Small Animal Imaging Facility: a metabolic and structural imaging center

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Aim

The ever-increasing number of experiments carried on rodents (mostly rats and mice) couples with advances in small animal imaging systems such as microPET, optical, microCT, microMR, ultrasound and microSPECT. In this context a technical center set-up for small animals imaging is required.

Methods

We recently designed a facility targeted to provide the best support to a wide range of investigators involved in multidisciplinary researches. The metabolic and structural imaging center was born thanks to a collaboration among the Second University of Naples, the university of Naples "Federico II", and the "A. Cardarelli" Hospital of Naples. The Facility for Small Animal Imaging (SAIF) is dedicated to research studies on rodents. We critically examined both research and regulatory issues. Our facility will be able to satisfy a wide range of needs: training for researchers, study scheduling, data acquisition, archiving, image display, and analysis. The SAIF is equipped with an hybrid custom-made system microSPECT/Optical, a 7T microMR system, a microCT scanner, and microUS. The main applications are: toxicology screening, viral infections development, gene therapy, hepatic diseases, oncological imaging, functional and physiological imaging and others. The SAIF is staffed with: biologists, clinicians, biotechnologists, veterinarians, physicians, radiologists etc.
Furthermore it will house more than 5.000 animals, also providing a constant procedural support in surgery, imaging, and analysis.

Characteristics of equipment

Micro-CT (GE eXplore Locus)

The GE eXplore Locus scanner is an X-ray computed tomography system capable of performing imaging studies of specimen or small animals in vivo . The Locus system uses a X-ray detector with kV range of 35-80, and mA range of 0-500. The system has three isotropic resolution settings (27, 45 and 90µm) with a field of view (FOV) up to 80 mm in diameter. The Locus system uses a CCD with 10 micron square detector element and 100 mm x 50 mm active area. The scan time is of 5-60 min depending on the protocol used, with a sensitivity of milliMolar order.

Micro-CT (GE eXplore Locus)

Micro-MRI (7T Bruker)

The 7T 30-cm bore Bruker Biospec scanner is a dedicated imaging system equipped with several shielded gradients for in vivo applications (< 50 micron). The BioSpec system is also equipped for multinuclear and spectroscopy imaging (i.e. 1H, 31P, 15N, 13C, 19F). This instrument includes a breathing and heart gating/monitoring system to limiting negative effects on image quality. This feature is essential to study animals with an high breath and heart rate.

Micro-MRI (7 T Bruker)

Micro-PET **(**GE eXplore VISTA)

The GE eXplore VISTA microPET is a positron emission tomography scanner with a 3 cm (axial) x 6.7 cm (transverse) field of view. The system has an absolute sensitivity of 3% with a spatial resolution of ~1.2 mm in the center of the field, when using OS-EM for image reconstruction.

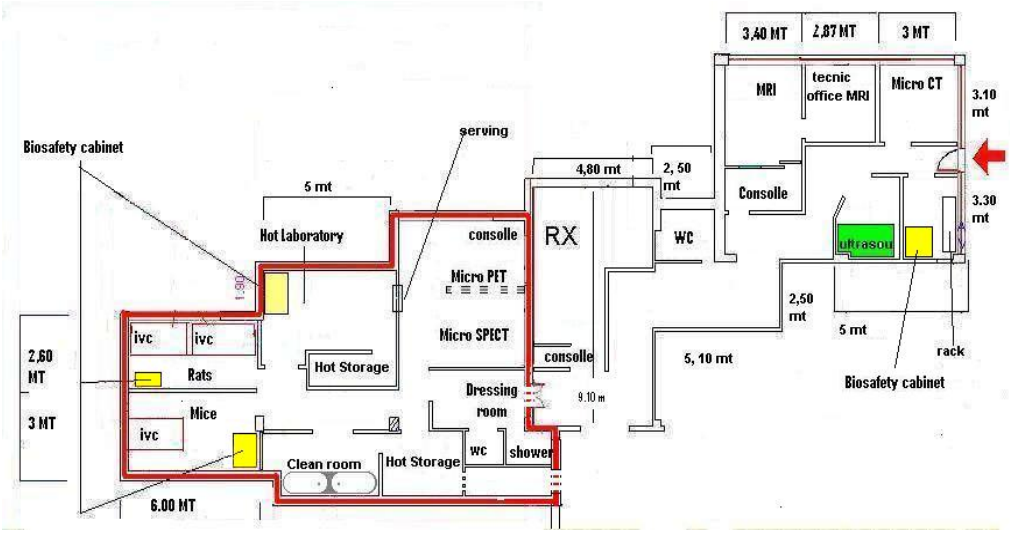
SPECT/FRI

MediSPECT/FRI is a sperimental, and small animal dedicated scanner for radiolabeled and fluorescence imaging, with a small field of view (2-56 mm), and a big spatial resolution (0.12 mm). Detector for Ionizing Radiations: hybrid detectors in Siliceous pixels (thick 0.3 mm), and in Cadmium Tellurium (thick 0.1 mm) linked to a reader chip MEDIPIX2; the detectors are matrices 256 x 256 with a gap of 55 □m, and a sensible area of 1.4 cm x 1.4 cm. Collimators: tungsten pinhole (diameter 0.3, 0.4, 1.0 mm) for Tc-99m, and I-125 tracers; Mask with opening coded for I-125.

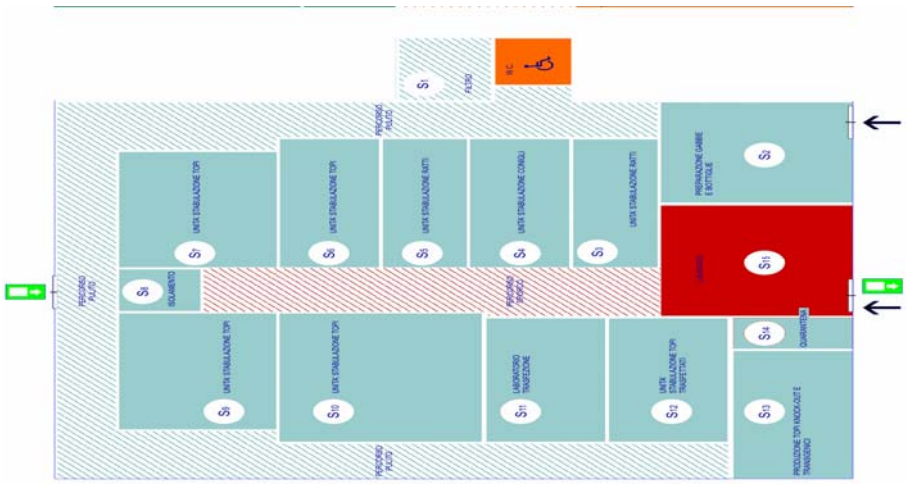
Micro-US (VisualSonics Vevo 770)

The VisualSonics 770 High-Resolution Imaging System enables visualization, assessment, and measurement of anatomical structures and hemodynamic function in non-invasive imaging studies of small animals. B-mode (2D and 3D), power Doppler (2D and 3D), M-mode and pulsed-Doppler imaging mode are available for anatomical, cardiac and flow analysis, respectively. The high frequency at which the 770 operates (20-55MHz) allows for achieving spatial resolution down to 30 microns, the highest spatial resolution currently available in real time imaging.

MSI Center Flat



Biotechnology Center vivarium



The vivarium is designated to hold mice, rats, and rabbits. It occupies an area of about 250 mq, including 8 housing units, two laboratories, as well as quarantine and isolation units able to hold about 5000 animals. Moreover a constant procedural support in surgery, imaging, and analysis is provided.
We have created as well a facility able to maximize our resources supporting the investigators as better as possible. At the same time we are focused to efficient network set-up between different specialists in order to obtain an adequate multidisciplinary approach .

Conclusions

We have created as well a facility able to maximize our resources supporting the investigators as better as possible. At the same time we are focused in efficient network between different specialists to obtain an adequate multidisciplinary approach.

The ever-increasing number of experiments carried on rodents (mostly rats and mice) couples with advances in small animal imaging systems such as microPET, optical, microCT, microMR, ultrasound and microSPECT. In this context a technical center set-up for small animals imaging is required.

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