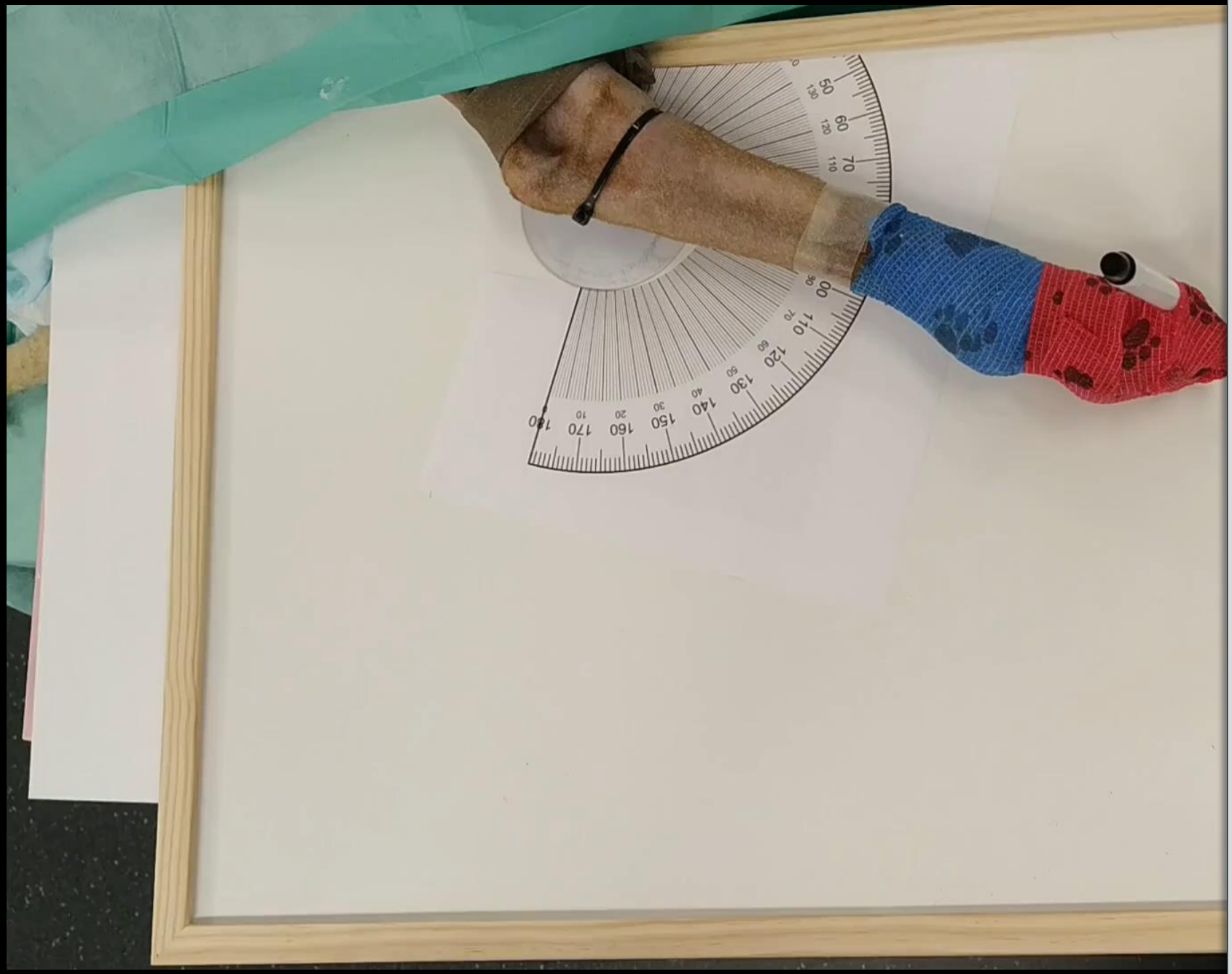
local stimulation

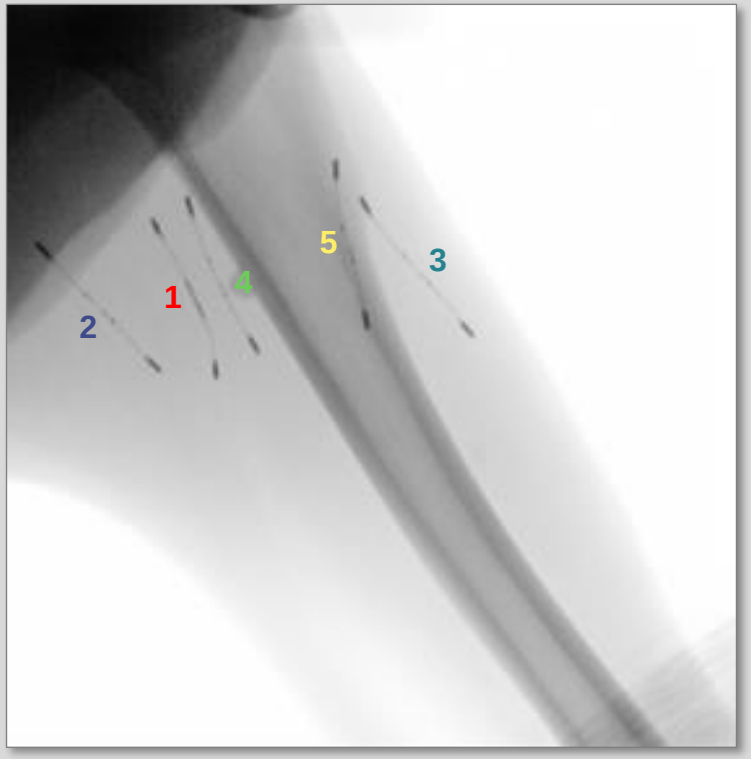
rectification can be performed in an IC

no need for bulky parts

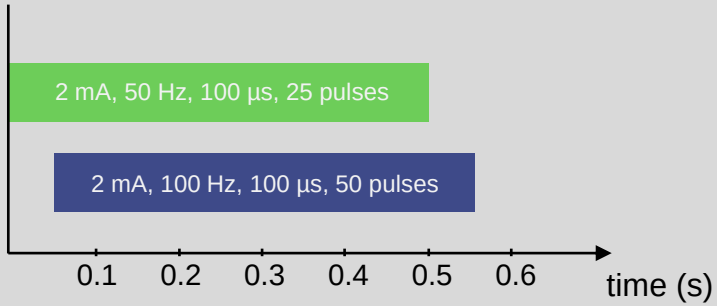
unprecedented miniaturization


silicone body
hermetic capsule
electrodes
feedthrough
integrated circuit (ASIC)
dc-blocking capacitor
reservoir capacitor
C_R
C_B
C_B
ASIC
electrode
outer tube
Ø 0.97 mm
interconnection coil
titanium capsule
silicone filling
electrode
C_B
A
C-
C_R
C+
C_B
B
LPF ATTENUATOR
Vcc
HV BG
HV LDO
Vdd_core(1.8V)
POR
RESET
RC OSC
CLK
CONTROL FSM
to A
to B
500xN
DAC(6bit)
N
ON/OFF x2
Analog Block
Digital Block





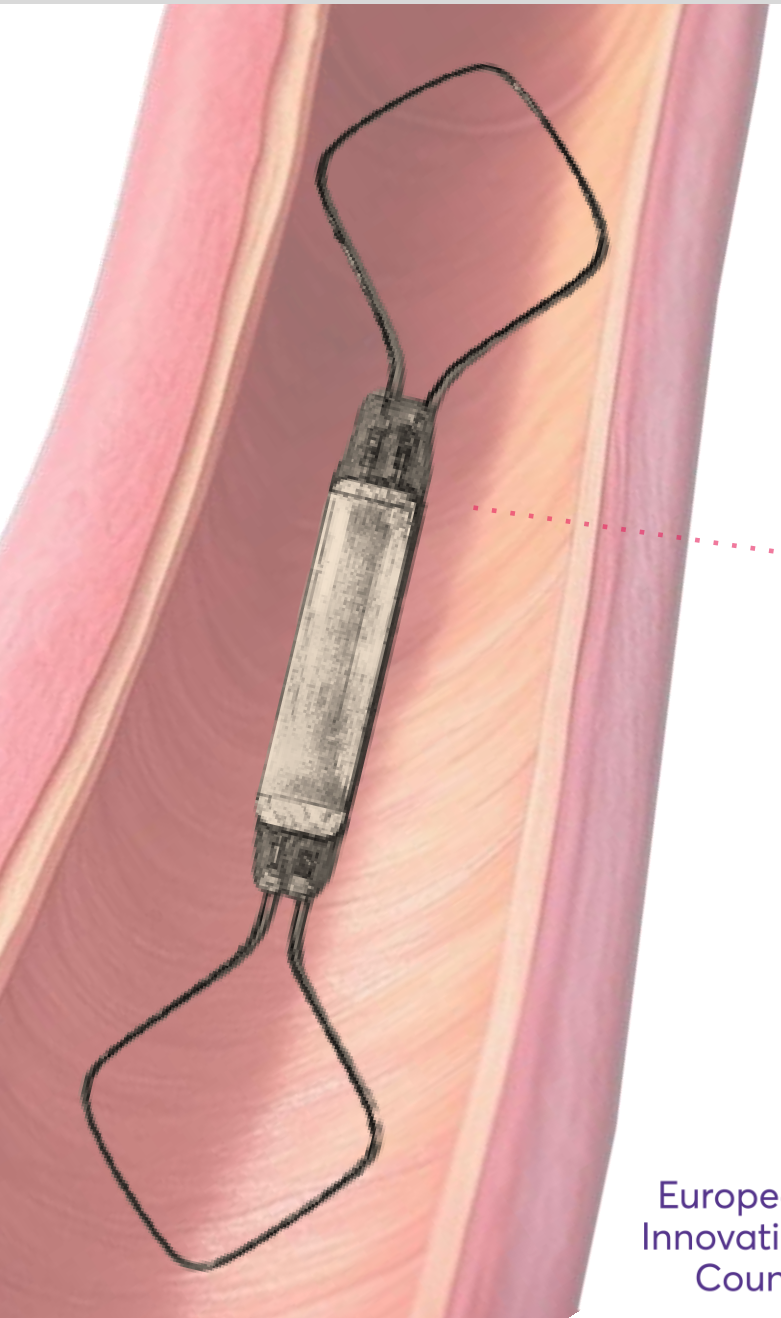
1 (flexor digitorum m.; finger flexor)
2 (gastrocnemius m.; foot flexor)
3 (tibialis m.; foot extensor)
4 (extensor digitorum m.; finger extensor)
5 (peroneus m; foot extensor)

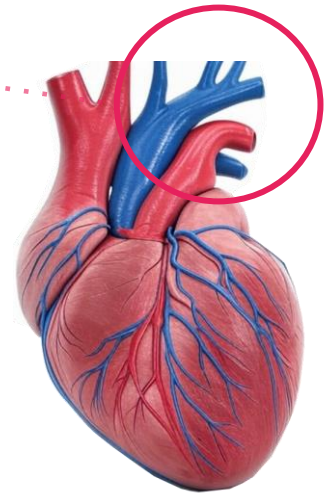


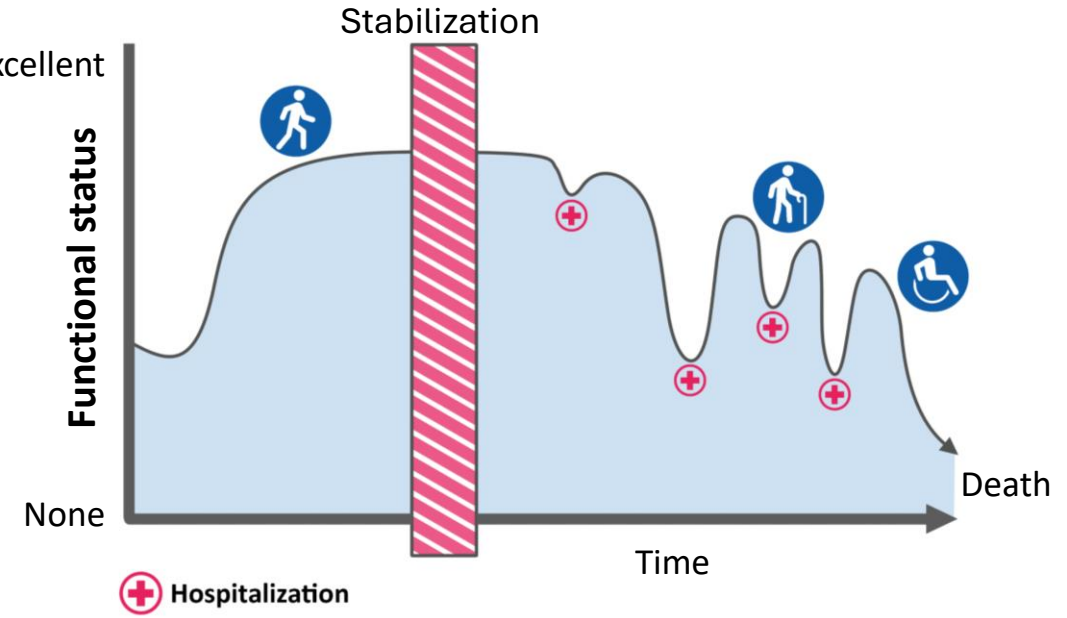
foresee MEDICAL TECHNOLOGIES

Remote Patient Monitoring of Chronic Heart Failure

Patient monitoring for avoiding decompensations in heart failure.







Adapted from: Can J Cardiol. 2020 Jul;36(7):1050-1060.

European Innovation Council

Funded by the European Union

Funded by the European Union (GA 101136633- FORESEE). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Agency. Neither the European Union nor the granting authority can be held responsible for them.

The journey

eAXON project
ERC CoG 2M€
5/2017-4/2022

2019

(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) EP 3 788 948 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication: 10.03.2021 Bulletin 2021/10

(51) Int Cl.: A61B 5/00 (2006.01) A61B 5/145 (2006.01) A61B 5/1455 (2006.01) A61B 5/1486 (2006.01)

(21) Application number: 19382757.3

(22) Date of filing: 04.09.2019

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States: BA ME
Designated Validation States: KH MA MD TN

(71) Applicant: Universitat Pompeu Fabra 08002 Barcelona (ES)

(72) Inventors:
- IVORRA CANO, Antoni 08002 Barcelona (ES)
- CASTELLVÍ FERNÁNDEZ, Quim 08002 Barcelona (ES)
- BECERRA FAJARDO, Laura 08002 Barcelona (ES)

(74) Representative: Hoffmann Eitle Hoffmann Eitle S.L.U. Paseo de la Castellana 140, 3a planta Edificio LIMA 28046 Madrid (ES)

(54) IMPLANTABLE ELECTRONIC SENSING SYSTEM FOR MEASURING AND MONITORING MEDICAL PARAMETERS

(57) The invention refers to an implantable sensing system comprising an electronic implant and a reading unit to obtain measurements originating at the implant or its surroundings to characterize physical and/or chemical clinical parameters of a living body. The electronic implant comprises an electronic circuit and at least two electrodes connected to the electronic circuit. The electronic circuit comprises a capacitor and a device of asymmetric conductance capable of rectifying an alternating current, both connected in series between two electrodes. An electronic component is connected in parallel with the device of asymmetric conductance, for the capacitor discharge. The capacitor, the device of asymmetric conductance and/or the electronic component, can be a transducer selected such as an operational parameter of the transducer is variable depending on a physical and/or chemical condition of a medium of a living body. The implant features a minimal invasiveness, such as it can be implanted by injection or by catheterization rather than by open surgery.

Patent application on use of eAXON technology for sensing

I'm tired of research. Let's try to make a real impact out of this.

Laura Becerra-Fajardo, PhD

UPF INNOValora
The UPF Proof-of-Concept Programme

Senso-eAXON project
UPF Innovalora 50 k€
2/2020- 4/2021

erc
European Research Council
Established by the European Commission

SENSO-eAXON project
ERC PoC 150 k€
1/2021- 6/2022

CaixaResearch
"la Caixa" Foundation

IntraSenso-eAXON project
CaixaResearch Validate 70 k€
1/2022-12/2023

European Innovation Council

FORESEE project
EIC Transition 2.5M€
12/2023- 12/2026

Current members:

Laura Becerra-Fajardo, PhD
Quim Castellví, PhD
Aracelys García-Moreno, PhD
Jesús Minguillón, PhD
Antoni Ivorra, PhD
Burak Altun
Gerard Fernández
Mar Gadea
Ivan Luque
Ting Shu
Masoud Hosseinidoost
Sandra Alcaraz
Anna Comas
Marina Giménez

Recent former members:

Albert Comerma, PhD
Ahmed Eladly, PhD
Tomás García-Sánchez, PhD
Ana González-Suárez, PhD
Mario Gómez, PhD
Nina Klein, PhD
Borja Mercadal, PhD
Enric Perera, PhD
Marc Tudela, PhD
Nerea Álvarez de Eulate

upf. Universitat Pompeu Fabra Barcelona

BERG Biomedical Electronics Research Group

http://berg.upf.edu

GOBIERNO DE ESPANA MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

AGENCIA ESTATAL DE INVESTIGACIÓN

AGAUR Agència de Gestió d'Ajuts Universitaris i de Recerca

FCRi Fundació Catalana per a la Recerca i la Innovació

La Marató 3cat

ICREA

erc European Research Council

European Commission | Horizon 2020 European Union funding for Research & Innovation

European Innovation Council

MARIE CURIE ACTIONS