Department of Cell Physiology
Division of Aerospace Medicine

Satoshi Kurihara, *Professor*
Masamichi Sudoh, *Associate Professor*
Hiroko Toshima, *Assistant Professor*

General Summary

Our main research interests are gravitational physiology and aerospace medicine. We have also studied the relation between human stress and adrenergic receptors (neurons).

Research Activities

Optokinetic nystagmus and after-nystagmus during 6 hours of bedrest

We examined both optokinetic nystagmus (OKN) and optokinetic after-nystagmus (OKAN) with a study in which 6 hours of 6° head-down bedrest was used to simulate microgravity conditions.

In 5 healthy adults, we repeatedly (5 times) and comparatively studied OKN and OKAN evoked by horizontal and vertical stimuli. Stage 1 used an upright sitting position. During the 6 hours' bedrest condition, we studied OKN and OKAN in the 90° recumbent lateral position (stages 2, 3, and 4). For stage 5, the subject was returned to an upright position.

We confirmed that changes in gravity direction had various effects on OKN and OKAN. We also found that more than 3 hours was needed to reach a desirable level of systemic adaptive modification to the unique environmental condition. We believe that the early change was due to changes in sensory inputs through the otolith organs and that the latter changes represent an adaptive process of the spatial orientation system. With tilting, the rates of both horizontal and vertical OKAN decreased; however, the conditions of these changes were different.

A lengthy alteration of gravity direction produced different effects on the intrinsic horizontal and vertical optokinetic oculomotor systems.

Stress

1. $Alpha_{2A}$ adrenergic receptors of the platelet membrane: Acute myocardial infarction and cerebral infarction are considered stress-associated disorders. They develop from intravascular microthrombus formation. Therefore, we studied changes in platelet aggregation after stress loading in human subjects.
2. Hypothalamus-sympathetic nervous-adrenal medulla-system: Generally, the heart rate is adjusted by the rhythm of the bulbar circulation centrum. After stress loading, the rhythm is changed through adrenergic neurons that connect the nucleus ceruleus and the medulla oblongata. We then examined the effects of stress on the human circulatory system through frequency analysis of heart-rate variability.

Publications

***Hida K*[1] (*[1]Nihon Univ), Nomura Y*[1], *Igarashi M*[1], *Sudoh M, Akira T (Japan Aerospace Exploration Agency), Sugiyama Y (Kido Hosp), Shigihara S*[1], *Ikeda M*[1].** Optokinetic nystagmus and after-nystagmus during a 6 hour bedrest study. *Acta Oto-Laryngol* 2008; **128:** 761–7.

Toshima H, Sugihara H*[1] (*[1]St Marianna Univ), Hamano H*[2] (*[2]Tokai Univ), Sato M (Teikyo Univ), Yamamoto M (Yokohama Stroke Brain Cen), Yamazaki S*[1], *Yamada Y*[1], *Taki M*[1], *Izumi S*[2], *Hoshi K*[1], *Fusegawa Y*[2], *Sato K*[3] (*[3]Yamanashi Univ), Ozaki Y*[3], *Kurihara S. Spontaneous platelet aggregation in normal subject assessed by a laser light sacattering method: an attempt at standardization. *Platelets* 2008; **19:** 293–9.

Sato K (Yamanashi Univ), Shimizu M*[1] (*Tokai Univ), Ohara S*[1], *Goto H (Juntendo Univ), Sano M (Toho Univ), Yamazaki M (Tokyo Women's Med Univ), Toshima H, Yamamoto M (Yokohama Stroke Brain Cent). Questionnaire survey on platelet aggregation tests in Japan (in Japanese). *Nihon Kensa Ketsueki Gakkai Zasshi* 2008; **9:** 167–77.