Perspectives on Preclinical Molecular Imaging Research at the Radiopharmacy Centre, Medical University of Bialystok

Anna Gromotowicz-Poplawska

RADIOPHARMACY CENTRE – from plans to goals

…end of 2021

…end of 2022

…end of 2023

RADIOPHARMACY CENTRE

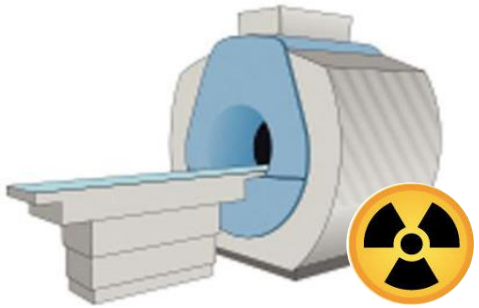
– a scientific unit of the Medical University of Bialystok,
modern infrastructure, fully equipped laboratories, specialized equipment

RADIOPHARMACY CENTRE

- Scientific unit at the Medical University of Białystok, opened in **January 2024**
- Fully equipped laboratories for radiopharmaceutical production and quality control
- Fully equipped *in vitro* and *in vivo* preclinical research laboratories with molecular imaging
- Specialized radiometric equipment
- Highly qualified personnel
- Licenses obtained in 2024 from the President of the National Atomic Energy Agency for work with radioactive isotopes
- Registered in 2024 with the Ministry of Science and Higher Education as a facility authorized for experimental procedures on animals (mice, rats) for scientific purposes
- License from the Ministry of Climate and Environment for closed use of GMOs and GMMs within a genetic engineering facility
- „Cyclotrone-ready" facility
- GMP documentation prepared for production

RADIOPHARMACY CENTRE

Radiopharmaceutical Synthesis
and Quality Control Laboratories



Preclinical Research Laboratories

- Cell cultures
- PET/MR imaging
- SPECT/CT imaging

RADIOPHARMACEUTICAL PRODUCTION

- Extraction of radionuclides from generators → ^{68}Ga, ^{99m}Tc
- Radiolabeling of kits for radiopharmaceutical preparation (e.g., DTPA, MIBI)
- Radiolabeling of radiopharmaceutical precursors (e.g., PSMA, DOTA-TATE)
- Radiolabeling of peptides and peptidomimetics (e.g., FAPI)

^{68}Ge/^{68}Ga generator

^{99}Mo/^{99m}Tc Generator

These generators are registered medicinal products used for radiolabeling in accordance with the European Pharmacopoeia.

RADIOPHARMACEUTICAL QUALITY CONTROL

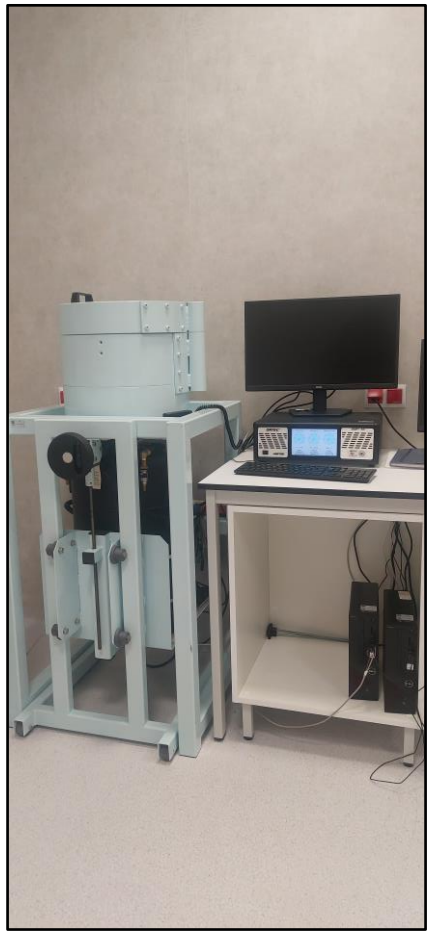
- Pharmacopoeial quality control methods:
  - ✓ HPLC+Flow-RAM,
  - ✓ HPLC+Posi-RAM
  - ✓ GC
  - ✓ TLC etc.

Additional uses of radiodetection-based instruments:

- Quantification of radioactive isotopes and metabolites in **biological samples** (e.g., animal blood, tissue homogenates, cell lysates)
- Quantification of radioactive isotopes in **environmental samples** (soil, water, food)

GC, HPLC+Flow-RAM

HPLC+Posi-RAM



HPGe

IN VITRO PRECLINICAL RESEARCH

Current research focus – development of specific radiotracers based on novel ligands for PET diagnostics of pancreatic and prostate cancer.

Cell Lines:

- Pancreatic cancer: PANC-1, MIA PaCa2
- Prostate cancer: 22RV1, PC-3

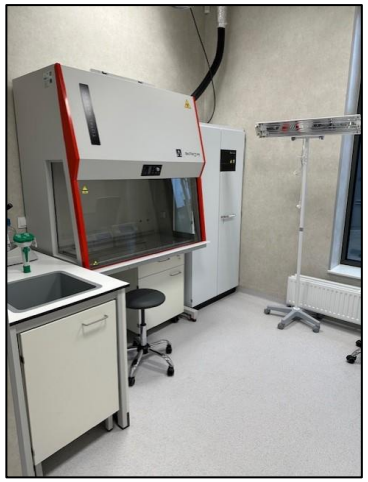
Evaluations:

- Expression of PSMA, FAP, somatostatin receptor (SSTR2) – Western blot
- Radioligand binding to receptor – using ^{68}Ga-PSMA, ^{68}Ga-FAPI, ^{68}Ga-DOTATATE – gamma counter (Hidex AMG)

Additional capabilities:

- Cellular metabolism studies
- Protein, lipid, DNA synthesis, transport, and degradation analysis
- Biochemical reactions with ATP
- Intracellular signaling pathway analysis

Equipment includes also: flow cytometer, ELISA reader, confocal fluorescence microscope



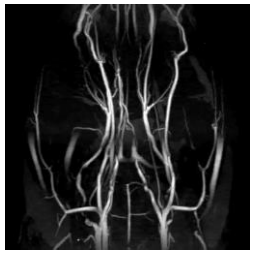
Cell culture lab

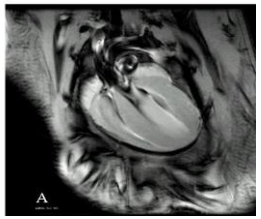
Hidex AMG Gamma Counter

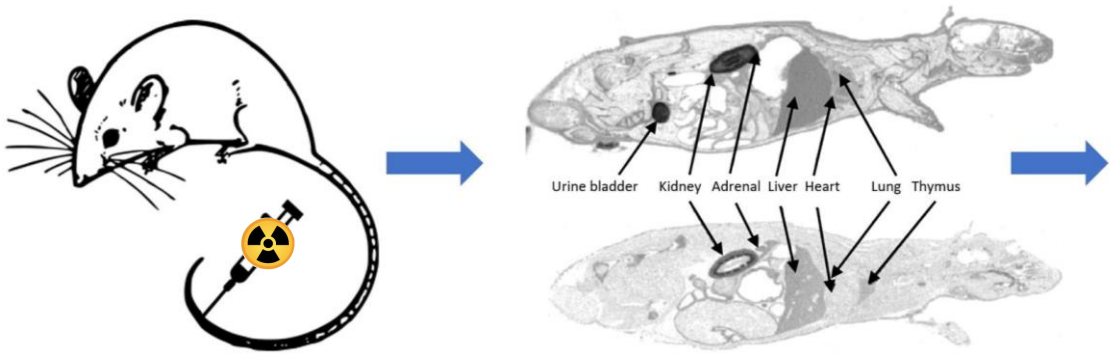
IN VIVO PRECLINICAL RESEARCH

Applications:

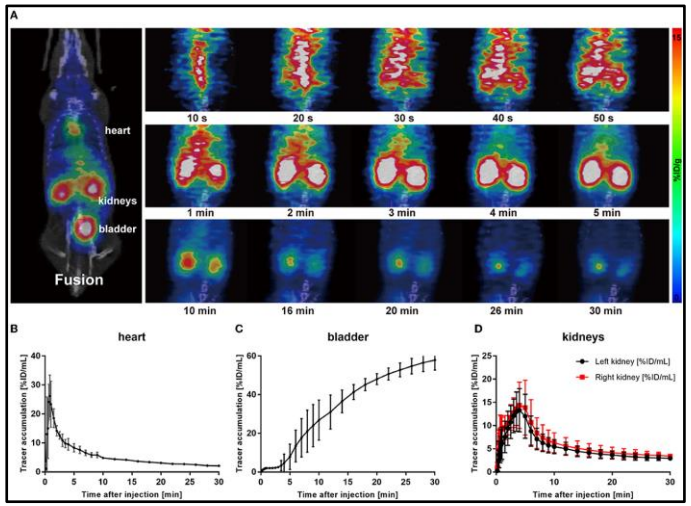
- Anatomical and functional imaging (e.g., brain imaging in neurodegenerative diseases, blood flow, cardiac function)
- Diagnostics and therapy (imaging of primary and metastatic tumors)
- Drug and tracer biodistribution studies – whole-body scan
- Animal models – mouse, rat







Dynamic PET
(tracer activity vs. time)

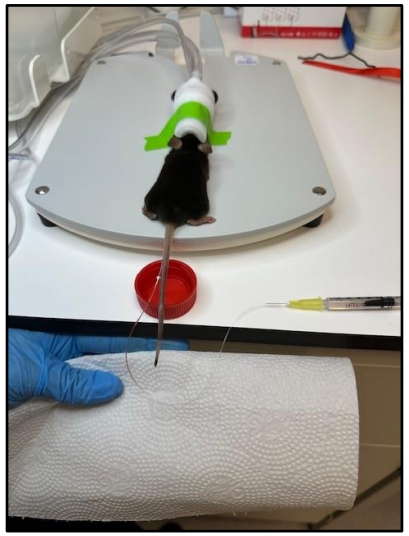


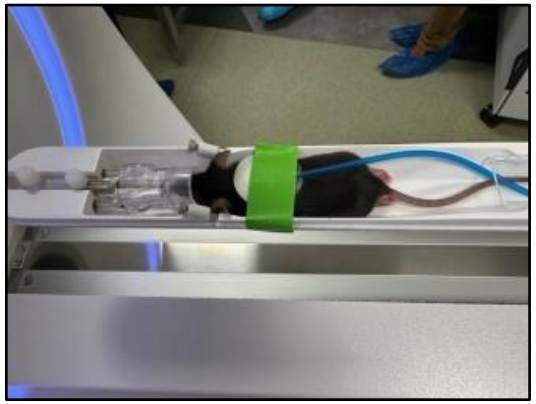
Pharmacokinetics

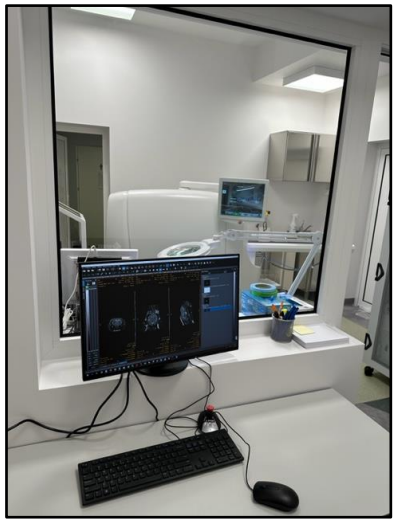
PET/MR LABORATORY

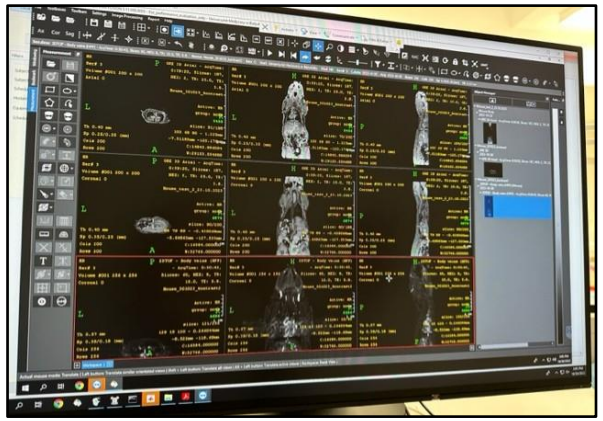
- 3T hybrid PET/MR scanner for mice and rats
- Fusion of anatomical and functional images
- Additional coils for heart and brain imaging in mice

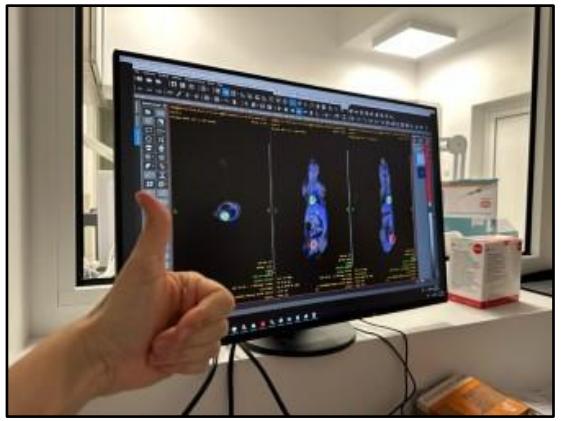
PET/MR LABORATORY



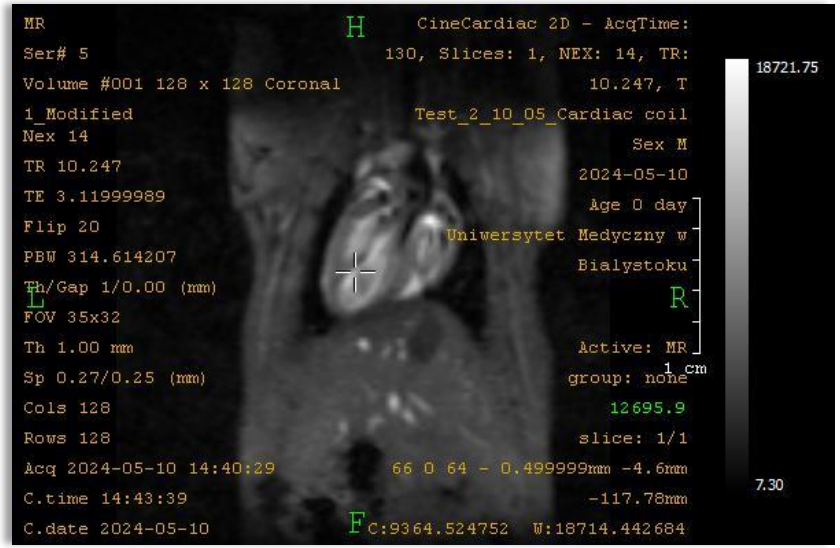


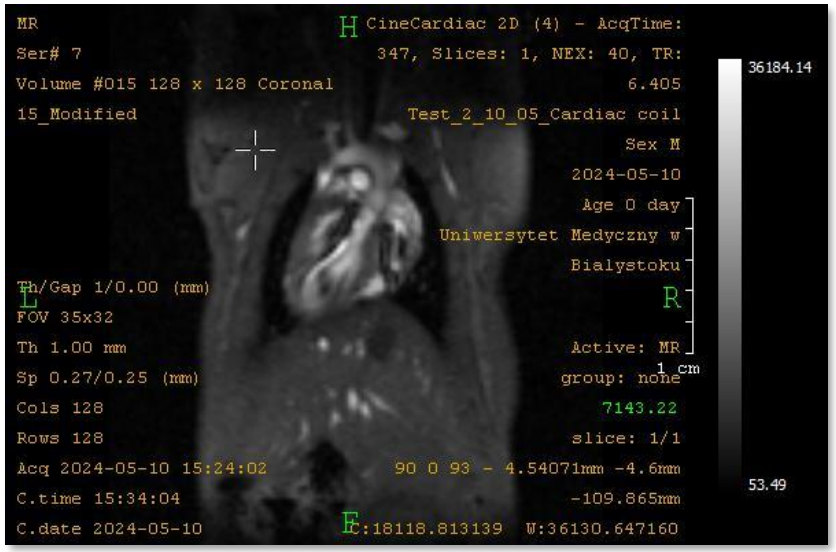


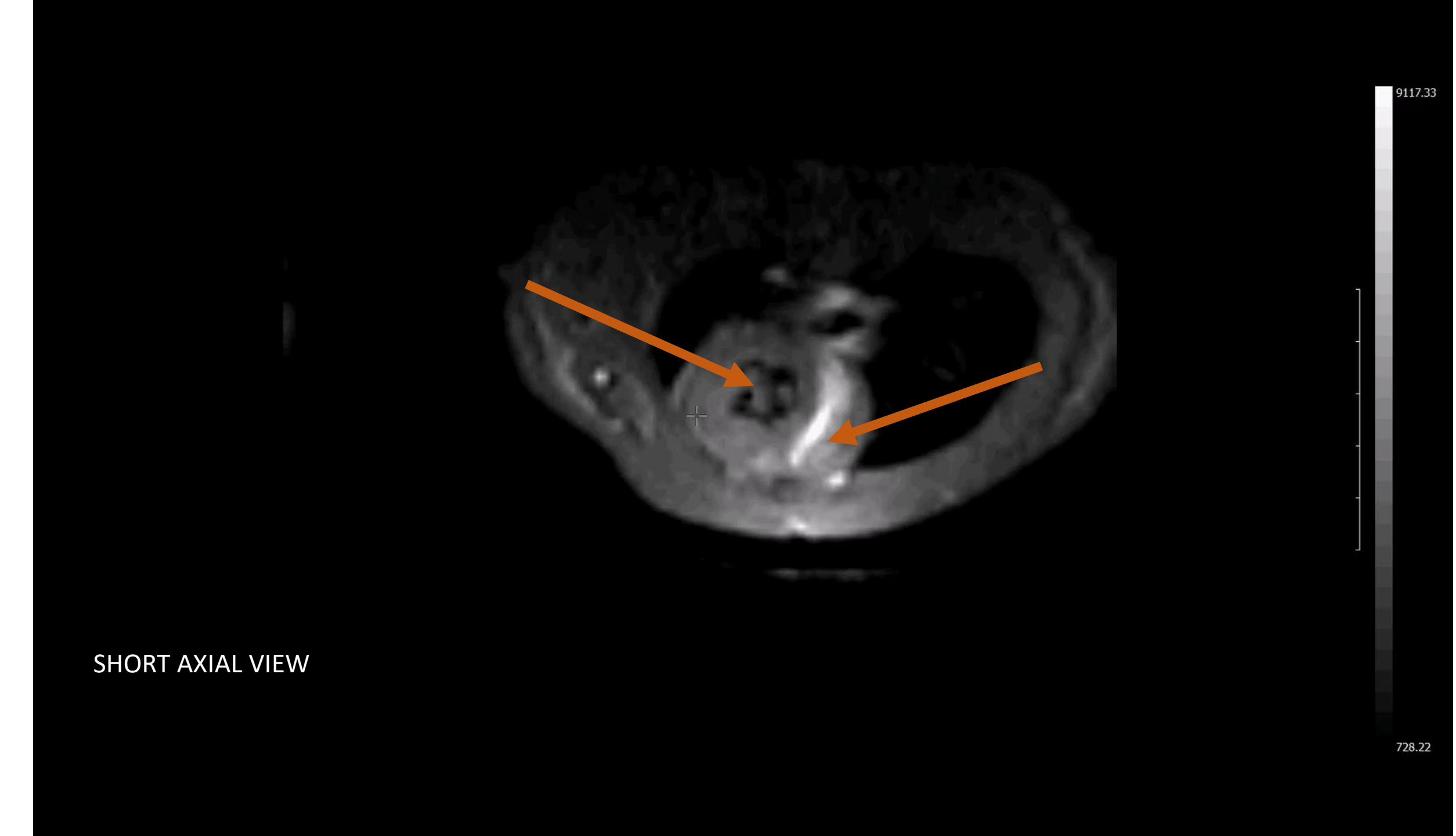




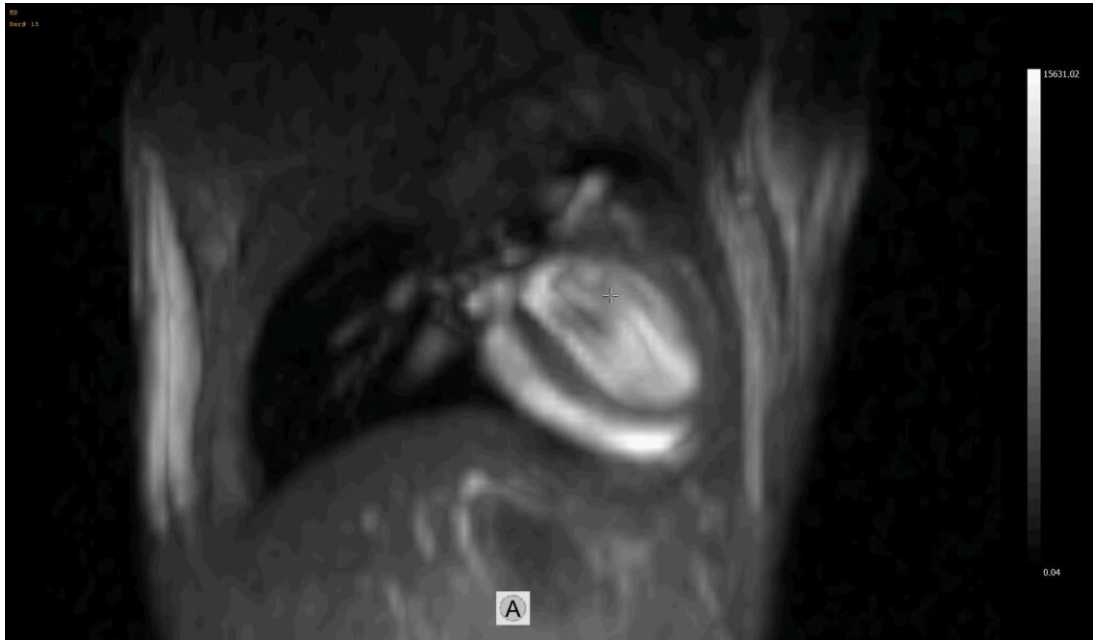
PET/MR LABORATORY – MRI OF THE MOUSE HEART

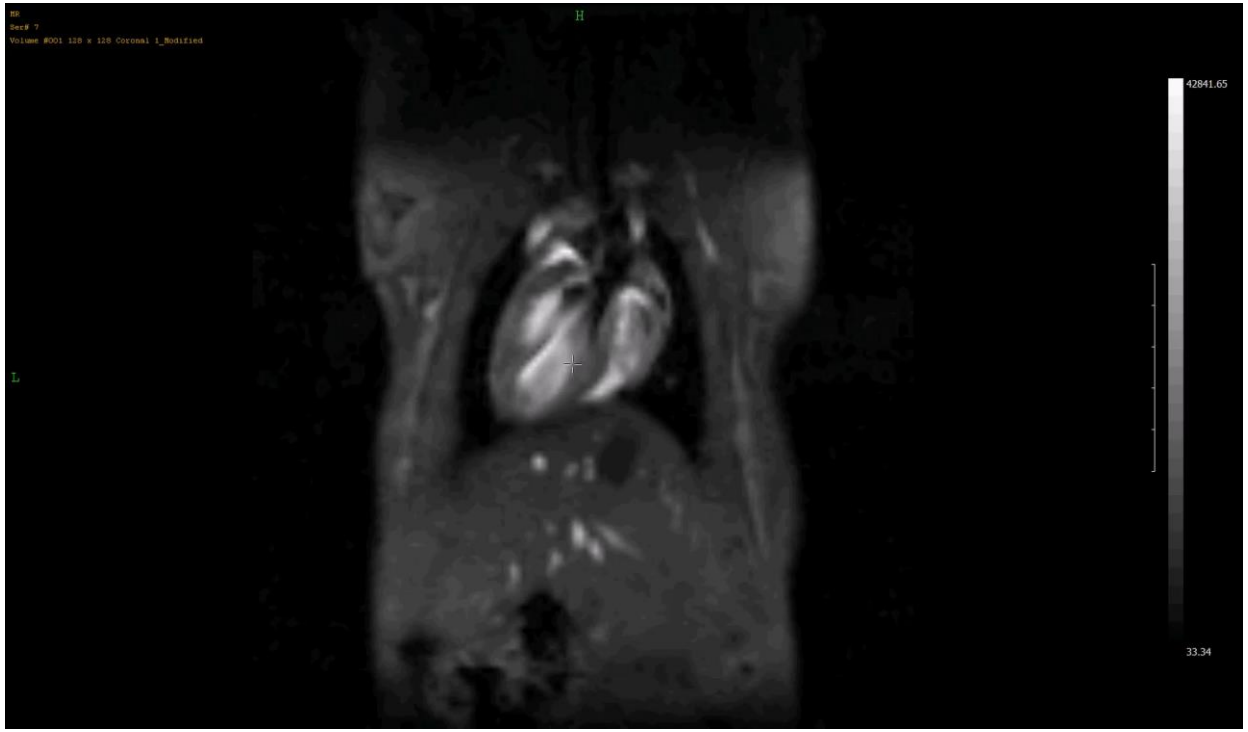




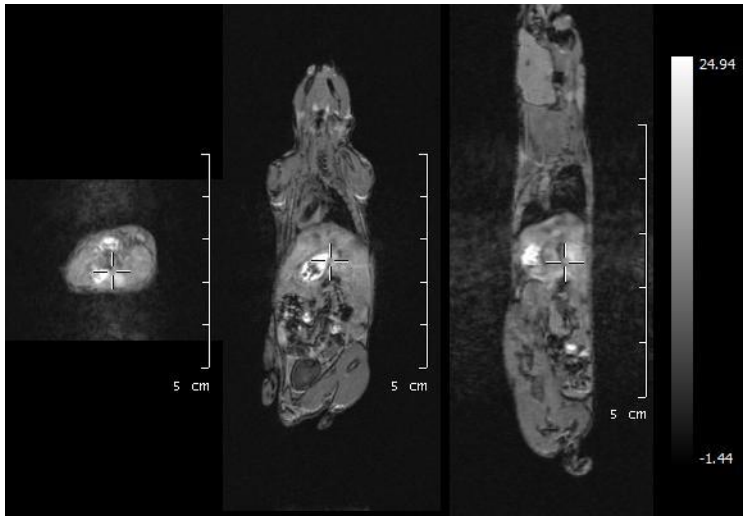


SHORT AXIAL VIEW

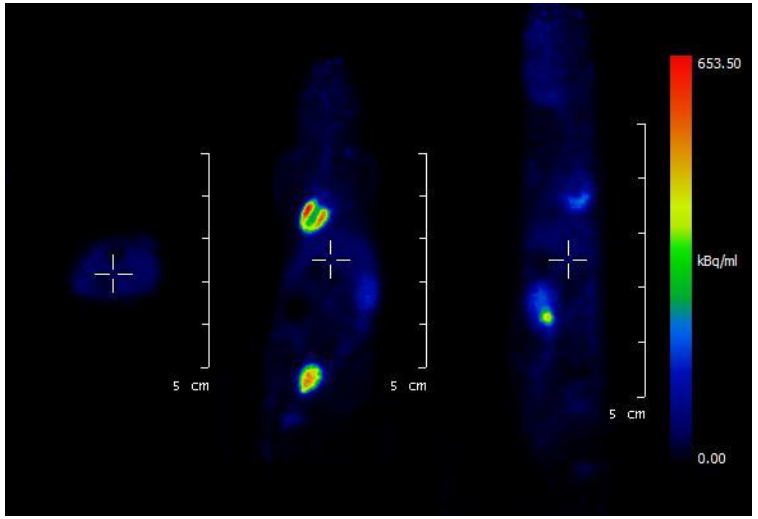

15631.02
0.04
A


H
L
42841.65
33.34

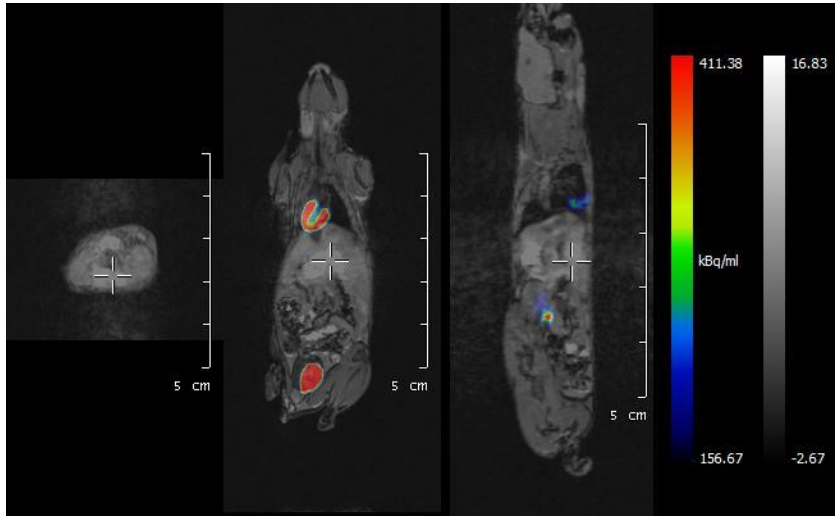
PET/MR LABORATORY – PET/MR IMAGE FUSION



‚Whole body' MR, mouse 22 g



‚Whole body' dynamic PET, 18F-FDG 10 MBq i.v.

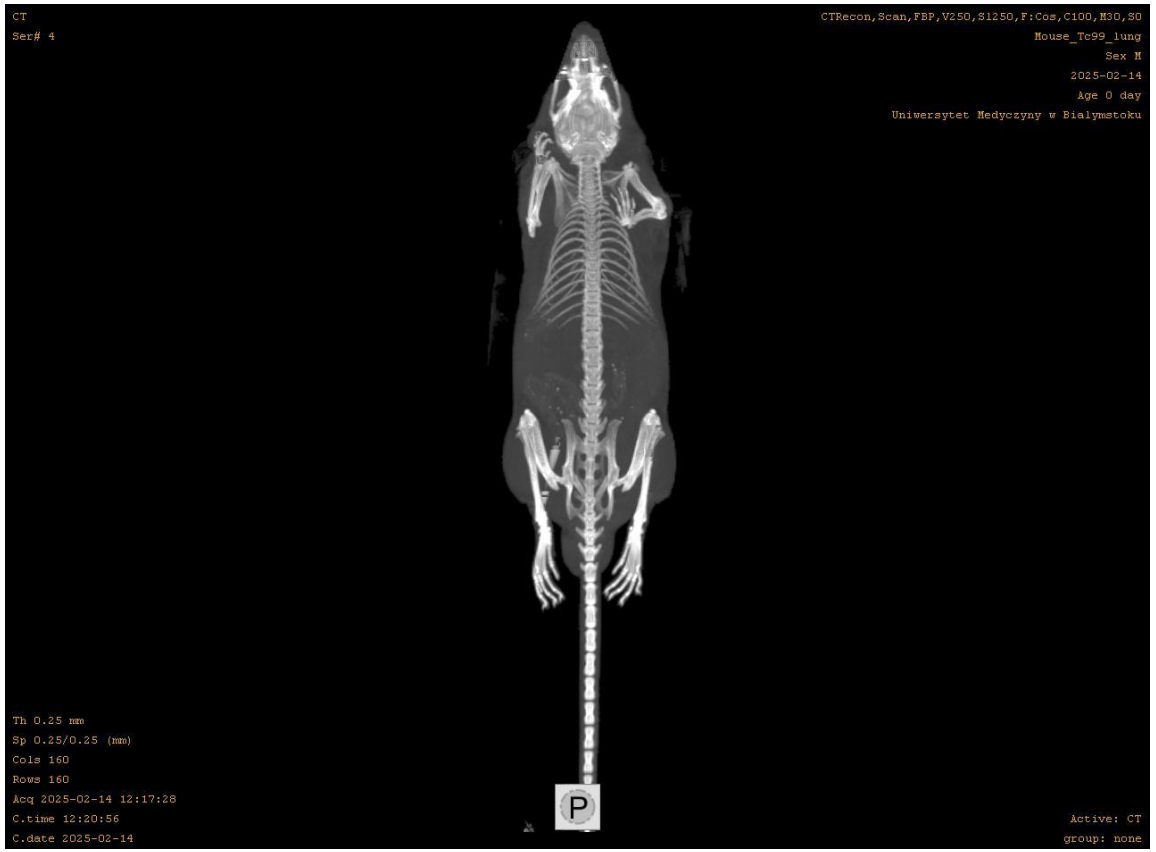


PET/MR image fusion

SPECT/CT LABORATORY

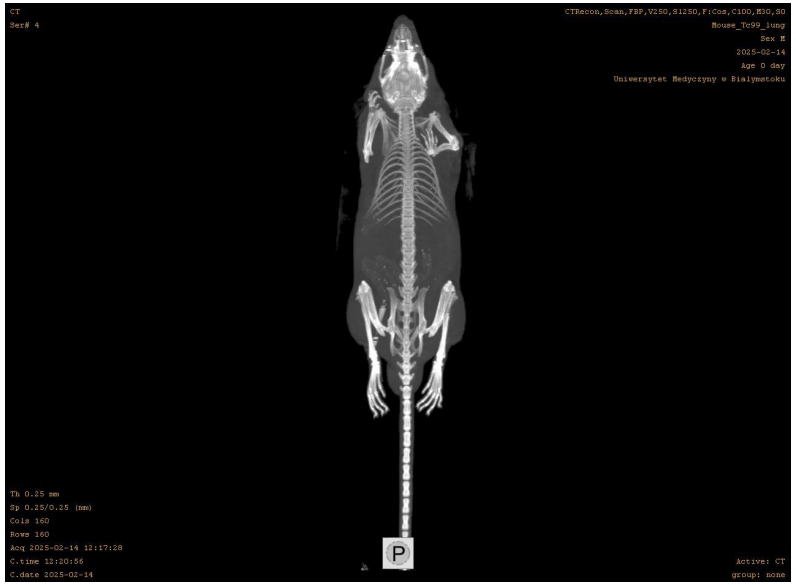
- Hybrid SPECT/CT scanner for mice and rats
- Fusion of anatomical and functional images
- Attenuation correction

SPECT/CT LABORATORY – CT IMAGES

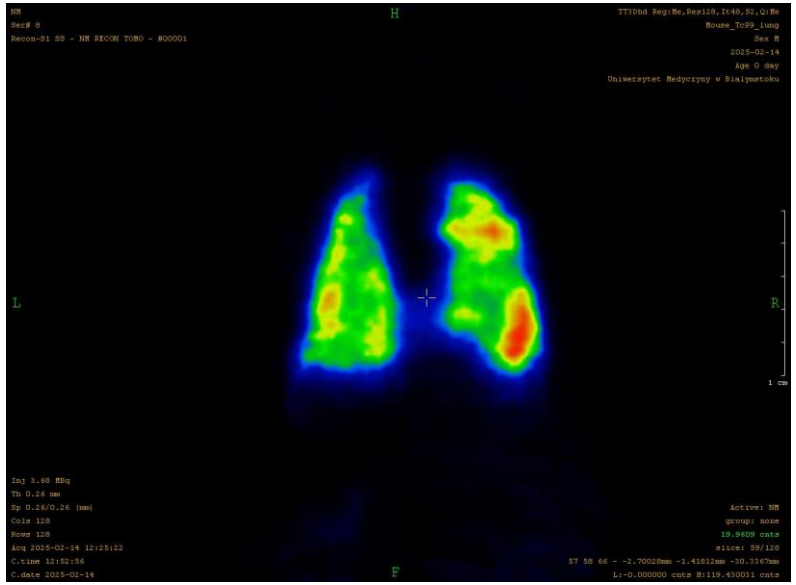


‚Whole body' CT, mouse 22 g

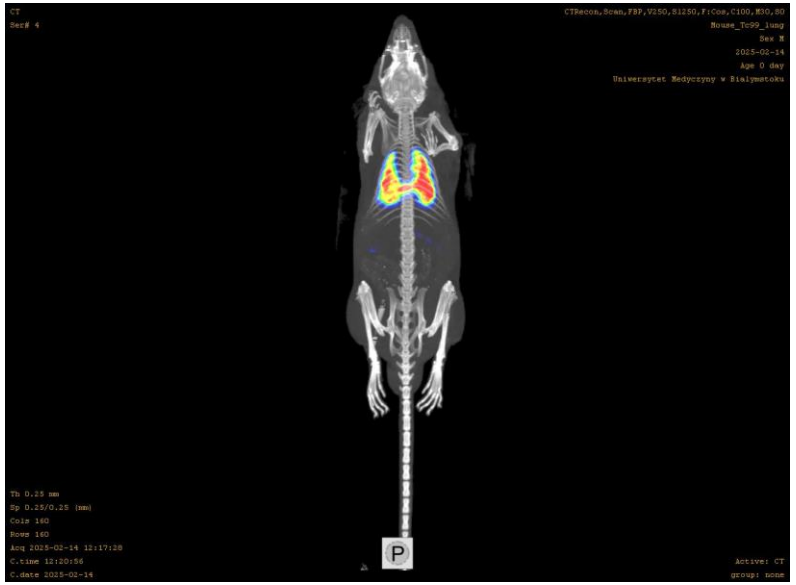
SPECT/CT LABORATORY – SPECT/CT IMAGE FUSION



‚Whole body' CT, mouse 24 g



Static SPECT,
^{99m}Tc-MAA, 3.6 MBq i.v.



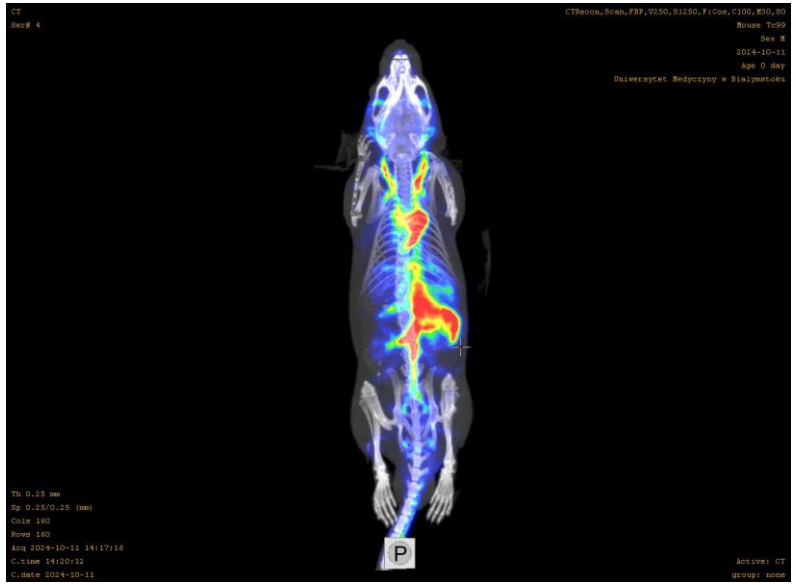
SPECT/CT image fusion


CT
Ser# 4
A

HYBRID SCANNERS FOR MOLECULAR IMAGING

DISADVANTAGES

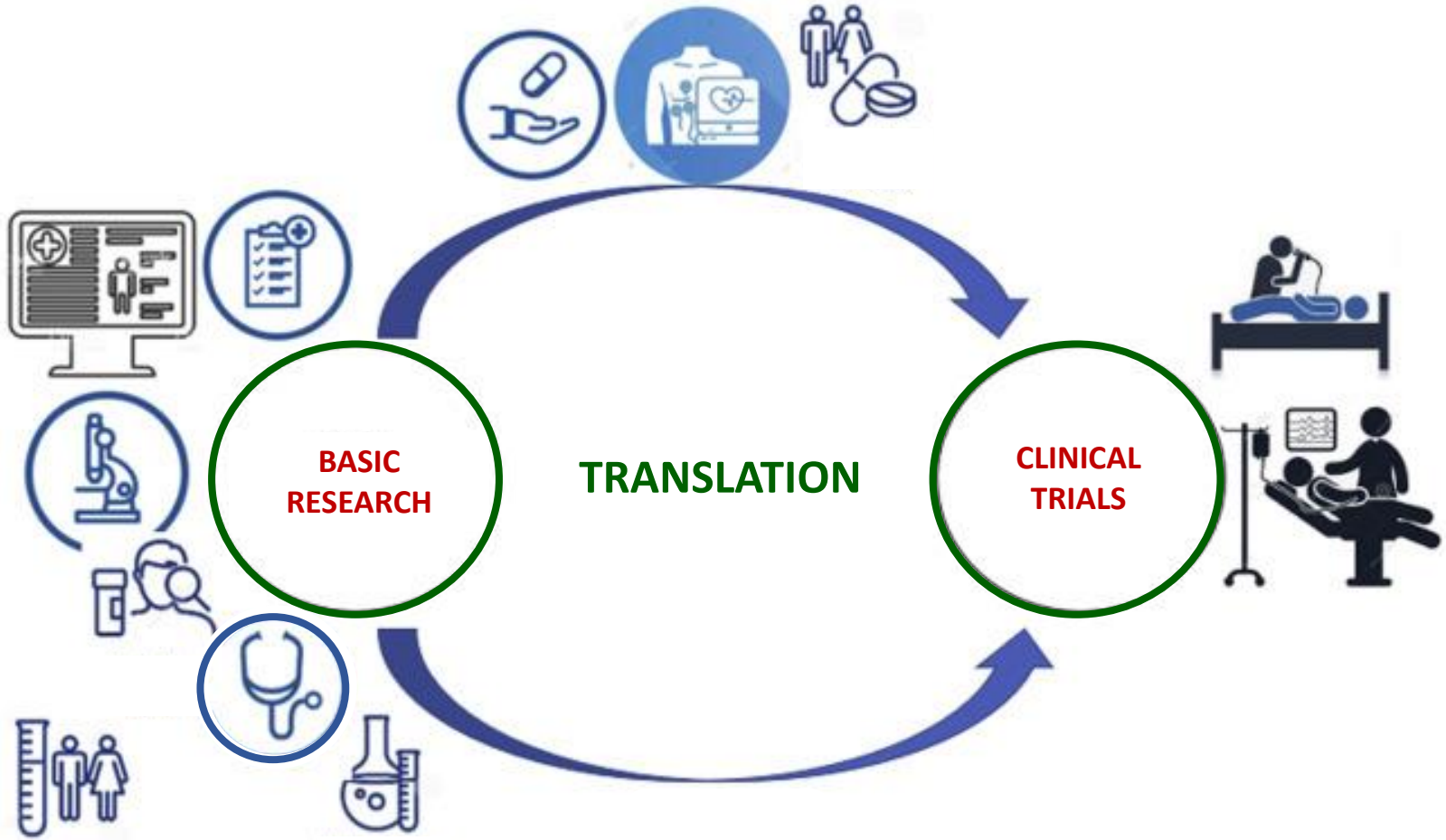
- relatively high cost
- proper infrastructure
- limited access
- trained personel
- many licenses required



ADVANTAGES

- high resolution methods of imaging
- not invasive - easier to obtain approval from the bioethics committee
- each modality can be used separetly or together
- **each modality is similar to clinical imaging**

FROM BENCH TO BEDSIDE – TRANSLATIONAL RESEARCH AT THE MEDICAL UNIVERSITY OF BIALYSTOK



RADIOPHARMACY CENTRE – contact details:

Contact Address:

Radiopharmacy Centre
Medical University of Bialystok
Jacka Kuronia 7 Str.
15-569 Bialystok, Poland
radiofarmacja@umb.edu.pl
tel. + 48 85 686 52 90

TEAM:

Anna Gromotowicz-Poplawska, PhD
Director
anna.gromotowicz@umb.edu.pl
tel. + 48 85 686 52 90, + 48 85 748 56 07

Izabela Suwda Kalita, MPharm
Radiopharmacist
izabela.kalita@umb.edu.pl
tel. + 48 85 686 52 92

Adam Jan Olichwier, PhD
Assistant
adam.olichwier@umb.edu.pl
tel. + 48 85 686 52 91