

Imaging from molecule to man

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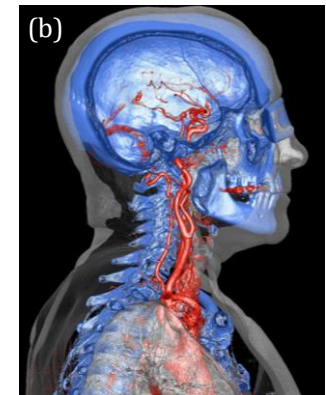
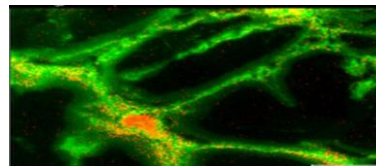
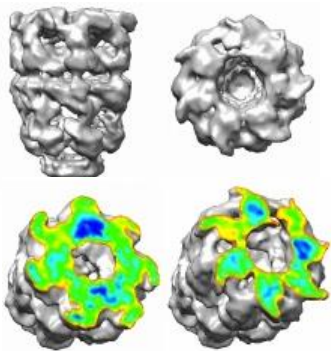
Master Open Day 2019, Maastricht, NL

2019/03/19



Why imaging from molecule to man?

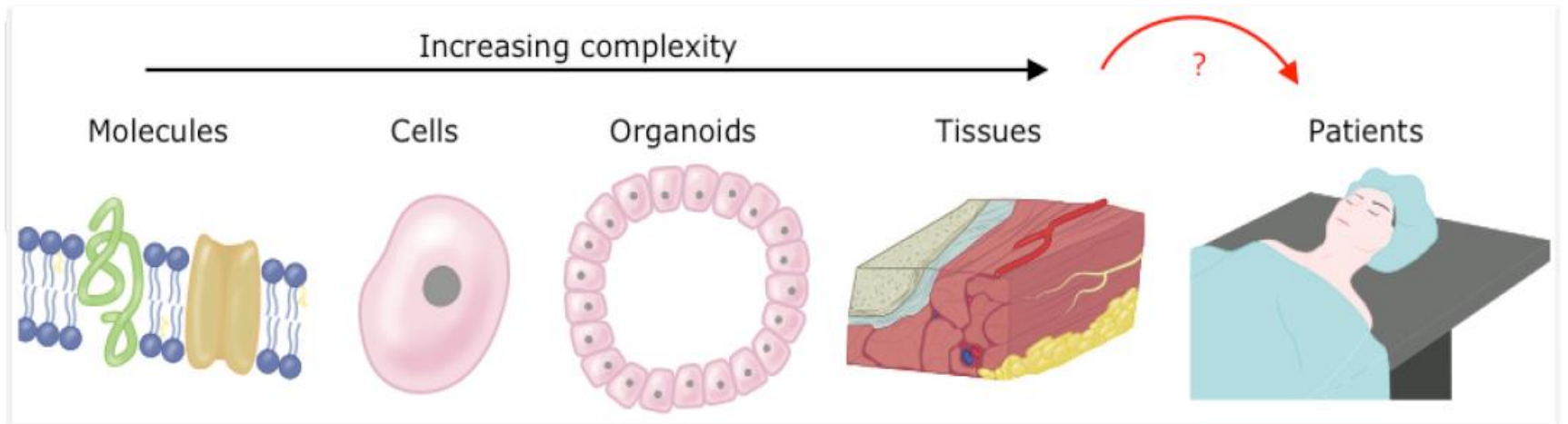
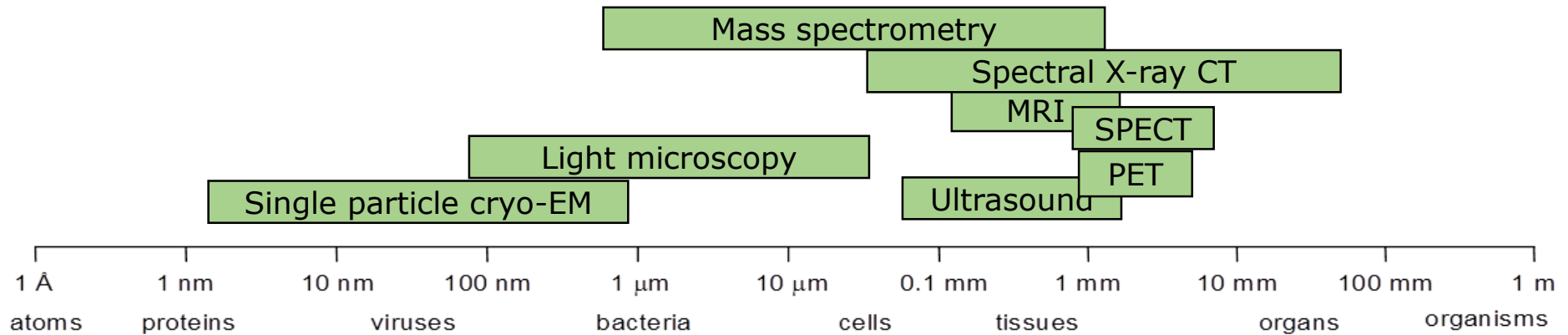
- Essential to **visualize the key molecular players** of health and disease at the cellular, tissue and patient levels
- **Treatment decisions** are based on molecular information and patient images that need to be put in the hands of the clinicians
- Evolving field with **innovative** emerging technologies



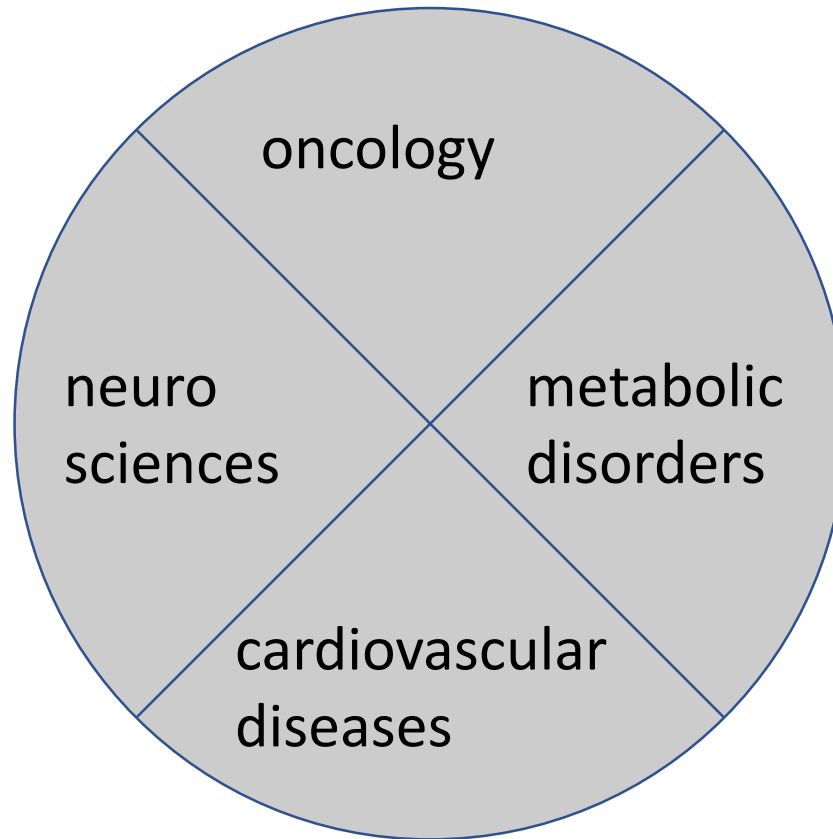
Nobel prizes for biomedical imaging

- 2017, Jacques Dubochet, Joachim Frank and Richard Henderson, **cryo-electron microscopy**
- 2014, Eric Betzig, Stefan W. Hell and William E. Moerner, **super-resolved fluorescence microscopy**
- 2003, Paul Lauterbur and Sir Peter Mansfield, **MRI**
- 2002, John Fenn, Koichi Tanaka (**Mass Spectrometry**), Kurt Wüthrich, **Nuclear MR spectrometry**
- 1979, Allan Cormack, Godfrey Hounsfield, **CT**
- 1901, X-ray, Wilhelm Conrad Röntgen, **X-rays**

Imaging from molecules to patients

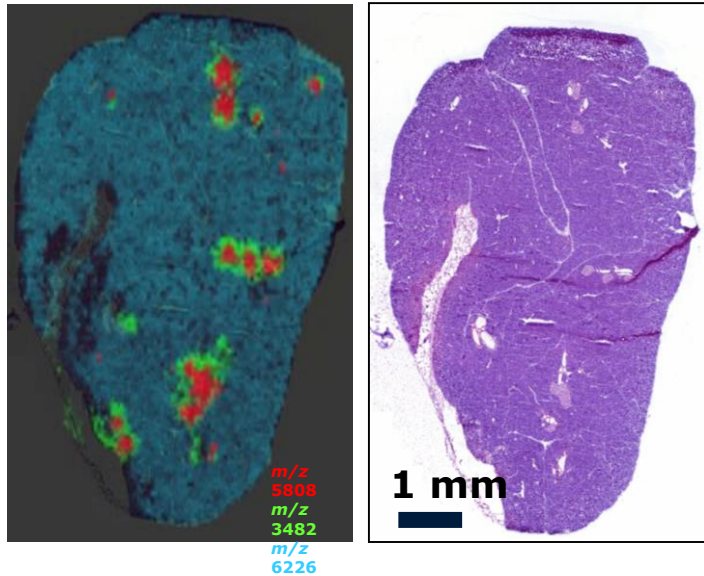


Imaging from molecule to man



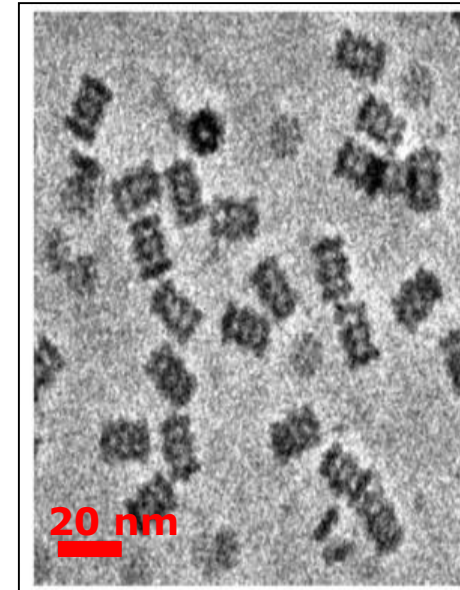
MSI and CryoEM = Two main technologies at M4I

Mass Spectrometry Imaging



+ label-free
+ multiplexing

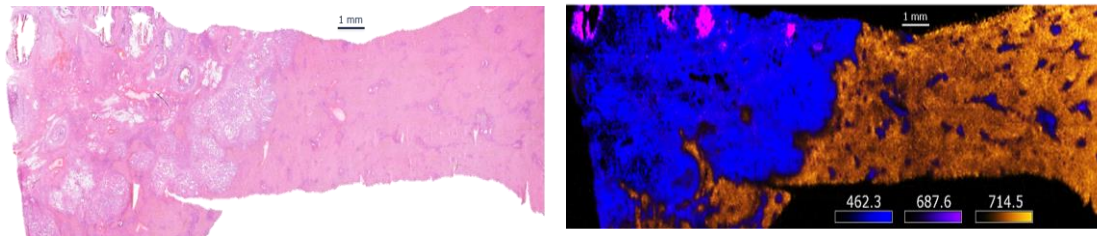
(Cryo-)Electron Microscopy



+ highest magnification level
-> see molecules

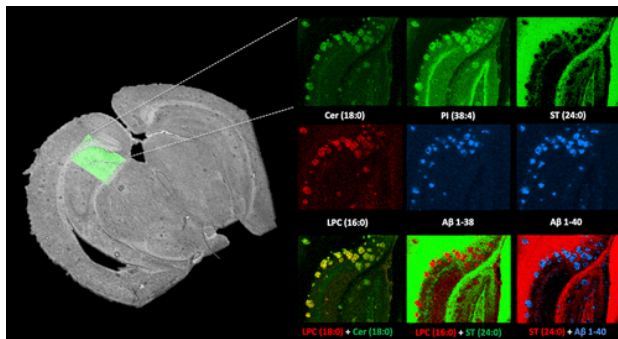
Mass spectrometry imaging for different applications in (pre)-clinical research

Oncology (pathological assessment of tumor margins)



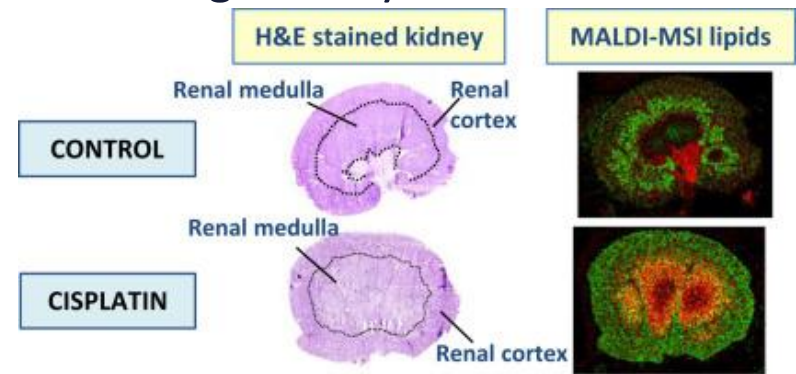
Vaysse (M4I)

Neurology (Alzheimer plaque formation)



Kaya, 2018

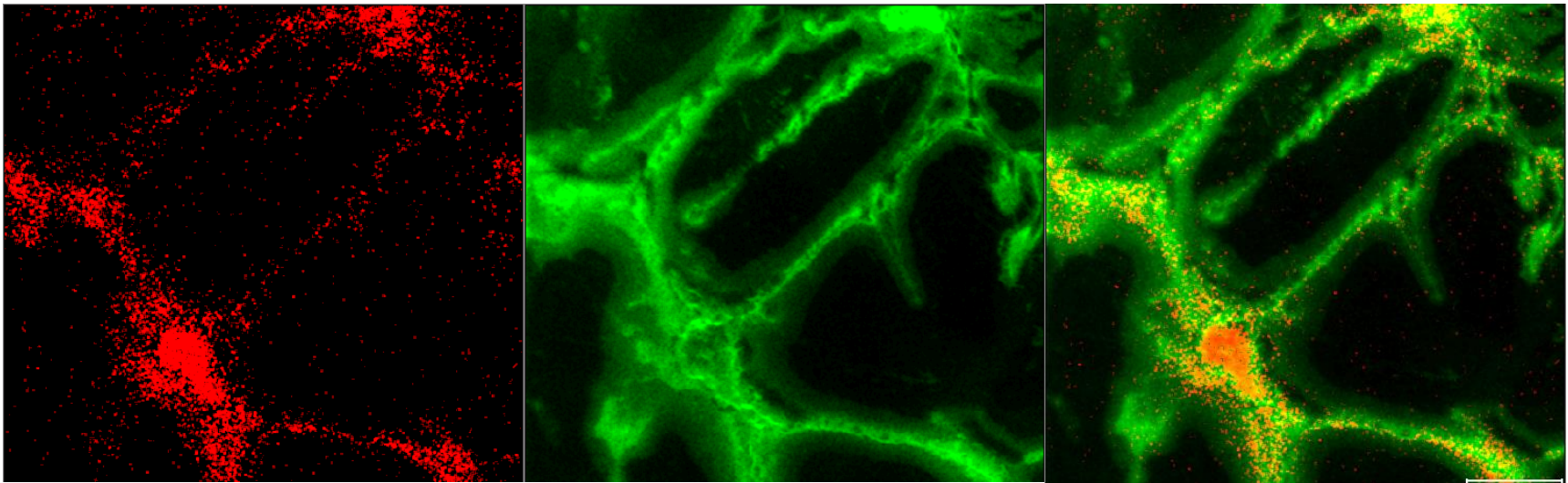
R&D (pharma) Drug toxicity assessment



Moreno-Gordaliza, 2017

From a single cell to a whole organ

NanoTof SIMS imaging of human neuronal cells



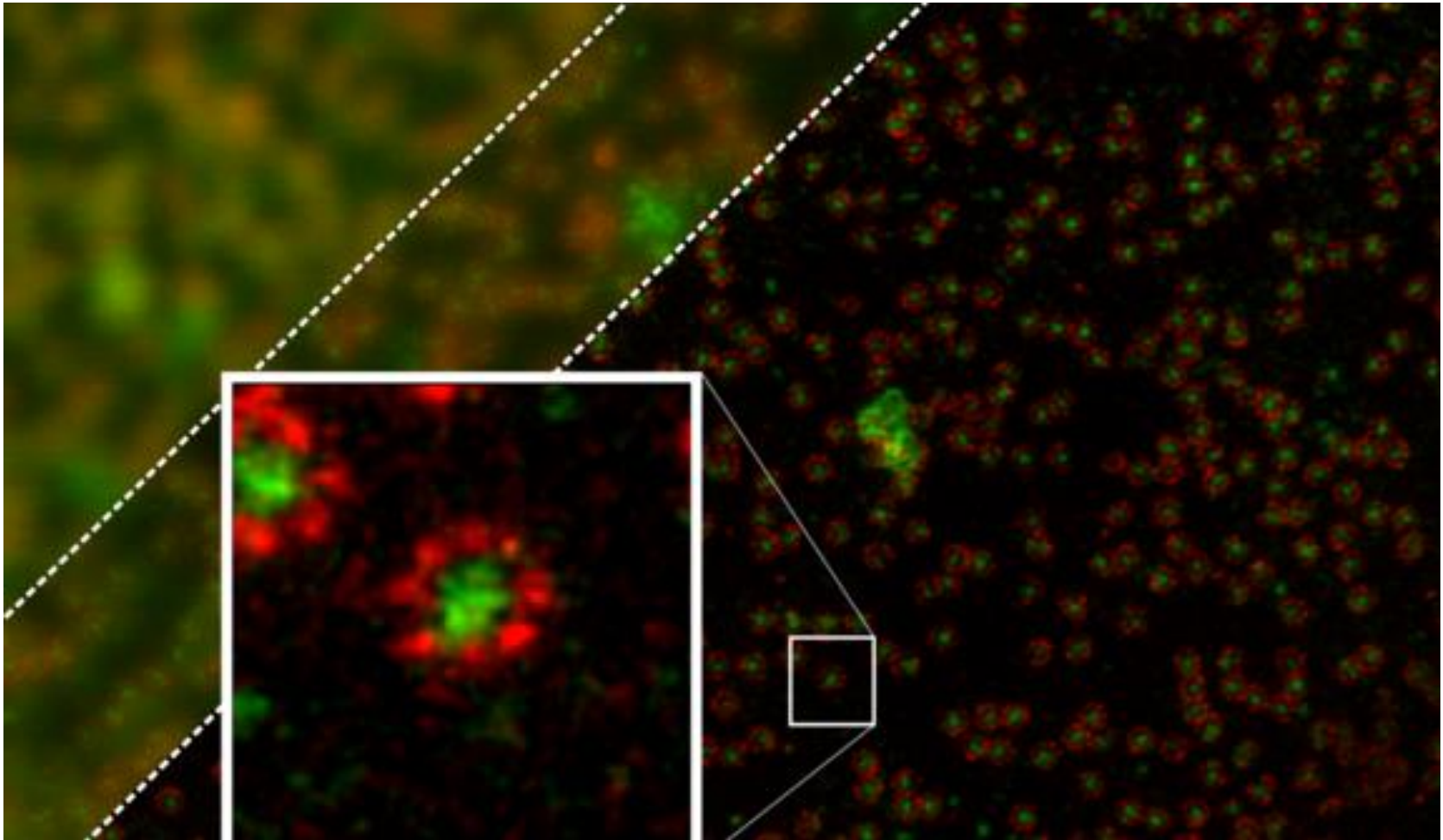
MS2 PL

MS1 Choline

Overlay

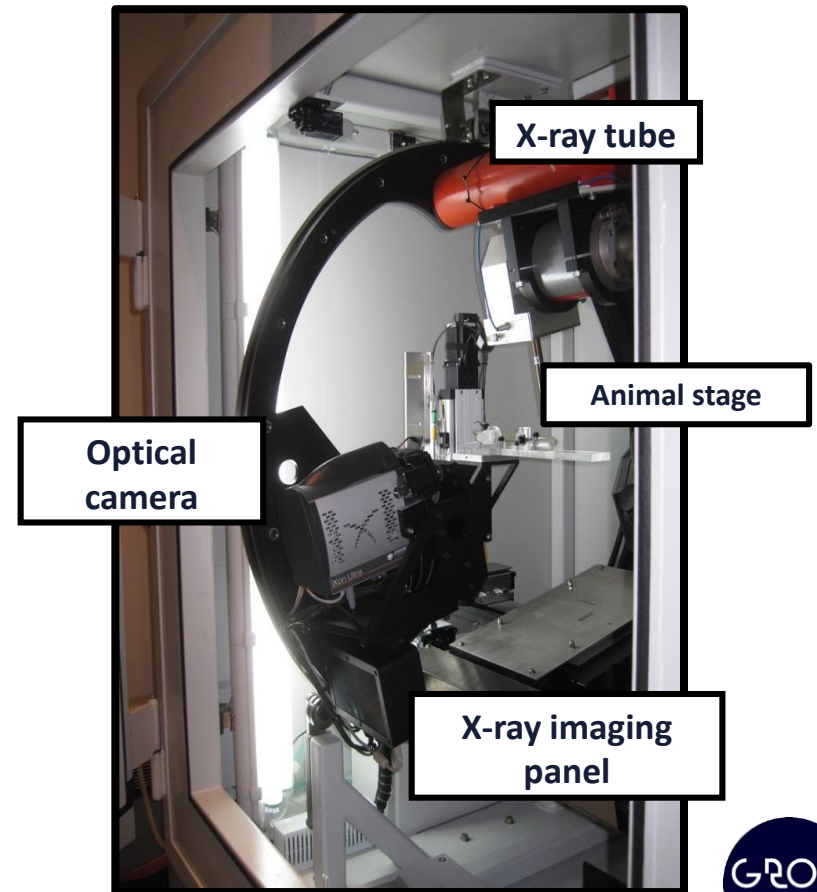
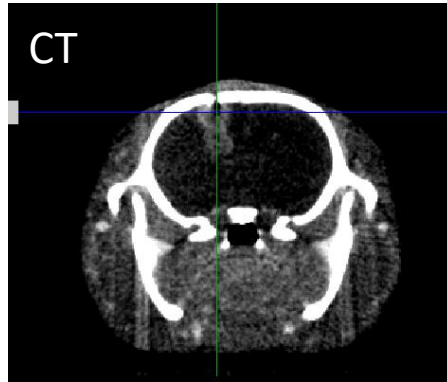
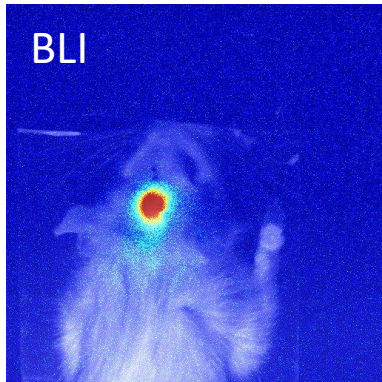
Courtesy of Prof. Ron Heeren

Advanced microscopy



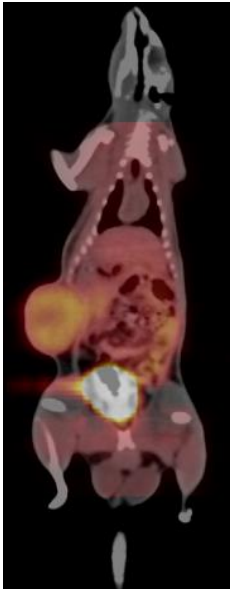
A novel approach in preclinical research: SmART = Small Animal RadioTherapy

- precision radiotherapy for rats & mice: 0-225 kV
- image-guided (CT, BLI, portal imaging)
- combine this with novel animal tumor models (orthotopic brain, lung, breast,...)

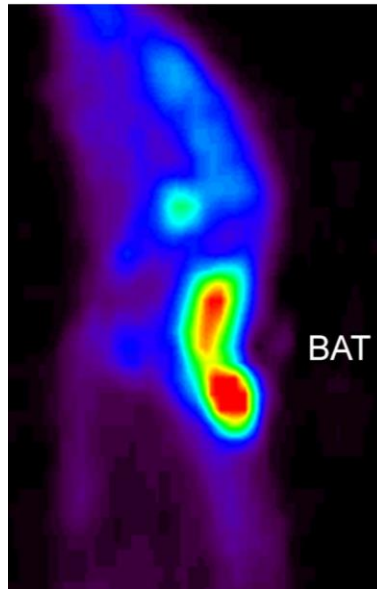


PET imaging for different diseases

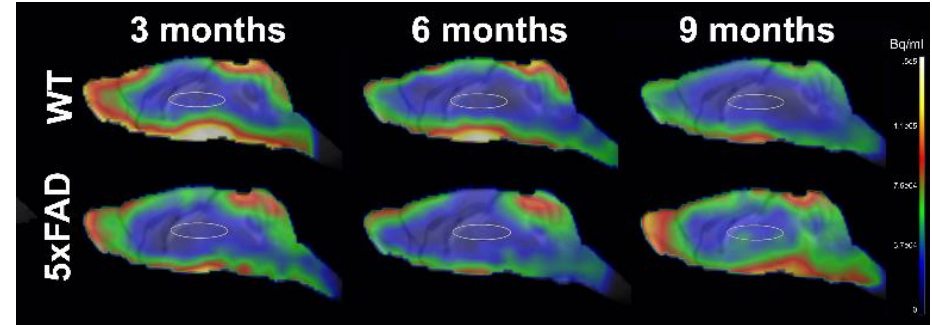
Oncology (hypoxia)



Metabolism

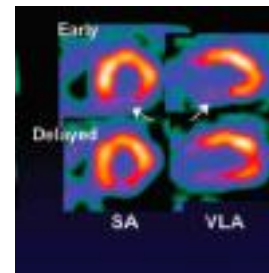


Neurology (Alzheimer plaque formation)

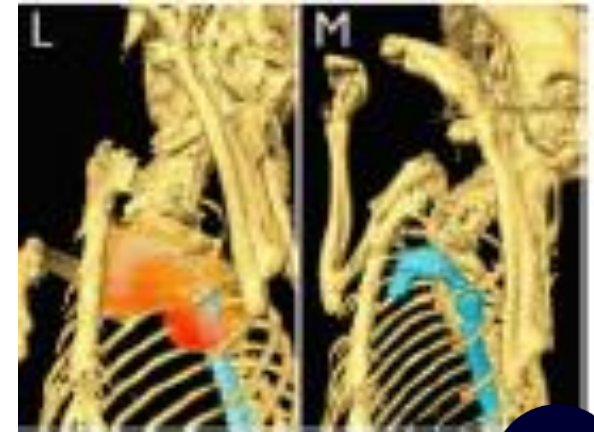


Cardiology

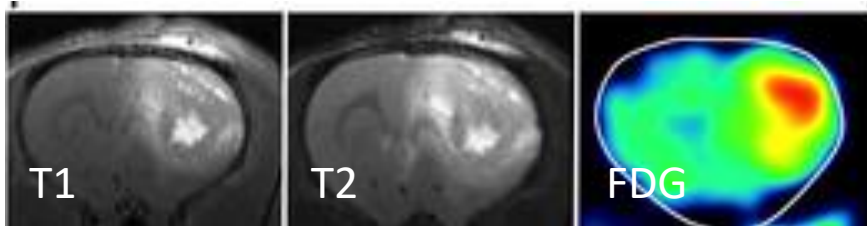
Perfusion



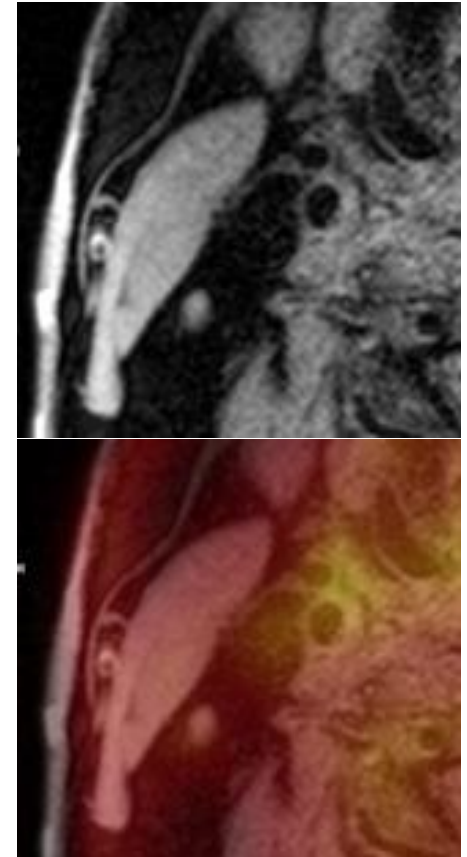
Atherosclerotic plaques



Oncology (orthotopic brain tumors)

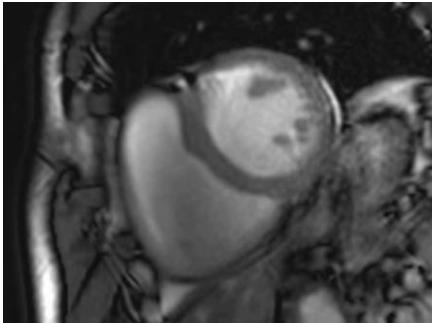


First integrated PET-MRI system in the Netherlands, whole body 7T MRI,...

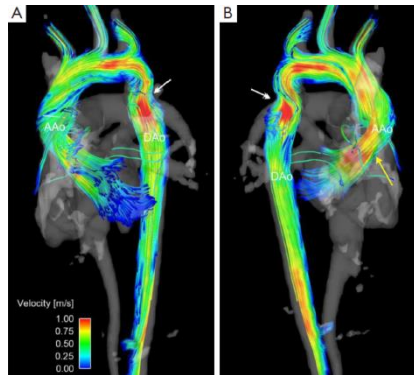


MRI: a non-invasive window to the heart

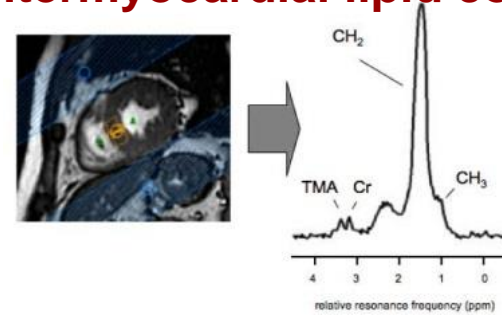
Systolic function



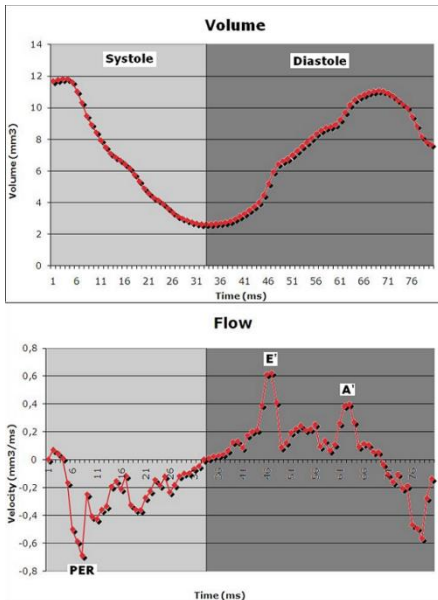
4D flow



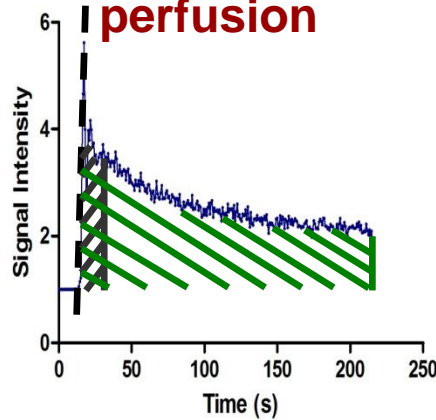
Intermyocardial lipid content



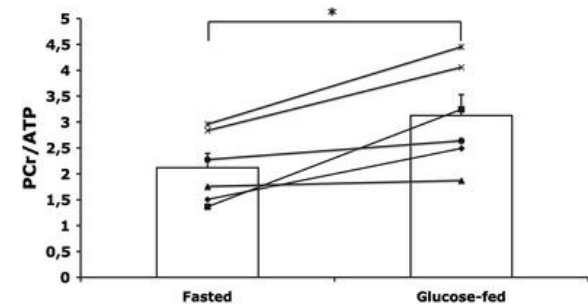
Diastolic function



First-pass myocardial perfusion



Cardiac energy status



Advantages of imaging

- Spatial information, often in 3D
- Functional measurements, such as movement of the heart and blood flow
- Follow a disease process, also before clinical symptoms occur
- Gives insight in disease processes that lead to clinical events
- Better risk stratification
- Personalized treatment and treatment evaluation

Specialization: focused on applications

Course 1: preclinical imaging

- introduction to different imaging platforms
- apply imaging to answer a biomedical research question

Course 2: clinical imaging

- opportunities and limitations of different imaging modalities
- focus on application in a clinical (research) setting

Junior and senior internship

Educational activities in course 1 and 2

- Workshops
- Hands-on training
- Journal Clubs
- Lectures
- Tutorials
- Meet the expert and meetings
 - Academic, industrial and clinical experts
- End project

Imaging from molecule to man

- Prepare students for a future with **broad expertise** of biomedical imaging to understand and treat disease
- An **interdisciplinary** and **translational education** in biomedical imaging
- Career opportunities in different fields in industry, academia, and hospitals

Broad jobs opportunities

Go
the **extra**
mile

Carrier opportunities after the Imaging master program:

- PhD student
- Career in research
- Junior scientist in the medical devices industry or biomedical imaging industry
- R&D professional in medical industry
- Consultant in industry or for governmental organisations

PHILIPS
Research

 **PIE MEDICAL**
IMAGING
an Esaote group company


scannexus

PHILIPS
Healthcare

For any questions about the specialisation...

- Contact the specialisation coordinator

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