

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)
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- 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)

Annex 3

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 (one 7-T scanner, 2014, Siemens; one 3-T Cima.X scanner, 2024, Siemens)

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 shimming, automatic shimming 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

*7-T MRI(one Siemens 7-T scanner) may be stopped at the end of December 2027 due to the end of manufacturer maintenance.

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 shimming, automatic shimming 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.