Department of Rehabilitation Medicine
Division of Physical Fitness

Satoshi Miyano, *Professor and Director* Hideki Yamauchi, *Lecturer*

General Summary

The research of our division has been focused on skeletal muscle plasticity, neuroscience, and exercise physiology.

Research Activities

Neuroscience

We have previously demonstrated the presence of activated areas in the uninjured contralateral sensorimotor cortex in addition to the ipsilateral sensorimotor cortex of the area surrounding a brain infarction using a rat model of focal photochemically induced thrombosis (PIT) and functional magnetic resonance imaging. In this model, we next used gene expression profiling to screen key molecules upregulated in the activated area. RNA was extracted from the sensorimotor cortices ipsilateral and contralateral to the focal brain infarction and from the sham-controlled cortex; the extracted RNA was hybridized to gene-expression profiling arrays containing 1322 neurology-related genes. We found that glycine receptors were upregulated in the cortices ipsilateral and contralateral to the focal ischemic lesion. To determine the preclinical significance of upregulated glycine receptors, kynurenic acid, an endogenous antagonist of glycine receptors on neuronal cells, was administered intrathecally. The kynurenic acid significantly improved behavioral recovery, as evaluated with beam walking, within 10 days after paralysis was induced by focal PIT. These results suggest that intrathecal administration of a glycine receptor antagonist may facilitate behavioral recovery during the acute phase after brain infarction.

We determined whether the ipsilateral cortex surrounding the lesion or the uninjured contralateral cortex is more important for motor recovery after brain damage after PIT in the sensorimotor cortex in rats. Recovery of motor function was examined using the beam-walking test. Motor recovery patterns did not indicate whether motor recovery was dependent on the ipsilateral cortex surrounding the lesion or the cortex of the contralateral side. The results emphasize the need for selection of appropriate programs tailored to the area of cortical damage to enhance functional motor recovery in this model.

Exercise physiology

We investigated the effects of long-term wheel running exercise and food restriction on blood adiponectin levels in male Otsuka Long-Evans Tokushima Fatty rats (26 weeks old). Both running exercise and food restriction induced similar reductions in body weight, abdominal fat volume, and plasma leptin concentrations compared with ad

libitum control. Although plasma adiponectin levels were increased with food restriction, adiponectin levels did not change with running exercise. Plasma testosterone levels were higher in the running-exercise group than in either of the other two groups. A significant inverse relationship existed between plasma levels of adiponectin and testosterone for all groups. Our results suggest that 12 weeks of voluntary wheel running exercise induces different effects on plasma adiponectin level than does food restriction, despite similar reductions in body weight, fat tissue mass, and plasma leptin concentrations. We speculate that the elevated plasma testosterone concentration offsets any hyperadiponectinemic effects of body weight and fat volume reduction in exercising rats.

Publications

Abo M, Yamauchi H, Suzuki M, Sakuma M, Urashima M. Facilitated beam-walking recovery during acute phase by kynurenic acid treatment in a rat model of photochemically induced thrombosis causing focal cerebral ischemia. *Neurosignals* 2006-2007; **15:** 102–10.

Takata K, Yamauchi H, Tatsuno H, Hashimoto K, Abo M. Is the ipsilateral cortex surrounding the lesion or the non-injured contralateral cortex important for motor recovery in rats with photochemically induced cortical lesions? *Eur Neurol* 2006; **56:** 106–12.

Kimura M[1], Shinozaki T[1], Tateishi N[1], Yoda E[1], Yamauchi H, Suzuki M, Hosoyamada M[1], Shibasaki T[1] ([1]Kyoritsu Univ Pharmacy). Adiponectin is regulated differently by chronic exercise than by weight-matched food restriction in hyperphagic and obese OLETF rats. *Life Sci* 2006; **79:** 2105–11.

Yamauchi H. Rehabilitation on disuse atrophy in skeletal muscle (in Japanese). *Rihaigaku* 2007; **44:** 158–63.