MRI

BioSpec 70/40

Fully Flexible Preclinical MRI

Innovation with Integrity

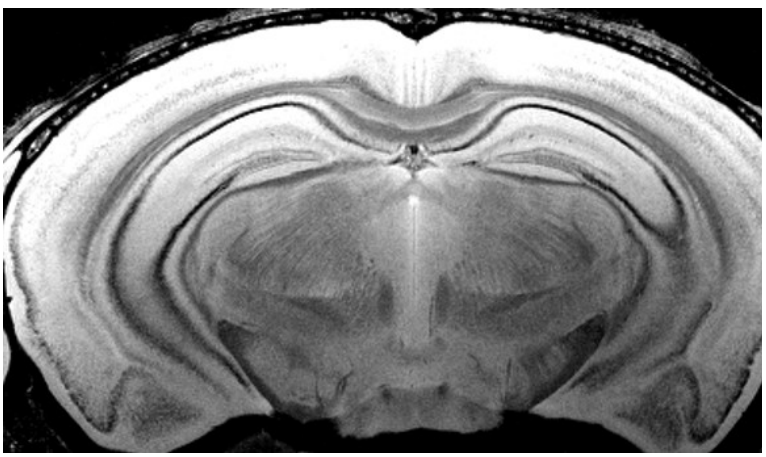
The Most Room for Research

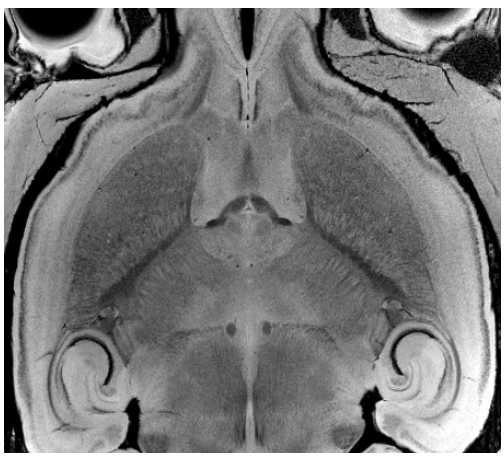
Many impacting preclinical neuroscience studies require the most relevant models and in many cases, this in turn demands an MRI instrument that is tailored to these models. Due to the size of the species under investigation or the necessity of extra room for extensive peripherals, preclinical MRI experiments can require a large degree of physical freedom. Whatever the reason, Bruker's largest bore MRI instrument gives you all the room you need.

Designed for the Widest Species Range

With a 7 Tesla field strength and a 40 cm bore, the BioSpec 70/40 combines increased sensitivity for highest resolutions with maximal space to accommodate the largest range of preclinical species research. This largest bore enables scanning of species as large as piglets to as small as mice, allowing studies to be performed on the most relevant model for your research. While studies on larger species require a larger bore, a larger amount of spatial freedom can be necessary even when performing studies on smaller species, when the mounting of awake animals or the use of optogenetic-, or stimulation equipment is required.

To perfect studies on small rodents, an extended range of head, cardiac, spine, and body coils and cradles are available. These coils come in classical proton as well as in x-nuclei versions and are complimented by the MRI CryoProbe, which provides an additional sensitivity boost. Furthermore, gradient inserts with up to 1000 mT/m gradient strength and slew rate of 9000 T/m/s provide optimal images even in species as small as mice.





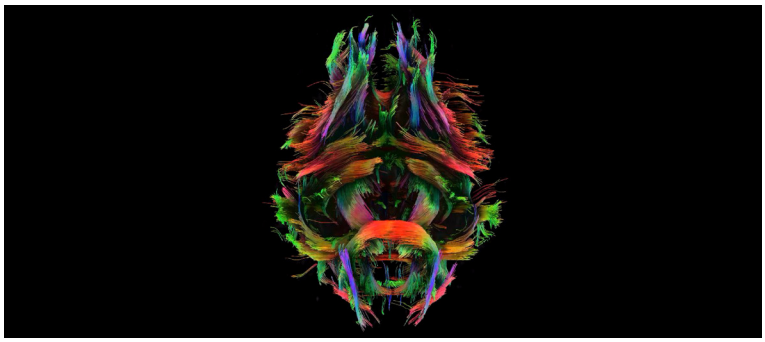
25 µm³ resolution reveals finest structures in the mouse brain. MRI CryoProbe, FLASH.

Courtesy: J Kim, NPIL, Wu Tsai Neurosciences Institute, Stanford University, Stanford, CA, USA

Structural MRI
Anatomical scans can be used to calculate tissue volumes that can be altered in certain pathologies, allowing diagnosis, staging, and disease follow-up. Contrast between gray and white matter can be used to investigate demyelinating, infectious, and neurodegenerative diseases.

Jieun Kim, NPIL, Wu Tsai Neurosciences Institute, Stanford University, Stanford, CA, USA

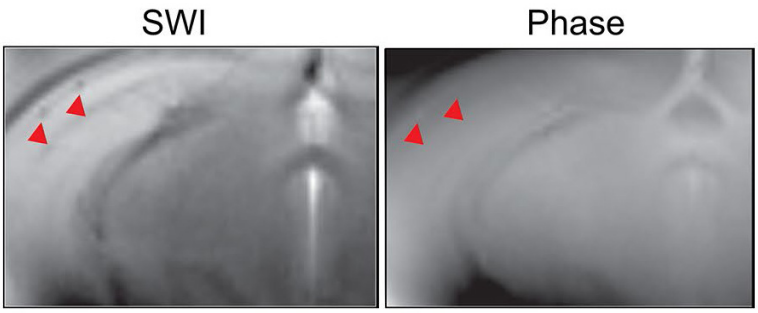
Investigators are really excited about the opportunity to utilize our MRI due to the wide range of species that we are imaging



Courtesy: J Kim, NPIL, Wu Tsai Neurosciences Institute, Stanford University, Stanford, CA, USA

400 µm² resolution DTI of piglet brain. 90 consecutive slices covering entire brain. 8 segment EPI. 40 directions with b = 1000 s/mm²

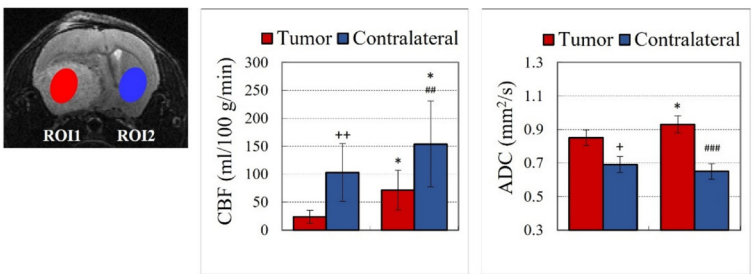
DTI
Diffusion tensor imaging (DTI) maps water diffusion in tissue. This diffusion is affected by physical barriers, such as fibers and membranes. Distortions of these physical boundaries due to disease can be indirectly visualized via this method.



Reference: Ni R.; Zarb Y.; Kuhn G.; Müller R.; Yundung Y.; Nitsch R.; Kulic L.; Keller A.; Klohs J. SWI and phase imaging reveal intracranial calcifcations in the P301L mouse model of human tauopathy. Magnetic Resonance Materials in Physics, Biology and Medicine (2020) 33:769–781 https://doi.org/10.1007/s10334-020-00855-3

Brain calcification model. Susceptibility weighted and phase images of potential mouse model for brain calcifications in tauopathies shows hypointensities and phase shifts in the hippocampus.

SWI
Susceptibility Weighted Imaging (SWI) uses magnitude and phase images to detect venous blood and the iron storage within. Iron accumulation within the brain is associated with tau pathologies such as Alzheimer's disease and Parkinson's disease.



Reference: Sumiyoshi, A.; Shibata, S.; Zhelev, Z.; Miller, T.; Lazarova, D.; Aoki, I.; Obata, T.; Higashi, T.; Bakalova, R. Targeting Glioblastoma via Selective Alteration of Mitochondrial Redox State. Cancers 2022, 14, 485. https://10.3390/cancers14030485

Tumor growth treatment. Effect of menadione/ascorbate treatment of glioblastoma in mice 21 days after tumor cell implantation and 14 days post treatment.

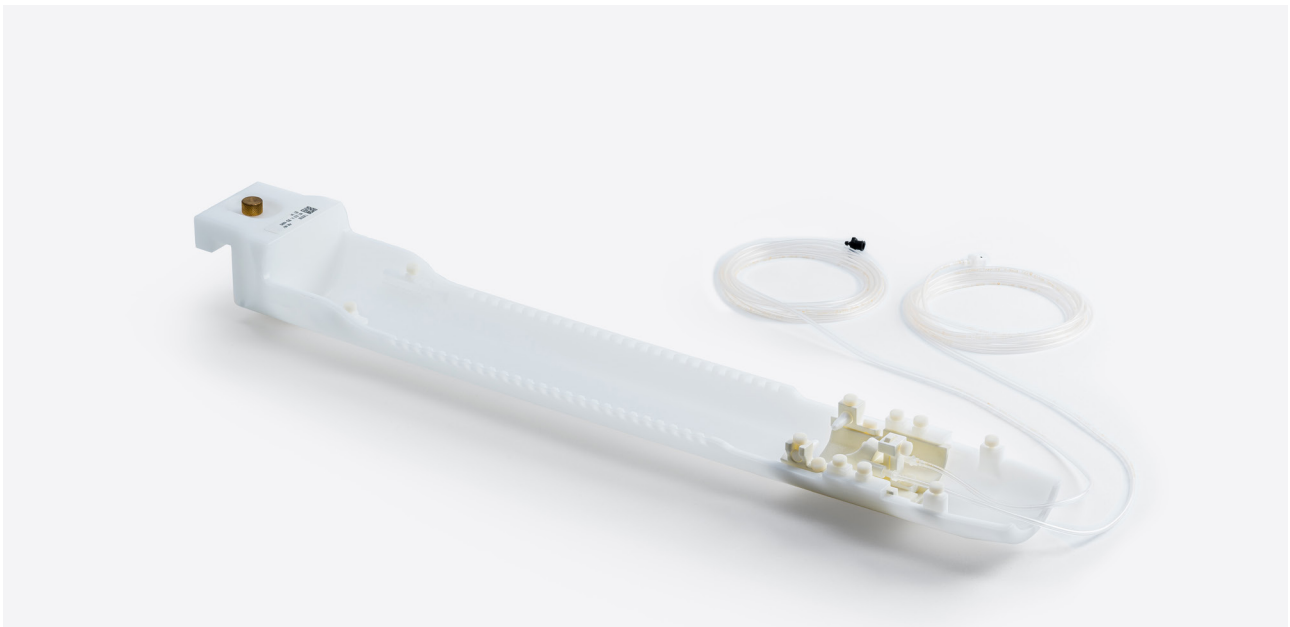
CBF
In addition to altered diffusion (measurable via ADC), blood flow in tumors is highly heterogeneous with portions of the tumor being hypoperfused while others are hyperperfused. Hypoperfusion causes immune suppression. Cerebral Blood Flow (CBF) can be used to detect these changes.

Designed for Superior Neuroscience

A vital extent of medical treatment research is performed on non-human primates. From structural to metabolic studies, this research covers validation of therapeutic strategies, drug testing, disease development, and therapy monitoring, focusing on oncology, infectious diseases, and metabolism.

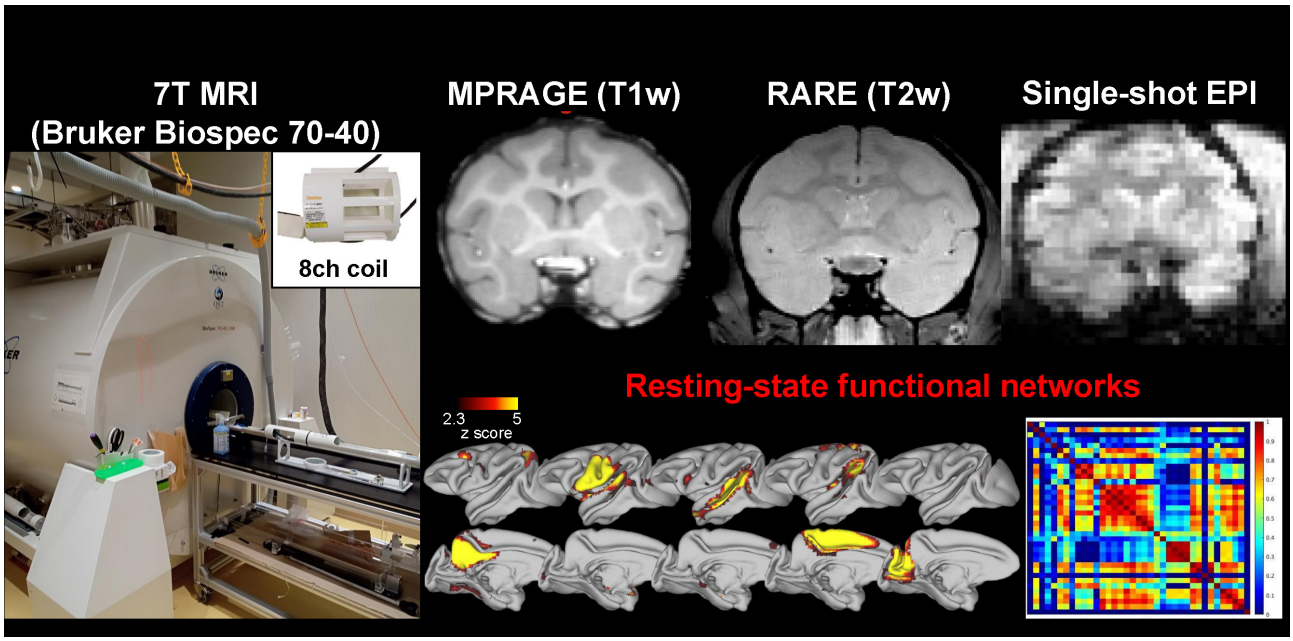
Neuroscience studies to better understand basic brain function particularly benefit due to the neural similarity of these species to humans. Beyond this, genetic engineering to model neurodegenerative diseases enables non-human primate research to cover a wide range of neurological disorders, such as psychiatric disorders and cognitive (dys-) function, e.g. Parkinson's, Alzheimer's Disease, and Multiple Sclerosis.

The BioSpec 70/40 facilitates this research with features such as the specially designed dockable animal cart, and animal monitoring and handling provisions. A brain coil designed for studies on macaques and cradles for small or medium size marmosets are available. Imaging of awake behaving marmosets can be achieved with training and use of the medium marmoset cradle and its corresponding accessories. This cradle can be used in conjunction with a reward system as well as a restrainer for stabilization of the marmoset head and body. The restrainer can be used in combination with ear bars or customer helmets.



Awake imaging studies.
Marmoset imaging cradles and accessories. Open marmoset cradle for medium size marmosets as well as restrainer for stabilization of marmoset head and body, and reward system.

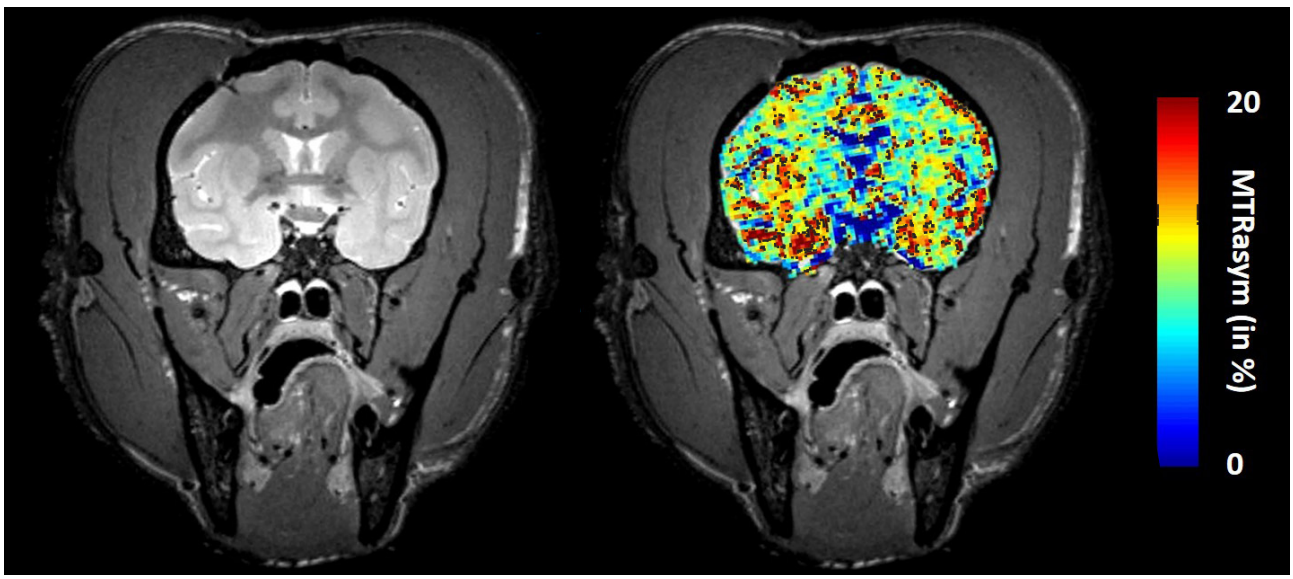
fMRI
Areas of the brain that are neuronally active have an increased blood flow and oxygen consumption that is detectable via functional MRI (fMRI). By correlating neuronal activity across brain regions and structures, functional connectivity maps can be created.



Neuronal connectivity. Macaque resting state functional networks.

Courtesy: Y. Hori, T. Minamimoto, National Institutes for Quantum Science and Technology, Chiba, Japa

GluCEST
Glutamate-weighted chemical exchange saturation transfer (gluCEST) enables visualization of the concentration and spatial distribution of glutamate, which is the main excitatory neurotransmitter in the brain.

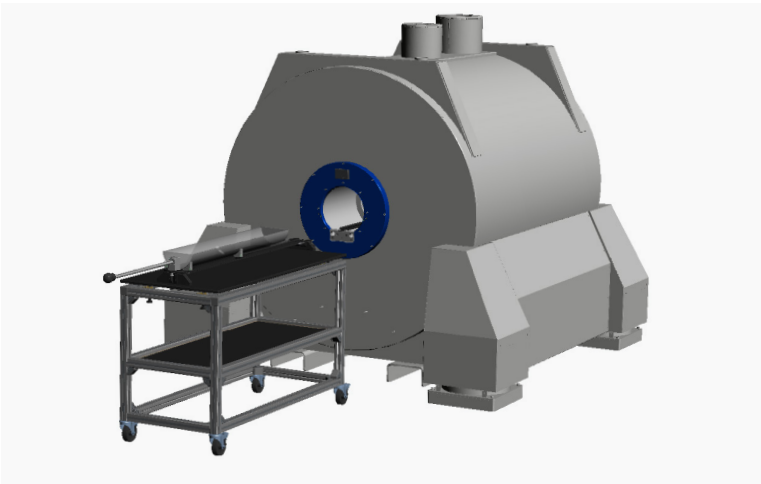


Neurotransmitter imaging. GluCEST image of macaque brain with 1x1x2 mm^3 resolution.

Courtesy: J. Flament, MIRCen-CEA, Fontenay-aux-Roses, France

Designed for the Ultimate Scanning Experience

- Smooth workflows for non-human primate studies with specialized solutions
- Easy animal handling of non-human primates with specially designed cart
- Dedicated non-human primate neurology RF coils
- Cradles with reward systems for awake imaging studies



- Gradient inserts for studies on smaller species available
- Large range of proton and x-nuclei coils for mouse and rat head, brain, body, spine, and cardiac studies with up to 16 channels, including arterial spin labeling and optogenetic coils as well as flexible planar surface coils

- Significant signal-to-noise boost *in vivo* with the MRI CryoProbe™ for small rodents available as quadrature, four-channel phased-array, and ^{13}C versions.

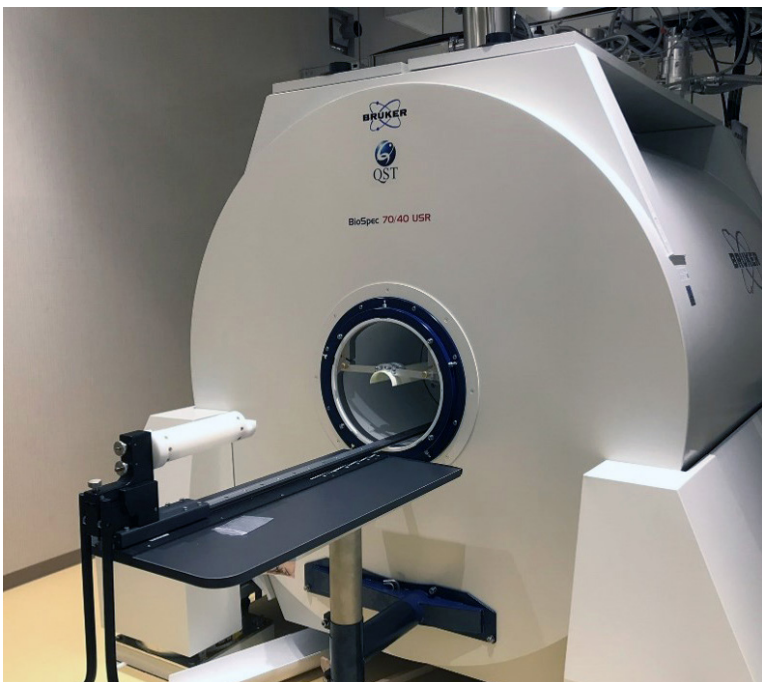
- Intuitive ParaVision software for multi-dimensional MRI/MRS data acquisition, reconstruction, analysis, and visualization including IntraGate based methods, UTE, ZTE, EPI, DTI, parallel acceleration, multi-band excitation, and fast 3D mapping
- Open sequence architecture for full freedom of study design

- In-house development and production of all key components (software, magnet, gradient, spectrometer, RF-coils) ensures the best performance and short repair times

- Premium LabScape service and support maintenance agreement

LabScape

we've got you covered



BioSpec 70/40 installed at QST Hospital, National Institutes for Quantum and Radiological Science and Technology, Chiba, Japan

Courtesy: I. Aoki, Quantum and Radiological Science and Technology, Chiba, Japan

BioSpec 70/40 installed at Stanford University, Stanford, CA, USA

Courtesy: J. Kim, NPIL, Wu Tsai Neurosciences Institute, Stanford University, Stanford, CA, USA

All Bruker in vivo animal work was approved by the institutional animal care and use committee (IACUC) or local authorities and conducted under valid study permit.

Bruker Division/Partner or Distributor
info.brkr@bruker.com

bruker.com

Worldwide offices
bruker.com/

Online information
bruker.com/