

Brain Interdisciplinary Research Division (“BIRD”)

R & D Infrastructure for the Study of the Brain, Neural Information and Neural Systems

Period : April 1, 2016~March 31, 2021

Members :

- Director **Teiichi FURUICHI** (Prof., Appl. Biol. Sci., Fac. of Sci. & Tech.)
Jun-Ichiro OKA (Prof., Pharm., Fac. of Pharm. Sci.)
- * **Osamu ARAKI** (Prof., Appl. Physics, Fac. of Sci. Div. I)
Naoyuki AIKAWA (Prof, Appl. Electronics, Fac. of Ind. Sci. Tech.)
Toru Ikeguchi (Prof., Info. Comp. Tech., Fac. of Eng.)
 - * **Takeshi NAKAMURA** (Prof., Res. Inst. Biomed. Sci.)
Hiroyuki NISHIYAMA (Assoc. Prof., Ind. Admin., Fac. of Sci. & Tech.)
 - * **Eri SEGI-NISHIDA** (Assoc. Prof., Biol. Sci. Tech., Fac. Ind. Sci. Tech.)
 - * **Hiroshi TAKEMURA** (Assoc. Prof., Mech. Eng., Fac. of Sci. Tech.)
Hiroko ICHIKAWA (Lect., Lib. Arts, Fac. of Sci. & Tech.)
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 - # **Mitsuhiro HASHIMOTO** (Assist. Prof., Fukushima Med. Univ.)
 - # **Takahiro KIMURA** (Assist. Prof., Kochi Univ. Tech.)
- * Executive Secretary; # Visiting Researcher at TUS

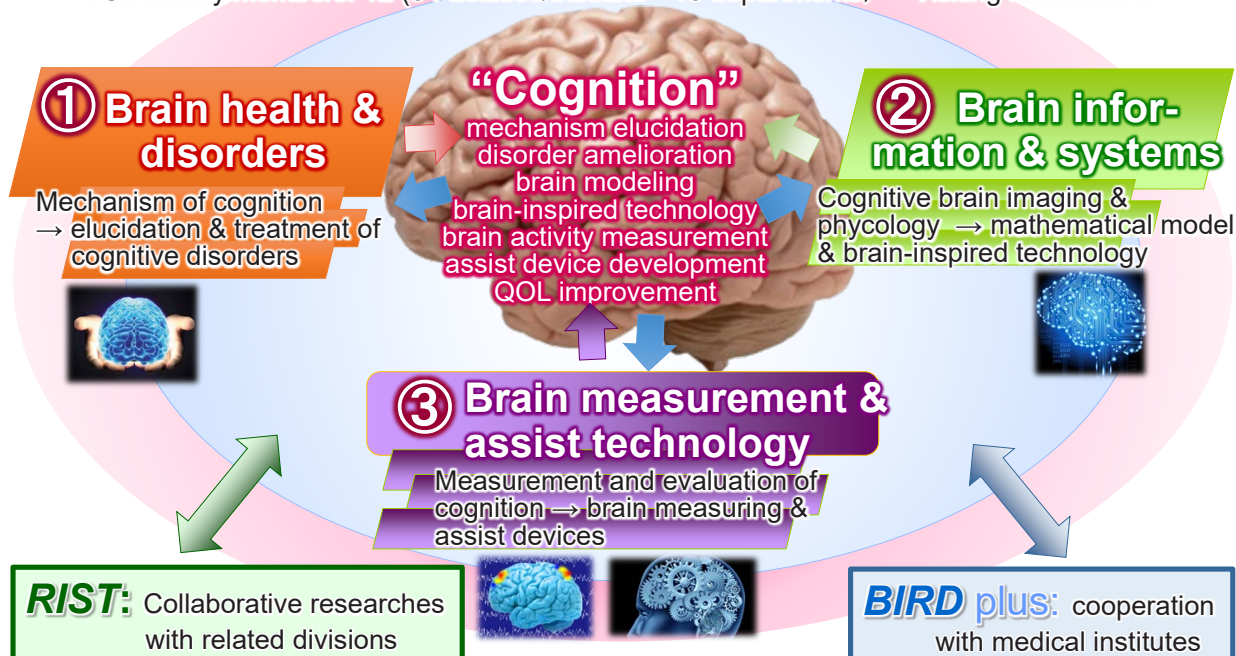
Objectives

Creative & Innovative Brain Science in TUS

(Brain health · Brain modeling · Brain measurement & assist device)

R & D Infrastructure for the interdisciplinary study of the brain, neural information and neural systems

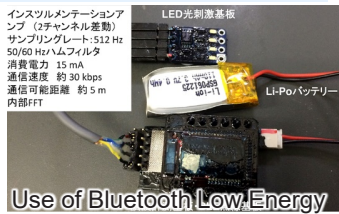
TUS faculty members: 12 (6 Faculties/Institute - 10 departments) + Visiting members: 2



Project 1

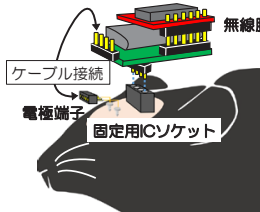
Interdisciplinary study from brain measurement to mathematical statistics on cognition and memory behavior by developing compact/wearable electroencephalograph and mini-microscope

① Development of compact wearable brain activity measuring apparatus

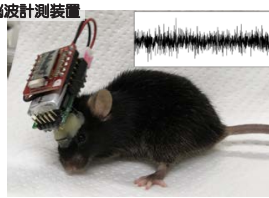


Use of Bluetooth Low Energy

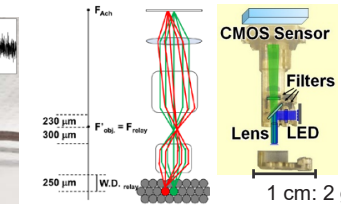
Measurement of brain waves in awake, freely-moving mice



Compact brain wave measuring apparatus (electroencephalograph)

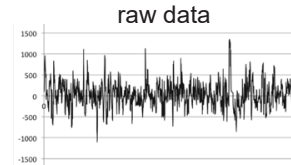


Mouse models with a defect in social cognition & memory

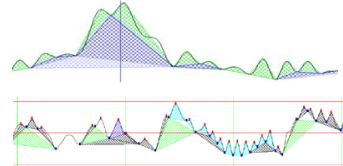


Compact and lightweight mini-microscope

③ Statics of time-series information on electroencephalogram signals



Waveform recognition & signal processing



For imaging of brain activity (Fluorescent Ca^{2+} imaging, etc.)

We aim to develop wireless/compact apparatuses (weightlessness, low power consumption & resistance to wave interference) for real-time measuring brain activities in cognitive behavior of awake, freely moving mice. We also aim to evaluate relationship between brain activity and behavior by statistical analysis of time-series brain waves.

Project 2

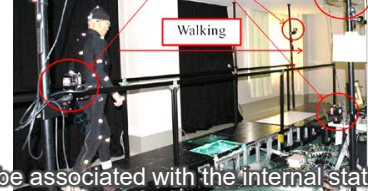
Relationship between gait information and personality trait

① Evaluation of personal trait (social cognition)

② Cognitive psychological experiment



③ Biomechanical engineering walking measurement



Evaluating features of walking which may be associated with the internal state

Our data suggest that a difference in personal traits is associated with movement of the hip during walking.

Project 3

Data mining of gene expression in depression-related neural network

① Brain region-specific gene expression

Gene coexpression network analysis

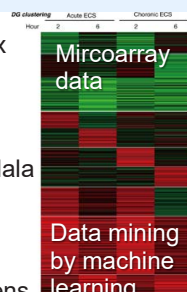
Antidepressant treatment

- Antidepressant
- Electroconvulsive therapy
- Psychotherapy

BIRD Link

Prefrontal cortex
↕
Hippocampus
↕
Amygdala
↕
Hypothalamus
↕
Nucleus accumbens

② Depression-related gene networks



BIRD Link

③ Depression-related functional molecules

Cognition (Decision)
Memory, anxiety
Stress response
Appetite, Sleep,
Emotion

Depression state Improvement

New agents
(pain, schizophrenia, dementia, obesity, insomnia)

Antidepressant treatment may be associated with differentiation and maturation of hippocampal neurons.