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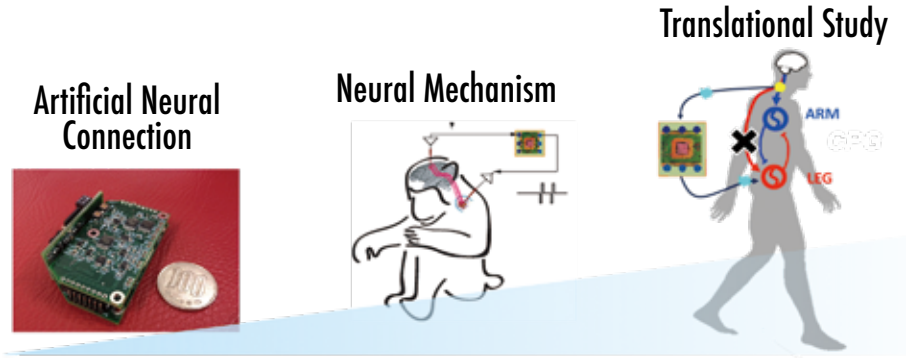
Project Leader **Yukio Nishimura** Neural Prosthesis Project

Restoring Lost Function After Neural Damage

Our research goal is to conceive innovative neuro-rehabilitation to restore lost functions after impairment of central nervous system, and to translate our findings into clinical applications capable of improving the quality of life for individual with neural damages.

"Bridging Damaged Neural Pathways using a Neural Interface."

Regaining the function of an impaired limb is highly desirable in individuals experiencing paralysis. Functional loss of limb control in individuals with spinal cord injury or stroke can be caused by transection of descending and ascending pathways connecting cortical to spinal network, although neural circuits that locate above and below the impaired site remains their function.



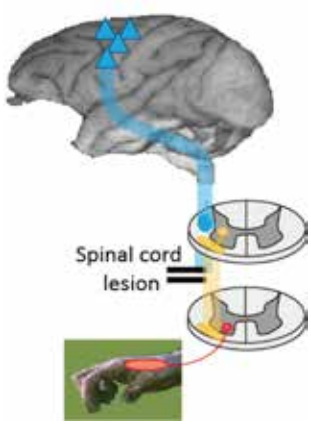
Neuron 2013 | Frontiers 2013 | J Neurosci 2014

We are developing a neural interface which so-called "artificial neuronal connection (ANC)". The ANC bridges supra-spinal system and spinal network beyond the lesion site to restore lost function. We are conducting clinical trials to assess effectiveness of ANC in restoring motor function in paralyzed patients. We investigate neural changes that occur during recovery.

Neural Prosthesis

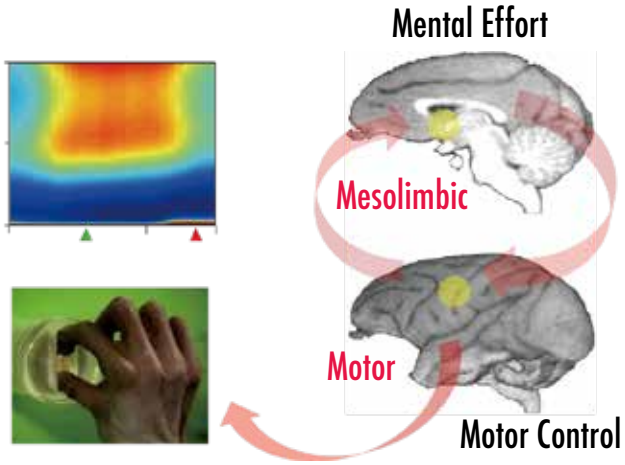
Neural Mechanisms of Functional Recovery

Using a large scale multichannel recording, pharmacological intervention, neuroanatomy, viral tools, computation and whole brain imaging, we seek to uncover the neural mechanisms underlying the voluntary limb movement in intact animals, as well as the processes in which motor functions are reestablished after neural damages such as spinal cord injury and stroke. We are also performing clinical studies to test the efficacy of the ANC in human patients.



Science. 2007, Brain 2009

Psychological Effect on Motor Control



PLoS ONE 2011, Science. 2015

Emotional states influence how we perform motor activities and how we perceive errors. Depression impedes and motivation enhances functional recovery after neuronal damage. However, the neuronal substrate underlying such psychological effects on functional recovery remains unclear. We investigate the neural substrate underlying such psychological effects on motor performance in human and animal model of neural damages.

Members

Yukio Nishimura
Toshiki Tazoe
Osamu Yokoyama
Nobuya Sano
Noboru Usuda
Kei Obara
Yu Shimada
Yoshihisa Nakayama
Hiroaki Ishida
Michiaki Suzuki
Miki Kaneshige
Ryoutaro Numata
Naoya Kabe

Neural Prosthesis