

Overview of equipment used for analyzing physiology in mice and rats

【Major items to be analyzed and/or measured】

- (A) Evaluation of behaviors related to emotions, learning, and memories, and analyses of neural and muscular activities
- (B) Non-invasive 4D cardiac function and capillary blood flow ultrasound imaging in mice
- (C) Functional analysis of neuroimmune interactions in mouse models of diseases
- (D) Multicellular activity measurement and manipulation *in vivo*
- (E) Physiological measurements and analysis *in vivo*

【Equipment】

- Brain wave-measuring apparatus (Nihon Kohden, AB611J)
- Electromyograph (Nihon Kohden, AB611J)
- Telemetry automatic measurement system for chronic experiments (Harvard Bioscience, mouse, rat, etc.)
- 4D ultrasound imaging device VEVO3100 (Primetech Corporation, for mice)
- Isolated heart perfusion system (Primetech Corporation, for mice and rats)
-
- Open field test analyzer (Section of Instrument Design Room of NIPS and other, for mice)
- Light/dark transition test device (O'HARA, for mice)
- Barnes circular maze test device (O'HARA, for mice)
- Elevated plus-maze test analyzer (Section of Instrument Design Room of NIPS and other, for mice)
- Forced swimming test analyzer (Section of Instrument Design Room of NIPS and other, for mice)
- Rota-rod test analyzer (Ugo Basile, for mice RotaRod NG, 47650)
- Passive avoidance test analyzer (O'HARA, for mice)
- Fear conditioning test analyzer (O'HARA and other, for mice)
- Morris water maze pool (O'HARA and other, for mice)
- Intellicage: group-housed automated high-throughput behavioral and cognitive screening system (TSE-systems, for mice)
- Nikon A1MP + holographic microscope (Nikon & Division of Multicellular Circuit Dynamics, for mice and rats)
- The head-mounted miniature microscope (INSCOPIX)
- X-ray irradiation device (MediXtec, for mice and cells)
- silicon CMOS digital neural probe (Neuropixels)

Overview of magnetic resonance imaging (MRI) scanners installed at NIPS

Performance and features of the MRI scanner installed at the NIPS Supportive Center for Brain Research (two 3-T Verio scanners, 2009, Siemens; one 7-T scanner, 2014, Siemens; one 3-T Cima.X scanner, 2024, Siemens)

3-T Verio

1. Superconducting magnet

- 1) Magnetic field strength: 3 Tesla, magnet inner diameter 70 cm
- 2) Magnetic field uniformity: 0.03 ppm or less (spherical range with a diameter of 20 cm, volume residual mean squared method)
- 3) Shimming: Active + passive shimming, automatic shimming for each subject
- 4) Liquid helium evaporation: 0.01 L/year or less

*The dual fMRI/hyperscan MRI system for simultaneous measurement of two subjects (two Siemens 3T Verio scanner) is scheduled to shut down at the end of FY2025. If applicant wish to use this system, please submit an application after discussing your research plan, etc. with your host researcher at NIPS.

2. Imaging functions

- 1) Nuclei: ^1H
- 2) Pulse sequence: echo planar imaging, turbo spin echo imaging, etc.
- 3) Slice direction: axial, sagittal, coronal, oblique
- 4) Min. slice thickness: 1 mm (2-dimensional imaging), 0.3 mm (3-dimensional imaging)
- 5) Gradient magnetic field: 45 mTesla/m, rise time 0.225 ms
- 6) Probe: 32-channel head coil, circular polarized body coil, etc.
- 7) Data processing device: Automatically saves obtained images in DICOM format via Windows network
- 8) Other functions: T1, T2, T2*, proton density-weighted images, MR angiography, diffusion-weighted image, image statistical processing software, communication mediation relay system for simultaneously measuring neural activity during interaction between two individuals

7-T MRI

1. Superconducting magnet

- 1) Magnetic field strength: 7 Tesla, magnet inner diameter 60 cm
- 2) Magnetic field uniformity : 1 ppm or less (spherical range with a diameter of 25 cm, volume residual mean squared method)
- 3) Shimming: Active + passive shimmming, automatic shimmming for each subject
- 4) Liquid helium evaporation: 0.01 L/year or less

2. Imaging functions

- 1) Nuclei: ^1H , ^{13}C , ^{17}O , ^{19}F , ^{23}Na , ^{31}P
- 2) Pulse sequence: echo planar imaging, turbo spin echo imaging etc.
- 3) Slice dimensions: axial, sagittal, coronal, oblique
- 4) Min. slice thickness: 0.5 mm (2-dimensional imaging), 0.05 mm (3-dimensional imaging)
- 5) Gradient magnetic field: 70 mTesla/m, rise time 0.350 ms
- 6) Probe: 32-channel receive-only head coil (^1H), circular polarized transmit/receive head coil (^1H , ^{23}Na , ^{31}P), transmit/receive surface coil (^{13}C , ^{17}O , ^{19}F), etc.
- 7) Data processing device: Automatically saves obtained images in DICOM format via Windows network
- 8) Other functions: T1, T2, T2*, proton density-weighted images, MR angiography, diffusion-weighted image, image statistical processing software

3-T Cima.X

1. Superconducting magnet

- 1) Magnetic field strength: 3 Tesla, magnet inner diameter 60 cm
- 2) Magnetic field uniformity: 0.008 ppm or less (spherical range with a diameter of 20 cm, volume residual mean squared method)
- 3) Shimming: Active + passive shimmming, automatic shimmming for each subject
- 4) Liquid helium evaporation: 0.01 L/year or less

2. Imaging functions

- 1) Nuclei: ^1H
- 2) Pulse sequence: echo planar imaging, turbo spin echo imaging, etc.
- 3) Slice direction: axial, sagittal, coronal, oblique
- 4) Min. slice thickness: 0.1 mm (2-dimensional imaging), 0.05 mm (3-dimensional imaging)
- 5) Gradient magnetic field: 200 mTesla/m, rise time 1 ms
- 6) Probe: 32-channel head coil, 64 channel head neck coil, 20 channel head

- neck coil, 18 channel flex surface coil, 18 channel knee coil, etc.
- 7) Data processing device: Automatically saves obtained images in DICOM format via Windows network
- 8) Other functions: T1, T2, T2*, proton density-weighted images, MR angiography, diffusion-weighted image, and image statistical processing software.