

INL's role in the European Nanomedicine innovation chain

First Q: What is INL?

Prof Lars Montelius
Director General, INL

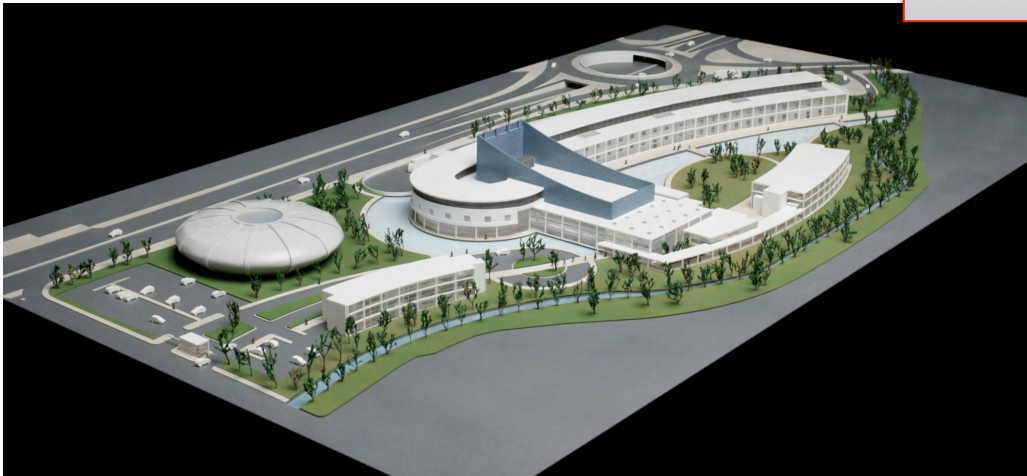
www.inl.int

The International Iberian Nanotechnology Laboratory



**Avenida Mestre José Veiga
4715-330 BRAGA, PORTUGAL**

2007



2014



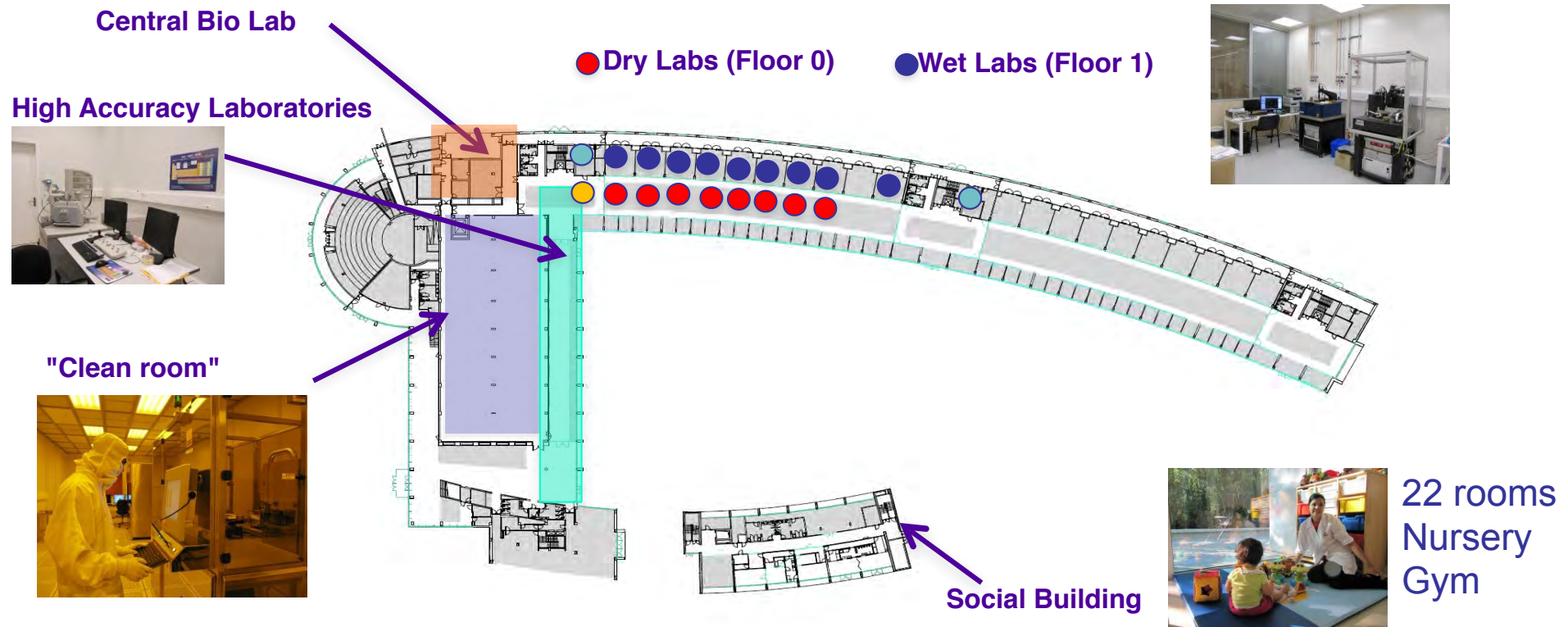
2005 : P-S RI 2006 : Legal statutes 2008 : UN /Constr. 2011 : Personnel

- *Total site area: ca. 47,000 m²*
- *Total buildings area: ca. 26,000 m²*
- *Main scientific bldg: ca. 22,000 m²*
- *Social Building (Hostel, Gym and Nursery)*
- *Incubator Area*





- The scientific infrastructure comprises central laboratories (providing services for the INL resident research personnel and visiting scientists) and specialized laboratories associated with individual Principal Investigators (PIs) or research groups and research topics.
- TheScientific building includes: Cleanroom, High Accuracy Laboratory, Wet and Dry PI laboratories, Biochemistry laboratory and other support labs.





Science offer

Technology offer

Health

Food &
Environment

ICT

Energy

Nanofabrication & Processes
Exploratory

Joao G

Nanomaterials Synthesis

Carlos R

WORLDWIDE NETWORK

Dmitri P

Bio & Cell Laboratory
Nanotechnology
System & IC Design Solutions

Marta P

Joao P

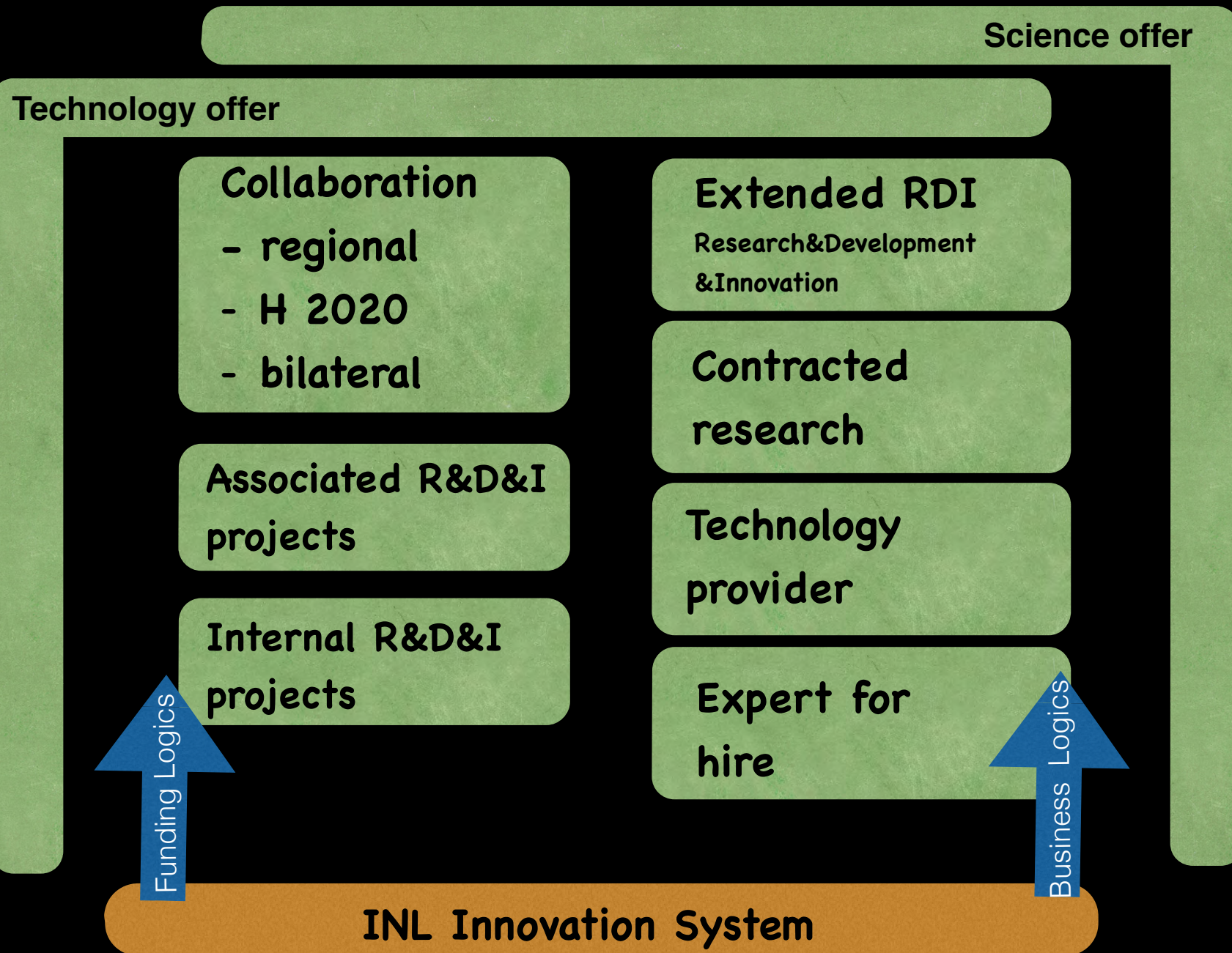
INL-X Laboratory

Ines P

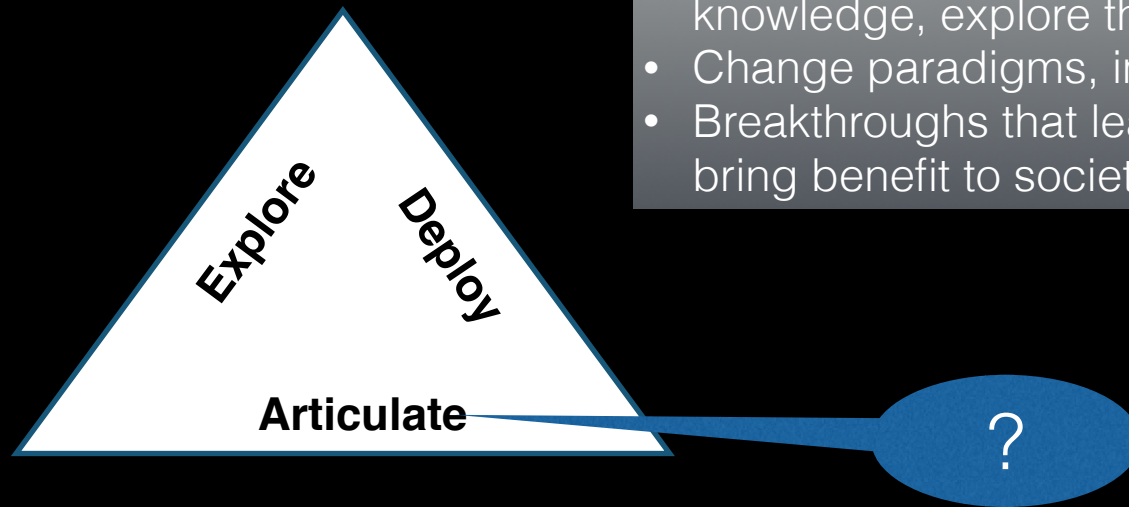
Begona E

Ricardo F

Sascha S



INL Operations



Explore

- Excellence in research & being brave enough to create new knowledge, explore the unknown and break boundaries.
- Change paradigms, invents new fields and open opportunities
- Breakthroughs that lead to new products and processes that bring benefit to society.

The INL Innovation Systems

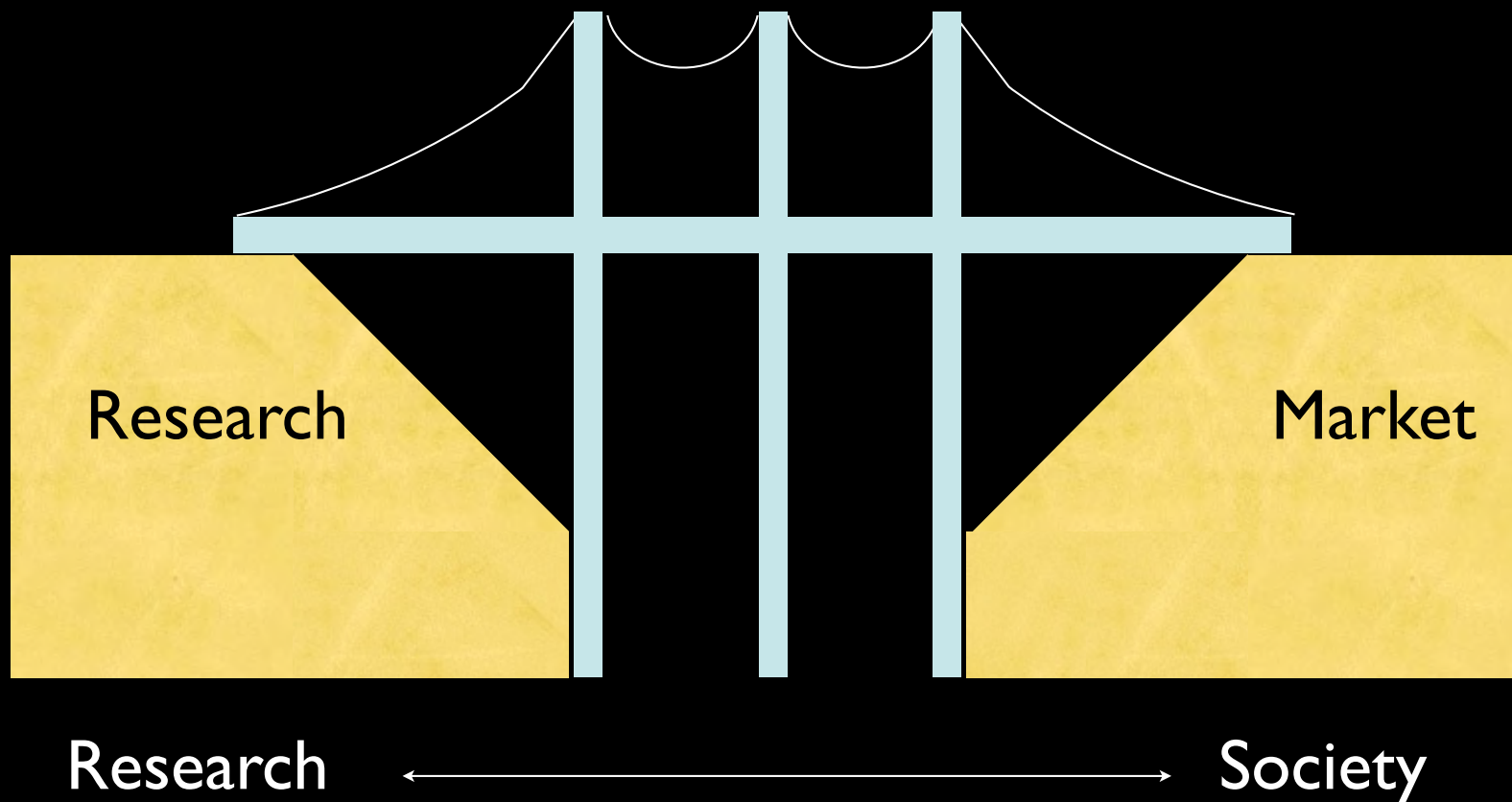
- Business model
- Conferences
- External Relations
- IPR Policy & Portfolio

INL strives to embrace the concept of excellence, to prepare for the unexpected and to be sufficiently dynamic and adaptable in order to foster ambitious and ingenious breakthroughs that will tackle challenges of today and those not yet imagined.

Articulation

- Clarification
- Science for Society
- Meaningfulness

Valley of death



ARTICULATION !

What are you doing ?



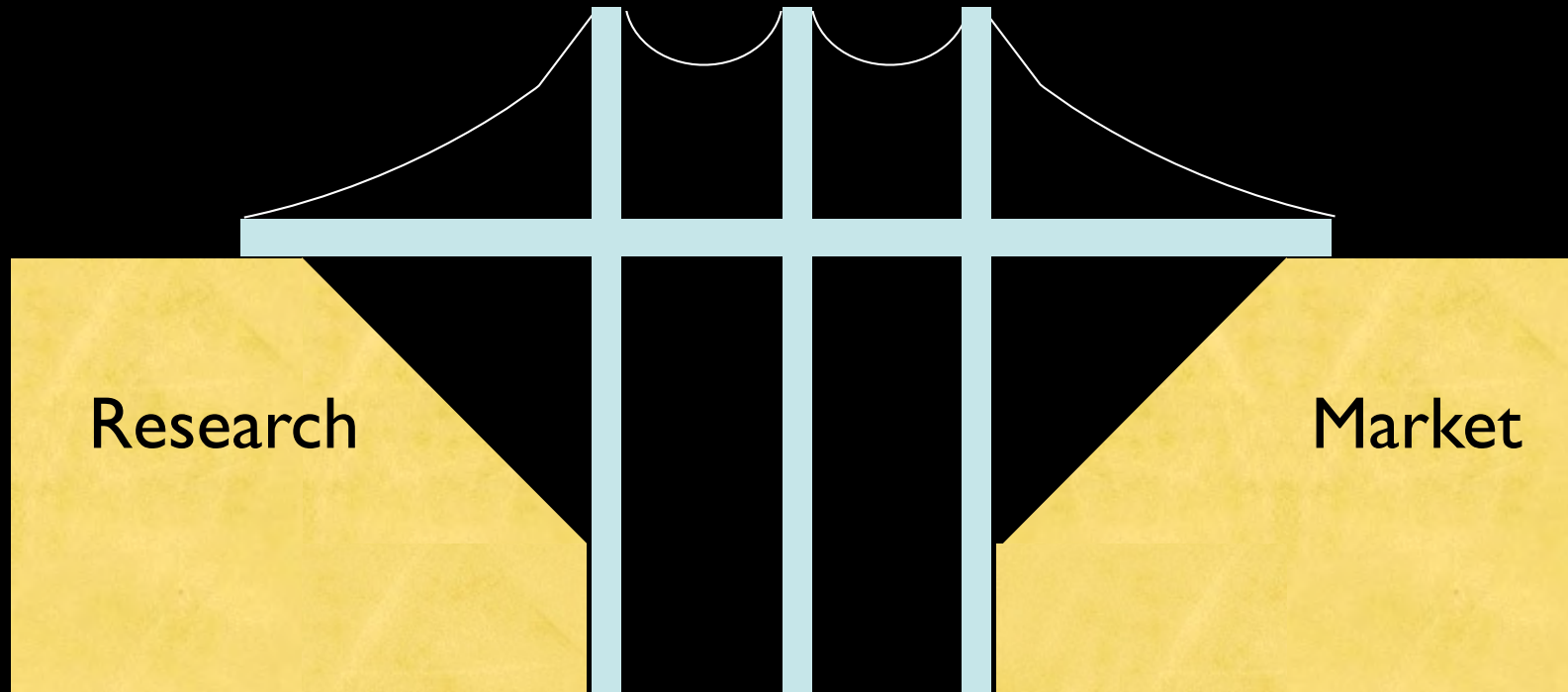
I am cutting stone!

..and you: What are you doing ?



I am building a cathedral!

Valley of death



Research



Society

ARTICULATION !

Scientific Social Responsivity

The INL International Advanced Projects Program

The INL International Visiting Scholar Program

The INL International Fellow Program

The INL International PhD Program

The INL International Incubator Program

The INL International Industrial Program

The INL Colloquium Program

Annual INL Scientific Symposium



WELCOME TO INL

www.inl.int

Lars Montelius, Prof, Dr, Dr hc
Director General

The Role for INL in the NanoMedicine Innovation Chain

Q1:

How can INL play
a role?

Q2:

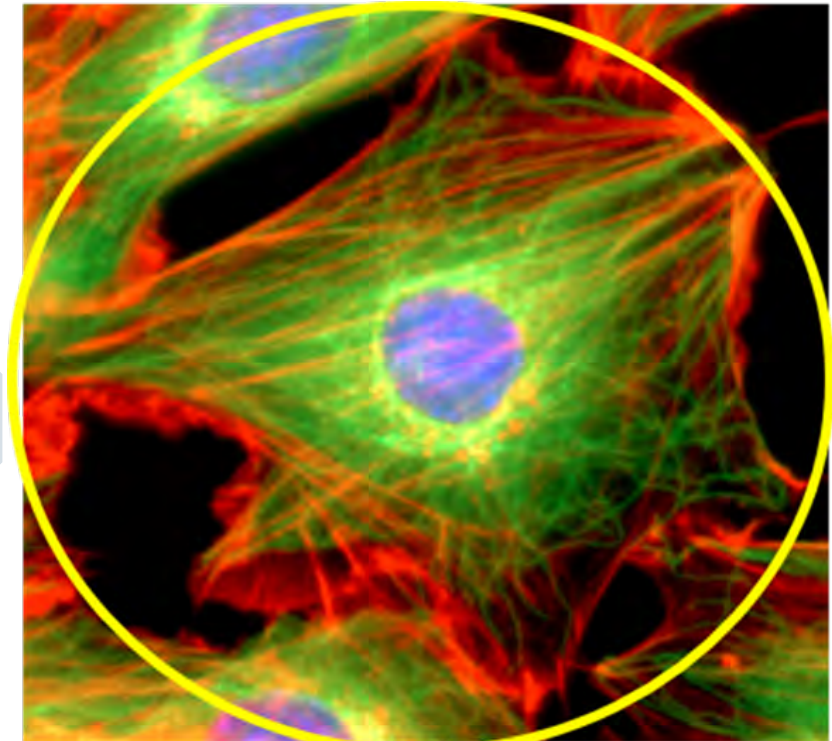
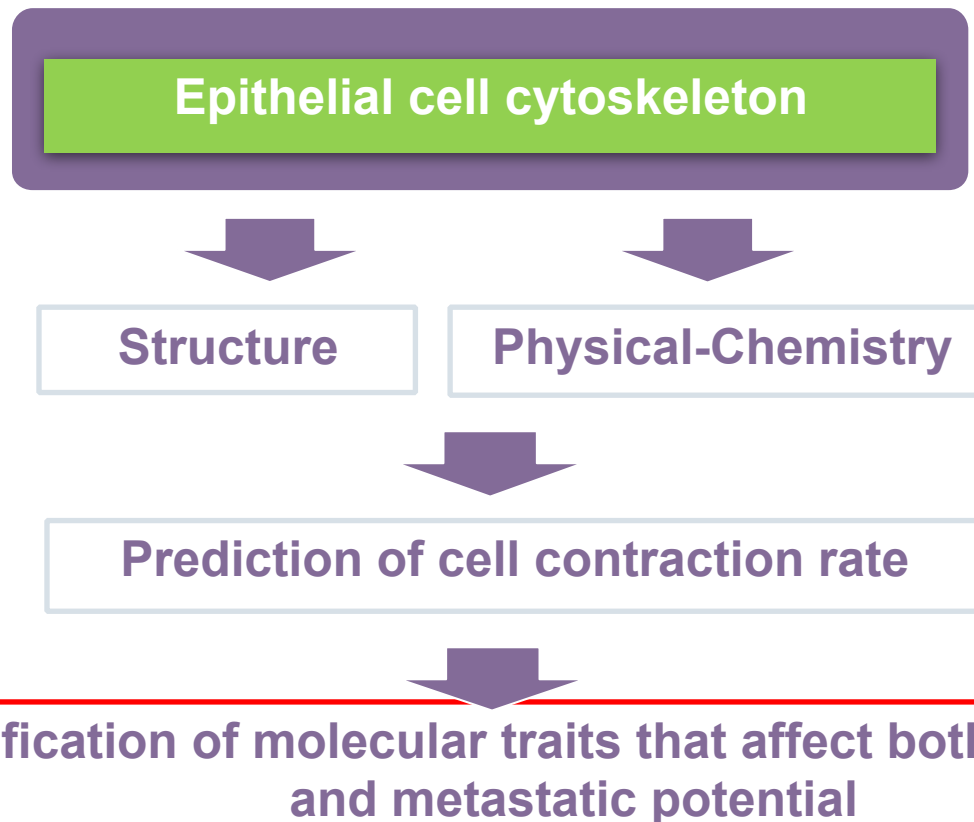
Through Innovation?





Epithelial cell contractility

- Depends on the assembly and dynamics of the cellular skeleton (=cytoskeleton).
- Hypercontractility of the cytoskeleton correlates with epithelial tumor proliferation and metastasis.



Cytoskeleton

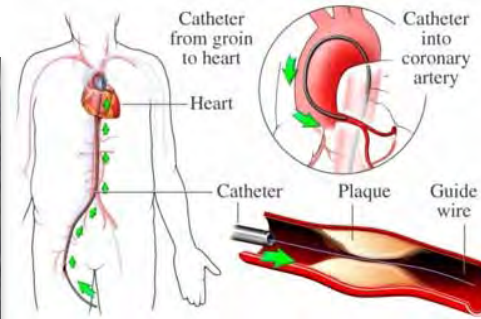
Need:

Coronary Angiography detects flow blockage and other atherosclerotic plaques: vulnerable or stable?

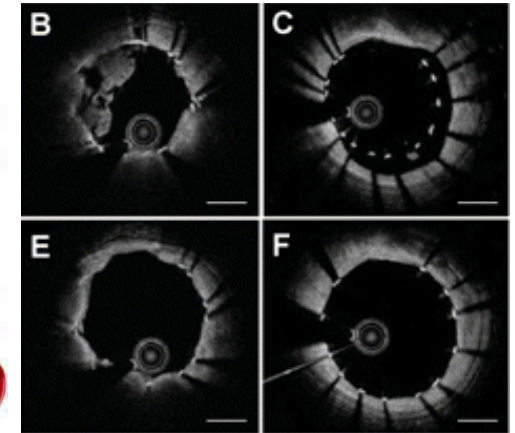


Project Concept

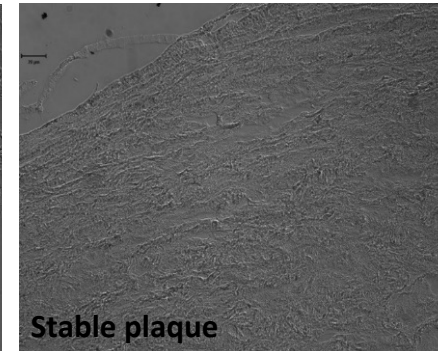
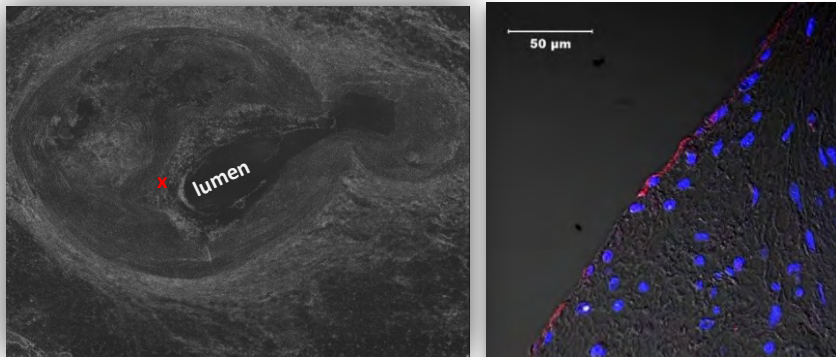
Cardiac Catheterization:



Optical coherence tomography

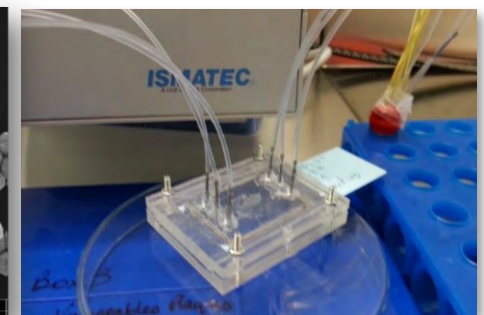
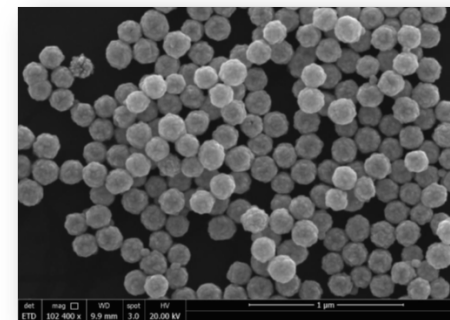


✓ **Biomarkers for vulnerability validation in human coronary arteries**



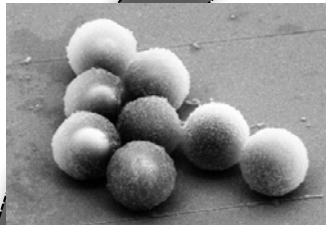
✓ **In-house testing mockup** (mimicking *in vivo* scenario)

marina.brito@inl.int

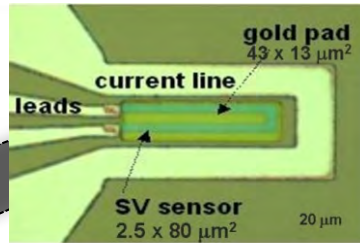
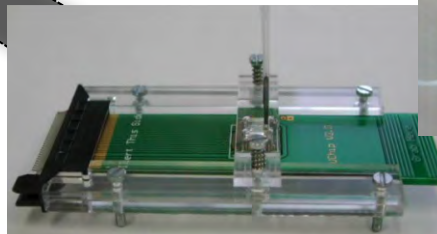


Magnetoresistive Platform for Medical Diagnosis

- Production of magnetic nanoparticles

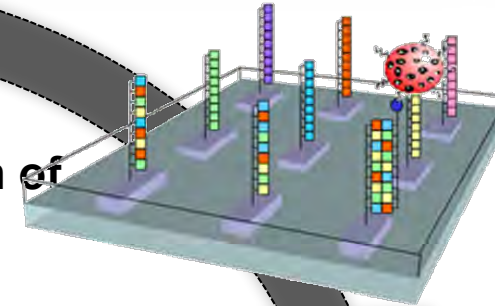


- Design of microelectronic board: chip control and read-out



- Microfabrication of MR sensor

- Development of surface biochemistry

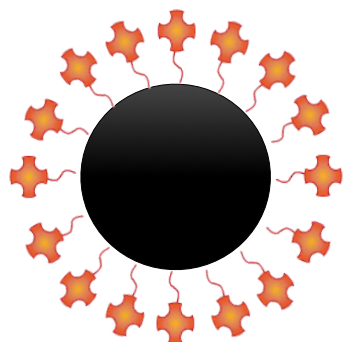


- Microfluidic system design and fabrication



Nanoparticles for cancer treatment with hyperthermia

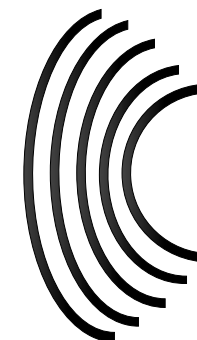
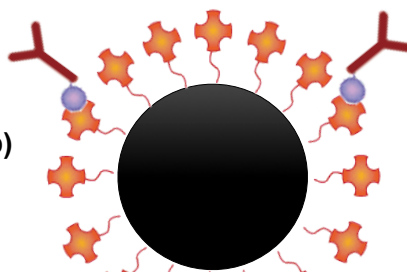
1 - MNP + protein



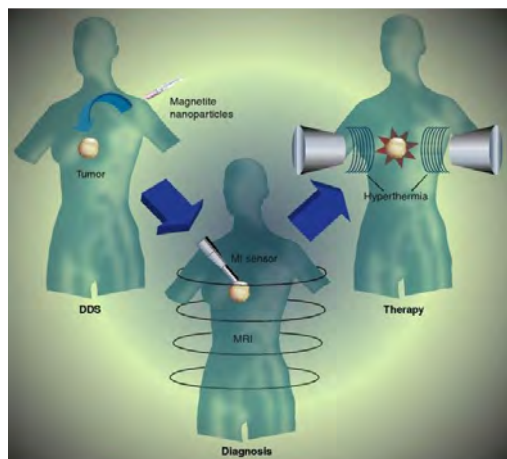
Add recognition molecule (ex. mAb)



2 - MNP + protein + mAb

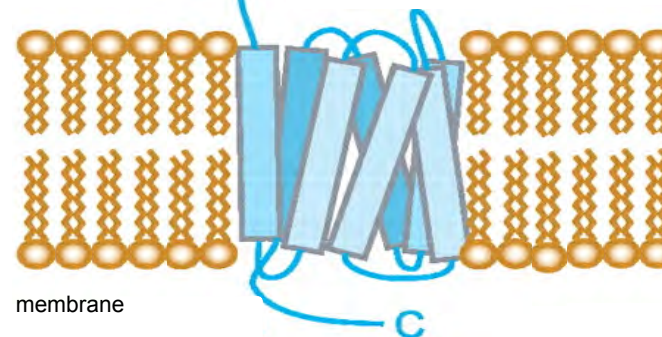


4 - Magnetic field application



3 - Specific binding

5 - Magnetic heating



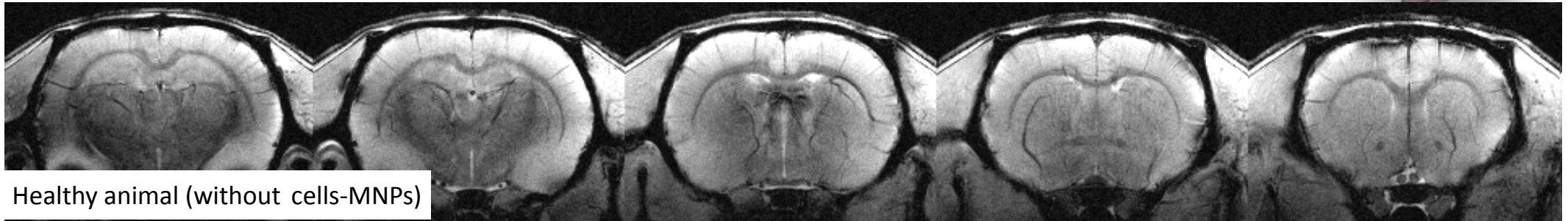
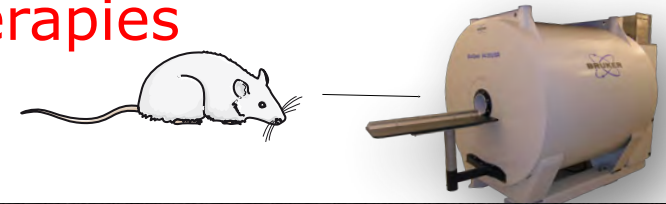
Cell death



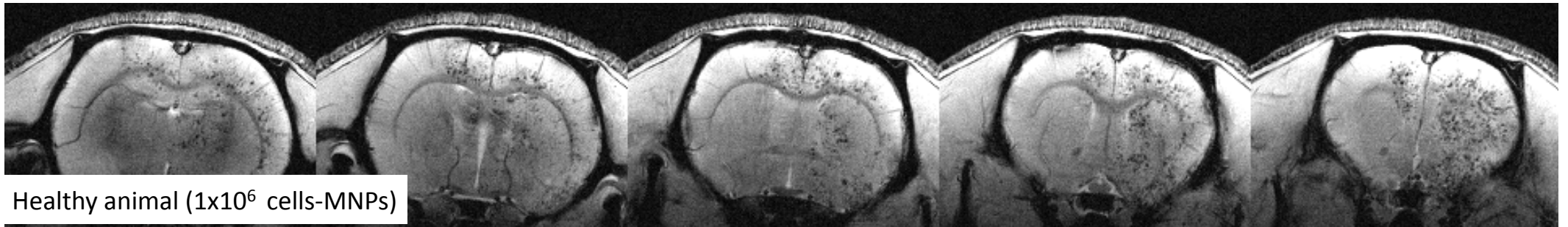
Cancer Treatment

Cell tracking of stem cells in brain ischemia therapies

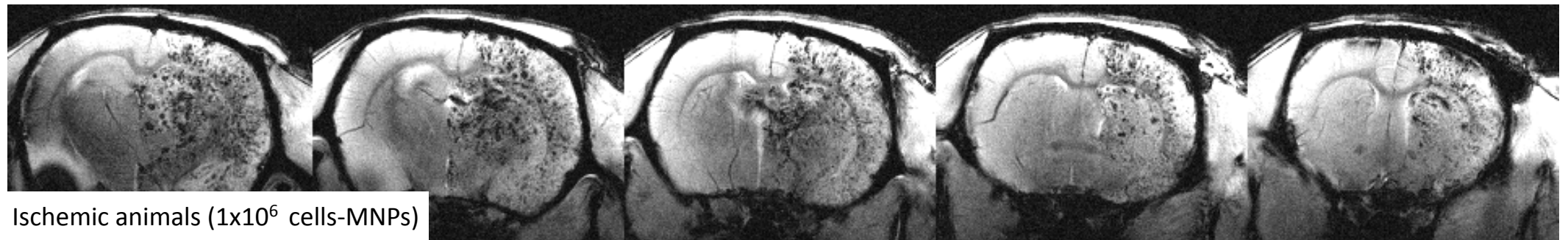
(in collaboration with CHUS, Santiago de Compostela)



Healthy animal (without cells-MNPs)



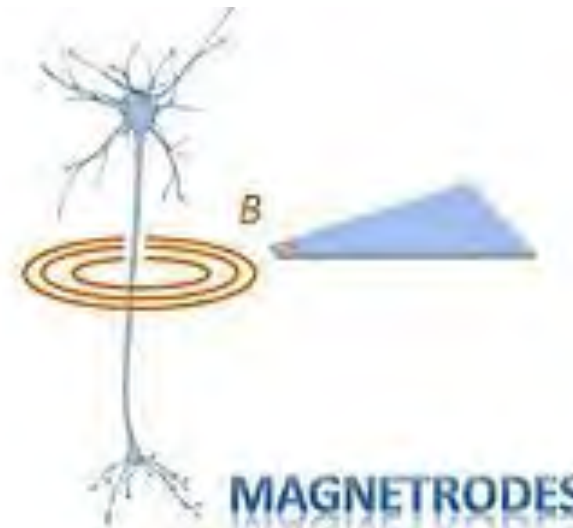
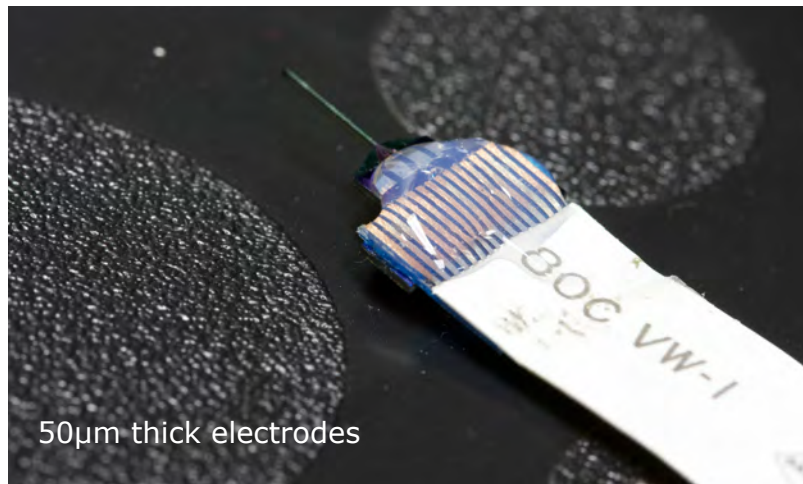
Healthy animal (1×10^6 cells-MNPs)



Ischemic animals (1×10^6 cells-MNPs)

• Magnetorodes

Development a **new generation of tools for local magnetic imaging and spectroscopy at the neuron scale** in order to model the electromagnetic response of a neuron.



- Detecting the magnetic field generated by the currents in the neurons @ low-frequency signals <1kHz
- Detecting the Nuclear Magnetic Resonance (NMR) signal for the chemical analysis of the area concerned (few 100 μm^3); MHz range signals

The Role for INL in the NanoMedicine Innovation Chain

Q1:

How can INL play
a role?

Q2:

Through Innovation?

Q3:

Radical Innovation?



Let me talk about a learning experience:

A sector having had - and still is of - large
importance for today's society !

A sector where standardisation is
absolutely instrumental!

And a sector that is about to go through a
spectacular change !

Which one?

The lighting sector is very big.....



.... lighting has been one of the disruptive technologies that have built our modern society.....

....but the lighting sector has been (forced to be)
rather stupid!!!



....we know well that natural lighting is nice and....& changing.....



Plants feels better if they get the right light



HPS-lampa



Heliospectra's LED-lampa



Strong light at day time
can help Alzheimer patients sleep better

Strong light at night
can alert you as much as coffee



**"Red colours put the brain into a more excited state...
those...in a negative mood, became more affected"**

Kuller-08



Circadian rhythm and health



Photoreceptor Cells in the Retina



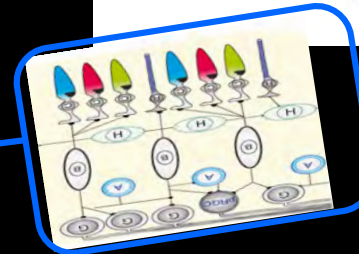
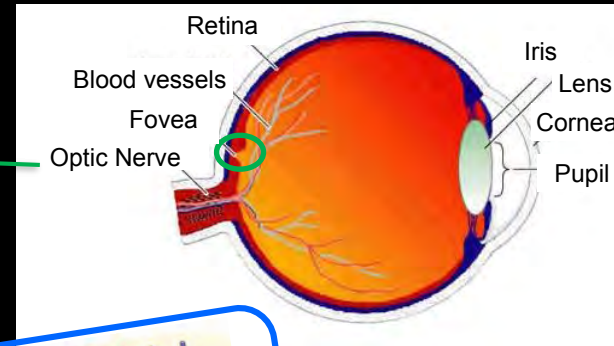
visual

Cones are concentrated in the fovea
Image forming
High resolution



biological

ipRGCs are widely distributed
Higher sensitivity in lower retina
Large receptive fields



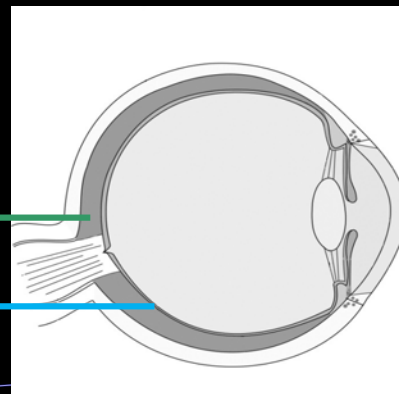
Light from above is more effective



visual



biological



Health & Wellbeing



- “St. Katharina” Improved quality of life for resident dementia patients
Location: Vienna, AU
- Lessons learned:

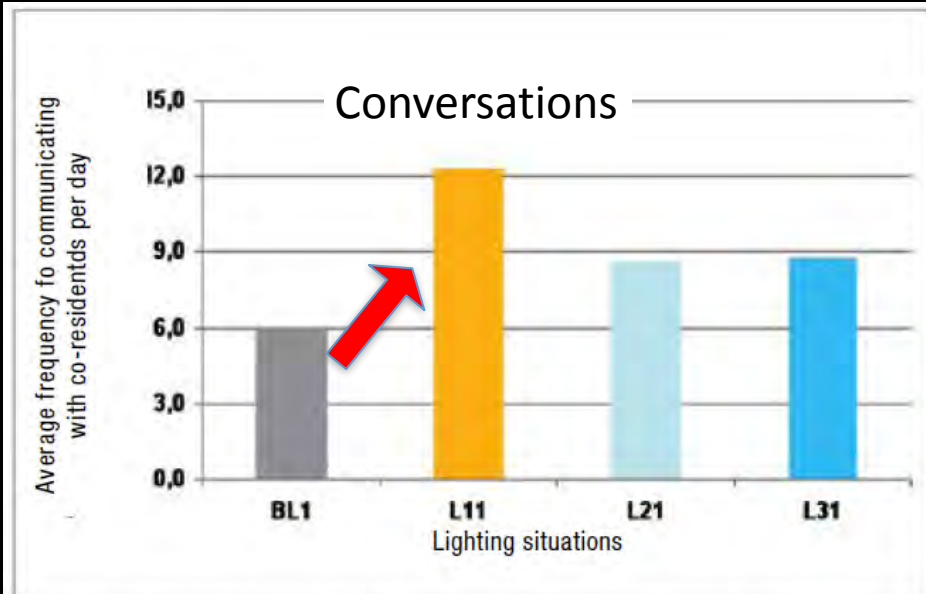


Fig. 5-10. Average frequency of conversations – average of all residents per day in the various lighting situations

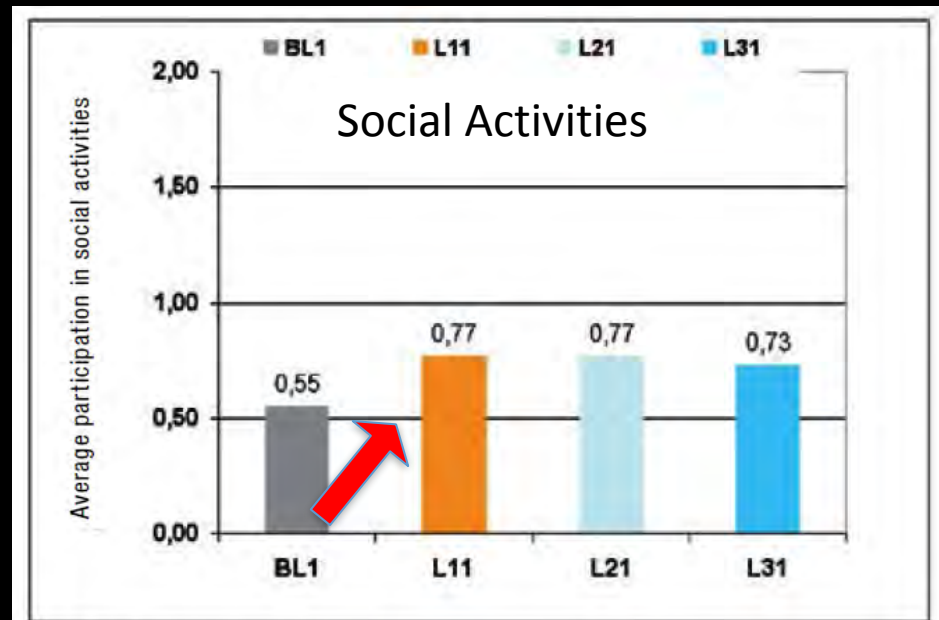


Fig. 5-16. Average participation in social activities during the lighting situations in the first run

Education & Productivity



➤ **“In der Alten Forst”**
Dynamic school lighting
Location: Hamburg, Germany

- **Lessons learned:**
- 35% increase in reading speed
 - 45% drop in frequency of errors
 - 76% reduction in hyperactivity

We are right now entering a new paradigm!

Solid State Lighting:



LED



Saves energy

Last long time

Architectur & Design

Sustainability

Past:
More or less
Color temp
Static

Presently:
....
Wavelengths
Dynamic

Smart Lighting



Future:
Obviously
values are created
beyond sustainability!!
Interactive, intelligent, active...

Smart Living Light

The spotify of (digital) light !

What is it? And who will create it?



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Q2:

Through Innovation?

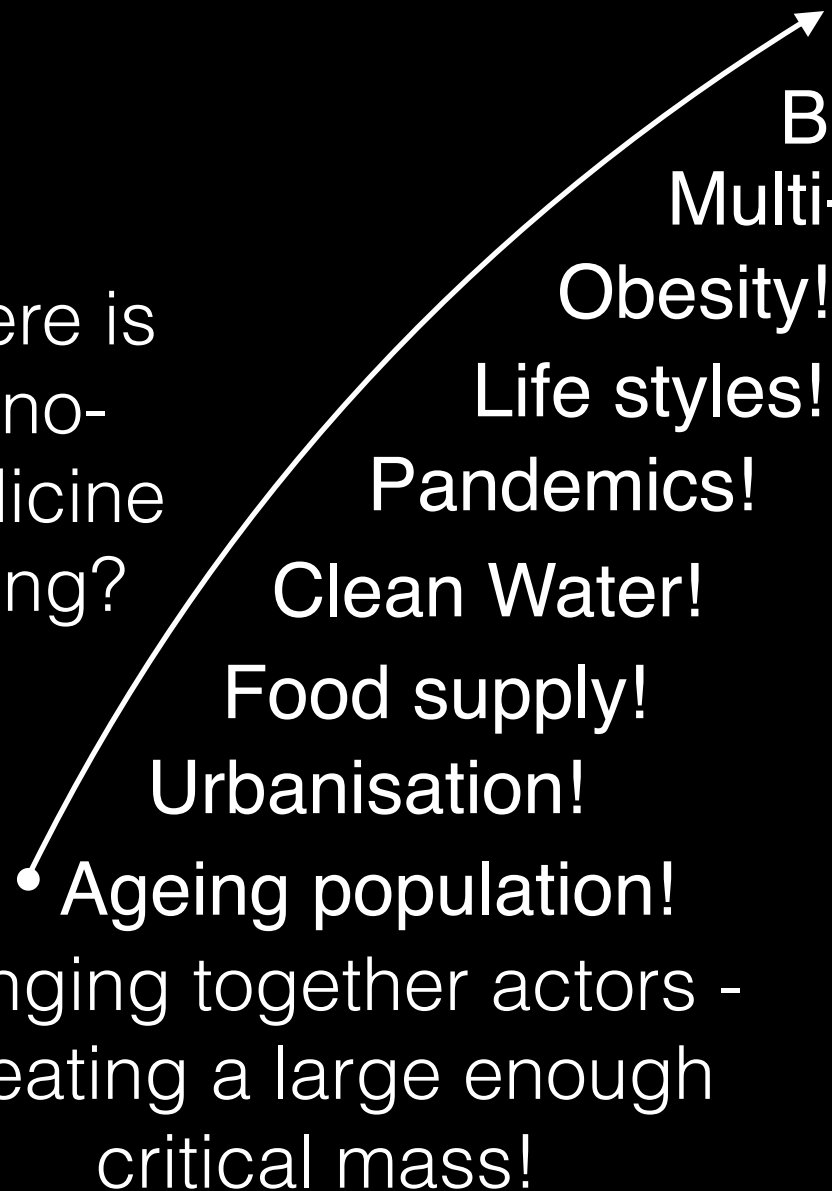
Q3:

Radical Innovation?

As a
neutral
Hub for
Iberian
efforts?



Where is
nano-
medicine
going?



A Health System Ceiling!

Big Data- history & experiences
Multi-sickness panorama!

So, what is called for?

A holistic translational
Health perspective!

Cross-KET &
Smart Specialisation

ESFRI - proposal
EuroScience Corridor!

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Radical Innovation?

As a
neutral
Hub for
Iberian
efforts?



Summary

International Iberian Nanotechnology Laboratory

- 1) Location: Braga- Portugal
- 2) Status: Intergovernmental Organization
- 3) Built area: 26,000 m²
- 4) Total Staff: ~ 400 people (100)
- 5) Research Space: 40 PI labs (15)





VISION:

Become the world wide
hub for nanotechnology
addressing society's grand
challenges

MISSION:

Perform interdisciplinary
cutting edge research,
deploy and articulate
nanotechnology - all for the
benefits of society.

WELCOME TO INL

Thank you for Your attention!

www.inl.int

Lars Montelius, Prof, Dr, Dr hc
Director General