Molecular imaging in vitro and in vivo

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Molecular Imaging

Definition:

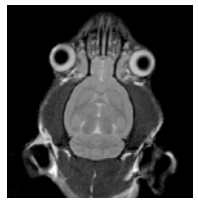
Molecular imaging is the visualization, the characterization and the measurement of biological processes at the molecular and cellular levels in living systems

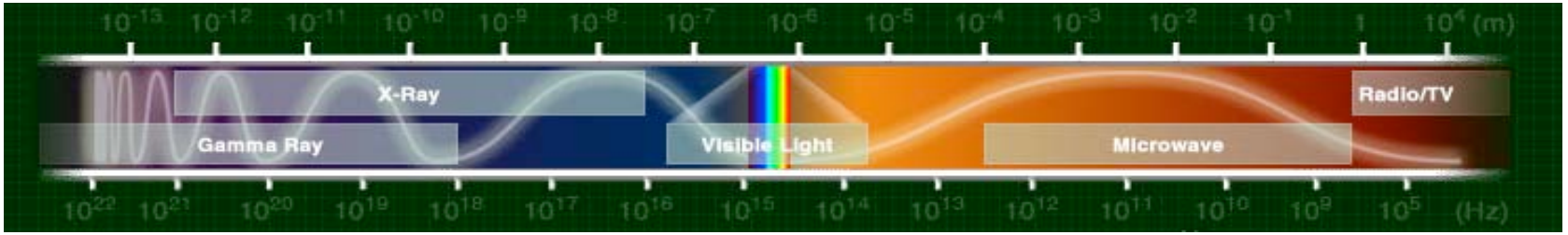
MICoE, SNM 07/2007

Spectrum of Imaging Modalities

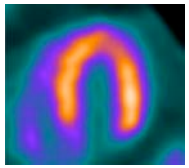
mCT – X-ray

MRI

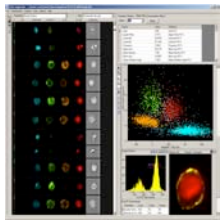


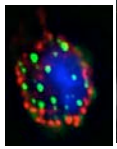


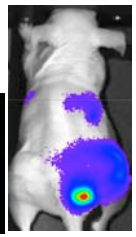
MicroSPECT & MicroPET



Bioluminescence
Fluorescence



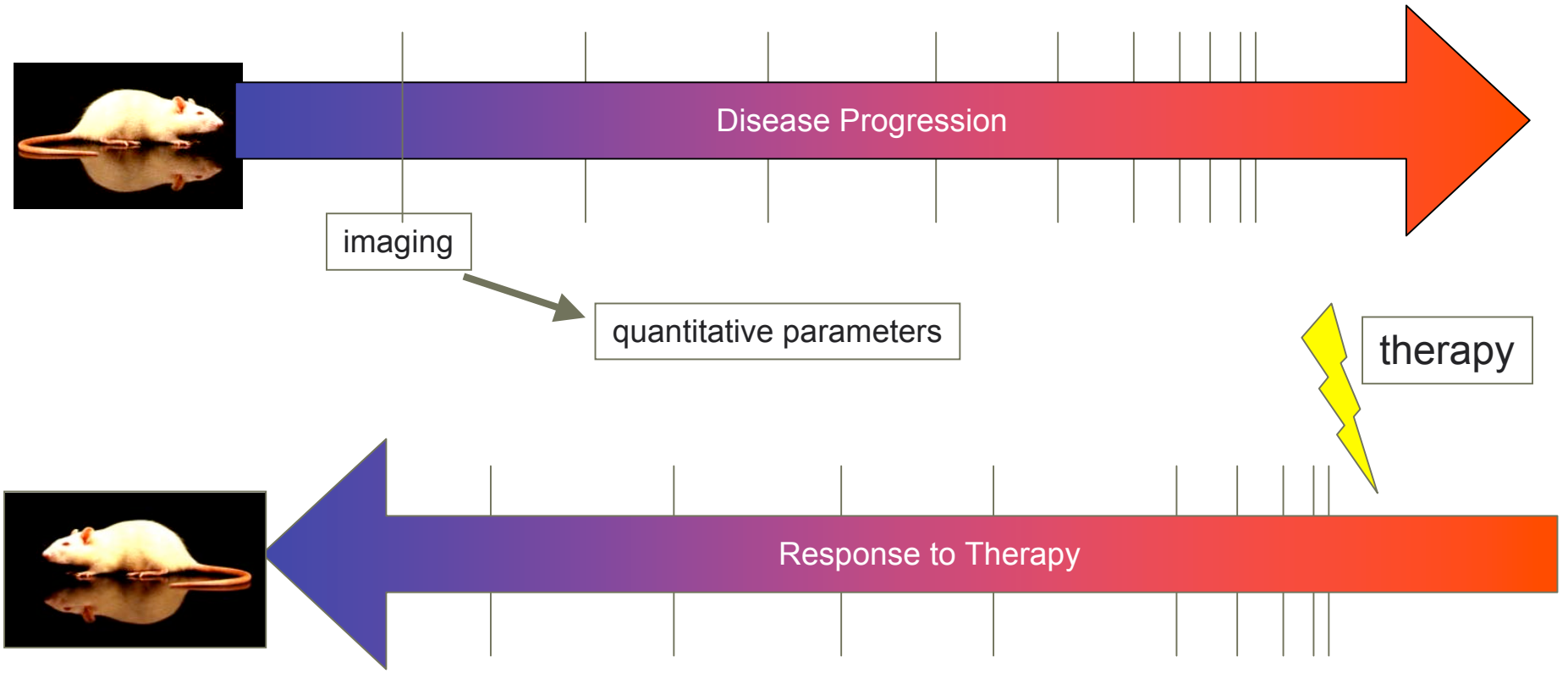




FRET/FRAP
ImageStream

www.mi-central.org

Small Animal Molecular Imaging

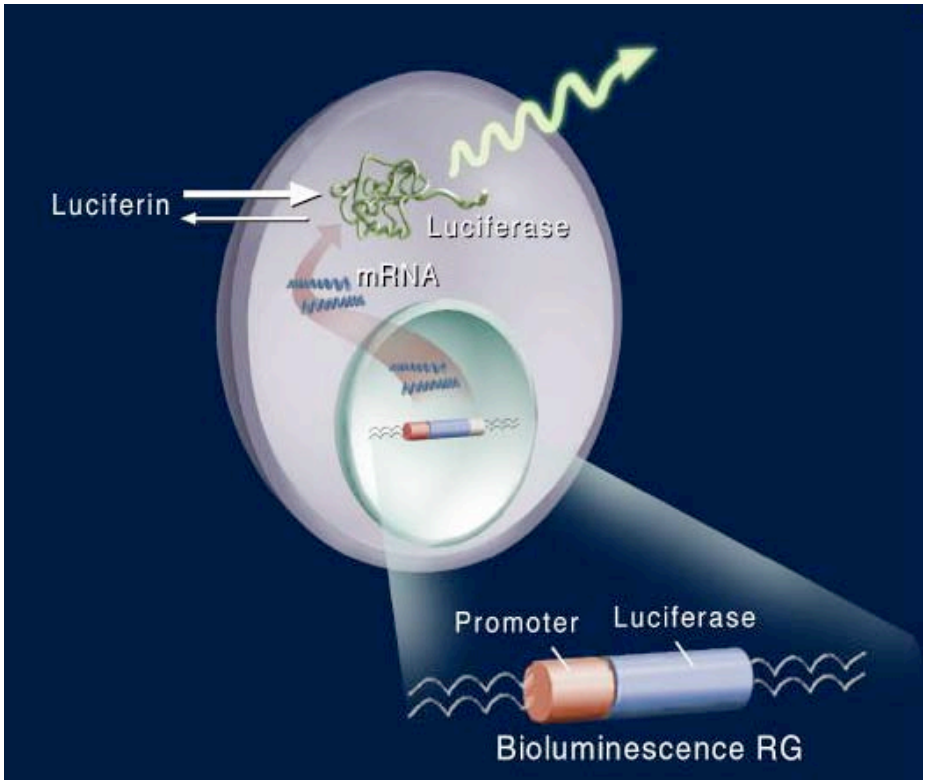


In Vivo Molecular Imaging

Bioluminescence

- Dynamic imaging
- Extremely sensitive
- 2D
- Cell tracking
- Oncology

In Vivo Molecular Imaging



Prof Gambhir S, MIPS, Stanford

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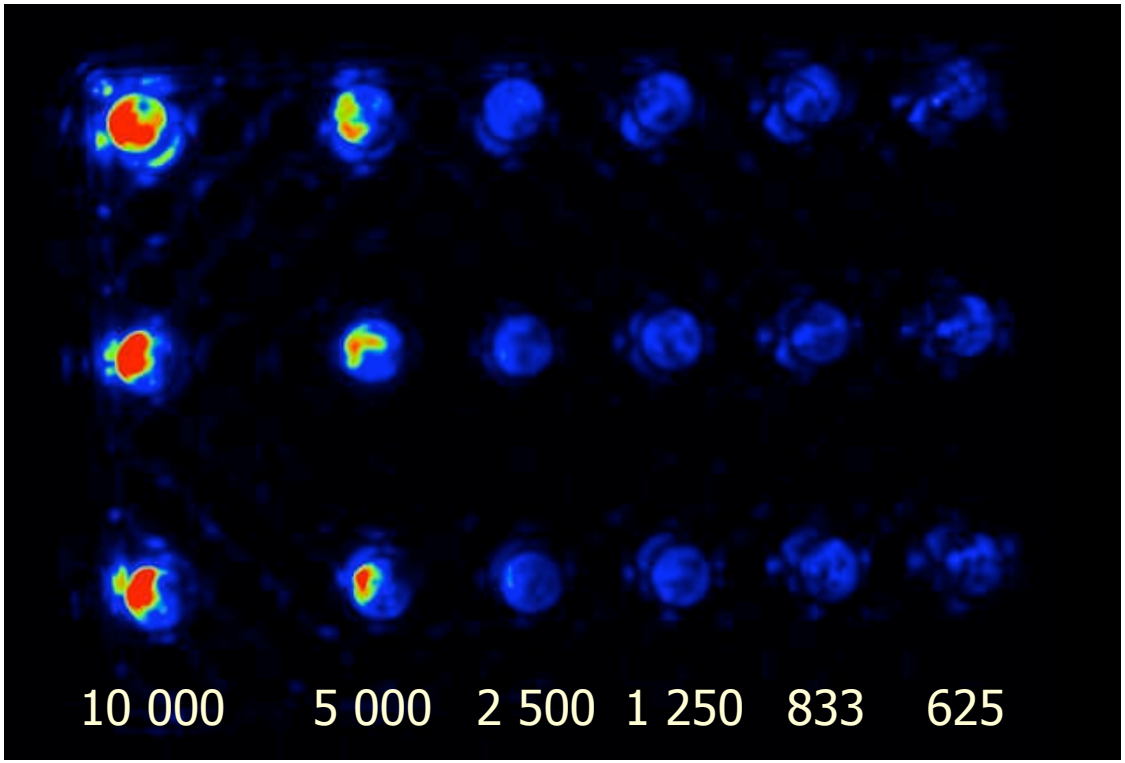
In Vivo Molecular Imaging



Dr Keyaerts M, ICMI, VUB

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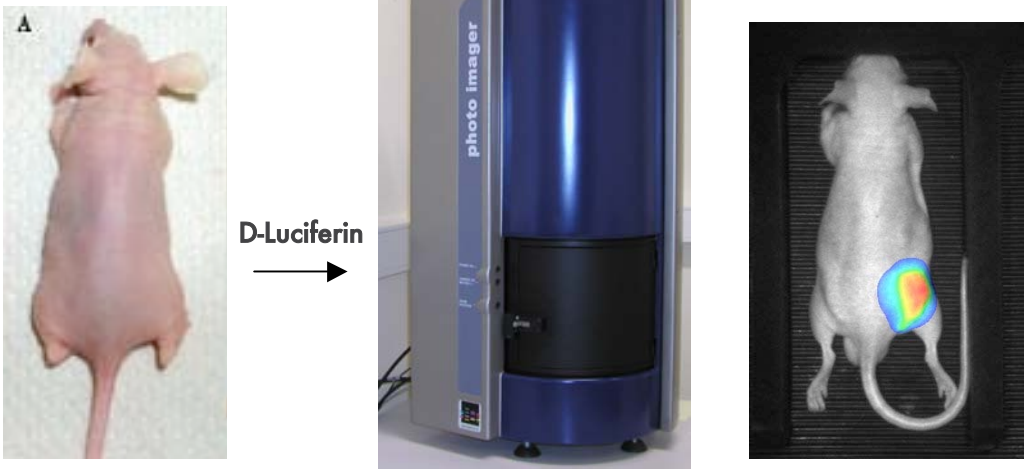
In Vivo Molecular Imaging



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Bioluminescence

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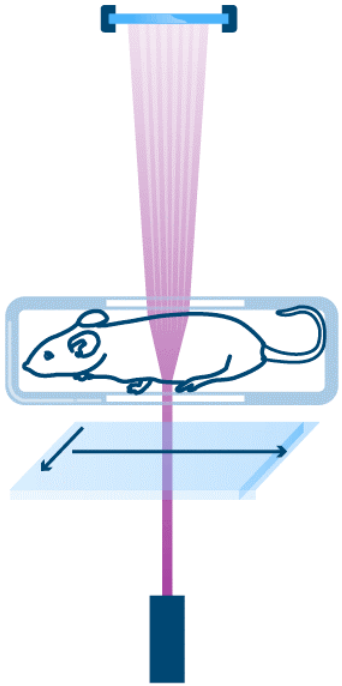
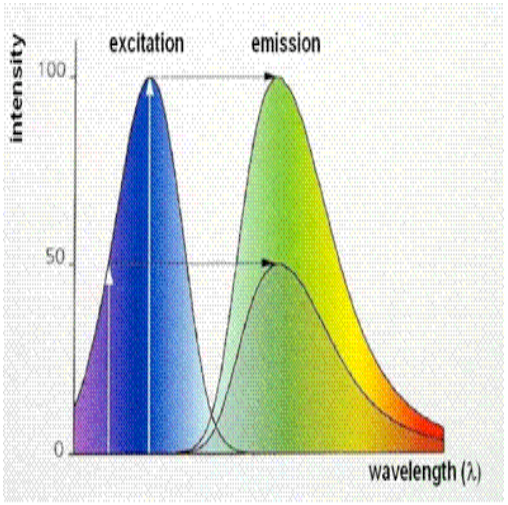
In Vivo Molecular Imaging

Fluorescence imaging

Visen Medical

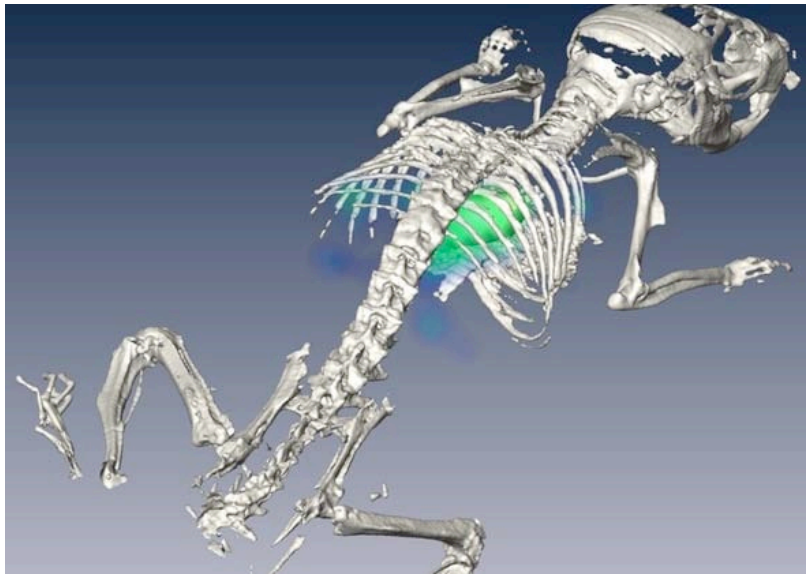


- 3D method
- Fusion with CT
- quantitative



In Vivo Molecular Imaging

Fluorescence imaging



Visen Medical

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In vivo Molecular Imaging

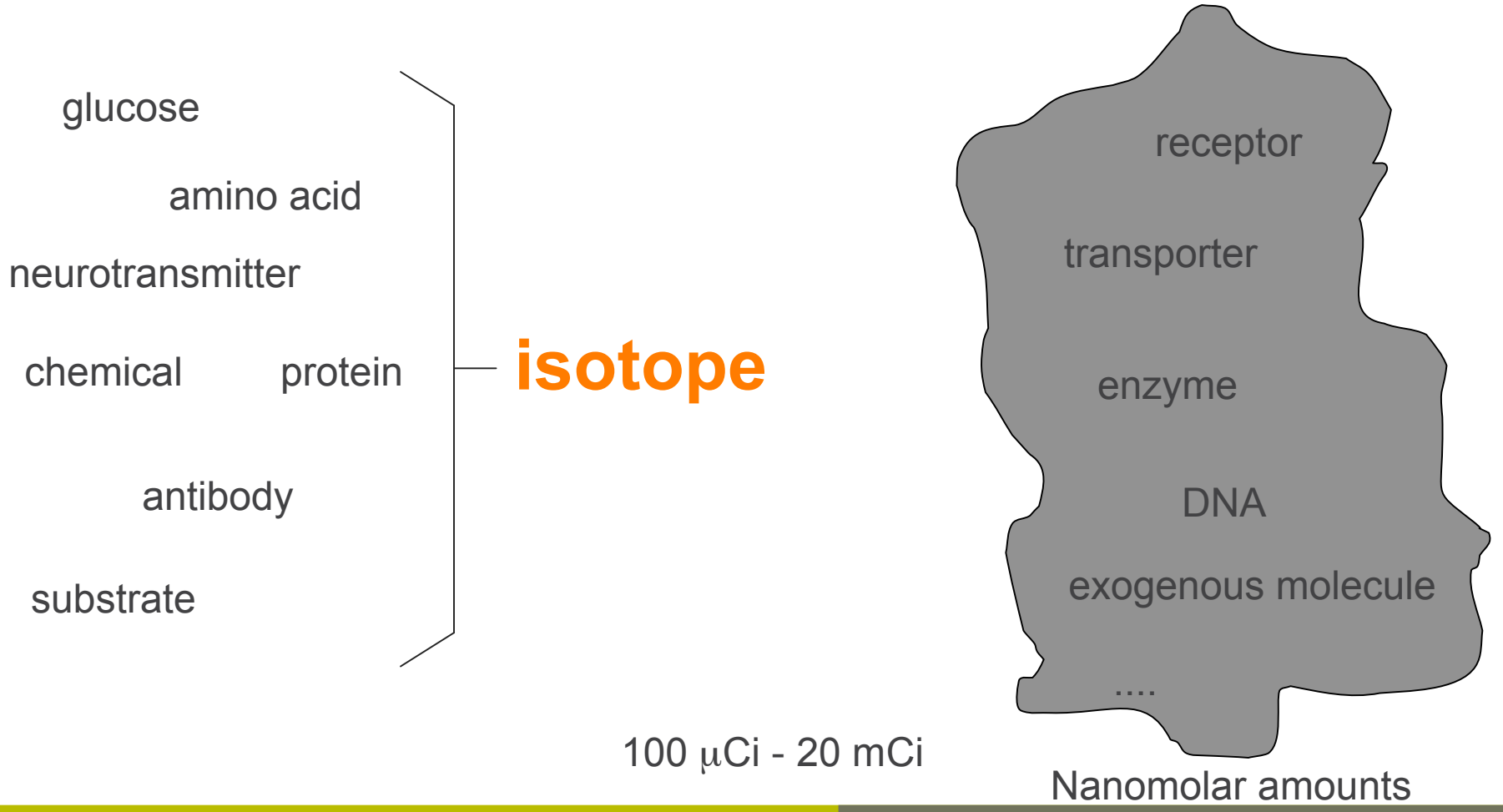
MicroSPECT/CT and MicroPET/CT

Single Photon Emission Tomography
- resolution 0,35 mm
- ^{125}I, ^{123}I, ^{99m}Tc, ^{111}In, …

Positron Emission Tomography
- resolution 1,2 mm
- ^{18}I, ^{124}I, ^{68}Ga, …

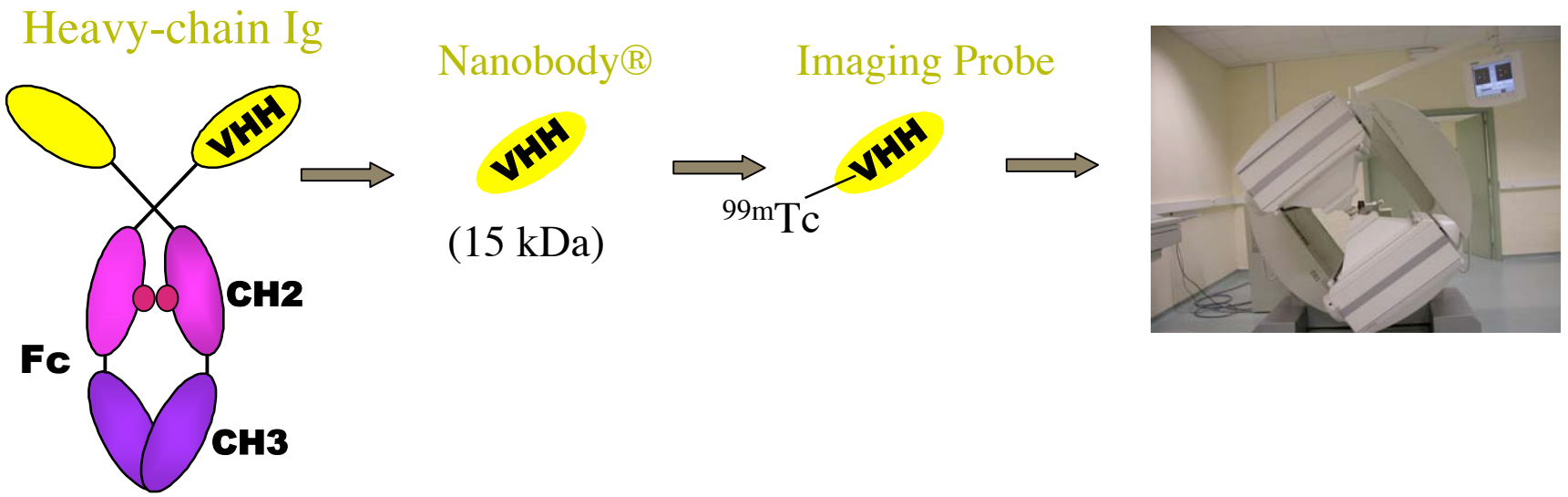
3D imaging and Quantitative

In vivo Molecular Imaging



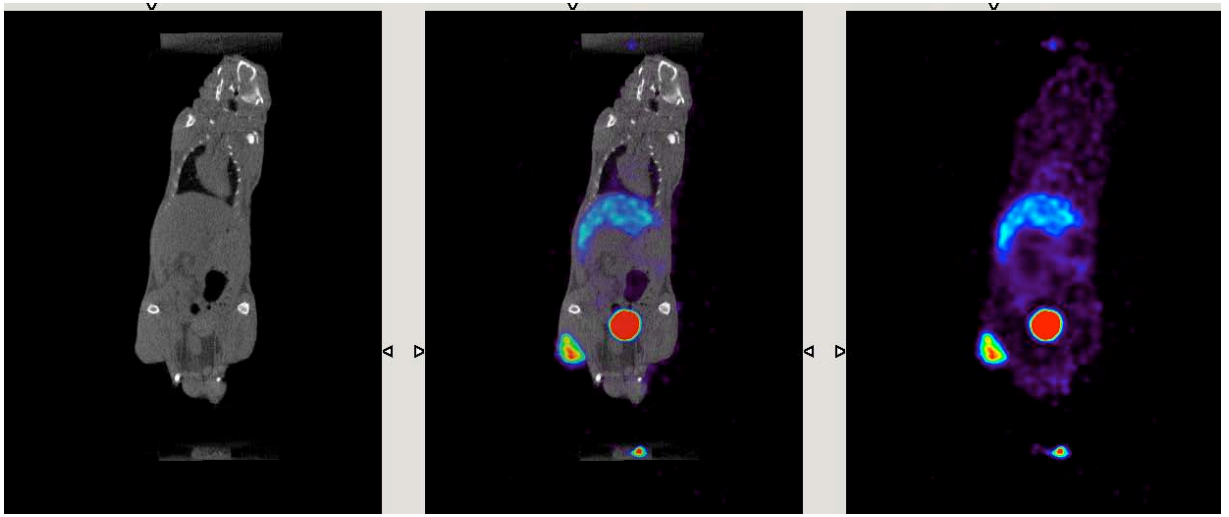
Nanobody Imaging

Molecular imaging probes for disease related cell surface biomarkers



Nanobody Imaging Program

Development of Imaging Probes for disease related biomarkers



MicroCT Fusion SPECT

Nanobody Imaging Program

Development of Imaging Probes for disease related biomarkers

- Organ biodistribution and targeting
- Pharmaco-kinetics
- Intra-individual comparison
- Serial intra-individual monitoring

Conclusion: Imaging & 3R

Imaging methods are non-invasive and allow repetitive measurements

- The animal is treated as a patient

Intra-individual comparison reduces the variability of the measurements

- Lower number of animals needed for obtaining statistical relevant results

Disease related parameters can be measured at early stages