

## Department of Cell Physiology Division of Aerospace Medicine

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### General Summary

Our main research interests are gravitational physiology, aerospace medicine, and stress reaction.

### Research Activities

#### *Optokinetic nystagmus and afternystagmus during the 7 days' bed rest*

We analyzed the time-dependant change of optokinetic nystagmus (OKN) and optokinetic afternystagmus (OKAN), during a 7-day experiment of 6-degree head-down bed rest in which various biomedical variables were measured during long-term alteration of the direction of gravity. At the Tsukuba Space Center of the National Space Development Agency of Japan (now the Japan Aerospace Exploration Agency), 6 healthy men were studied. We collected OKN and OKAN data (both right and left directions) 6 times: in the sitting position on the day preceding bed rest, in the supine position on the 1st, 3rd, and 5th days of bed rest, and in the sitting position again immediately after bed rest on the 7th day and on the day following bed rest. The increase in OKN (OKN slow-phase-velocity/stimulus speed) tended to decrease on the 1st day of bed rest, had recovered gradually by the 5th day, and after bed rest exceeded the level before bed rest. The gain was higher when the OKN slow phase was directed rightward than when it was directed leftward throughout the 6 times. The appearance rate of the OKAN first-phase decreased during bed rest and recovered after bed rest to the level before bed rest. In contrast, the appearance rate of the OKAN second-phase increased on the 1st day of bed rest, and the increase was maintained thereafter, suggesting that an OKAN generator might differ between the first and second phases. The maximum slow-phase velocity of OKAN decreased markedly on the 1st day, but the recovery was unclear during and after bed rest. No clear tendency was found in the time-dependency of the OKAN duration. We speculate that these time-dependent changes observed in the optokinetic—oculomotor system are based mainly on the alternation in gravity information to the otolith organ and that bed rest is useful for studying long-term adaptation in the vestibular system under microgravity.

#### *Stress*

1. The processing of stress in the human brain and the stress-related disorders  
We performed near-infrared optical topography and recorded event-related P300 potentials when subjects felt stress. We then investigated information processing in the brains of human beings.

2. Brain imaging in *karuta* players by means of near-infrared optical topography and measurement of event-related potentials

We recorded the event-related P300 potentials and performed near-infrared optical topography of *karuta* players during an auditory oddball task that is similar to *karuta*, and we investigated information processing in the brains of *karuta* players.

3. Stress facilitates spontaneous platelet aggregation in healthy young persons

After arithmetic stress loading, the concentration of norepinephrine was significantly increased. Spontaneous platelet aggregation was also accelerated by arithmetic stress, which was correlated with the increase in norepinephrine concentration. Stress releases norepinephrine from sympathetic nerve terminals, and the binding of norepinephrine to alpha-2 adrenoreceptors of platelets triggers platelet aggregation.

**Publications**

**Nomura Y<sup>1</sup>, Igarashi M<sup>1</sup>, Sudoh M, Hida K<sup>1</sup>, Sekiguchi C, Ishii M, Matsushima M, Kaneita Y<sup>1</sup>, Ikeda M<sup>1</sup> (<sup>1</sup>Nihon Univ).** Optokinetic nystagmus

and afternystagmus during the 7days bed rest study. (in Japanese). *J J Aerospace Environ Med* 2008; **45**: 3-9.