The role of start-ups in the evolution of the healthcare system

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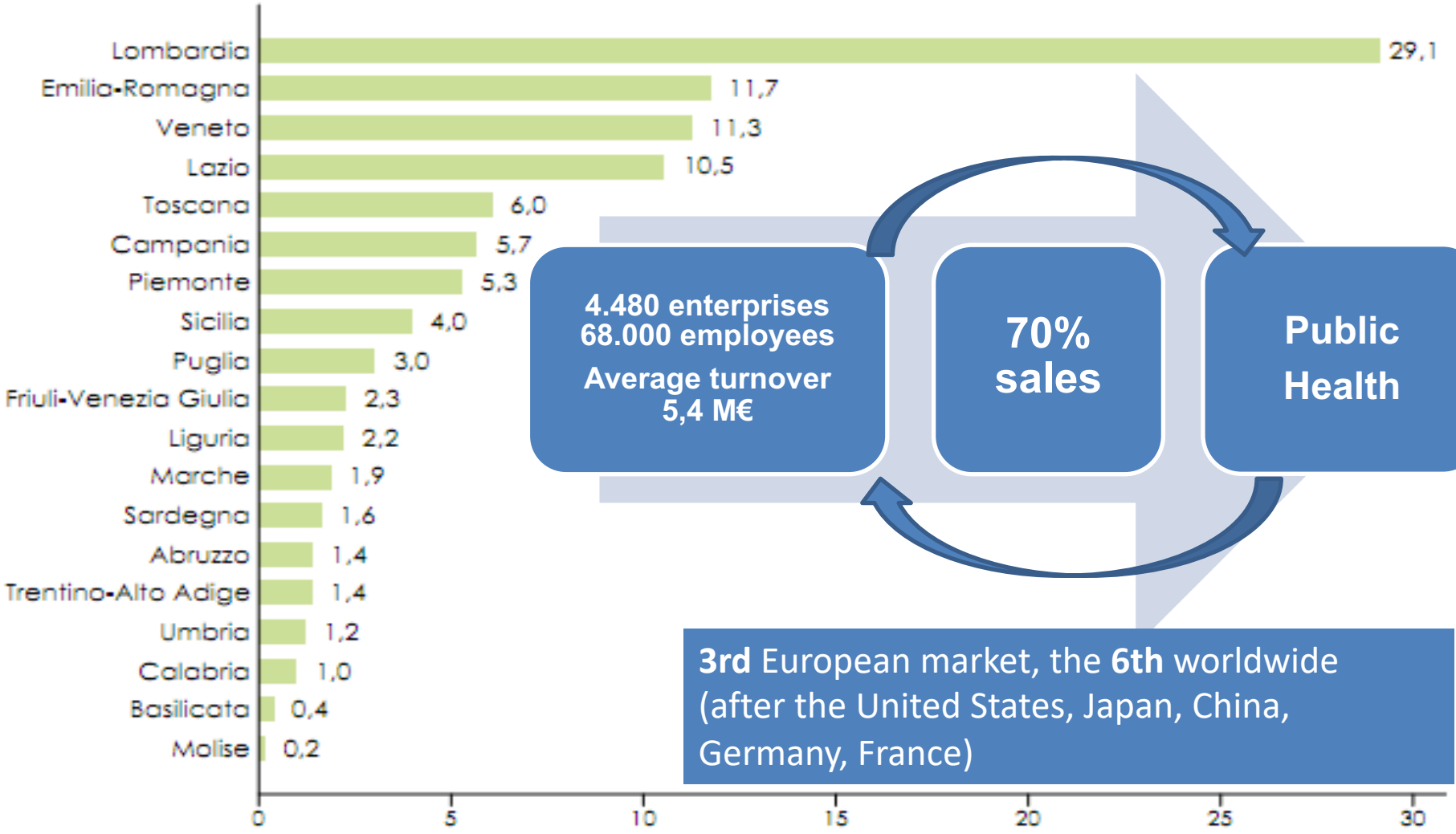
Biomedical Engineering Laboratory

THE MEDICAL DEVICES SECTOR IN ITALY



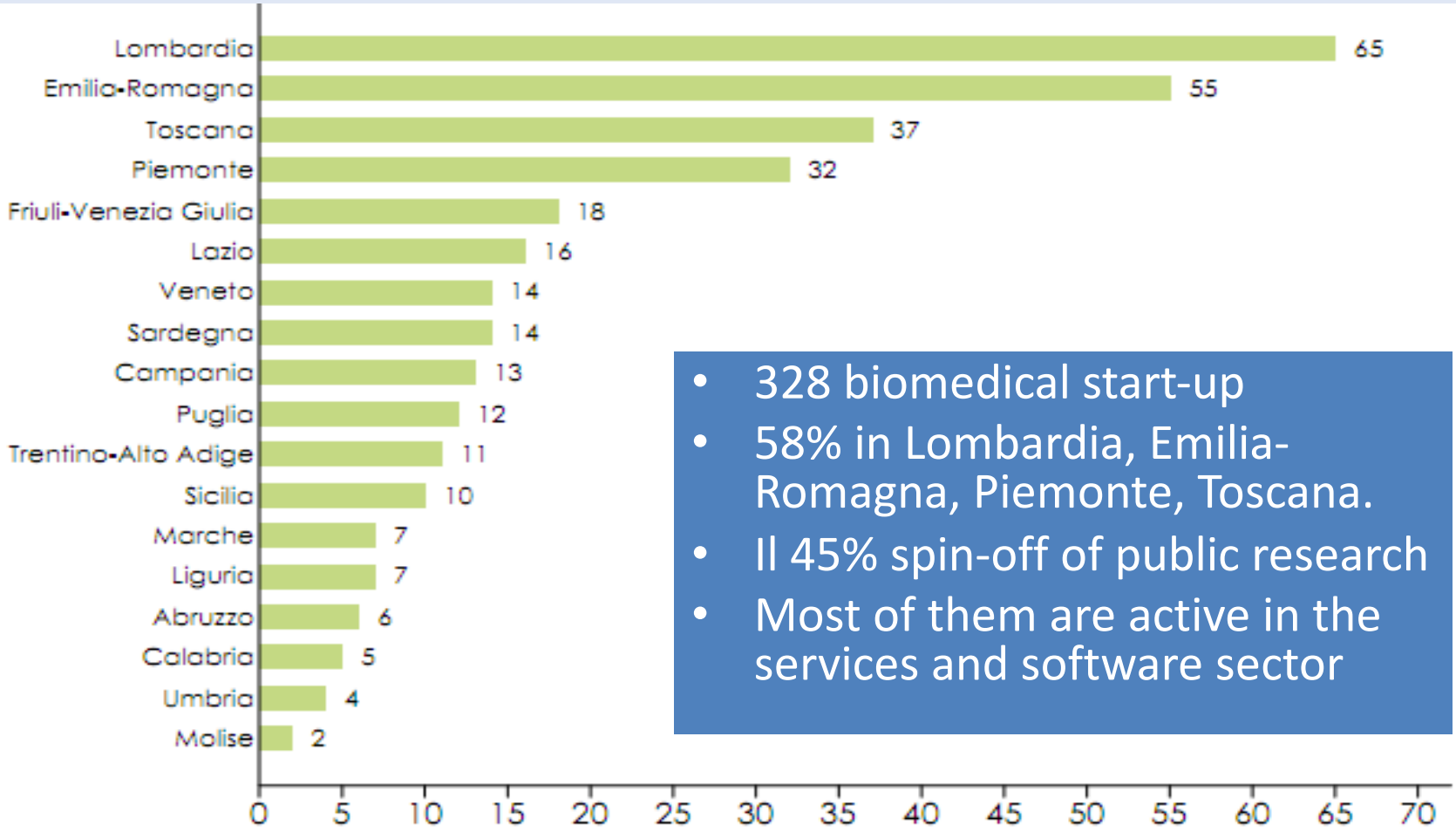
4.480 enterprises
68.000 employees
Average turnover 5,4 M€

70% sales

Public Health

3rd European market, the **6th** worldwide (after the United States, Japan, China, Germany, France)

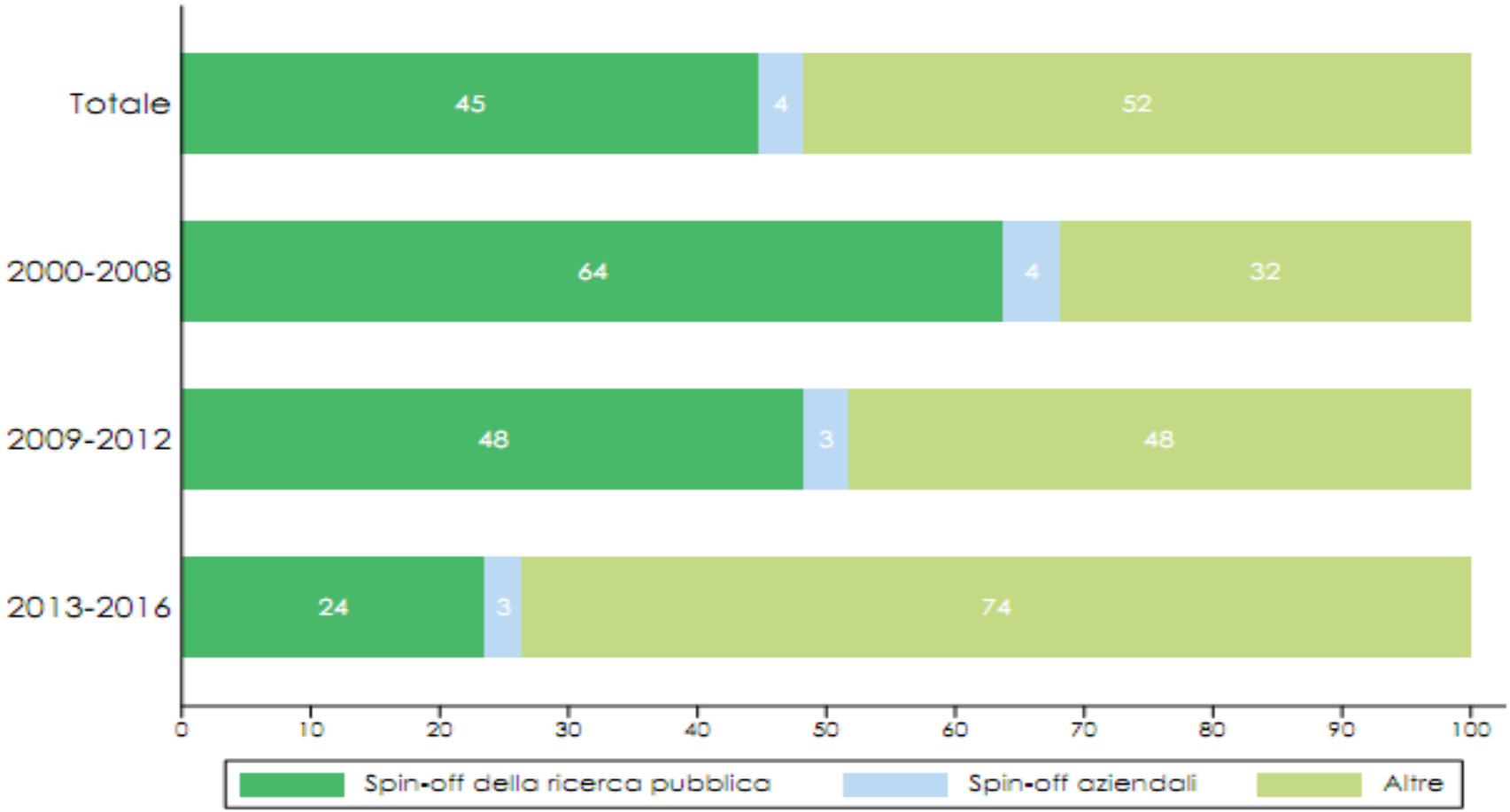
THE MEDICAL DEVICES START-UPS IN ITALY



- 328 biomedical start-up
- 58% in Lombardia, Emilia-Romagna, Piemonte, Toscana.
- Il 45% spin-off of public research
- Most of them are active in the services and software sector

Fonte: elaborazioni CSA su database start-up

THE MEDICAL DEVICES START-UPS OVER TIME



Fonte: elaborazioni CSA su database start-up

- Skills and technologies in our health system certainly place it among the most advanced in the world.
- It is mandatory to: 1) seize the opportunities present in the framework of European innovation funding; 2) offer services to companies in terms of R & D, technology transfer, clinical investigations.
- The winning idea of scientific and technological center where industry and university research laboratories can interact already during the programming phase of the respective activities and then collaborate in the phase of R & D and technology transfer.
- Structural actions are mostly possible at net cost equal to zero

STARTUP

Più spin-off universitari, ma il mercato resta lontano

Il Sole 24 ORE

–di Giampaolo Colletti | 16 gennaio 2018

- Today 2000, average turnoverdio 260k, 5% exceeding 1M euros
- Nord 46%, Central 20% South 34%
- Health and life sciences greater number of connections with research
- **58% only prototypes and only 3.1% on the market!**

LA STAMPA

La lunga vita delle start-up targate Poli: tre su quattro sopravvivono dopo il lancio

L'incubatore I3P riceve 600 proposte l'anno, ma solo le 70 più solide e innovative passano la dura selezione

The new scientific and technological center PolitoBIOMed Lab

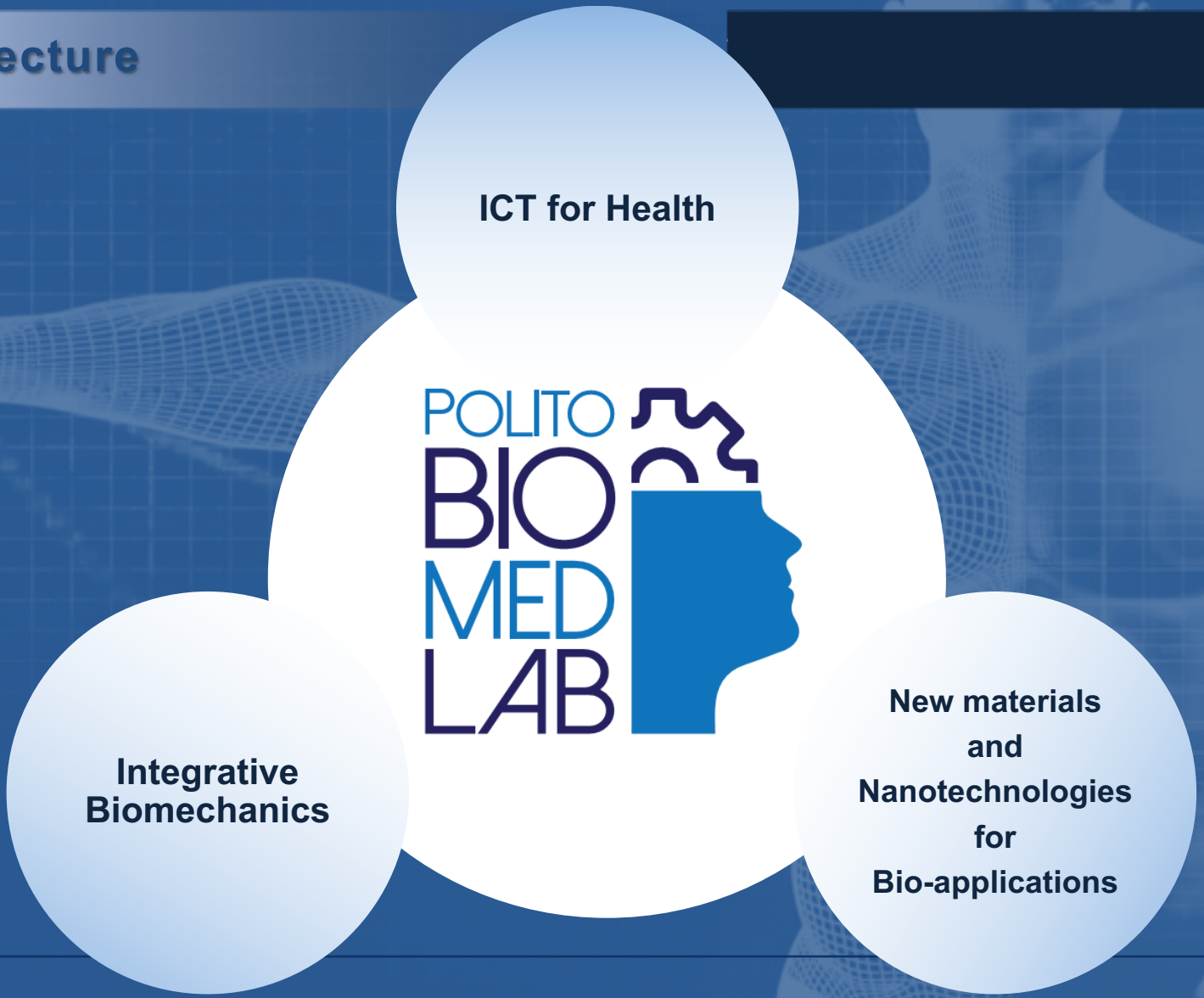
Addressing Societal challenge
Health & Wellbeing

Scientific/Technological specific skills

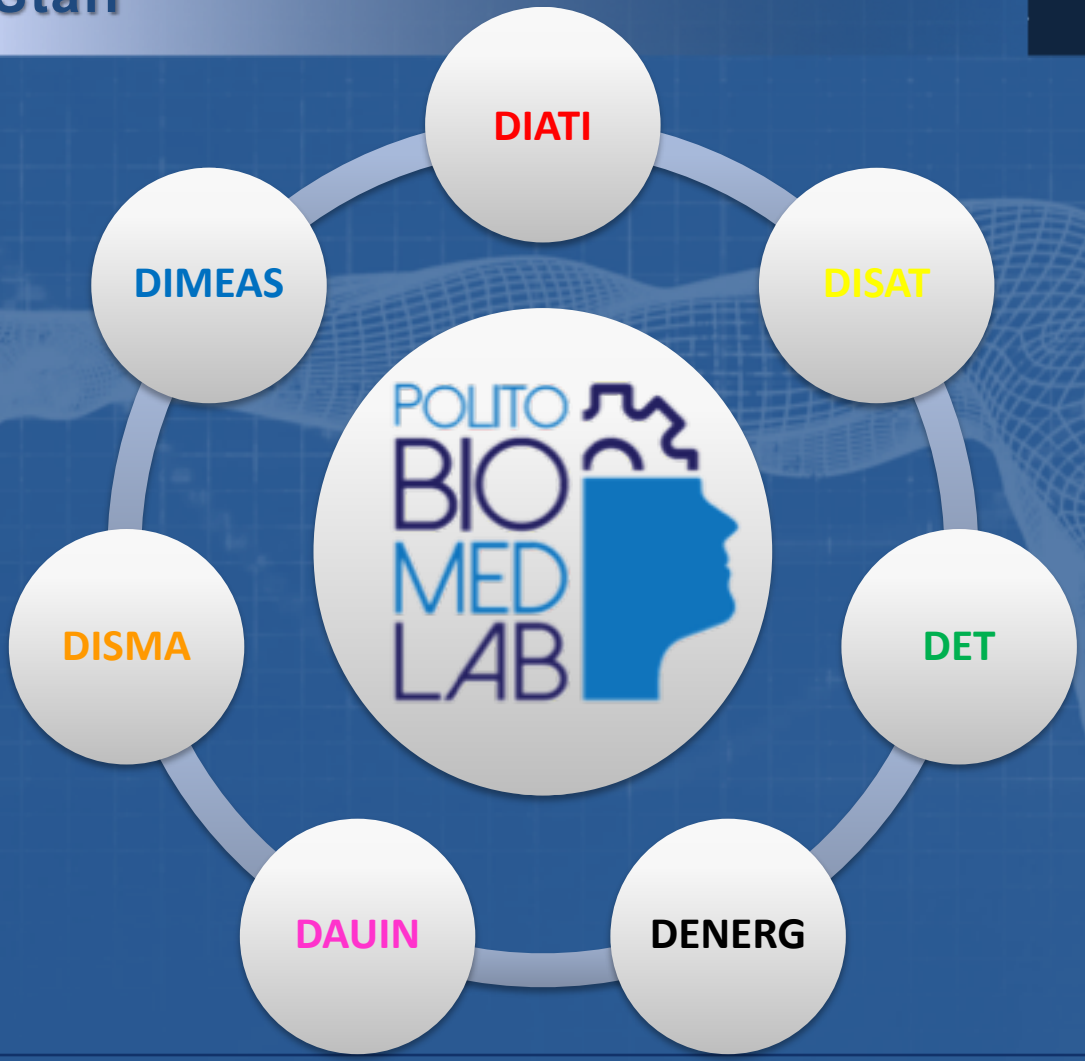
Biomedical Engineering framework expertise

Scientific Excellence - Technology Transfer to Territory

Architecture



Staff



Dept.	Senior Staff
DAUIN	5
DENERG	6
DET	17
DIATI	2
DISMA	3
DIMEAS	14
DISAT	20
Total	**67**

Topics

New Materials & Nanotechnologies

- *Tissue & Regenerative Eng.*
  Cell culture: biocompatible architectures reconfigurable by external stimuli application (e.g. pH, temperature, UV-Vis light).
- *Organic/inorganic interactions at the nanoscale*
  New technologies for NPs kinetic monitoring, multifunctional theranostic NPs and robust lab-on-chip point of care systems
- *Advanced Optical Imaging*
  Holographic imaging systems of thick biological samples such as tumor organoids

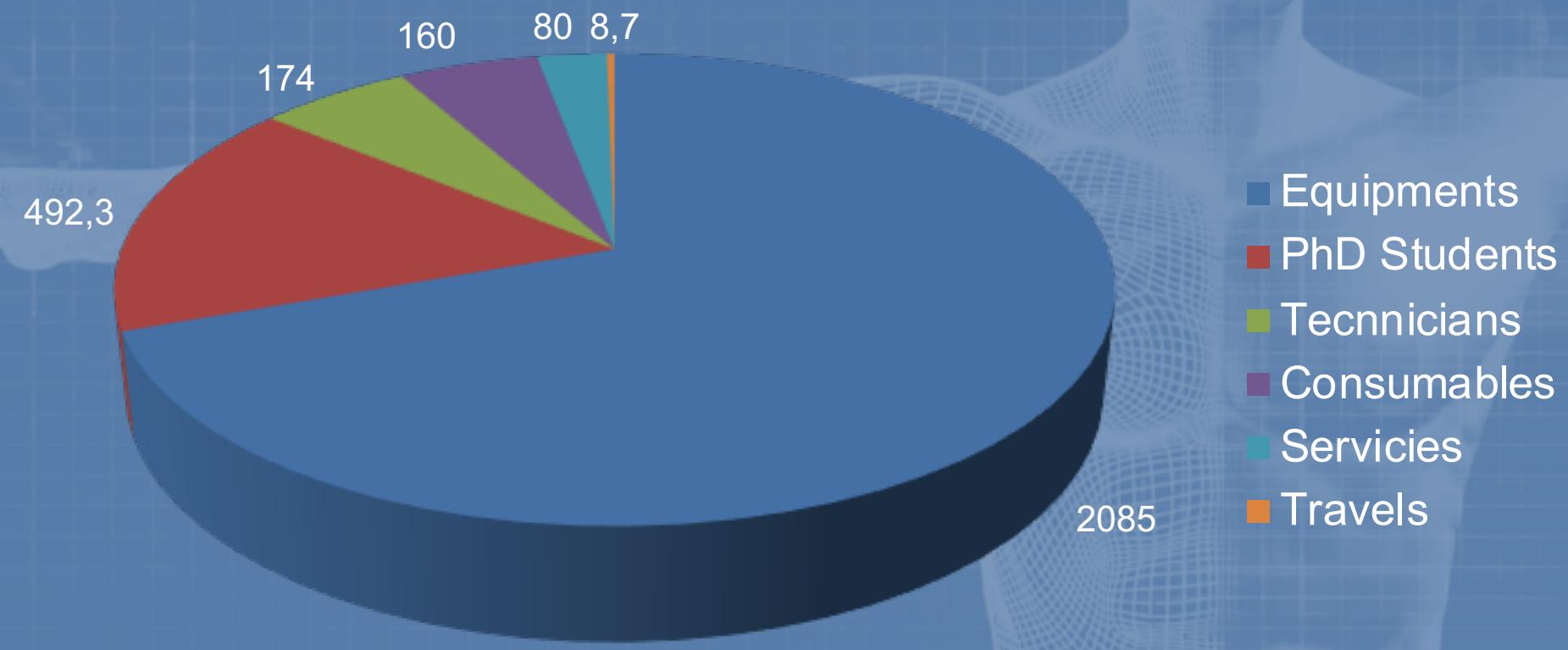
ICT for Health

- *Human Machine Interface*
  Adaptive sport; Rehabilitative devices; Tele-rehabilitation/monitoring
- *Oncology*
  Diagnostic devices; Bioimage processing and interpretation; Implantable chips and organs on chip
- *Ageing and Fragility*
  Motor weakness, osteoporosis; Psychological fragility; Voice disorders Occupational voice use; Cerebrovascular fragility

Integrative Biomechanics

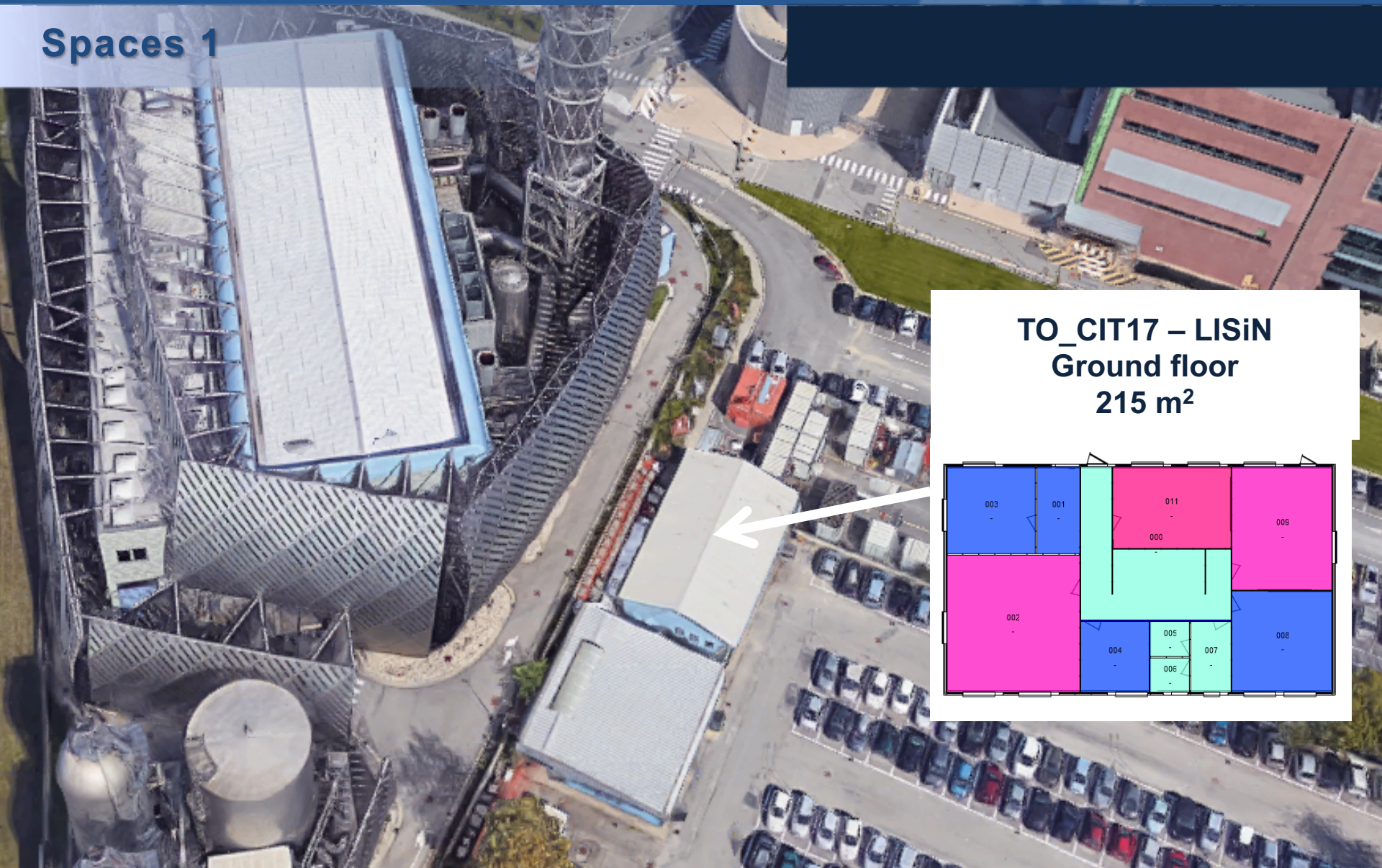
- *Cardiovascular Engineering*
  Cardiovascular image/signal processing; Integration of imaging and in silico hemodynamics; Blood recirculating devices; Emulators for surgical training
- *Prostheses, Implants, Systems for Fracture Synthesis and CAS*
  Arthroprostheses; Dental implants; Design in silico and experimental validation; Soft and hard biological tissues mechanics
- *Biorobotics*
  Minimally invasive surgery (MIS) and laparoscopic surgery and devices; Rehabilitation Orthoses

Budget 3 M€ – 3 years



+ 4 Researchers RTDs

Spaces 1

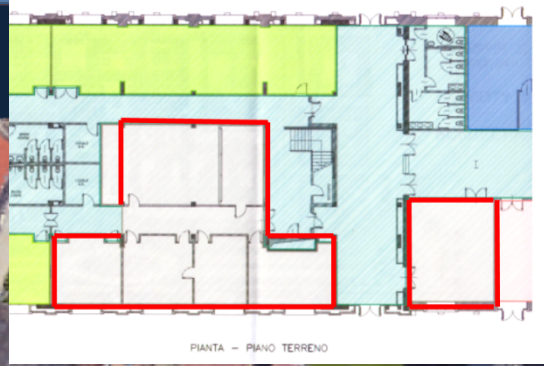


TO_CIT17 – LISiN
Ground floor
215 m²

Spaces 2

TO_CIT07 - NUOVI SPAZI
First floor
220 m²

TO_CIT07 – GRAPHENE LAB
Ground floor
250 m2

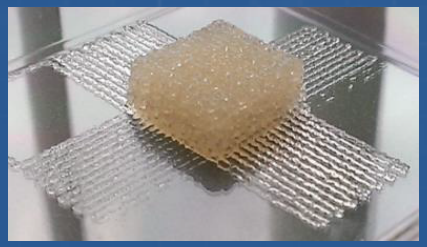
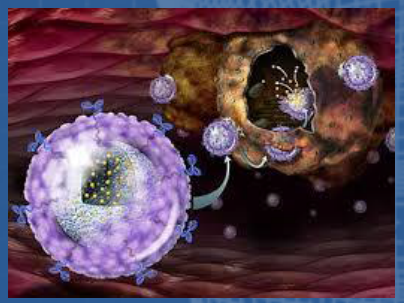


685 m²

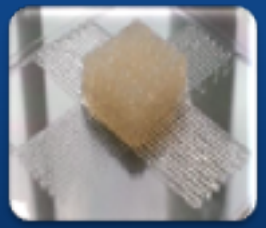
TOTAL

Equipments 1 (Nanobio)

- Polymeric 3D printing technologies for cell cultures (scaffold, organ-on-chip)
- Advanced high-resolution microscopy (optical, electron, scanning)
- Cell cultures labs and biological functionalization of surfaces
- Technologies for the development of Lab-on-chip based diagnostic systems


Equipments 1 (Nanobio)



Microfabrication

- 3D nanoprinting
- Elettrospinning
- Fused Deposition modelilng

Surface modification

- Spin-coater

Characterisation

- GLIM microscopy (Gradient Light Interference Microscopy)
- Confocal microscopy
- Quartz crystal microbalance (QCM)
- Polymerase Chain Reaction (PCR)
- Western Blot
- Flow cytometry

Equipments 2 (ICT)

- 3D Motion tracking system for gait analysis and rehabilitation; Capnograph, spyrometer, O2 consumption system
- Open ultrasuond system for quantitative elastography
- Biopotential acquisition systems with sensors (EEG, EMG, ECG)

Equipments 3 (Biomech)

- Multiaxial mechanical and fatigue characterization of tissues, organs, devices
- Test benches for hydrodynamic characterization of blood recirculating devices
- Thermal infrared camera for soft tissues characterization
- Laser Doppler Vibrometry systems for non-contact monitoring of vital signs

HUMAN-MACHINE INTERFACE (HMI)

MAIN TOPICS

- Rehabilitation technologies
- Devices for training/ assistance/ rehabilitation in ergonomics/sport/sport finalised to musculo-skeletal rehabilitation
- Tele-rehabilitation/monitoring

- Basic and translational research in the analysis of human movement

TECHNOLOGICAL ADVANCES

- Wearable devices for movement analysis
  - Kinematics
  - Kinetics
  - Electrophysiology
- Functional Electric Stimulation
- Methodologies and Systems for tele-rehabilitation and tele-monitoring

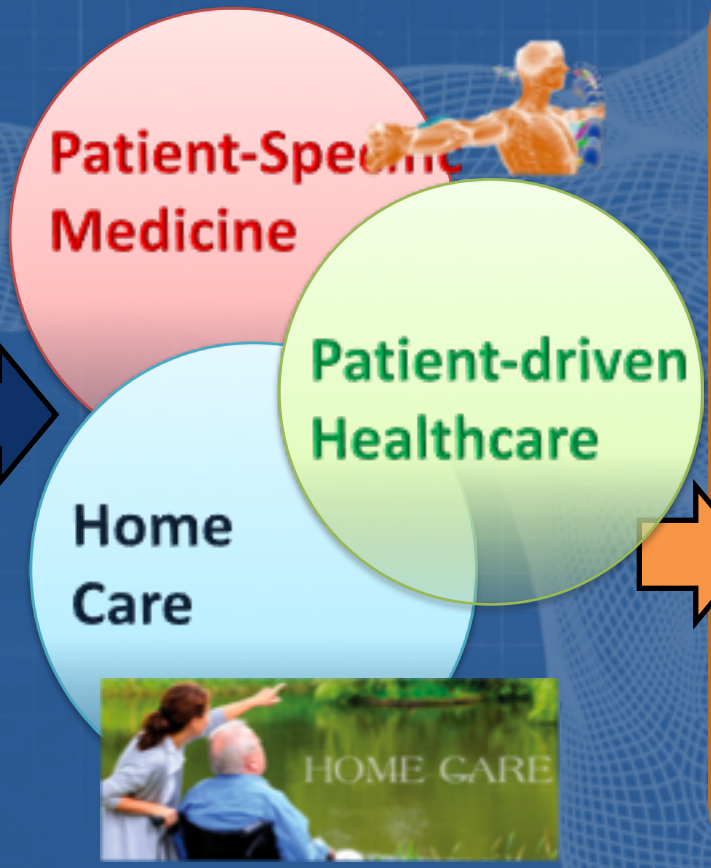
FRAILTY IN ELDERLY PEOLPLE

Prevention of

- Acute Cardiologic Events
- Acute Events in neurologic pathologies
- Lack of Self-Sufficiency

IoTs for Vulnerability

- Portability
- Durability
- Multi Sensing
- Usability
- Low Cost



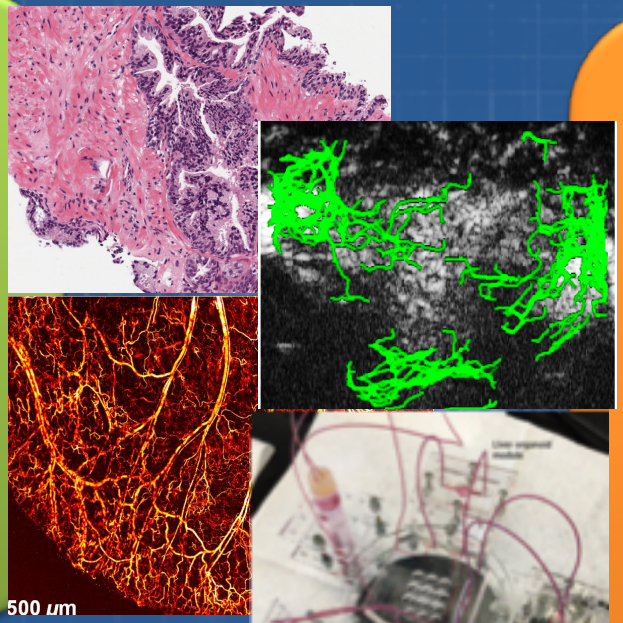
Technological Challenges

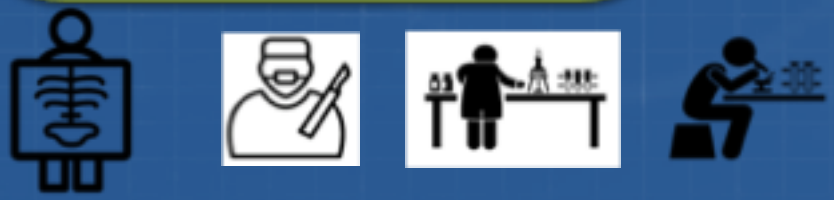
- Monitoring
- Analysis of Data
- Models to support medical and clinical decisions
- Data sharing
  - Transmission
  - Alarms
  - Interaction among Hospital Units

ONCOLOGY

MAIN TOPICS

- Systems for in-vivo diagnostics
- Bioimages processing, classifying and analysis
- Impiantable chips and organs-on-chip





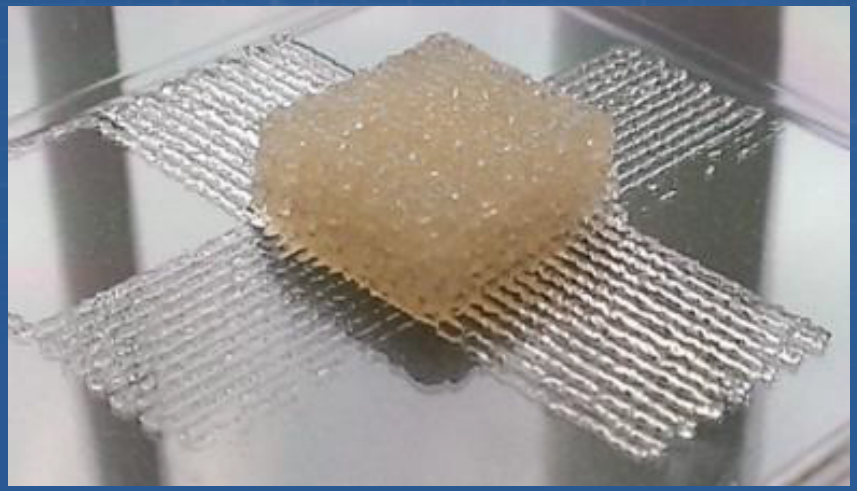
Workflow in oncology: improvement in diagnostics, analysis, and therapy

TECHNOLOGICAL DEVELOPMENT

- Methodologies for multiscale and automatic analysis
- Optic, ultrasonographic, optoacustic instrumentation
- New contrast agents
- Workflow automation in oncology

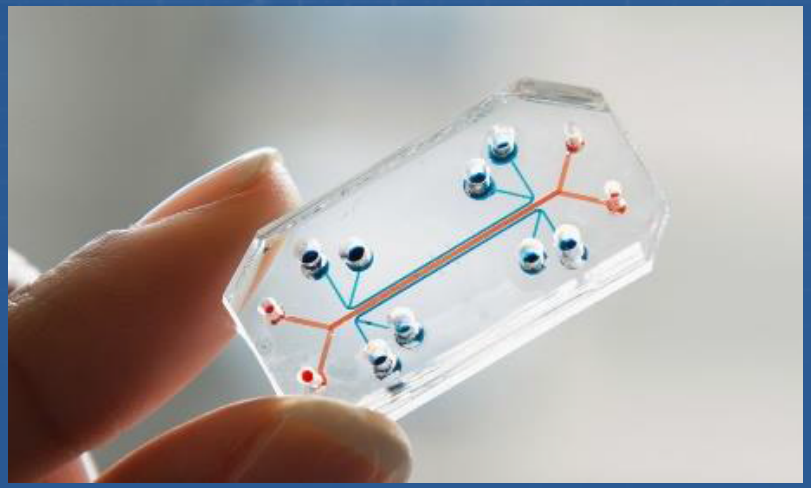
Tissue Engineering and Regenerative Medicine

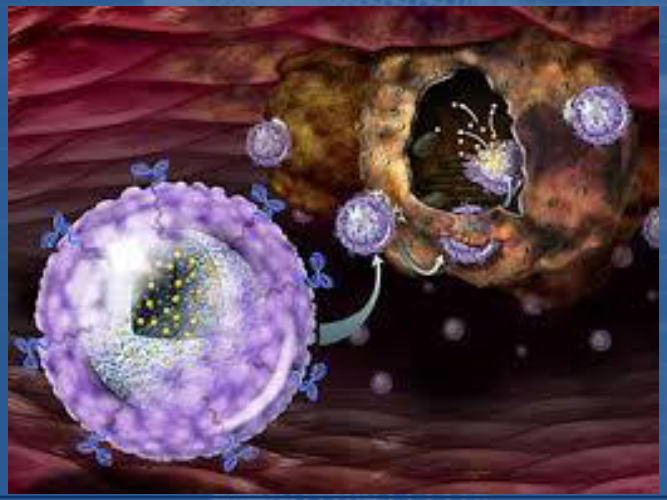
Design and development of “Smart scaffold” and “Organ-on-chip” through 3D micro and nano-patterning of functional polymers suitable to promote cellular expansion and differentiation.



Organic/Inorganic interaction at nanoscale level

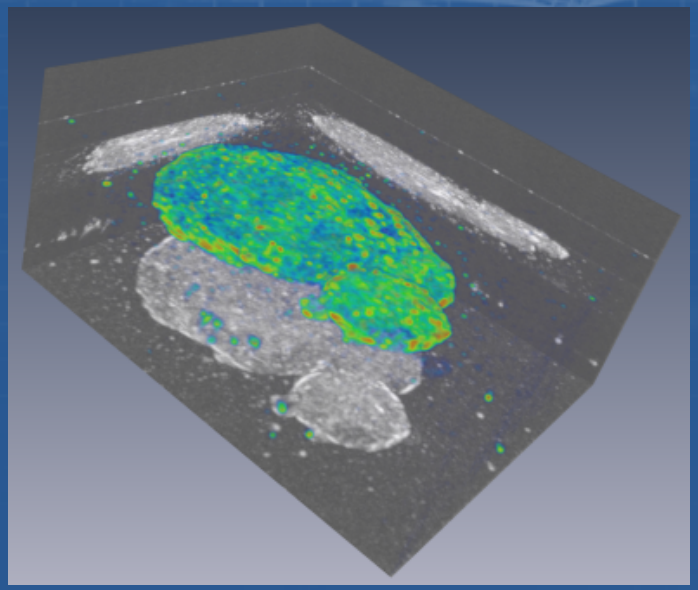
This activity is finalised to the deveopment of new technologies for diagnostics and therapy, such as specifically, nanosenors, lab-on-chip and theranostic functional nanoparticles for oncological applications.

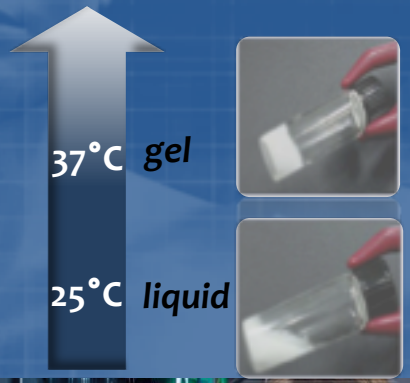




Advanced Optical Imaging

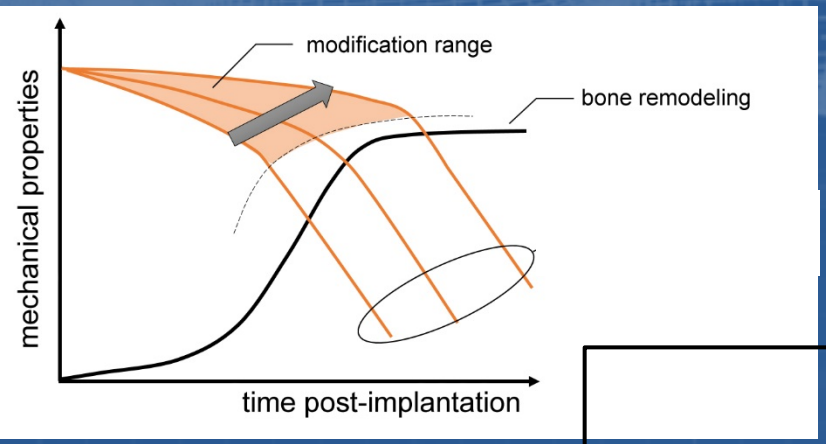
This activity is finalised to the deveopment of advanced techniques for hi-res 3D imaging of biological systems





BIODEGRADABLE DEVICES FOR TRAUMATOLOGY

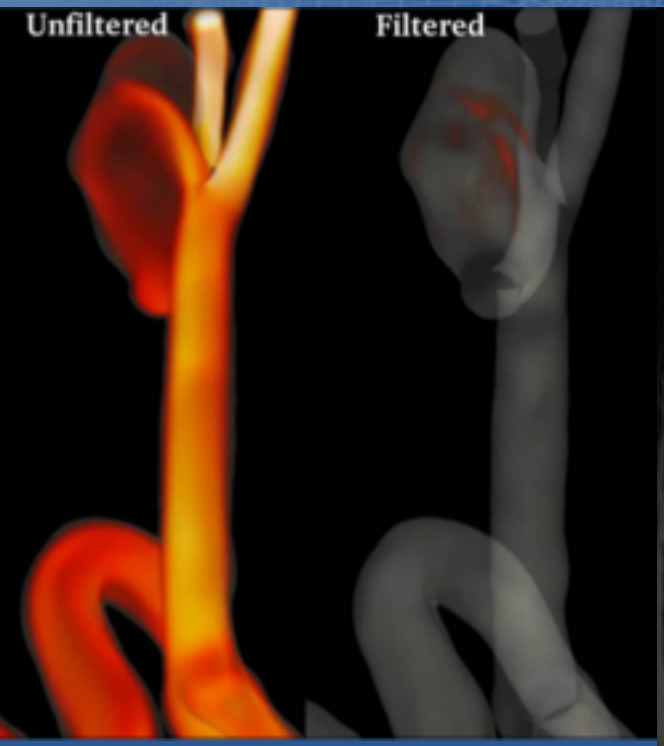
Superficially modified biodegradable materials:
ECAP Technologies
Cryogenic processing
Deep Rolling

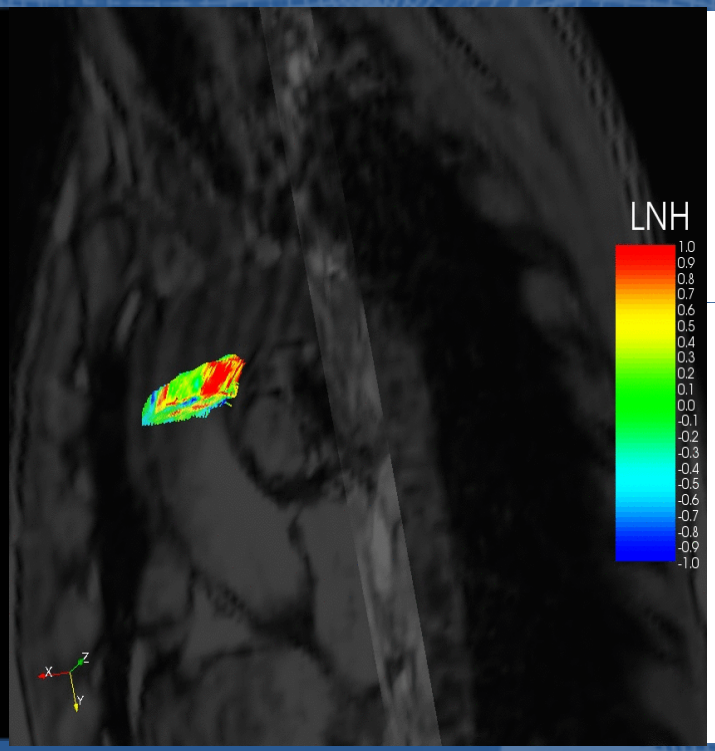


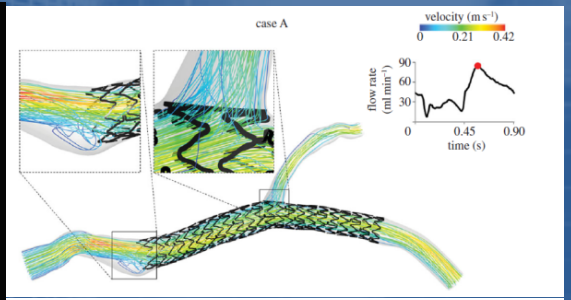
QUANTITATIVE HEMODYNAMICS

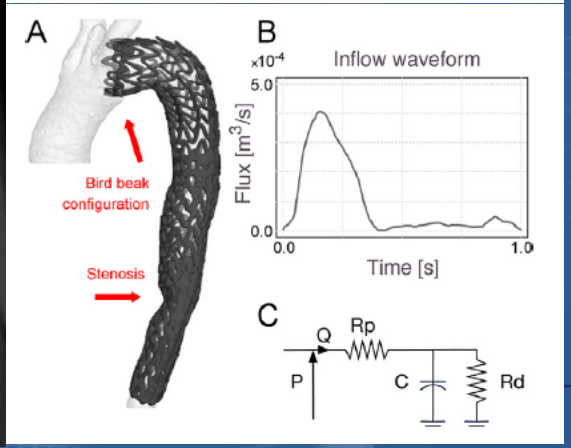
In vivo, in vitro e in silico fluidodynamics:

- Study of the pathophysiology of the cardiovascular system
- Design / characterization of blood recirculation devices
- Support for the clinical decision



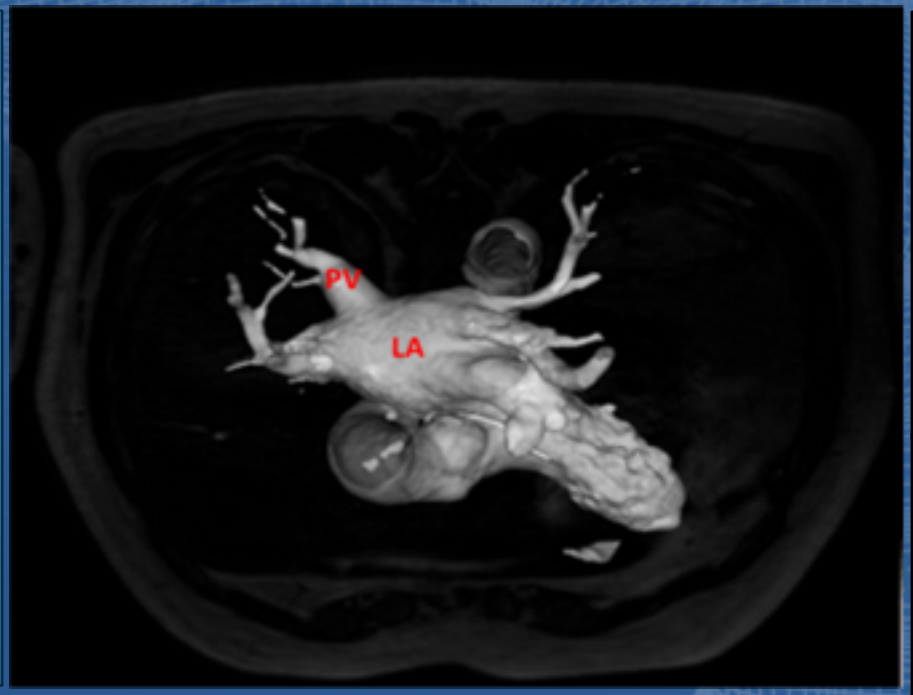


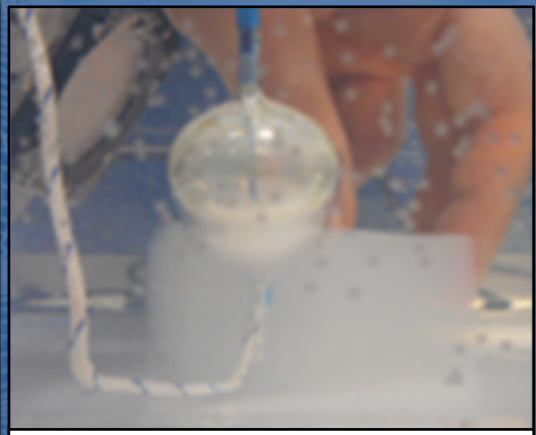


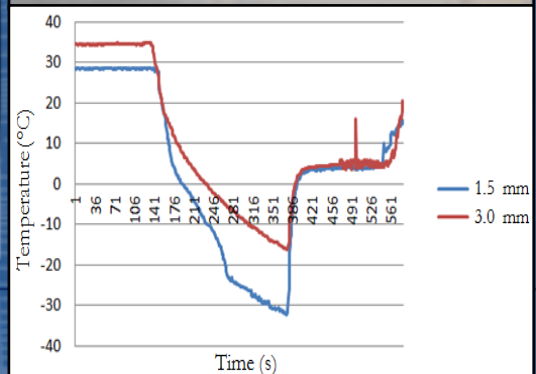


CRYOABLATION FOR FIBRILLATION TREATMENT

Development of technologies and methodologies to set up innovative cryoablation systems for atrial fibrillation treatment

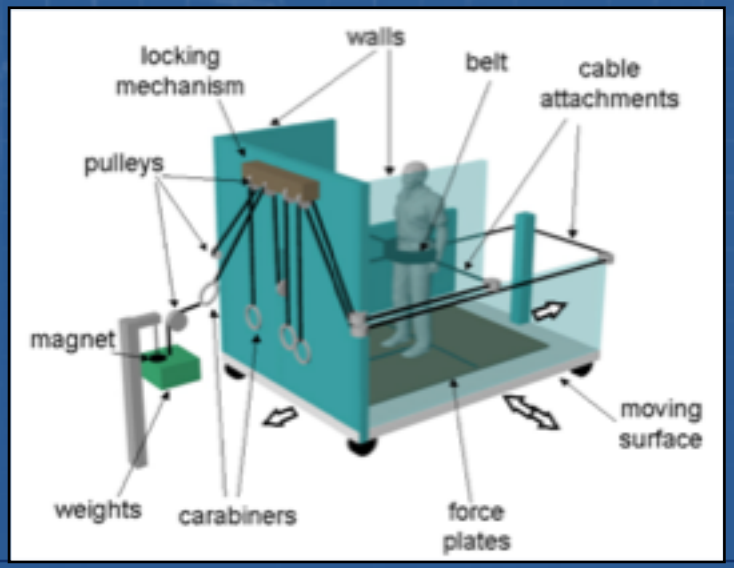


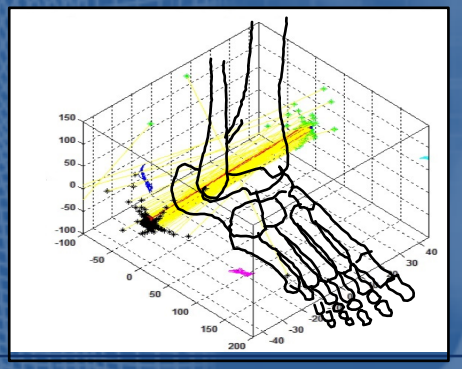


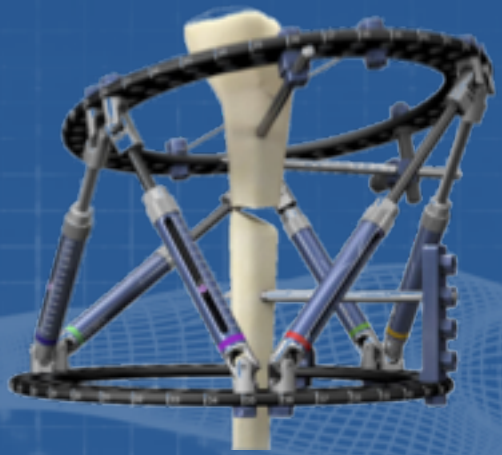


FUNCTIONAL BIOMECHANICS

- *Intermittent Pneumatic Components interacting with the cardiocirculatory system (IPC)*
- *Articulated ankle-foot orthesis, based on physiologic kinematics*
- *Systems for stabilometry*
- *Tunable static orthesis for articular rehabilitation*







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Sustainability

The technological innovation in healthcare is part of the solution, not part of the problem.

The fear that it can push public spending out of control is not only lacking in real foundations, but above all it prevents us from fully grasping the opportunities that Italy would expect from the enhancement of its National Health Service.