

ISTITUTO  
ITALIANO DI  
TECNOLOGIA

# The Added Value of Research

*Salvatore Majorana*

*Technology Transfer Director @ Istituto Italiano di  
Tecnologia*

# Istituto Italiano di Tecnologia

is a Foundation that promotes excellence in fundamental and applied research, develops higher education in the area of science and technology and fosters the evolution of industry towards the forefront areas of technological innovation.

**IIT@HARVARD**

Nanotech for Brain

**IIT@MIT**

Laboratory for Computational and Statistical Learning

CAMBRIDGE, USA

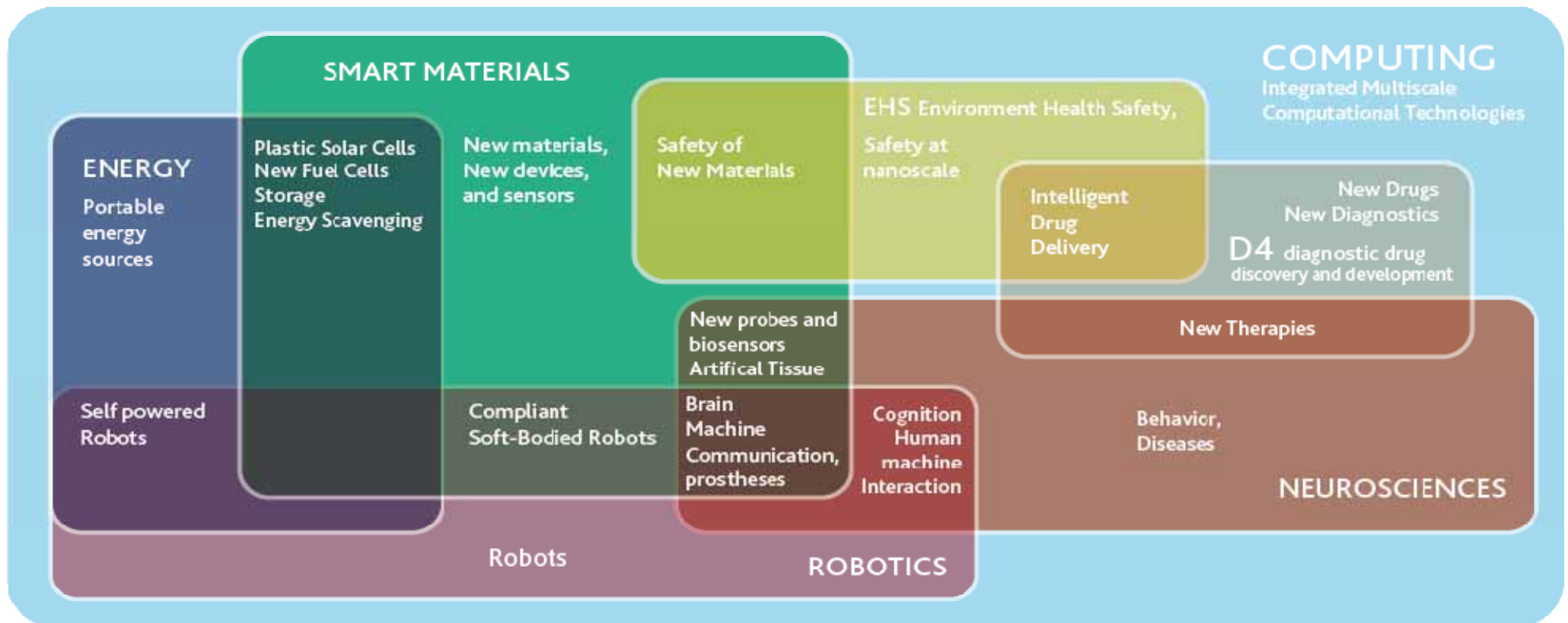


- GENOVA **Central Research Lab**  
NSYN@UniGe
- TORINO **IIT@PoliTo** Center for Sustainable Futures
- MILANO **IIT@PoliMi** Center for Nano Science and Technology
- MILANO **IIT@SEMM** Center for Genomic Science
- TRENTO **IIT@unitn** Center for Neuroscience and Cognitive Systems
- FERRARA **IIT@UniFe** Center for Translational Neurophysiology
- PISA **IIT@NEST** Center for Nanotechnology Innovation
- PISA **IIT@SSSA** Center for Micro-Biorobotics
- ROMA **IIT@SAPIENZA** Center for Life Nano Science
- NAPOLI **IIT@CRIB** Center for Advanced Biomaterials for Health Care
- LECCE **IIT@UniLe** Center for Biomolecular Nanotechnologies

ITALY



Genova Central Research Lab  
32.000 sqm, fully equipped,  
one of the largest single-site  
labs in Europe



Aimed at maximizing cross fertilization between disciplines, the scientific plan addresses some of the main trends that will impact the planet in the next decades, namely demographic shift, quality of life, and resource scarcity. To do so, scientific activity revolves around Robotics & Mechatronics, Life Science and Smart/Green Materials.

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- “The process of translating **an idea** or invention into a good or service that **creates value** or for which customers will pay” (<http://www.businessdictionary.com/definition/innovation.html#ixzz2LcZ31o6r>)
- “Innovation is the development of new values through solutions that meet new needs, inarticulate needs, or old customer **and market** needs in value adding new **ways**”  
(<http://en.wikipedia.org/wiki/Innovation>)
- “*The purpose of innovation is to create **new business***” ...and “*Innovation requires a **change***”  
(Paul Trott, *Innovation Management and New Product Development*, 4th edition)

***Invention*** is the formulation of new ideas for products or processes

**VS.**

***Innovation*** is all about the practical application of new inventions into marketable products or services

# HOW DOES IT HAPPEN?

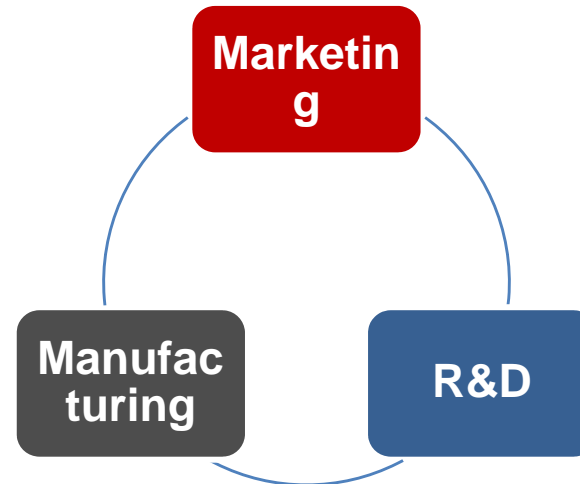
**TECHNOLOGY PUSH**



**MARKET PULL**



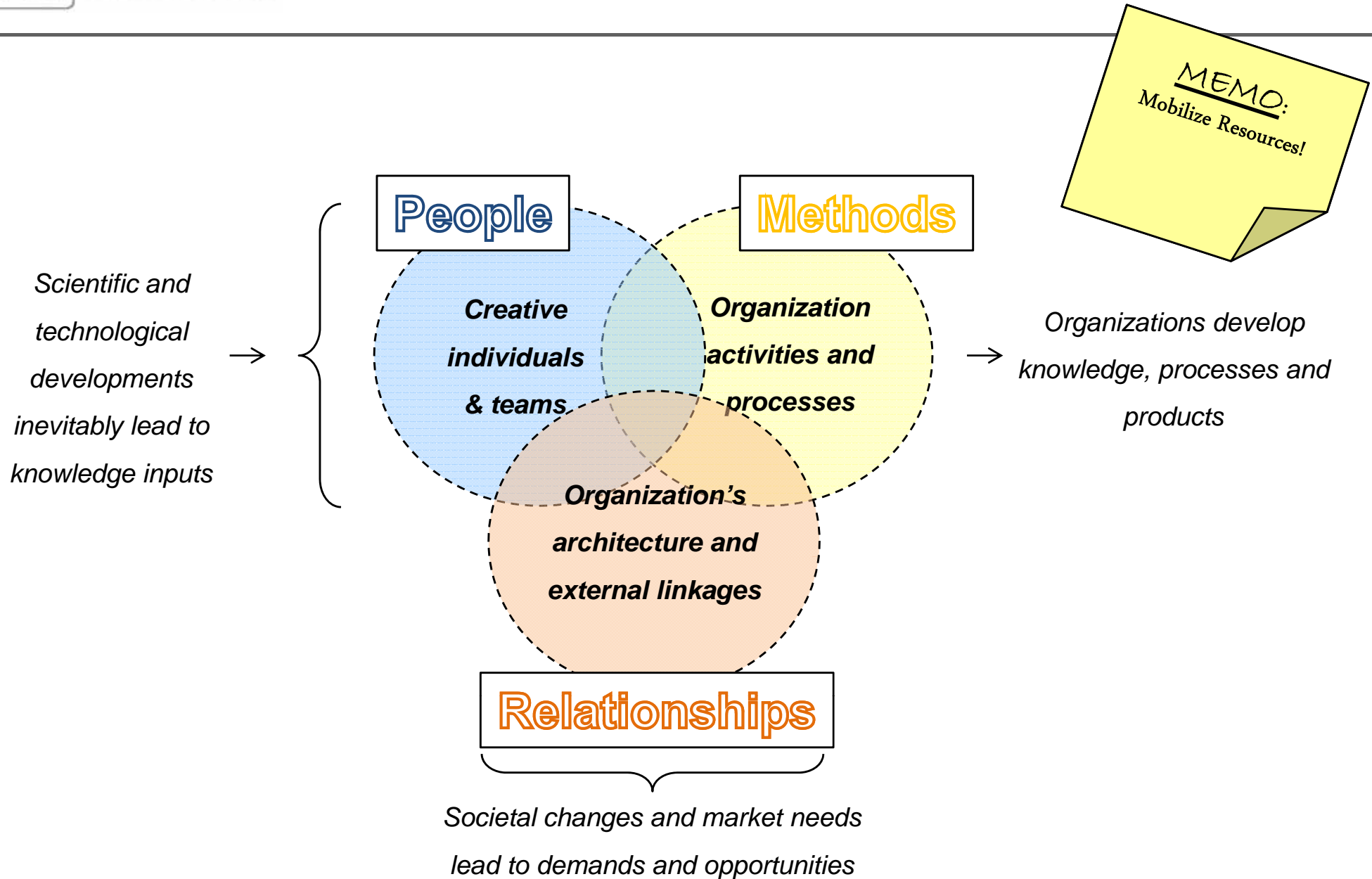
**SIMULTANEOUS COUPLING**



Innovation proved being the result of an articulated  
complex of actions, executed by different actors,  
either in a continuous or discontinuous way,  
both within one single organization and in  
cooperation with players outside the organization.

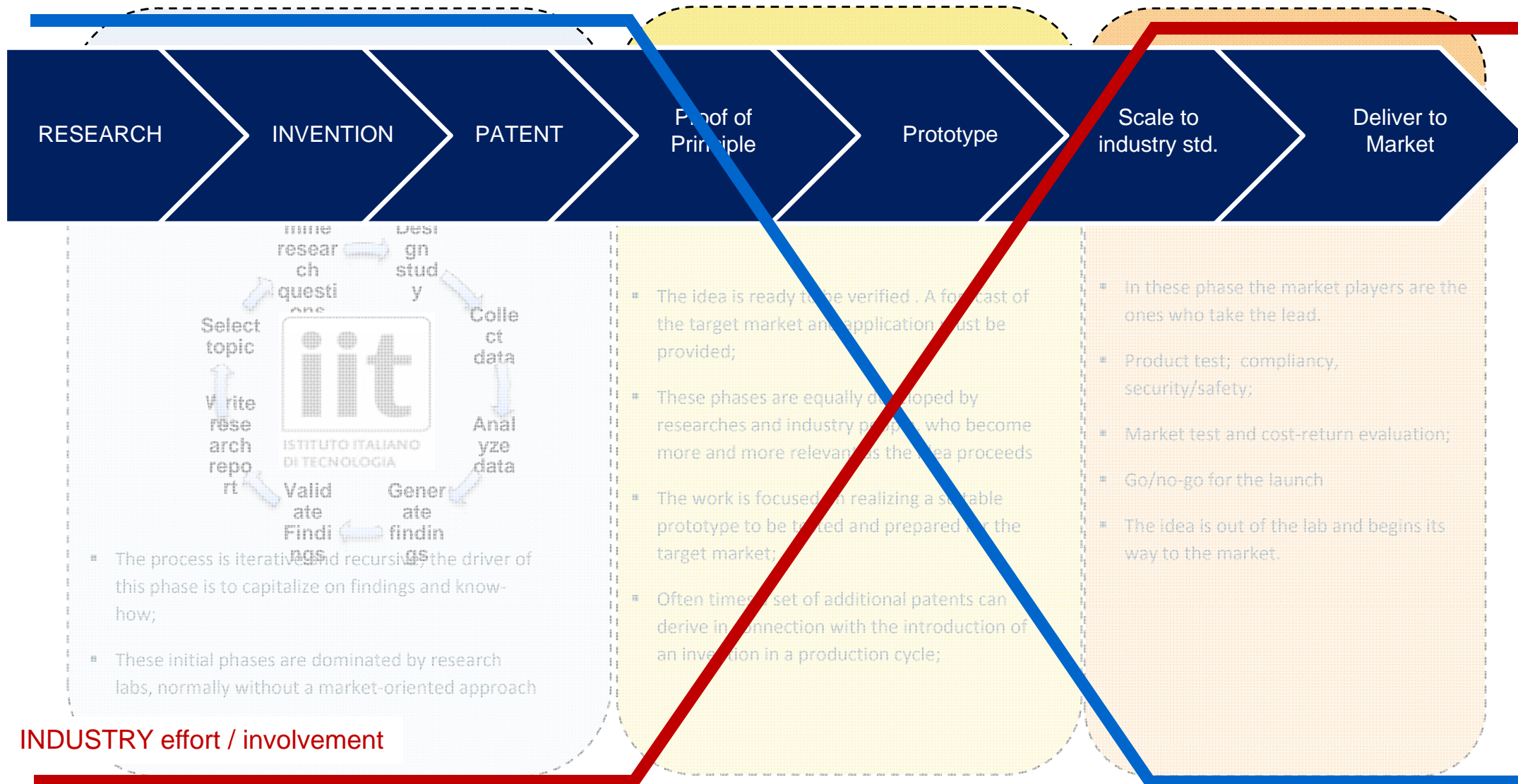


# INNOVATION DRIVERS



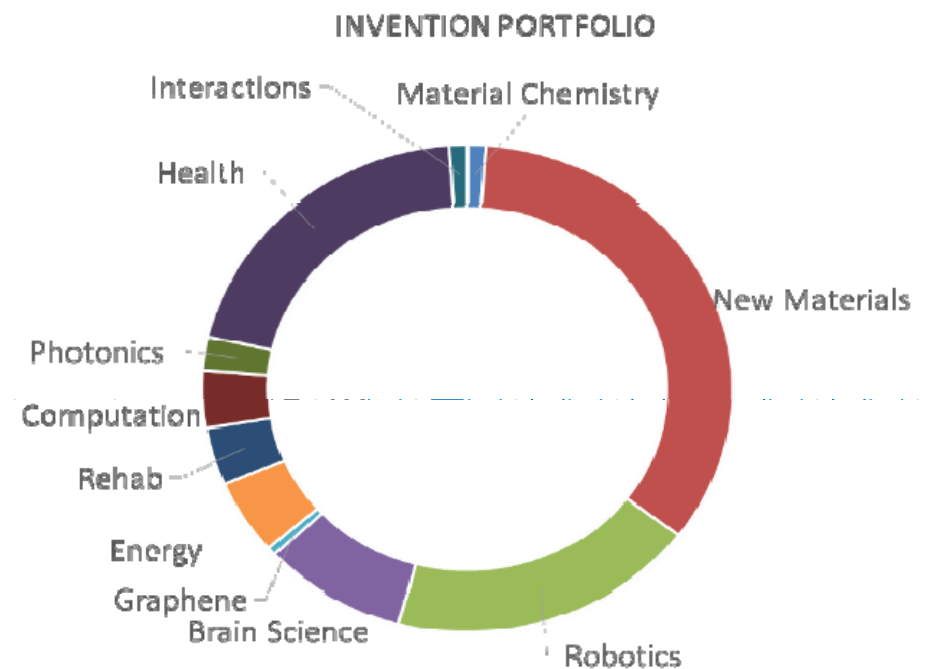









RESEARCH effort / involvement












INDUSTRY effort / involvement

- **Technology Transfer is part of the mission of IIT, and is realized through**
  - Feasibility studies and applied technology project developed together with industry players
  - Joint Labs between IIT and Corporations/Firms
  - Licensing of IIT technologies, based on know-how or patented technologies
  - Creation of technology-based spin-off companies
  
- **IP protection is one key activity of IIT, being t** starting point for technology transfer. To this purpose, a dedicated Patent Office has been established.
  
- **A dedicated team** and over € 1,0M per year invested in patent protection in 2016



Name	Topic
 <b>3Brain</b>	Med-Tech & Drug Discovery: HW & SW platform for in vitro response
 <b>Circle Garage</b>	Robotics and ICT: wearable sensors network
 <b>HiQ-Nano</b>	Smart Materials: High quality nano particles production
 <b>Micro-turbine</b>	Clean Energy Harvesting: micro converter from fluid to electric power
 <b>SEM+</b>	Robotics and ICT: flexible tactile sensors
 <b>Optogenix</b>	Smart Materials & Neuroscience: production of patented probes for brain stimulation
 <b>Artificial Retina</b>	Neuroscience and Smart Materials: biocompatible polymeric implant to repair blind retina

Name	Topic
 <b>Biki Tech</b>	Drug Discovery: SW platform to design new drugs
 <b>iCub</b>	Robotics: intelligent interactive robotic solutions
 <b>Rehab Tech</b>	Robotics and Healthcare: rehabilitation robotics
 <b>CompAct</b>	Robotics: workforce support solutions
 <b>Dual Cam</b>	Computer Vision: combined audio and video camera
 <b>Ribes Technologies</b>	Energy and Smart Materials: roll-to-roll printed polymeric solar cells
 <b>viBe</b>	Computer Vision: customer behaviour analysis technology.
 <b>Politronica</b>	Smart materials: nano-structured inks for printed electronics
 <b>qbRobotics</b>	Robotics: robotic modules to be assembled



Learning never exhausts the mind  
*Leonardo da Vinci*



# iCub and friends

iCub2.5



iCub3.0

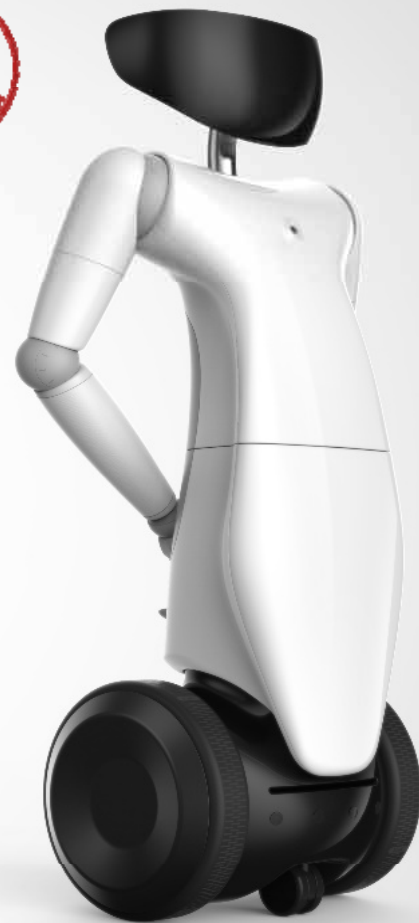
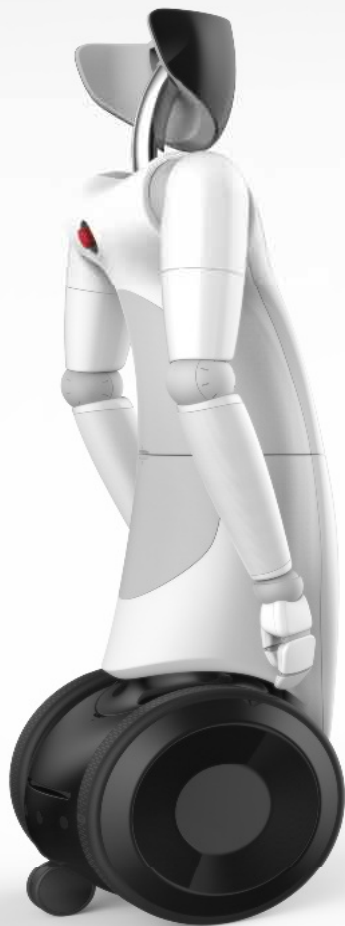


iCub2020



R1







# INAIL

ISTITUTO NAZIONALE PER L'ASSICURAZIONE  
CONTRO GLI INFORTUNI SUL LAVORO

The INAIL-IIT joint lab is focused on developing robotic solutions for people rehabilitation

<https://youtu.be/zYR1st-xtec>



Developing active robotic prosthesis to allow amputees recovering a large portion of their movements, thus improving the quality of life and work

**Combination of nanoparticles and polymers  
allows to change material properties**

**A simple sponge becomes an**

**OIL-WATER separator**



*By treating the sponge surface with appropriate nanoparticles, the sponge absorbs oil (blue drop) dispersed in water, leaving the latter clean, on top of the hydrophobic surface*



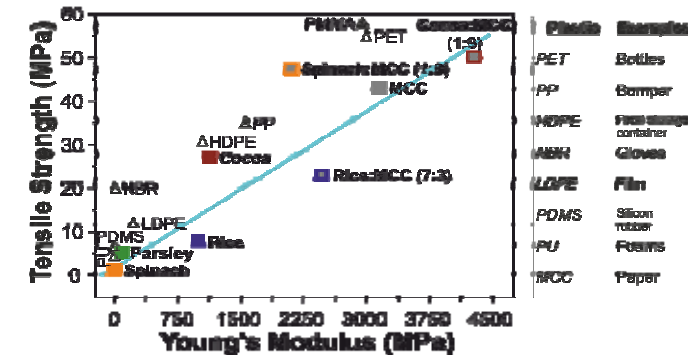
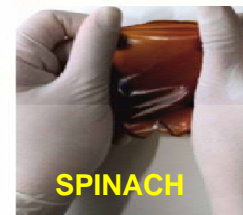
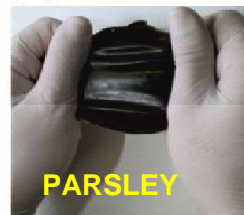
# Green Plastic from vegetable waste

- Most of the plastics we use today are made up of non-degrading petroleum based resources. Lack of degradability and the closing of landfill sites as well as growing water and land pollution problems have led to serious global concern about plastics. Processed vegetables and cereals produce large amounts of waste rich in cellulose all over the world. Such waste was **directly transformed into green plastics**.

From vegetable waste (e.g. cocoa)

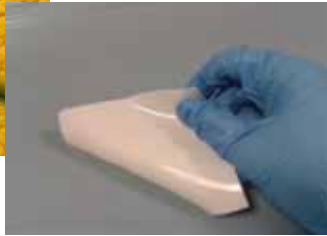
To Plastic

...with tunable mechanical properties





**Corn**



**Parsley**



**Spinach**

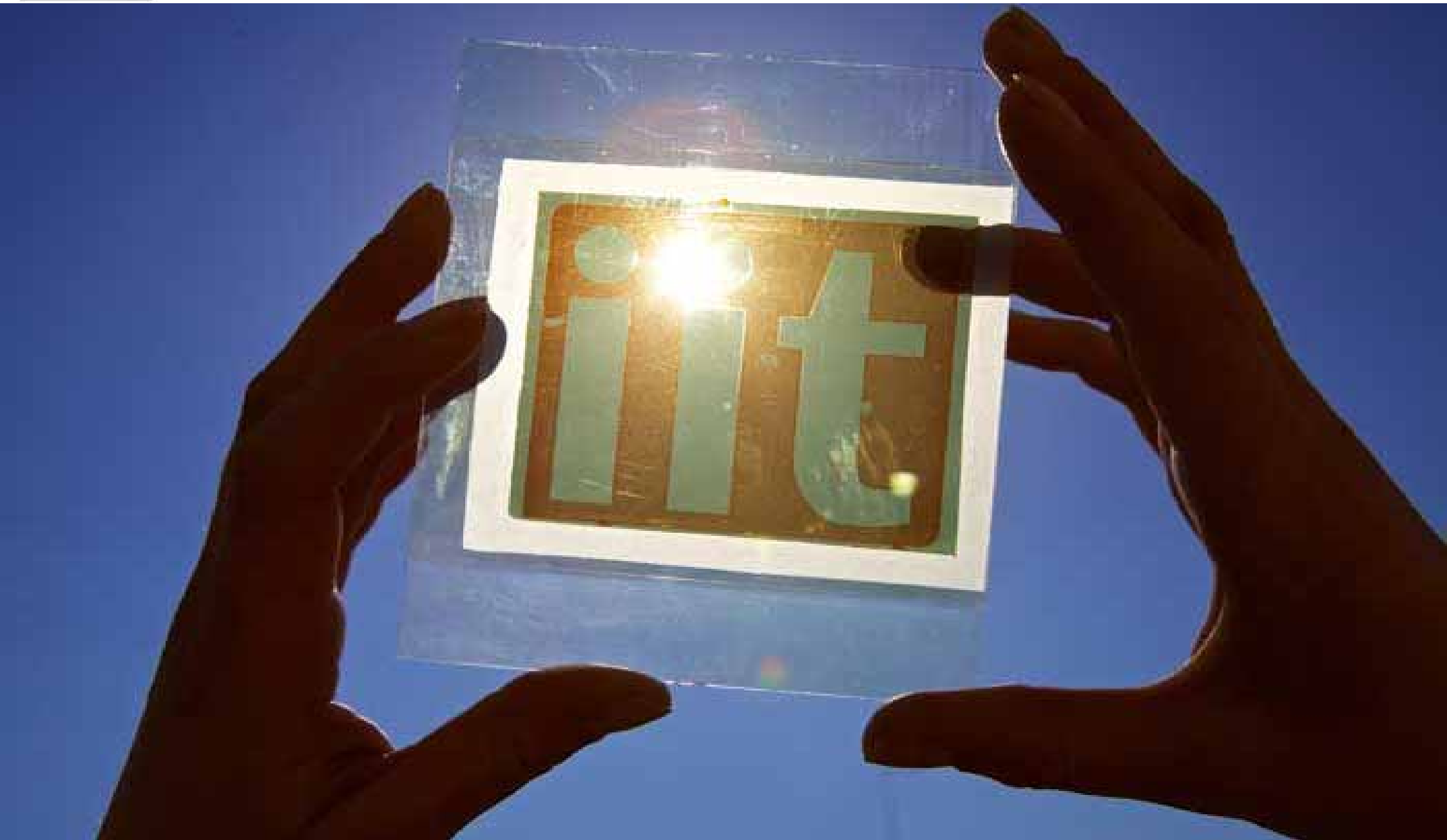


**Potatoes**



**Tomato skin**

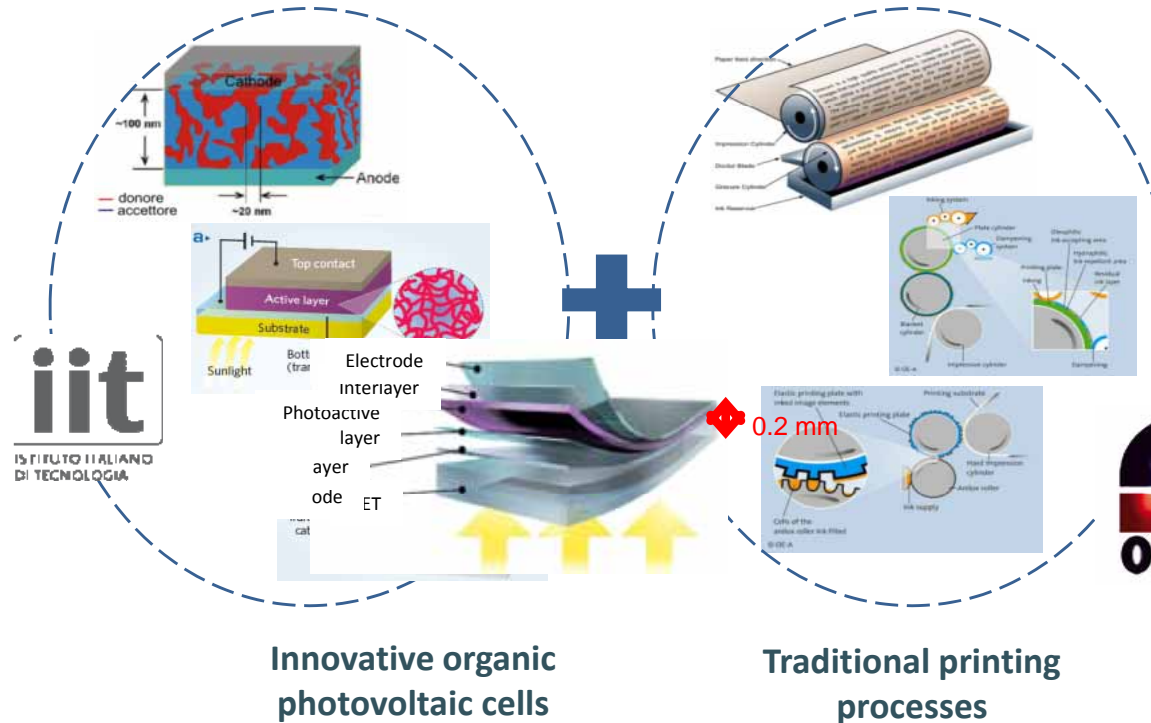




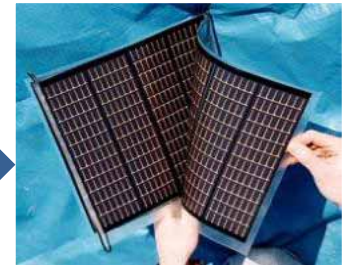




**ribes** TECHNOLOGIES mission is to become the leader suppliers of flexible, large scale, printed electronics, enabling the penetration of active parts in everyday objects (IOT).



New low cost, highly adaptable energy sources

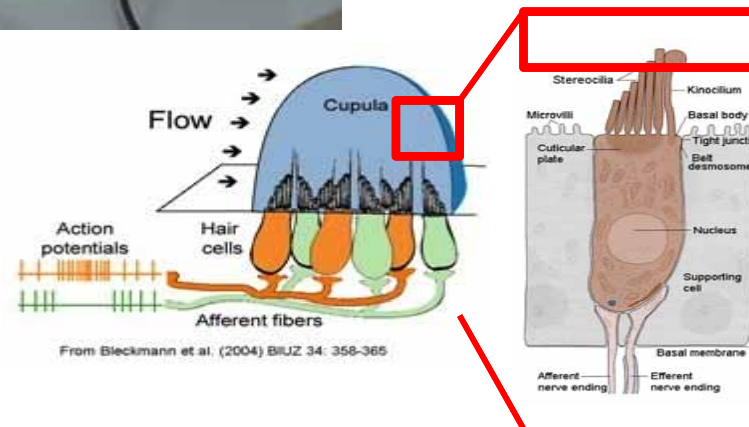




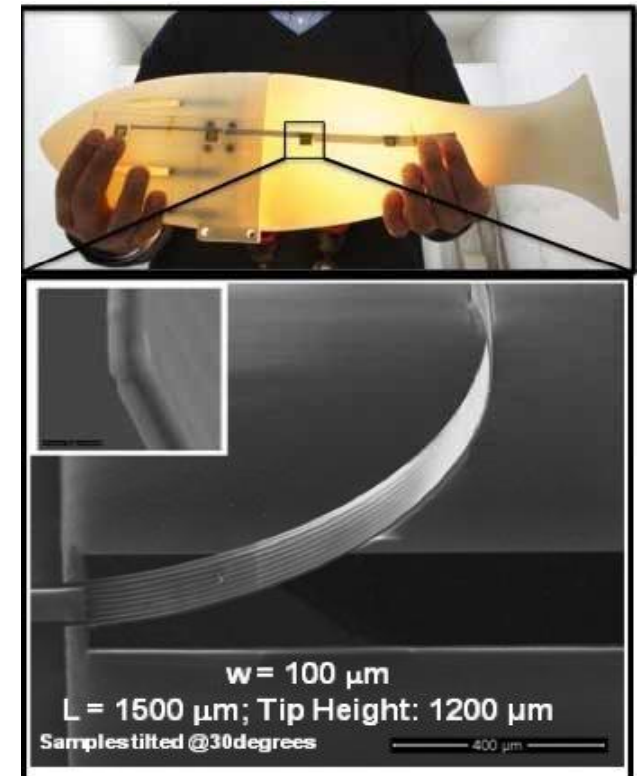
# Piezoskin – micro wind harvesting



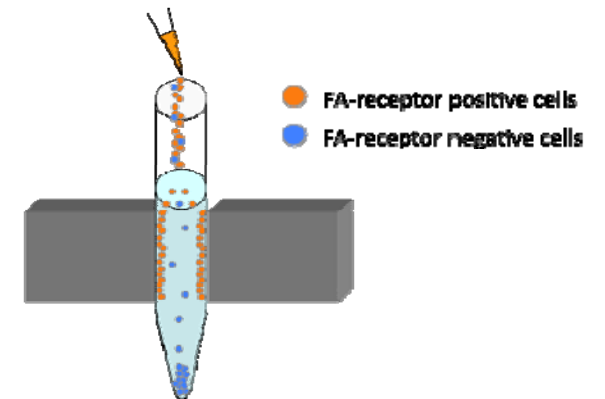
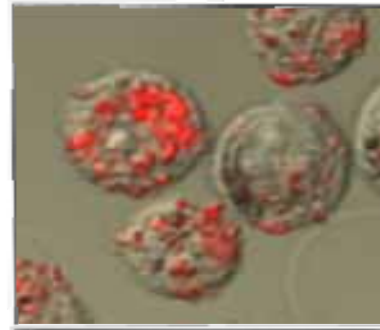
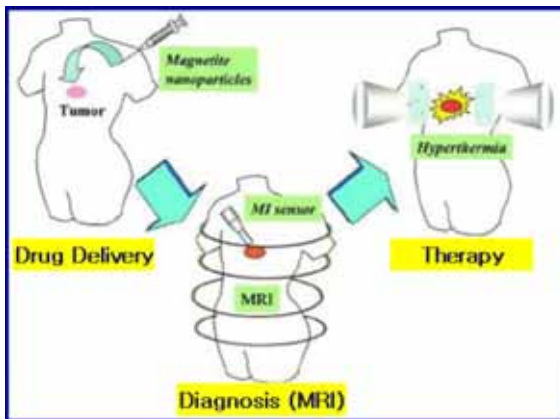
- Piezoelectric stress driven cantilever with microstrain gauge.
- Tuning of electro-mechanical response by Parylene Conformal coating
- Flow sensing in the range 1cm/s ÷ 35 cm/s as in real fishes



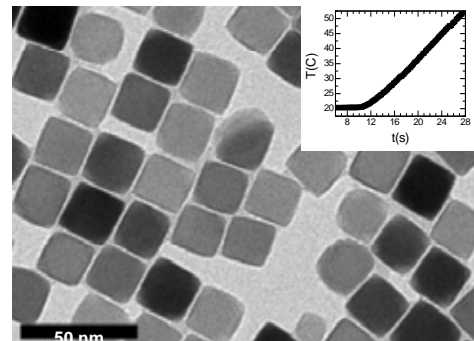
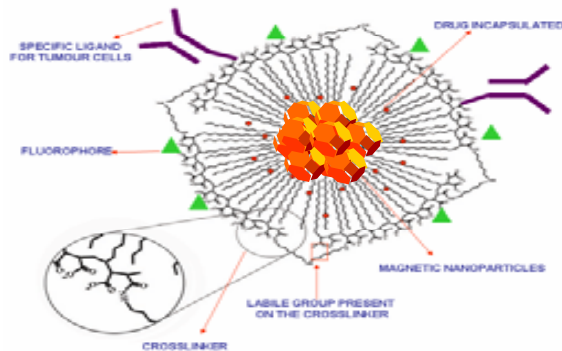
**Artificial Hair Cells for flow sensing in AUV**



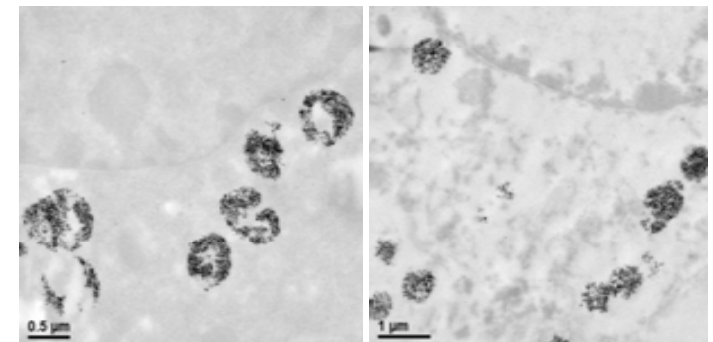
# Magnetic Nanoparticles for Biomedical Applications



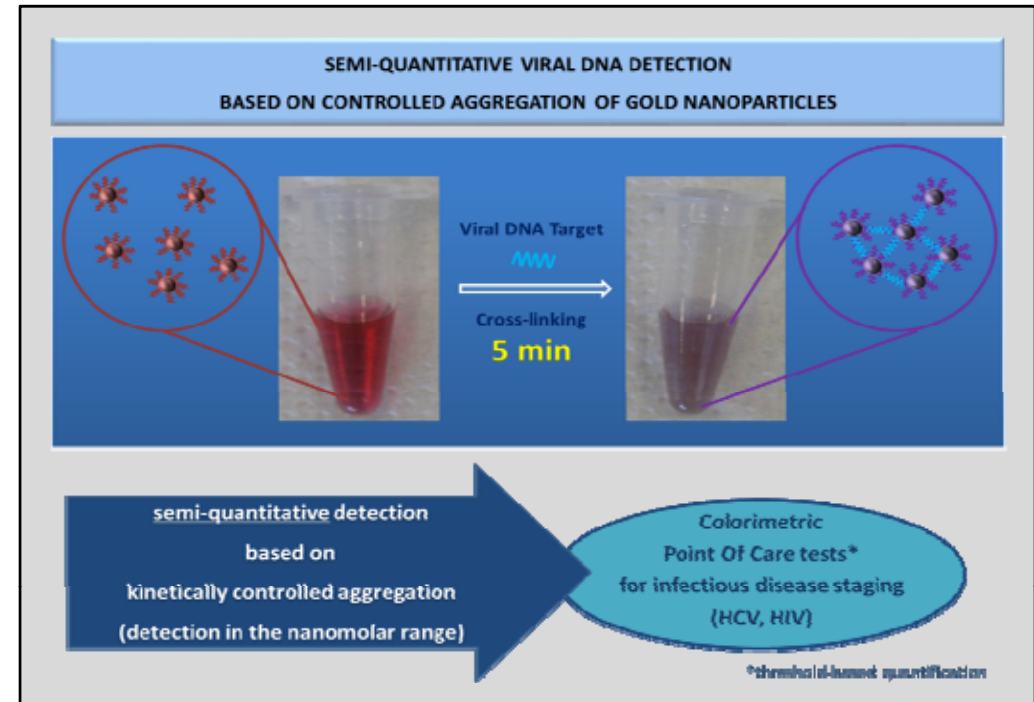
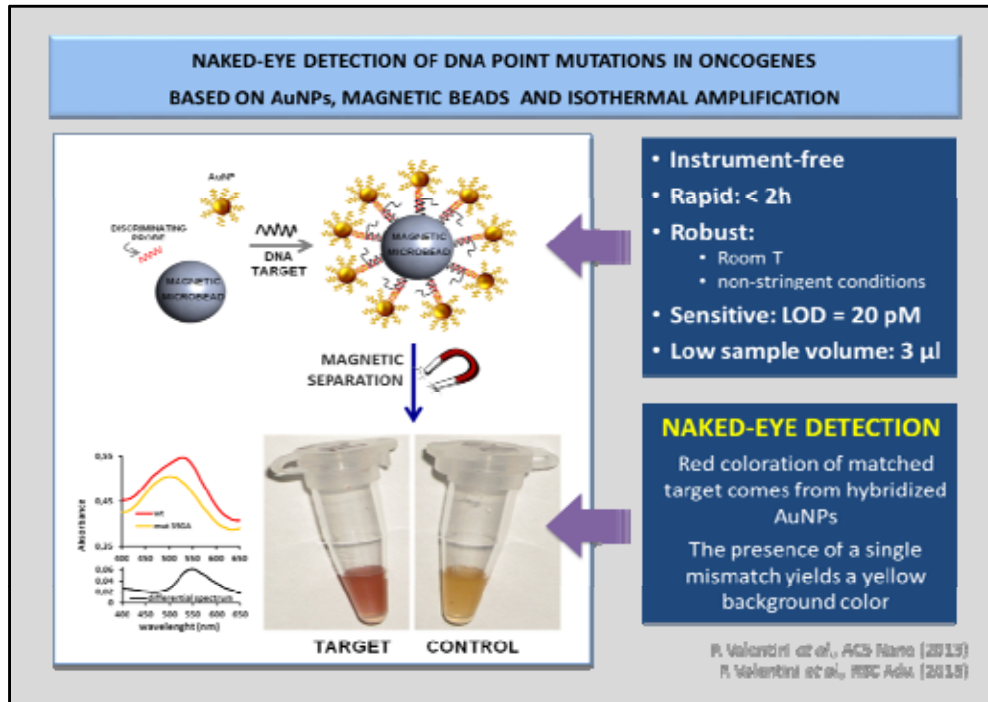
## Amphiphilic polymer coated dimers



## Before Hyperthermia      After Hyperthermia



- Hybrid nano-sensors, combining nanomaterials with organic sensing elements, allow simplified detection (up to naked-eye), suitable for point-of-care diagnostics



# **SMO** – Your portable microscope SMART MICRO OPTICS

**SMO** SMART MICRO OPTICS mission is to provide everyone with the tools to explore the micro-world, through a family of innovative products in the field of microscopy, consumer electronics and micro-optics.



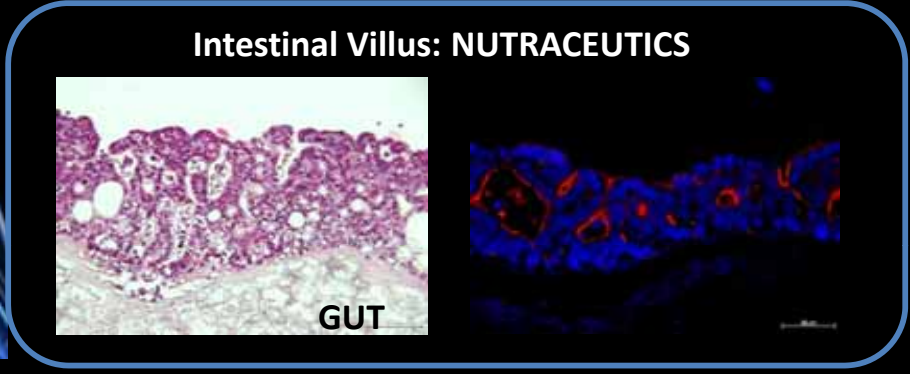
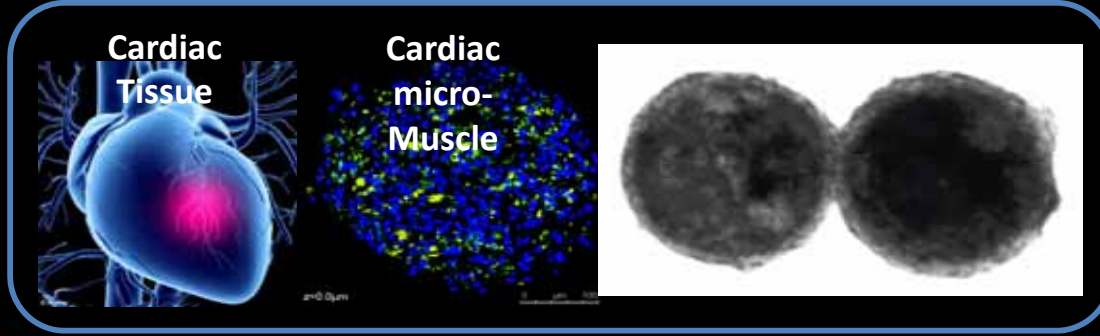
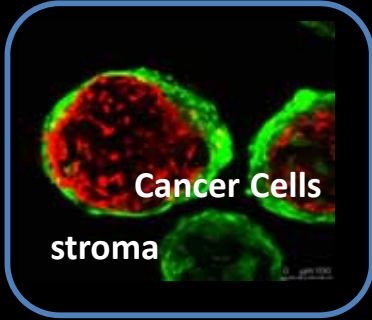
drop on a leaf / daisy / beetle on a flower / human eye



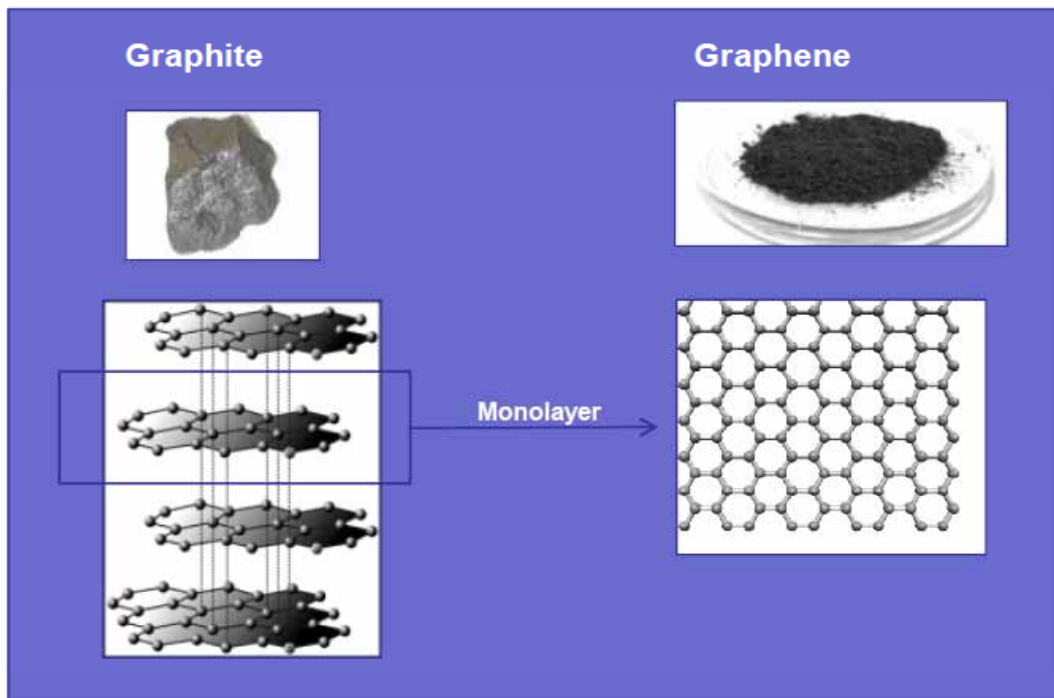
live shot with ELAPSO Micro



# In-vitro library of human tissue

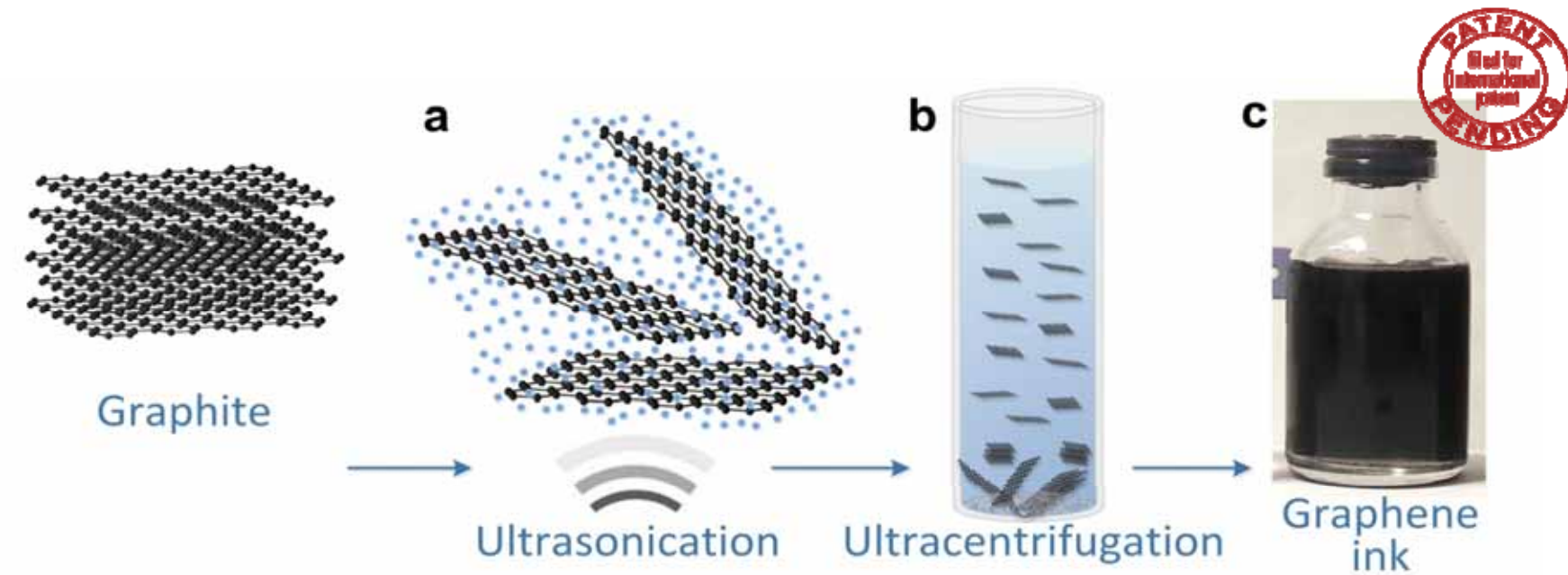


## 2010 Nobel Prize in Physics

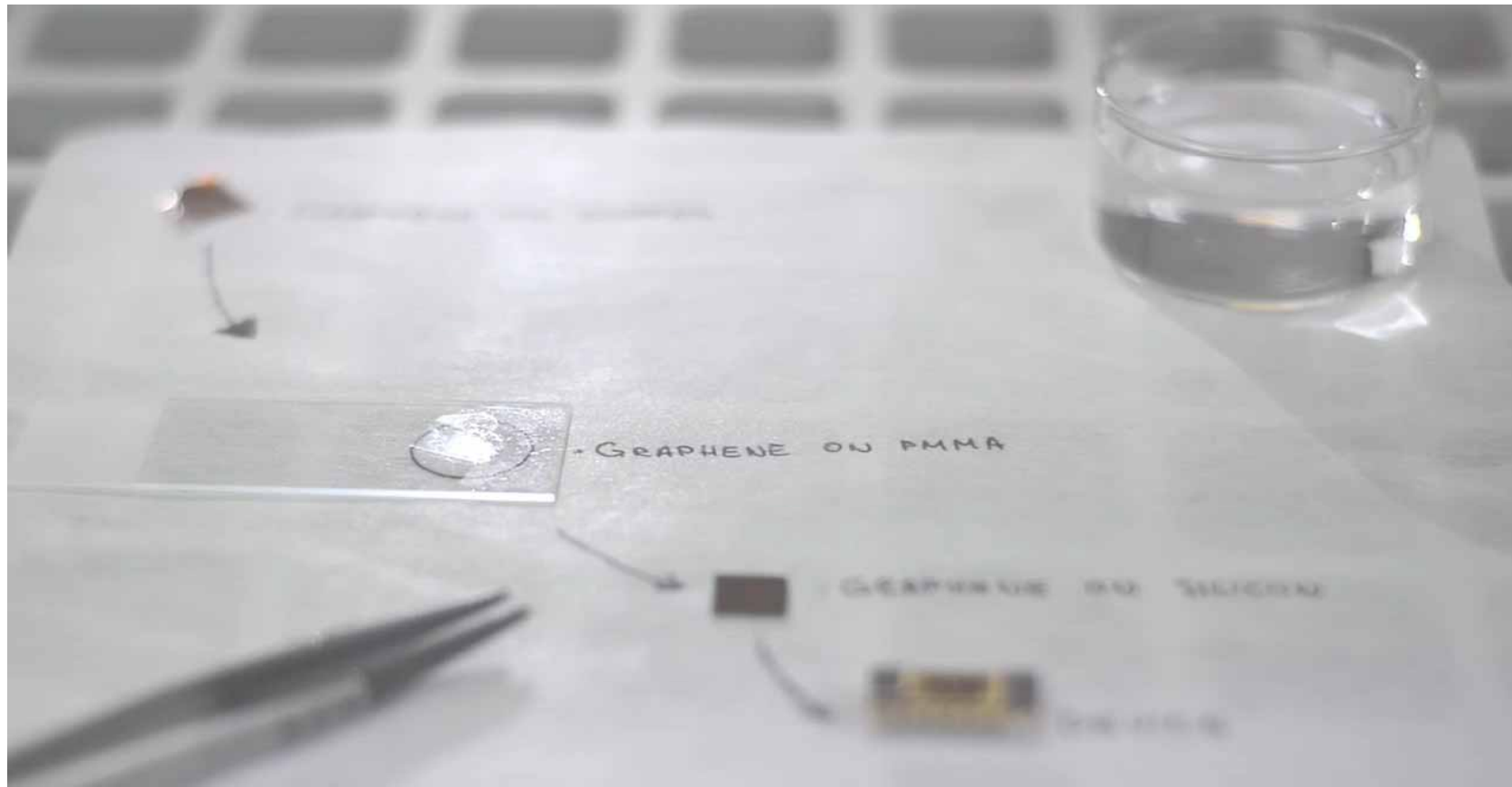


- **Strongest Material**
  - 100 times tensile strength of steel
  - Young's modulus = 1 Tpa
  - Tensile strength = 80 Gpa
- **Record Electronic Properties**
  - 60% higher conductivity than silver and copper; 1 million times the current density of copper
  - $e^-$  mobility 200 000  $\text{cm}^2/\text{V s}$
  - Bulk resistivity =  $10^{-6} \Omega\text{cm}^{-1}$
- **Highest Thermal Conductivity**
  - 5 times that of copper, better than diamond
  - Thermal conductivity = 5000 W/mK
- **Highest Surface Area**
  - Superior to active carbon
  - 2630  $\text{m}^2 \text{g}^{-1}$
- **Optically Transparent**
- **Completely impermeable**

# Producing Graphene inks



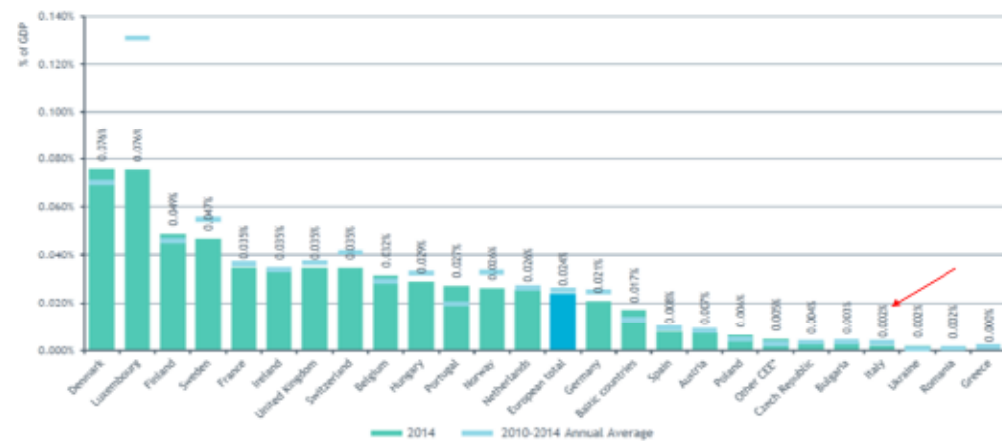




## Venture Capital - Investments as % of GDP - Industry statistics

EVCA

2014 - Industry statistics



Source: IMF, World Economic Outlook database (GDP) / EVCA / PERP\_analytics  
 Note: \*Other CEE consists of Ex Yugoslavia and Slovakia  
 2014 European Private Equity Activity

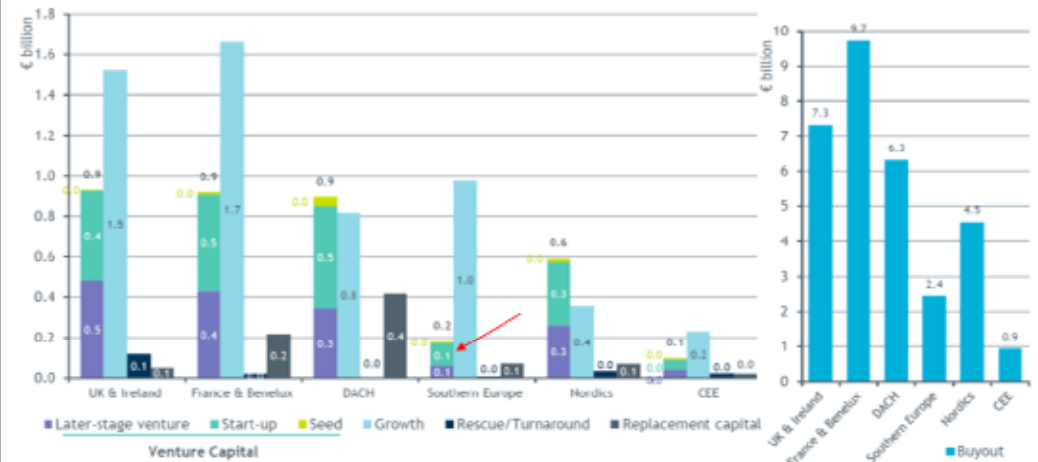
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Fundraising → INVESTMENTS → Divestments

## Investments by stage focus and regions

EVCA

2014 - Market statistics - Amount



Source: EVCA / PERP\_analytics  
 DACH: Austria, Germany, Switzerland / Southern Europe: Greece, Italy, Portugal, Spain / Nordics: Denmark, Finland, Norway, Sweden / CEE: Central Eastern Europe  
 2014 European Private Equity Activity

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Fundraising → INVESTMENTS → Divestments

Life is like riding a  
bicycle.

To keep your balance,  
you must keep moving.

Albert Einstein



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