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UPV



42nd Conference of Rectors and Presidents of European Universities of Technology: “The university’s role in global health and well-being”  
*National University of Science and Technology, POLITEHNICA Bucharest*  
*September 20th–21th, 2022*

## **RESEARCH AND EDUCATION IN BIOMEDICAL ENGINEERING AT UPV: *TWO DECADES OF SUCCESSFUL GROWTH IN JOINT INITIATIVES***

José E Capilla

*Rector*

Technical University of Valencia, Spain



**UPV**

Universitat Politècnica de València

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# Facts – cronology of involvement of UPV in biomedical Engineering

- **Young University (founded in 1968). → Origin and profile.**
- **1972-76 → Beginning of the Biomechanics Institute of Valencia**
- **1972-2000:**
  - **Development of Research groups and joint alliances with external partners (industry, universities, medical research centers, ...)**
  - **Actions: Continuing Education, Research and innovation**
  - **Topics:**

At the Instituto de Biomecánica (IBV) we develop and transfer scientific knowledge and technologies to improve people's health, well-being and quality of life, adding value to companies and the social and economic environment

At the Instituto de Biomecánica (IBV) we develop and transfer scientific and technological knowledge to improve the quality of life, adding value to companies and economic activities.



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1976

1991

UNIVERSITY  
INSTITUTE

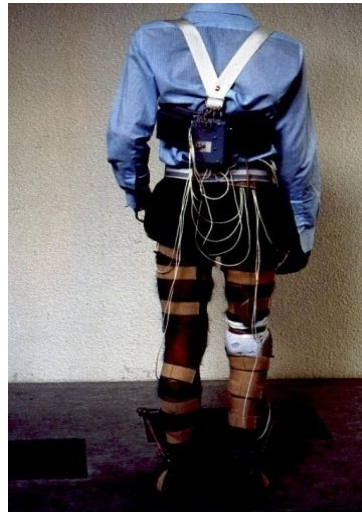


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DE VALÈNCIA

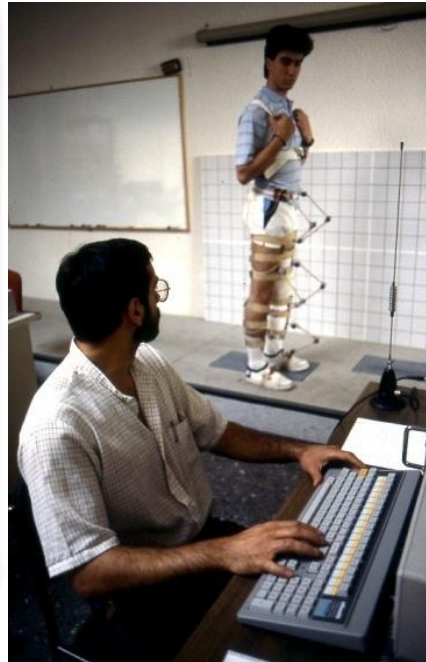
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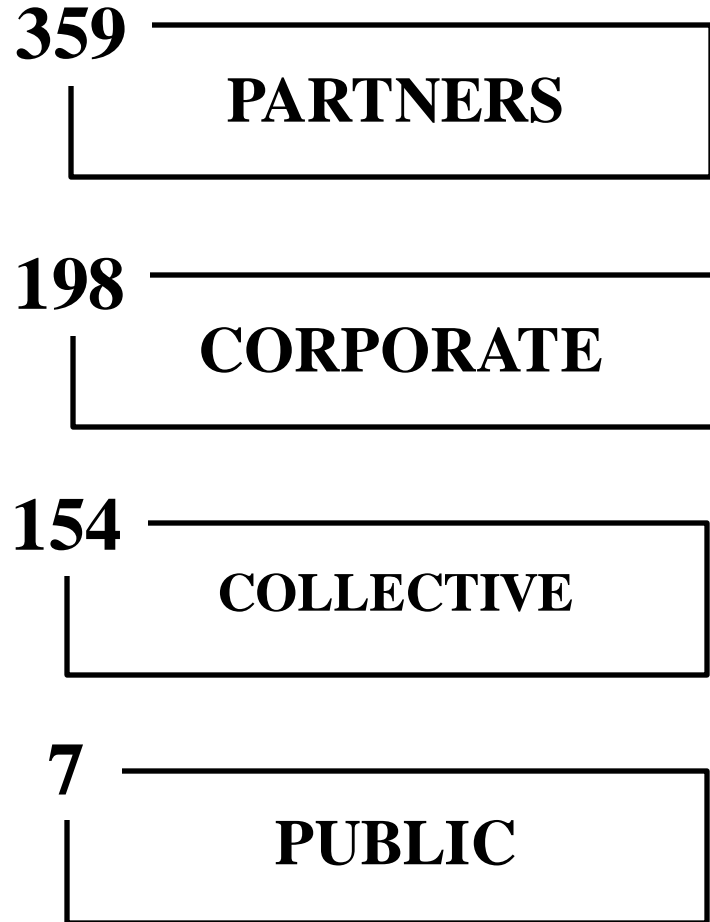


The first projects were focused on the field of implants for Orthopedic Surgery and Traumatology, although the institute very soon began to develop technology for the analysis and rehabilitation of human gait.



In 1984, the IBV taught the first Master's Degree of the Spanish Public University, the "Master in Biomechanics of the Locomotor System", in which, during its two editions, the people who, together with two UPV professors, gave rise to the embryo of what is now the IBV were trained.





**OUR  
ASSOCIATION**





# KNOWLEDGE AREAS

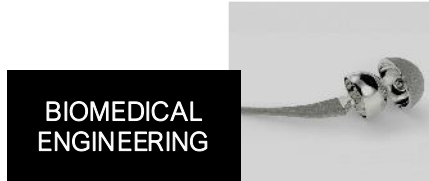
Always people centred, we organise our scientific knowledge into 5 areas



**ANT:** We generate morphometric and anthropometric criteria from the analysis of human metrics and shapes that are essential to design, evaluate and assign the products and services that people use.



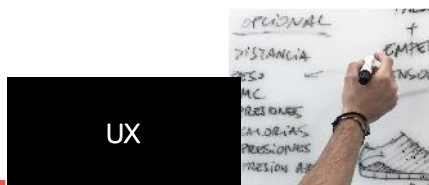
**FH:** We generate knowledge about people's characteristics and capabilities in order to assess how they interact with devices and services. We can thus establish recommendations to design interfaces, devices and environments suited to them.



**IB:** We work from the application of techniques and methodologies for recording and biomechanical analysis of human activities and movements, to functional evaluation and the design of medical devices.



**SD:** We generate knowledge related to the performance of human body, as well as the influence of different exogenous and endogenous factors on people's health. All this obtained from the recording and analysis of data about the person and their environment.



**UX:** We generate essential criteria to design, evaluate and assign products and services that lead to a satisfactory user experience, based on detailed knowledge about potential users' perception, behaviour and aspiration.



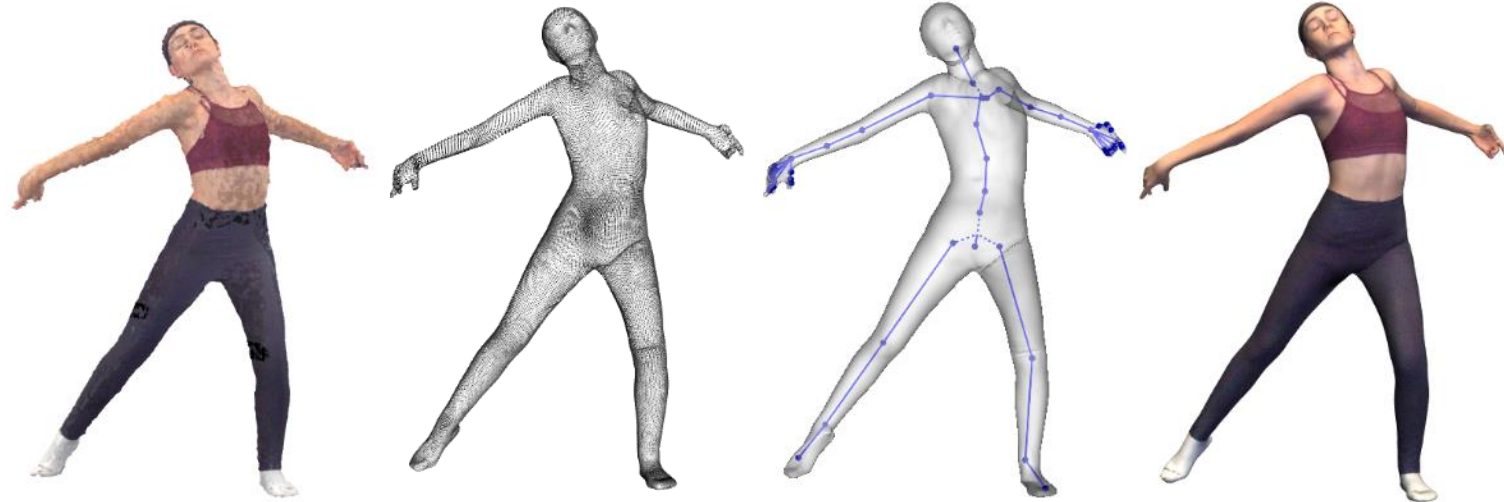
# BUSINESS AREAS

We provide  
answers to  
market needs  
through 3  
business  
areas

## HEALTH



## PRODUCTS AND ENVIRONMENTS



## TECHNOLOGIES





# INDUSTRIES

We apply our knowledge in multiple sectors, creating R&D to answer its challenges



**AUTOMOTIVE**

**HEALTHCARE  
TECHNOLOGY**

**SPORTS**

**MOBILITY AND  
SMARTCITIES**

**REHABILITATION AND PERSONAL  
AUTONOMY**

**TOURISM AND  
LEISURE**

**HABITAT**

**ELDERLY PEOPLE**

**CHILDREN**

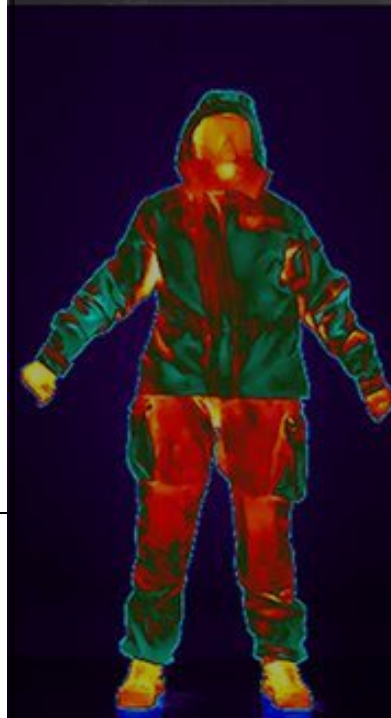
**CLOTHING**

**OCCUPATIONAL HEALTH AND WELL  
BEING**



# SOLUTIONS

We provide innovative solutions through R&D projects, high added value consultancy and technological applications



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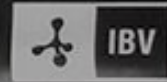
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# RESEARCH AND INNOVATION

We develop research and innovation projects that enable our clients to drive their own lines of research and development





## TECHNOLOGICAL CONSULTANCY

We provide expert  
advice to  
companies to  
**bridge the gap**  
between R&D and  
market launch

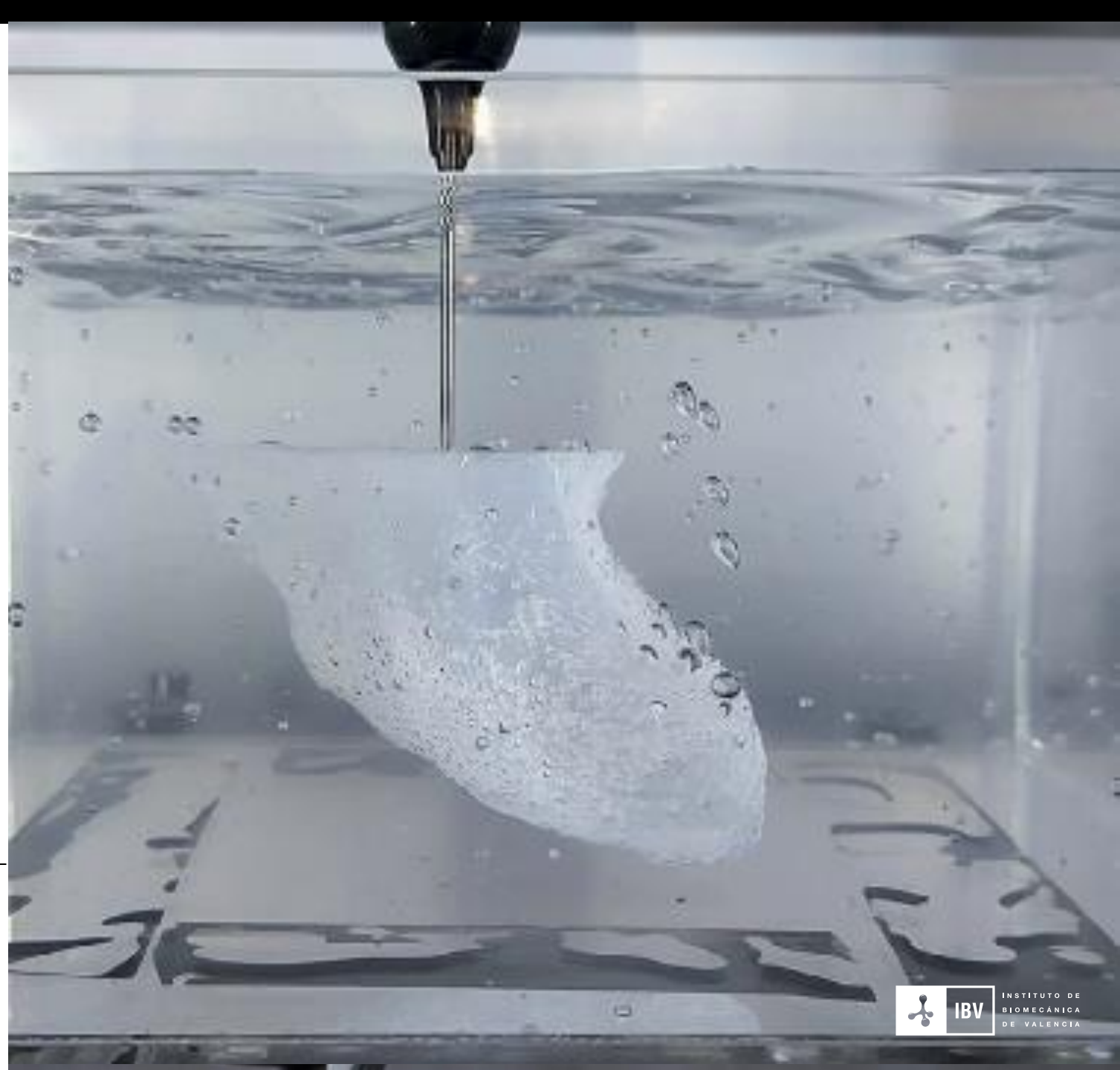




## PRODUCT

### DEVELOPMENT

**We provide solutions covering the entire design and development life cycle of product, from the initial concept phase through the detailed development, modelling, prototyping, validation and commercialisation**





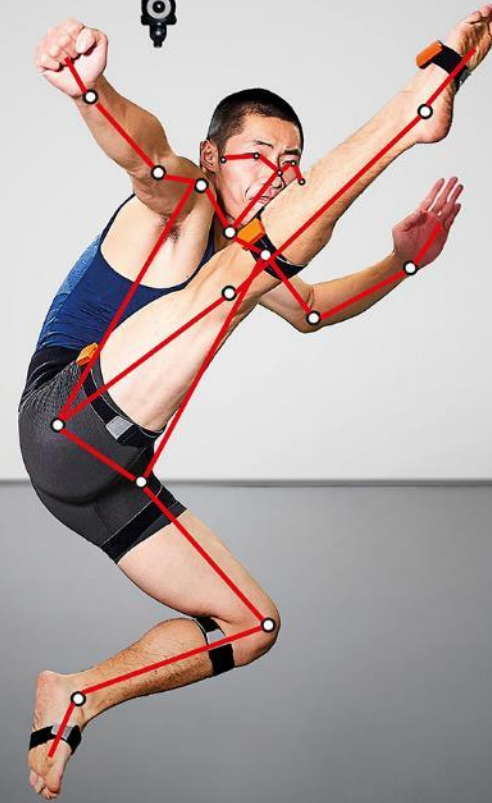
## TECHNOLOGICAL APPLICATIONS

**We provide companies with technological applications based on our R&D, with the aim of extending the impact of our transfer to the maximum number of companies and markets**





# HUMAN MOVEMENT LAB



**PROJECTS**



**SERVICES**



**TECHNOLOGICAL  
APPLICATIONS**

**R&D  
CONSULTANCY  
INDUSTRIAL DESIGN**

**INSPECTION AND TESTING  
BIOMECHANICAL  
ASSESSMENT  
TRAINING**

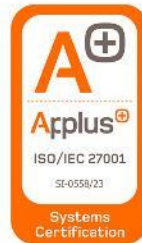
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# NETWORKS

We collaborate with a large number of agents and companies through global knowledge networks, thus maximizing the impact of our activity



# OUR ACCREDITATIONS

Our scientific and technical excellence is recognised by many national and international accreditations

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# Facts – cronològic de l'evolució del biomedical

- Young Universities
- 1972 → Begin of the biomedical research
- 1972-2000:
  - Development of the biomedical research (industry, medicine, etc.)
  - Actions: (e.g. research projects, etc.)
  - Topics: (e.g. research areas, etc.)

- Quality, enrichment and reuse of biomedical data
- Biomedical data mining and decision support systems in medicine
- Biomedical signals and image processing
- Development of equipment and specialized analysis methods in experimental and clinical cardiac electrophysiology
- Human-oriented technologies: Virtual rehabilitation, computer-assisted psychology, Environmental intelligence, medical image processing, emotional engineering and user-centred design, persuasion and assistance technologies
- Immunotechnology: Production of monoclonal antibodies for various analytes. Design and development of immunoassays and biosensors.
- Biological sensors: Development of biosensors and immunosensors, immunochemical assays, development of DNA and protein matrix methodologies on CD-type interactive supports
- Optical-type molecular sensors and probes: molecular sensors and probes; new sensor materials (nano-supramolecular approach to sensor development).
- Electrochemical sensors: Membrane electrodes, Electronic tongues and noses, analytical instrumentation applies to environmental control.
- Bioactivity studies: Anti-inflammatory activity, in vitro studies of xenobiotic-biomacromolecule interactions.
- Controlled release and retention studies: Development of nanometric devices, cell interaction studies, and pharmacokinetic profiles.
- Renewable energies and energy efficiency
- .....*many more*.....

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 centred design, **Key Aspects of the Current Healthcare Revolution:** d user-  
 -Immunotechno >Artificial Intelligence (AI) and Machine Learning design  
 and developme >Telemedicine and Digital Health: hemical  
 - Biological sens >Genomics and Personalized Medicine active  
 assays, develop >Biotechnology and Regenerative Medicine w sensor  
 supports  
 - Optical-type m >Data and Predictive Analytics  
 materials (nano >Wearable and Implantable Technologies  
 -Electrochemica  
 analytical instr >Bioactivity studies: Anti-inflammatory activity, in vitro studies of xenobiotic-  
 biomacromolecule interactions.  
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 interaction studies, and pharmacokinetic profiles.  
 -Renewable energies and energy efficiency  
 .....many more .....

# Facts – cronology of involvement of UPV in biomedical Engineering

- **2000 →**
  - **Consolidation of research centers, accreditations, ... more human resources, infrastructures and equipments**
  - **Development of the UPV Science Park, now close to 200.000 m<sup>2</sup> (*“Ciudad Politécnica de la Innovación”*)**
  - **Master degree in Biomedical Engineering (2006) – EUR-ACE (\*)**
  - **Degree in Biomedical Engineering (2012) – EUR-ACE**

(\*) EUR-ACE® is the European quality label for engineering degree programmes at Bachelor and Master Level.



# Facts – cronograma de implantación del Grado de Ingeniería Biomédica

## Master Degree:

- > 90 ECTS
- > Very high demand
- > Up to 30 ECTS training internships
- > Fields: IA, biomechanics, biomaterials, computational models and wearables
- > Employability: 100% (3 yrs)

- 2000 →

- Consolidación de infraestructuras and equipments

## Degree:

- > 240 ECTS
- > Very high demand
- > Interuniversities colaboration (Faculty of Medicine, UV) :
- > Cooperation with 4 hospitals for training internships
- > Internships during years 2nd, 3rd, y 4th
- > Employability 97% (3 yrs)

(Ciudad)

(\*) EU Bach



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## Master Degree:

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Research centers highly connected with Biomed Eng degrees:

BIT - Center for Biomaterials and Tissue Engineering

IBV - Biomechanics Institute of Valencia

I3BH - Institute for Research in Human-Centered Technology

Ci2B - Center for Research and Innovation in Bioengineering

ITACA - Institute for Applications of Advanced Information and Communication Technologies

I3M - Institute for Molecular Imaging Instrumentation

ProS - Center for Research in Software Production Methods

IDM - Institute for Molecular Recognition and Technological Development

NTC - Center for Nanophotonic Technology of Valencia

GPDS - Digital Signal Processing Group

IDAL - Intelligent Data Analysis Laboratory

- 2000 →

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infraestructures**

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(\*) EU  
Bach

# Facts – cronology of involvement of UPV in biomedical Engineering

## - 2010 →

- Beyond the consolidation of our ecosystem, UPV has reach a recognize position in the field of Biomed. Eng., and important public and private entities look to start or increase cooperation with our ecosystem: in education, research, innovation, transfer, and promotion of spin-offs.
- Individuals with leadership in Hospital La Fe<sup>(\*)</sup> and in UPV shared a common vision to approach technology to clinical practice. So,
  - New Hospital La Fe included the Word “politécnico” in its new name: ***“Hospital Universitario y Politécnico La Fe”***
  - **A Memorandum of Understanding was signed in July 2010**

*(\*) New Hospital La Fe: Main research hospital in Valencia Region; attends a population 300.000,, 5.000 births, 50.000 admissions, 30.000 surgery cases, and close to 240.000 emergencies..*

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# IIS La Fe

The **Health Research Institute Hospital La Fe** (IIS La Fe) is the biomedical research area created between the Hospital Universitari i Politècnic La Fe, the Universitat de València, the Universitat Politècnica de València, the Consejo Superior de Investigaciones Científicas, the Fundación para la Investigación del Hospital Universitario La Fe de la Comunidad Valenciana and the Fundación IVI.



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de Salut



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Instituto  
de Salud  
Carlos III



# IIS La Fe

The **Health Research Institute Hospital La Fe** (IIS La Fe) is the biomedical

Firsts joint activities were implemented:

- Biomedical engineering students internships in Hospital La Fe
- Short UPV courses to train and upgrade clinicians and other hospital personnel in Technology subjects
- Joint research units were agreed in photochemistry, biomechanics, and information Technologies, nanomedicine, precision nutrition for digestive pathologies, ... enabling UPV researchers for accessing to Spanish medicine research agencies funding.
- A joint programme for collaborative research and innovation, called **INBIO**, was conceived and still remains. It has been a cornerstone of UPV strategy in the health sector.

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# IIS La Fe

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- Biom
  - Short in Te
  - Joint inform patho resea
  - A joint conce health
- The UPV-La fe “INBIO” programme**
- Starting in 2012 with 30k€ each institution. Since 2021 every 2 years, 120k€ each.
  - Small actions to put to work UPV engineers with La Fe clinicians by means of:
    - Brokering activities to get to know UPV researchers with La Fe personnel
    - A seed funding programme with an annual call for proposals
      - Seed for research collaboration (“preparatory actions”)
      - Seed for PoC and innovation collaboration (“innovation projects”)
    - Dissemination activities to raise awareness in health innovation
  - Aiming at boosting further collaboration in other competitive programmes and in Knowledge transfer processes
  - Managed by the Knowledge Transfer and Innovation offices of both sides
  - INBIO programme 2017 evaluation highlight: 345,000 € seed investment by both institutions had returned 8,517,000 € in research projects funding (regional, national, European).

## Expanding the initiative ...

- **FISABIO Foundation**, covering research and innovation of most of the Valencian Hospitals asks UPV a similar programme: **POLISABIO** programme is launched in 2017 on an annual basis starting with just 15k€ each institution.
- Two other Valencian universities (UJI, UMH) requested similar bilateral programmes and in 2022 all of them are renamed as UNISALUT, with a joint budget of 260k€ in 2023.
- **INCLIVA**, the other major Valencian Research Institute asks UPV to set up a similar programme. In 2024 the **UPV-CLINIC** Programme is launched with 40k€ contribution from each part to boost bilateral research and innovation collaboration.

## Results and impact

- INBIO, POLISABIO/UNISALUT and UPV-CLINIC programmes have produced 243 preparatory actions and 45 innovation projects along 2012-2024 period, with an UPV investment of 905.500 €.
- UPV researchers participations account +1300. Similar amount in hospital partners
- Dozens of research projects, hundreds of scientific publications, patents and spin-off companies have been originated from collaborations coming from the UPV-Hospitals programmes
- As a consequence of these programmes UPV has entered in the Health Research and Innovation sector, despite not having medicine or pharmaceutical disciplines.
- During the last pandemic UPV was able to align most of the Health R&I sector to organize a program to answer to demands of clinicians.



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### MATCH COVID19: COLABORACIÓN PARA PROYECTOS Y SOLUCIONES INNOVADORAS CONTRA LA PANDEMIA

27/03/20



Resu

The first portable MRI device



**PhysioMRI**  
Magnetic Resonance Imaging

Revolutionizing accessibility without compromising quality  
The only truly portable device that will revolutionize the world of extremity imaging

- INBIC 45 in

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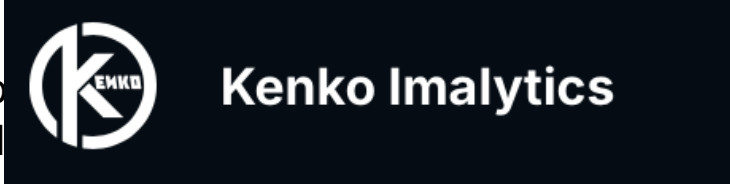
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### ***Lessons learned:***

- UPV - Small seed actions, if maintained along time, return great outputs and reach impact.
- Doze origin - Knowledge Transfer and Innovation Offices in both sides are appropriate units to jointly manage seed activities for R&I.
- As a despi - Matching methodologies developed for UPV-Hospitals programmes have been applied to other environments involving companies (e.g. Programmes “UPV-Empresa Matching”, “INNOTRANSFER”, “Pre-seed Empresa”).
- Durin answ - Research interest is shifting from a pure academic purpose to a social one

# Starting and Cooperating with Medical Faculties and Research Centers: a roadmap

- 1) Identify Synergies:** The first step is identifying common research interests between the technical university, faculties of medicine, health research centers, industry .... This can involve holding joint workshops, seminars, and meetings where researchers and clinicians exchange ideas.
- 2) Form an Advisory Committee:** Create a multidisciplinary advisory group, including leading faculty members from the universities and medical centers, to guide collaboration efforts and identify the most promising areas for joint research and education.
- 3) Develop Joint Programs:** Collaboratively design curricula that integrate technology with medicine, ensuring that these programs are rigorous and relevant to both fields. Interdisciplinary courses should be co-taught by engineering and medical faculty.
- 4) Shared Facilities and Resources:** Establish agreements that allow shared use of labs, clinical facilities, and technology resources. A dedicated space where medical researchers and technologists can work side by side would catalyze collaboration.
- 5) Build Trust and Mutual Understanding:** Regular communication, transparency, and a clear understanding of each partner's priorities and limitations are crucial. Developing long-term relationships with clinicians and researchers will ensure that the collaboration is sustainable.



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