



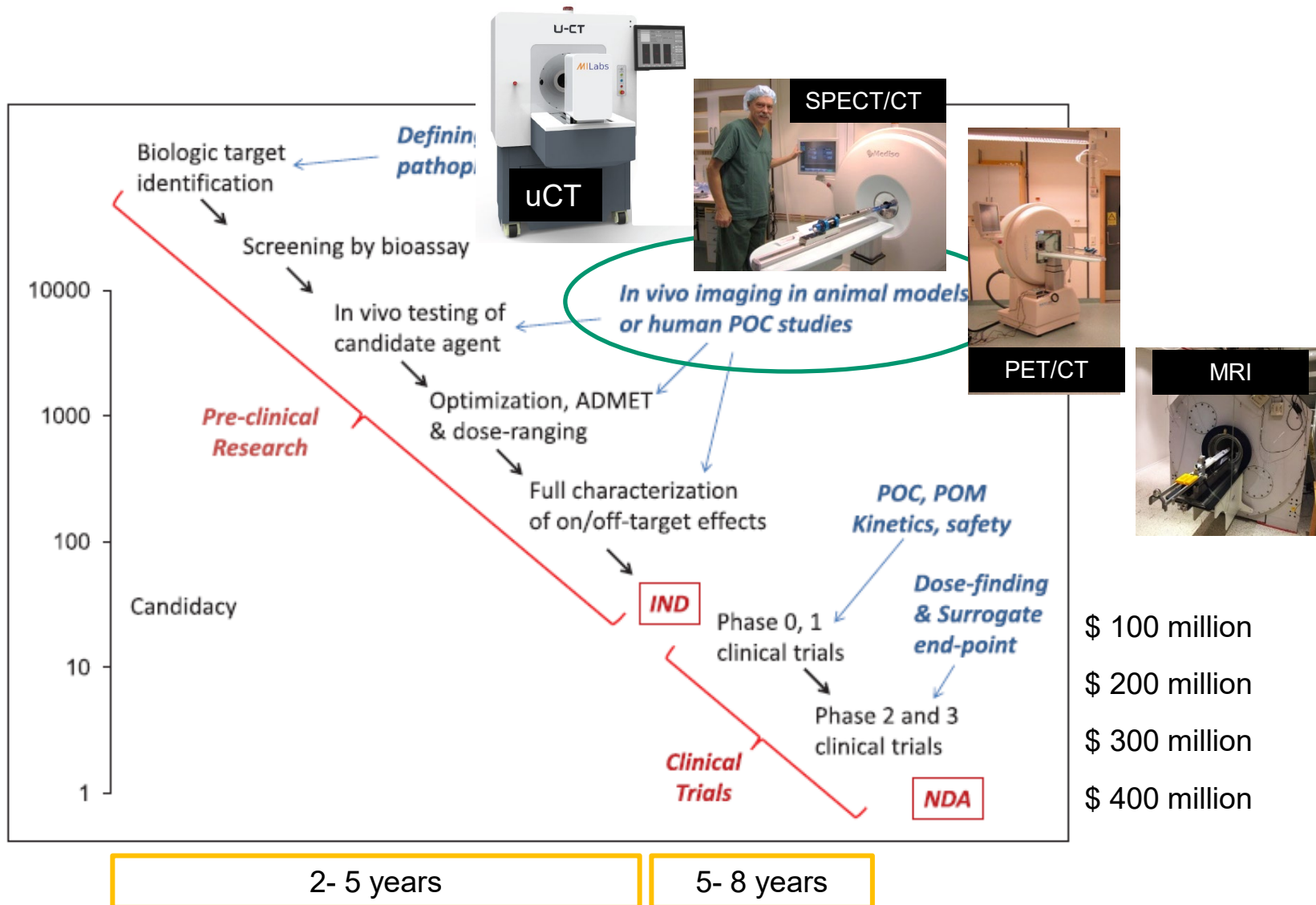
LUND
UNIVERSITY

LINXS Workshop on Biomedical
Imaging for drug
discovery/development –
Opportunities for MAXIV

*Limitations of
conventional imaging
methods X-ray, SPECT,
PET, MRI, US*

Lars E. Olsson
Lund University

Drug discovery and development



Why BioMedical Imaging in Drug Industry?

- In vivo data – non lethal!
- Provides 3D/regional information
- Assess and classify diseases
- Assess disease activity
- Assess treatment response
- Allow longitudinal studies
- Mouse to man

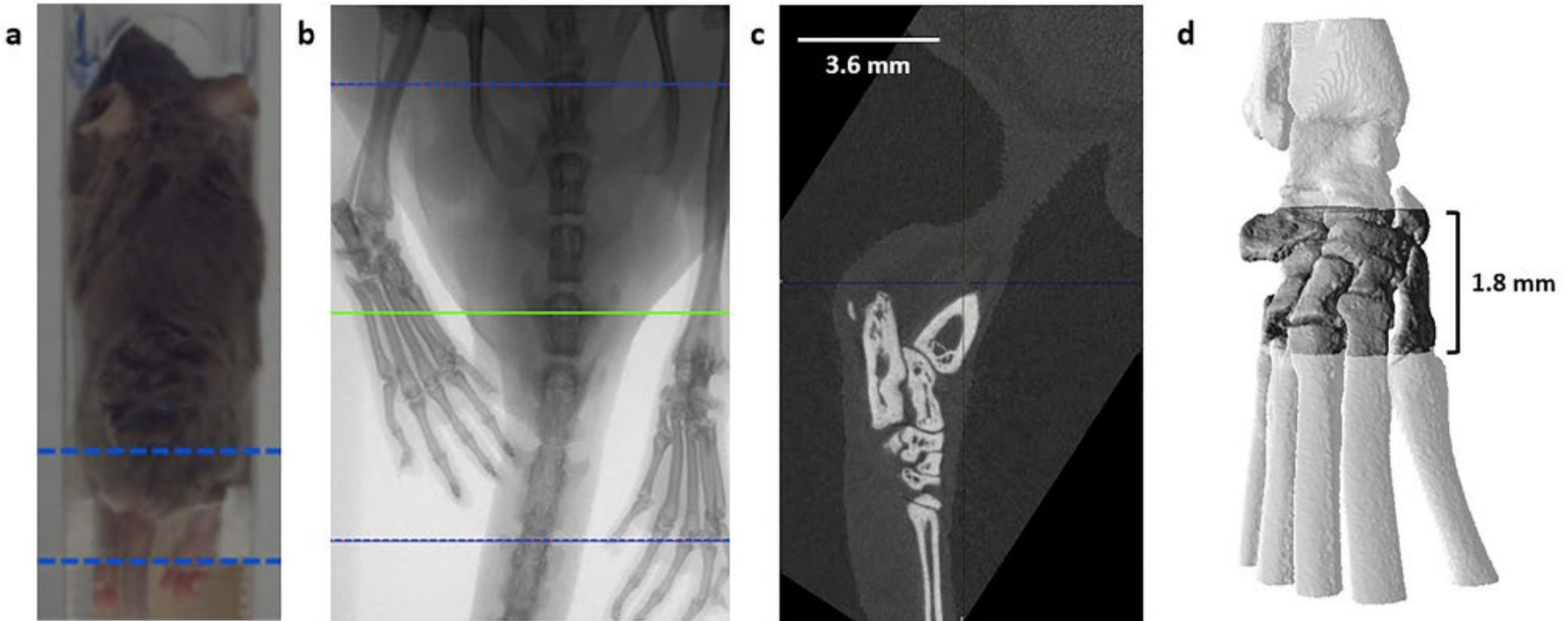


μ CT

in-vivo imaging mouse hind paw μ CT

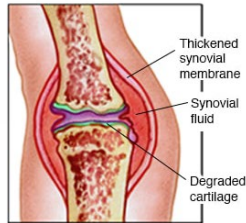


spatial resolution 18 μ m (voxel)

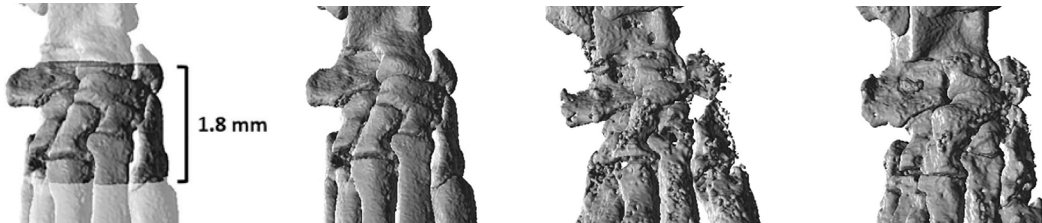
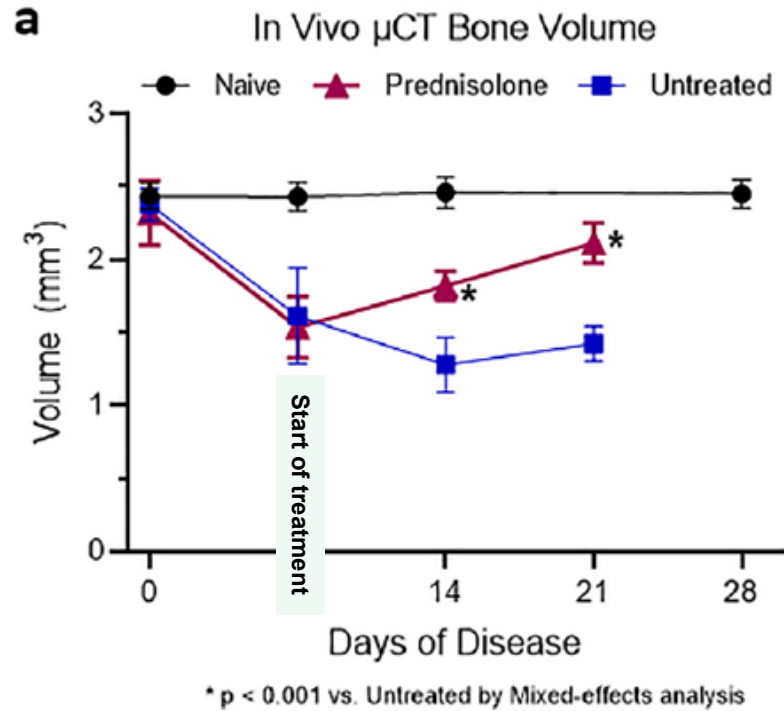


in-vivo μ CT imaging

Rheumatoid arthritis model



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in-vivo μ CT imaging

Rheumatoid arthritis model

- In vivo data – non lethal!
 - Provides 3D/regional information
 - Assess disease activity
 - Assess treatment response
 - Allow longitudinal studies
 - Mouse to man
-
- Limitations
 - radiation dose ~ 1 Gy
 - spatial resolution 2- 30 μm
 - anatomical data only





Nuclear medicin

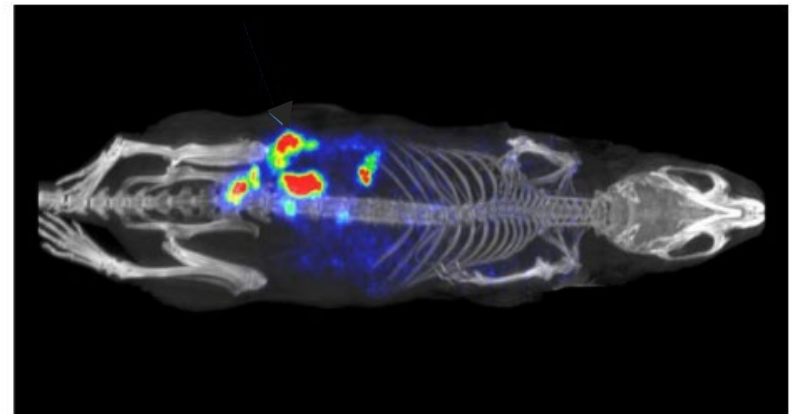
Nuclear medicine

Radionuclide
☢ γ-emitting

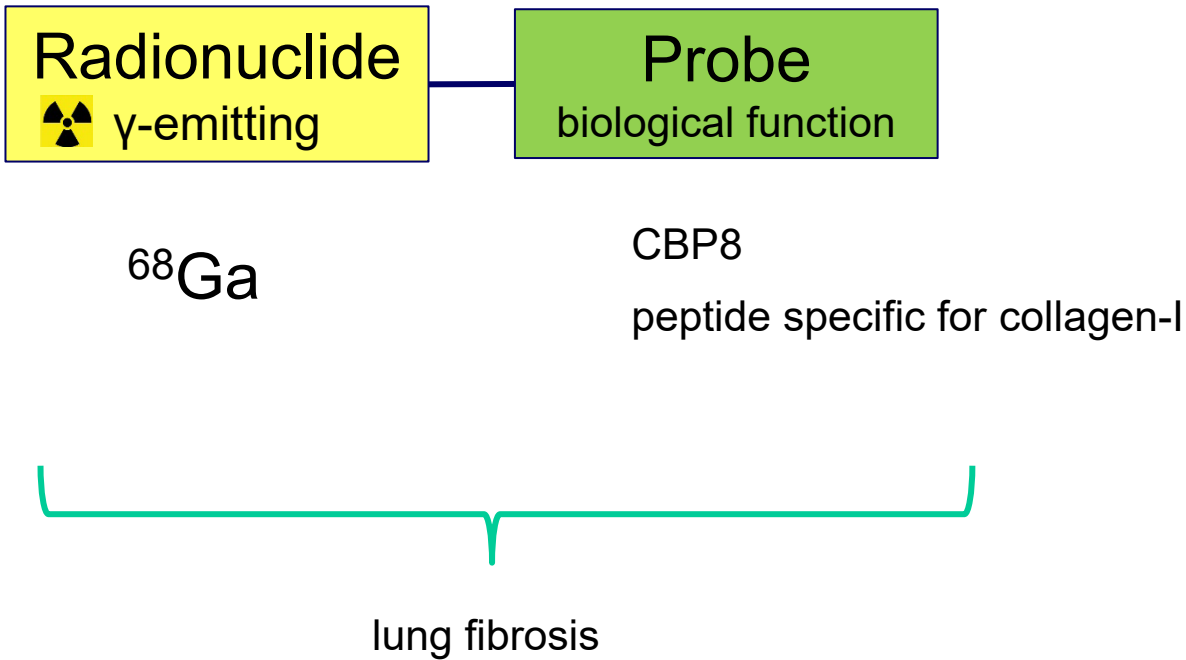
Probe
biological function



- Tumour, ^{18}F FDG
- Specific
 - amyloid
 - collagen-I
 - PSMA
 - ...



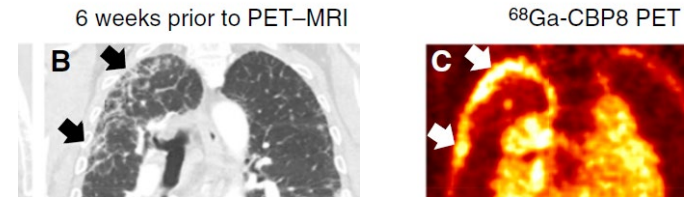
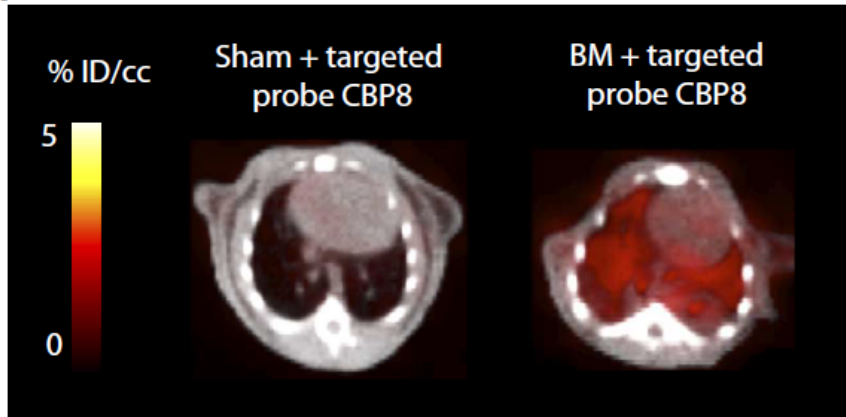
PET-tracer



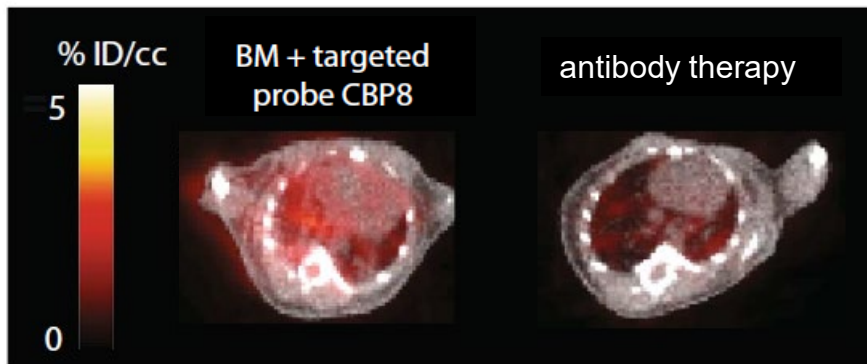
in-vivo PET/CT imaging

lung fibrosis model (bleomycin)

A



B



in-vivo PET/CT imaging

- Functional imaging
 - In vivo data – non lethal!
 - Provides 3D/regional information
 - Assess disease activity
 - Assess treatment response
 - Allow longitudinal studies
 - Mouse to man
- Limitations
 - Not radiation dose – but injected volume
 - Supply of radionuclides
 - Radiochemistry
 - Spatial resolution $\sim 0.5 - 1$ mm
 - Anatomical data from CT





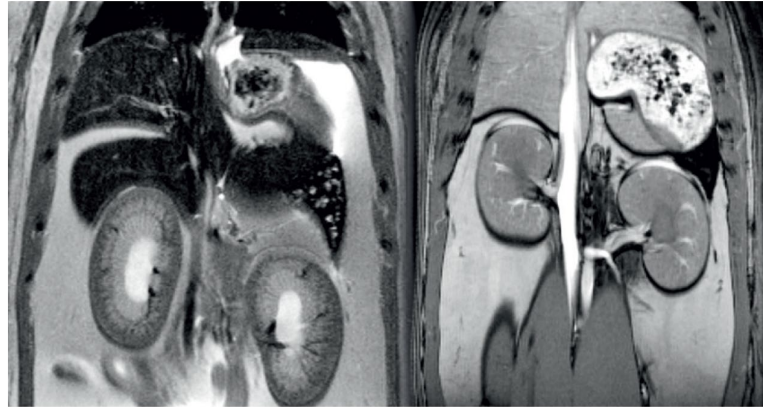
Magnetic Resonance Imaging

Magnetic Resonance Imaging, MRI

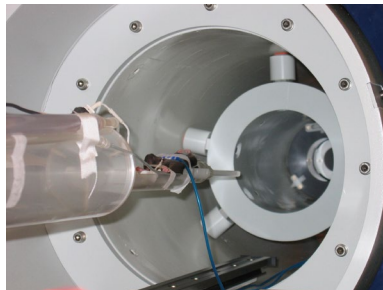
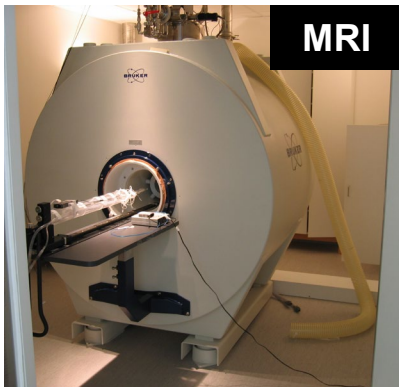
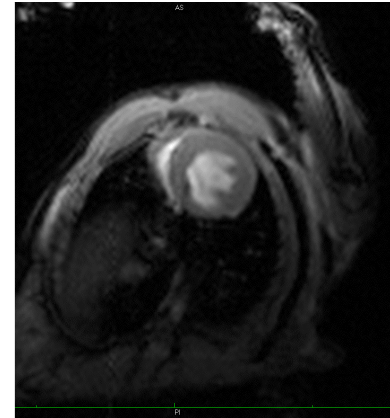
Angiography



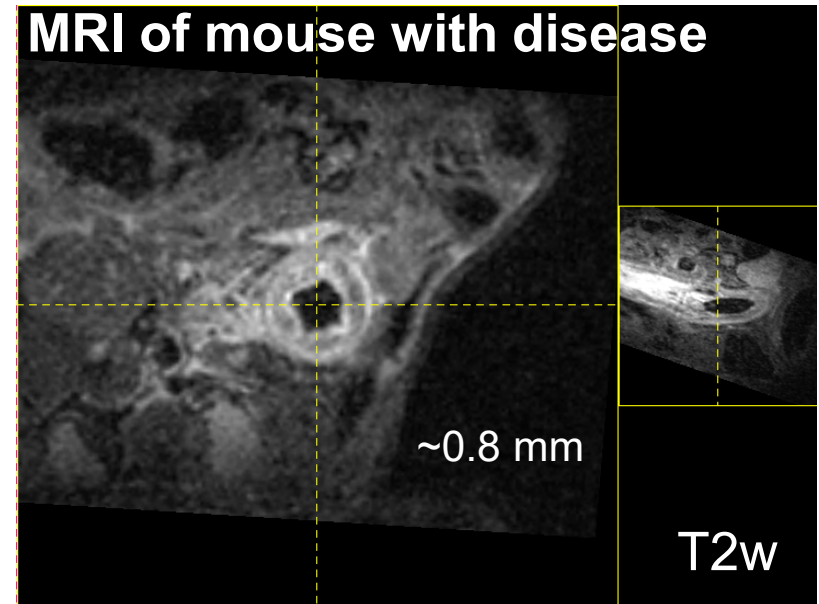
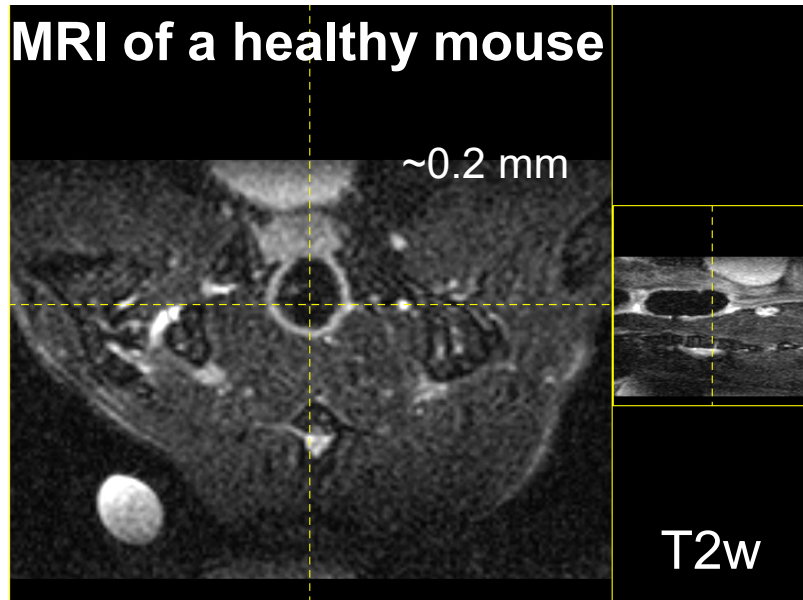
Abdominal Imaging



Mouse heart, 500 bpm



Inflammatory bowel disease, IBD mouse model



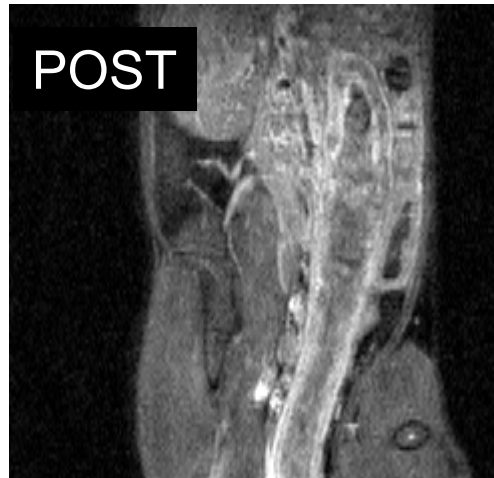
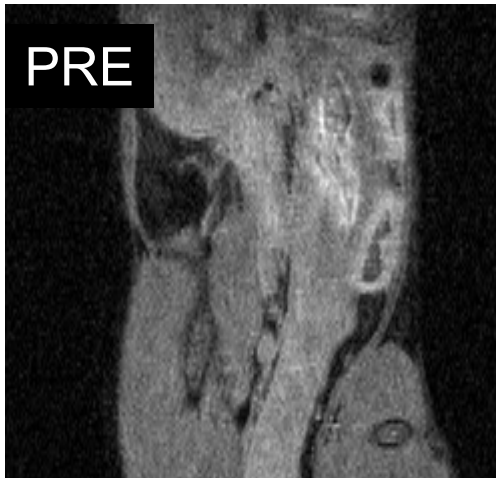
Macroscopic inflammatory score

- Stiffness: 0-2
- Oedema: 0-3
- Red-bloodiness: 0-1
- Thickness: 0-4

} 0- 10



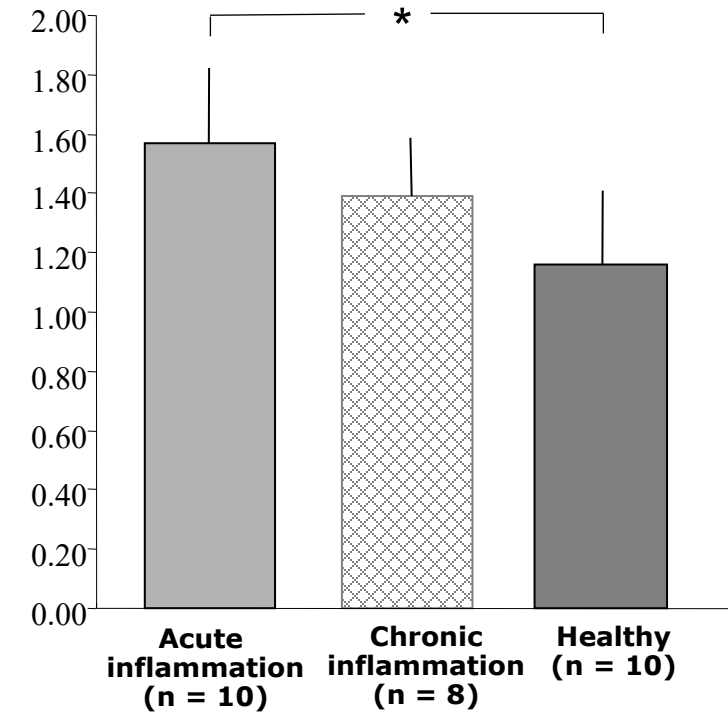
MRI with contrast enhancement



Patient with IBD

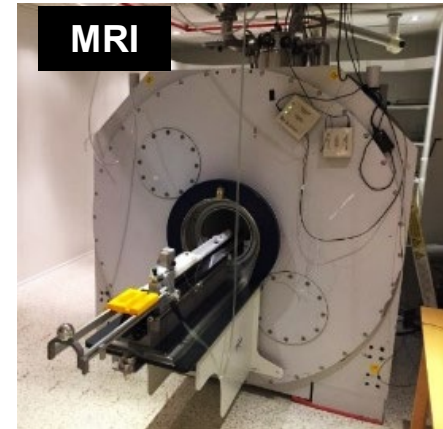


T1 post/T1 pre contrast



in-vivo MRI

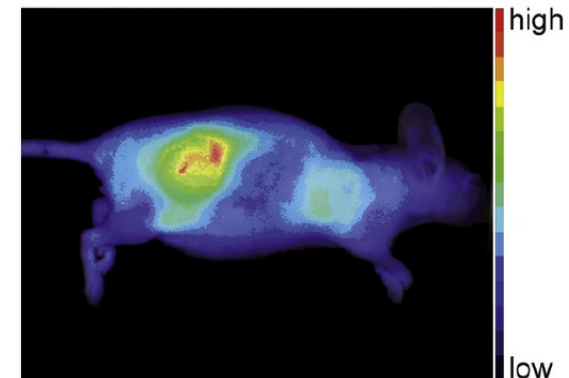
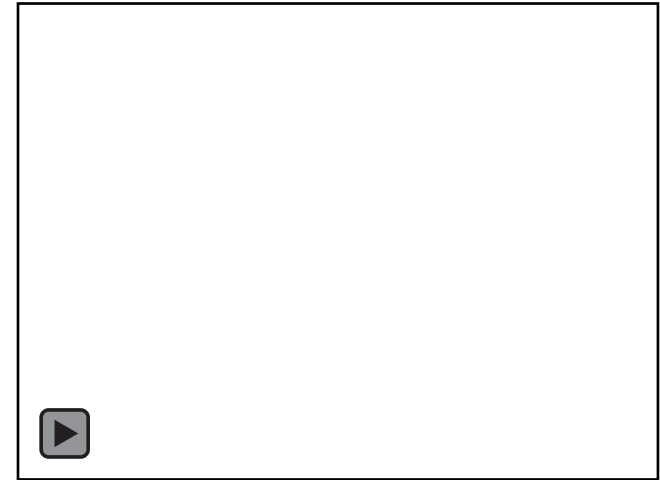
- Anatomical and Functional data
 - In vivo data – non lethal!
 - Provides 3D/regional information
 - Assess disease activity
 - Assess treatment response
 - Allow longitudinal studies
 - Mouse to man
- Limitations
 - spatial resolution $\sim 0.1\text{-}1\text{ mm}$
 - higher resolution – long acquisition times
 - low sensitivity



in-vivo imaging

ultra sound, optical imaging

- **Ultra sound**
 - anatomical
 - direct functional
 - spatial resolution a limitation
 - operator dependent
 - animals with fur needs shaving
- **Optical**
 - direct functional
 - not anatomical
 - high spatial resolution
 - tissue penetration depth a limitation



in-vivo imaging

μ CT, PET/CT, (SPECT/CT), MRI

- Functional Imaging
 - PET/CT and SPECT/CT –
 - o direct functional
 - o not anatomical
 - o spatial resolution a limitation
 - MRI
 - o indirect functional
 - o spatial resolution a limitation

in-vivo imaging

μ CT, PET/CT, (SPECT/CT), MRI

- Functional Imaging

- PET/CT and SPECT/CT —
 - direct functional
 - not anatomical
 - spatial resolution a limitation
- MRI
 - indirect functional
 - spatial resolution a limitation

- Anatomical imaging

- MRI
 - excellent soft tissue contrast
 - spatial resolution a limitation (but less than functional MRI)
- μ CT
 - radiation dose ~ 1 Gy
 - spatial resolution 2- 30 μ m
 - anatomic data only

