Biomedical Engineering

Diversifying the industrial fabric of the Canary Islands creating a virtuous cycle between Health and Industry
Origins

We were created with the purpose of providing engineering support to the R&D&I of the regional health service and promoting new clinical applications that could help diversify the industrial fabric of the Canary Islands in economic activities of high added value, intensive in scientific knowledge and with clear commercial vocation in the global market.

Objectives

To develop R&D&I activities in translational medicine and high added value services for surgical treatment in reconstruction and regeneration of bone and cartilage tissue.

To offer computer-aided engineering support to other industrial sectors in need of advanced design and manufacturing capabilities.
Biomedical Engineering
Department

We are committed to innovation applied to orthopaedic surgery and neurosurgery.

Teamwork with training and experience in 3D modelling and additive manufacturing technologies.

Creation of the spin-off Osteobionix.

Activity since 1999

Budget 2021: € 0.5 M

R&D&I lines...

... in bone and cartilage reconstruction and regeneration with highly porous titanium scaffolds ...

... in the manufacture of resorbable biopolymer scaffolds for tissue engineering and regenerative medicine

... and in the development of new minimally invasive surgical techniques.
First exploitation of biomedical patents

The HUMIC plate was designed for the fixation of hip osteotomies in children and adolescents, and was installed for the first time in 1999; since then, more than 200 units have been implanted.

2004

CADCAM Laboratory for Computer Aided Design and Manufacturing: First Prosthetic Prototypes

Since 2005, the Canary Islands Institute of Technology has been providing companies with various technological services in design and advanced manufacturing for the mechanical sector (CADCAM - Computer Aided Design Computer Aided Manufacturing)

2005

Biomechatronics Laboratory: development of new processes and devices for tissue regeneration. Manufacture of the first nanofibers in the Canary Islands

The Canary Islands have been a pioneer in the applications of regenerative medicine for the reconstruction of various tissues (bone, nervous, cartilage and vascular) with the use of three-dimensional supports for cell adhesion (scaffolds)

2009

First 3D printer (titanium) by electron beam melting of the Canary Islands: manufacture of the first prototypes of porous structures

The acquisition of the first 3D printer by electron beam melting (Titanium) in the Canary Islands allowed the development of new implantable devices and specific instruments for orthopedic surgery, both in humans and animals. These porous implants have an elastic behavior similar to that of bone.

2010

Manufacture of the first nanofiber scaffolds in the Canary Islands in the biomechatronics laboratory. Development of new processes and devices for tissue regeneration

2009
**Biomedical Engineering Department**

- **2012** First custom implants performed in humans in Canary hospitals
  - Maxillofacial reconstruction in patients, in collaboration with the Canary Islands University Hospital (HUC)

- **2012** Launch of the first serial product for veterinary surgery
  - Development of a bone intervention technique for the treatment of cranial cruciate ligament tears in dogs, based on the fixation of the bone fragment of the tibia

- **2013** First custom-made bone implants in Spain
  - Based on the approval obtained by the ITC for the manufacture of custom implants in humans, a new hospital service was developed to improve the typology of prostheses and respond to tumor recessions, a pioneer in Spain and with very few analogies in Europe.

- **2018** Creation of the Osteobionix Spin-off
  - Creation of the Osteobionix spin-off based on scientific and technological knowledge in biomedical engineering

- **2014** First custom implants abroad: Italy, Argentina, Colombia
  - ITC begins exporting designs and implants abroad, expanding international destinations.

Milestones
Activity Lines

Large bone defects reconstruction

CADCAM
Computer Aided Design - Computer Aided Manufacturing
Agüimes

Custom implant approval

Advanced design
Additive metal fabrication and CNC
White room
Activity Lines

Regenerative medicine

Approval for custom implants

Development of new processes

Electromechanical integration

Scaffolds with biopolymers

Surface finishes

BIOMECHATRONICS AREA
Santa Cruz de Tenerife
**Product features**

**Porous structures**
- Inert structure
- Biomimetic surface
- Biodegradable filler
- Millimeter scale
- Electron Beam Melting

**Bioreactor**
- Cells
- Nutrients
- Chemical factors
- Stimuli
  - Functional bioreactor (Scaffold)
  - Tissue

**Biodegradable Scaffolds**
- Biodegradable structure
- Growth factors
- Micro/nano scale
- 2D Electrospinning
- 3D fused deposition
Technological Services

01 Custom implants for bone and cartilage reconstruction with applications in orthopedic, cranio-maxillofacial, thoracic and spinal surgery

02 Product development in the mechanical-electromechanical sector

03 Design assisted by computer

04 Development of scaffolds for tissue engineering and regenerative medicine

05 3D Manufacturing printing and chip removal

Biomedical Engineering Department
**Equipment**

- Optical scanner for reverse engineering
- Machine tools by numerical control chip removal, lathes and milling machines
- Metal, polymer and resin 3D printers
  - Laser cut
  - Laser engraving
- Surface finishing by abrasion

**Software**

- CREO software platform with CAD, CAM, FEM modules, for solids and surfaces
  - 3D Studio MAX
    - Fusion 360
    - Geomagics
    - Magics
  - 3D CLOUD
Specifically...

- 20% in international reference centers (Italy, Argentina, Colombia)
- Pioneers in highly porous implants
- 9 related scientific articles
- 1 new patent application
- 1 Interreg MACbioIDi project
- 1 H2020 NANOVERTEBRA project
- 1 H2020 project under evaluation

+ 250 custom implants in humans

- Leaders in Spain of porous TTA
- Leaders in salvation of vital members
- 15 communications in congresses
- 1 scientific article
- 8 national training courses, 2 in master's degrees

+ 10.000 implants in animals

Spin-off creation

- 4 new jobs
- 3 new projects
- 2 European brands
INTERNATIONAL PATENTS
PCT/ES2003/599 fixing device for hip osteotomies
PCT/ES2003/598 external wrist-fixing device
PCT/ES2003/597 intramedullary nail
PCT/ES2005/302 surgical needle holder for stitch suturing
German patents under evaluation process (2019): dynamic thoracic implant structure for chest wall reconstruction

ADVISED COMPANIES
more than 50

PROJECTS IN PARTNERSHIP
MULTISCAFF - Multicomponent scaffolds for osteoarthritis treatment, CIBER-BBN
CoaTReg-3D - Bioactive coatings to promote Tissue regeneration and ingrowth into 3D custom-made porous titanium endoimplants CIBER-BBN

CONFERENCES, SEMINARS AND ORGANIZED COURSES
10 conferences, 80 seminars on surgical techniques in regional, national and international hospitals, 40 courses on veterinary surgical techniques

PEOPLE HISTORICALLY TRAINED WITH THE AREA’S ACTIVITY
10 PhD Theses, 25 final degree projects; 4 projects TORRES QUEVEDO

contracts FOR TECHNOLOGY TRANSFER TO COMPANIES
IBK 13-741- BIOSCAD – Raomed;
PCT/ES2003599 to ACETUM INGENIERIA BIOMÉDICA 2003;
PCT/ES2003599 to OSTEOFARMA in 2009;
Know-How to OSTEOBIONIX spin off in 2018
Challenges

Introduction in new international markets: Germany, England, USA

Presence in the European Research Area

Industrial impact search with serial implant line

Strengthening regional manufacturing environment in the mechanical and electromechanical sectors

Manufacture according to ISO: 13485