

Live Animal Imaging

● Humane Animal Research

• Eliminate Unnecessary Sacrifices

Replace Histologies with 3D MRI Histology

Bruker's patented MRI CryoProbe opens up possibilities for MR-histology. Compared to traditional histology, MRI covers the entire 3D volume, with no sharp distortions from slice to slice. High quality digital data can be stored at minimal cost without physical disintegration or quality loss.

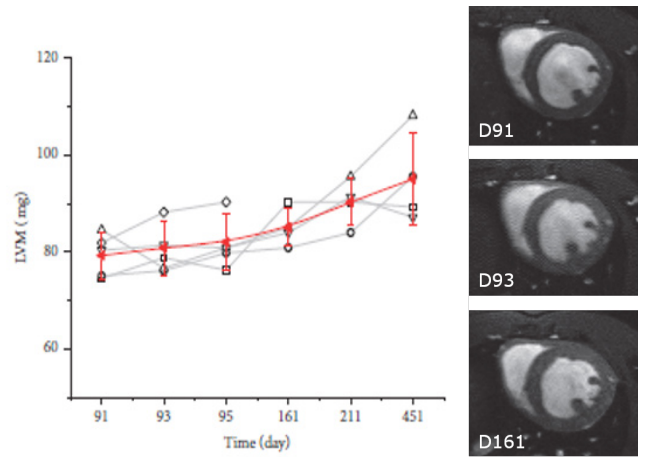


MRI histology of mouse brain at 11.7 T equipped with an MRI CryoProbe

Courtesy of Y. Yoshioka, Osaka University, Osaka, Japan

Reduce Number of Animals with Longitudinal Studies

MRI is a non-ionizing method, ensuring the measurement has no effect on the model or treatments being tested. A single animal can be imaged multiple times, significantly reducing the number of animals needed for statistical relevance. Furthermore, the animals can be used as their own controls, improving pre/post treatment comparisons.



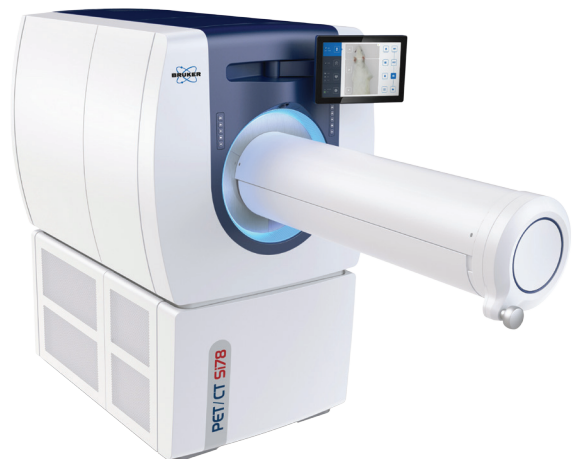
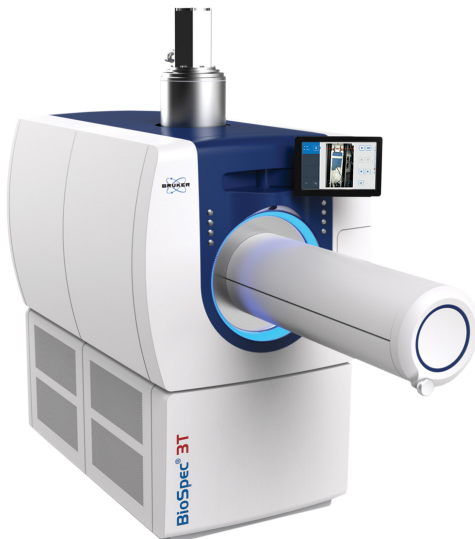
Assessment of increase of left ventricular mass in five mice over the course of more than one year using self-gated IntraGate FLASH CINE MRI at 11.7 Tesla (days 91, 93, and 161 are shown on right)

Courtesy: V. Rasche, Core Facility Small Animal Imaging, Ulm University, Ulm, Germany

Reference: Z. Zuo, et al., BioMed Research International, 2017

Stay Behind the Barrier

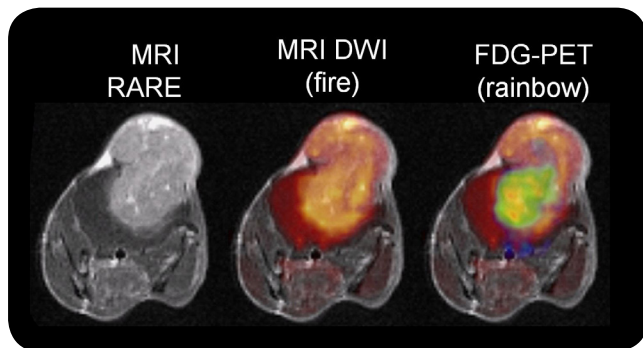
Many preclinical instruments, such as the BioSpec 3T or the PET/CT Si78 can be placed within an animal housing facility, so experiments can be performed on site. Animals can be scanned repeatedly within the vivarium, so they do not have to be sacrificed.



• Use Animals Wisely

Perform More Insightful Studies

PET and MRI open up a multitude of application possibilities to acquire data that complement each other. In addition to the metabolic information provided by PET and the superior soft tissue contrast provided by MRI, multi-parametric PET/MR imaging allows even deeper insights. For example, FDG uptake in PET can show heterogeneity in tumor corresponding to regions with low diffusion suggesting loci of high cellular division. All of this data taken together form a better picture of the disease.

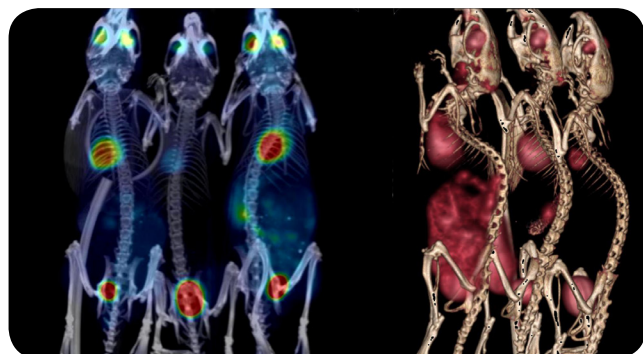


Mouse glioma study performed with simultaneous PET/MR at 7 Tesla. Fusion of one underlay and two overlay datasets.

Courtesy: U. Himmelreich, W. Gsell, C. Casteels, and C. Deroose, Molecular Small Animal Imaging Center (MoSAIC), KU Leuven, Leuven, Belgium.

Benefit from More Meaningful Controls

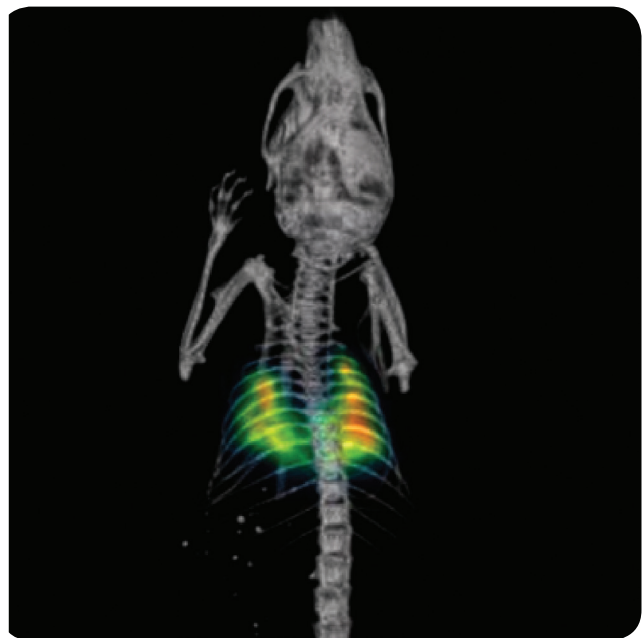
The multimodal animal cradles (MMPF) allow measurement of up to three mice simultaneously, enabling true 1:1 comparisons between test animals and controls.



Simultaneous F18-FDG imaging of three mice in PET/CT Si78 using the multimodal three mouse cradle.

Multipurpose Your Animals

Acquire PET, SPECT, and CT images with a single Albira system, eliminating the need to transfer animals between instruments, or the use of multiple animals.



SPECT^{99m}Tc-MAA lung imaging combined with CT bone scans

Reduce Side-Effects

Micro-CT imaging is an extremely fast technique, enabling whole body visualizations in less than 8 seconds. Bruker's SkyScan micro-CT provides the maximum amount of information possible from one experiment yet at the lowest possible dose in the industry, significantly reducing the contribution of the scanning dose to the effects of disease or treatment.

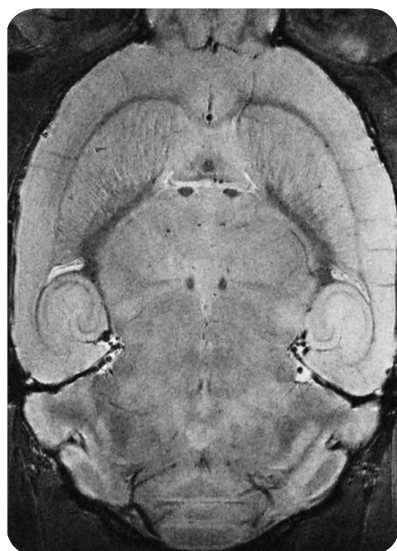


Whole body micro-CT scan of a mouse's bones and vasculature.

• Scan Faster for Improved Animal Well-being

Decrease Measurement Time

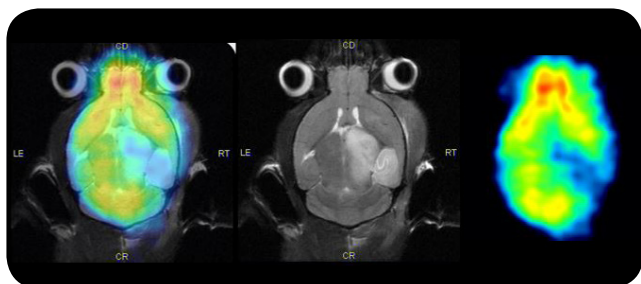
Interpretability of MR images is dependent on a substantial signal-to-noise ratio (SNR). SNR can be increased by scanning longer in order to obtain increased signal or by reducing noise. Compared to measurements performed with conventional coils, the MRI CryoProbe significantly decreases noise, which allows images with to be recorded in a fraction of the time.



In vivo mouse brain with 29 μm in-plane resolution acquired using a BioSpec 15.2 Tesla equipped with an MRI CryoProbe

Scan Multiple Modalities Simultaneously

A fast experiment means a shorter endurance time for your animals. Combined with an MRI BioSpec, the PET insert allows MRI and PET measurements to be recorded simultaneously significantly reducing scan time.

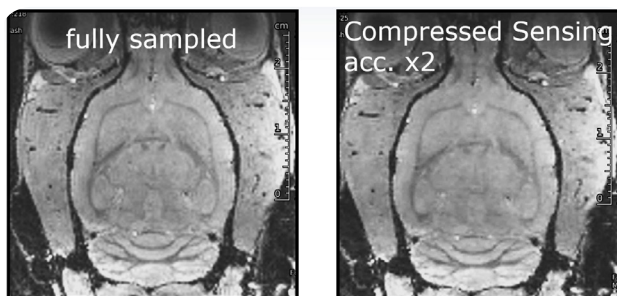


Ischemic MCAO mouse model (intraluminal transient MCAO, 24 h post occlusion / reperfusion)

Courtesy: U. Himmelreich, W. Gsell, C. Casteels, C. Deroose, Molecular Small Animal Imaging Center (MoSAIC), KU Leuven, Leuven, Belgium

Reduce Acquisition Times

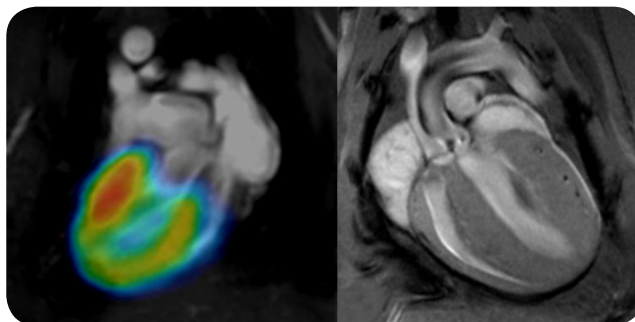
Compressed sensing* is available with the ParaVision 360 software, which allows a multi-fold reduction of scan time while maintaining image quality.



Compressed Sensing leads to a factor of x2 acceleration in this rat brain image (example showing retrospective under-sampling)

Shorten and Plan Cardiac Studies Better

Conventional cardiac imaging requires application of ECG leads and triggering throughout the duration of the scan. IntraGate methods record all heart phases and perform retrospective gating. This means that no ECG leads are necessary, shortening preparation time. Scanning time is also shortened, since there is no delay time after triggering needed. This has the added value of being able to accurately determine the length of the scan, so that all necessary scans can be performed within the given animal anesthesia time and that animals in the queue can be prepared without inessential waiting time.



Left: PET/MR mouse cine using the IntraGate method to gate both the MRI and the PET image. Right: IntraGate MRI cine of mouse heart recorded on a BioSpec 11.7 T.

PET/MR image, courtesy: W. Gsell, C. Deroose and U. Himmelreich, Molecular Small Animal Imaging Center (MoSAIC), KU Leuven, Leuven, Belgium

* Compressed Sensing is work in progress, not commercially available, and its future availability cannot be ensured. Not for distribution or use in the U.S.

• Animal Comfort, First

"In order to reduce the number of animals involved, the experiments will maximize the information from each individual: MRI study will be used to follow each animal during the treatment, thus limiting the number of animals to use to small cohorts. MRI is a non-invasive technique allowing to monitor the same animal over time without need to sacrifice at each time point."

Serena Pellegatta, Fondazione IRCCS Istituto Neurologico C. Besta, Milan, Italy

Drawing on over 50 years of expertise in the life and animal sciences, Bruker designs preclinical imaging systems that deliver outstanding research results. Furthermore, in designing its product line, Bruker has always placed an emphasis on providing optimal, humane treatment of study animals while they are being imaged.

Reduced and Refined *In Vivo* Imaging

Performing *in vivo* imaging with Bruker instruments has minimal to no adverse effects on study animals, allowing the same animal to be imaged multiple times over the course of an experiment. This has the benefit of minimizing data variability, of documenting true progression in an animal model, and of reducing the overall number of animals required for any given study.

• Multimodal Animal Cradles

Bruker's multimodal animal cradles and supported animal monitoring system ensure that your animal is as comfortable as possible throughout the experiment. These cradles have a common quick-lock connector. One single click of the quick-lock connector to the interface of the Animal Transport System, affixes all input and output lines for animal supervision, warming, and anesthetic gas management.

The animals freely breathe anesthetic gas, eliminating the need for intubation or intravenous anaesthetics. Respiration, temperature, and heart-rate are monitored constantly, alerting the researcher if the animal requires assistance.



• **Bruker BioSpin**

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