

Department of Cell Physiology Division of Aerospace Medicine

Satoshi Kurihara, *Professor*
Hiroko Toshima, *Associate Professor*

Masamichi Sudoh, *Professor*

General Summary

Our main research interests are 1) gravitational physiology and aerospace medicine, and 2) physioepidemiological studies of health.

Research Activities

Gravitational physiology and aerospace medicine

1. Technique of electrocardiography in medaka

The medaka, or Japanese killifish, is an indigenous model vertebrate of Japan. This fish has various strains, is transparent during embryogenesis, and has been used as a research animal since the 1940s. Experiments with medaka aboard the International Space Station are now being prepared. Using the transparent medaka strain Sukesuke (SK2), we established a way to detect the heartbeat and to observe heart-rate variability with live imaging under a stereomicroscope. However, because there is no evidence that the live imaging data is coincident with electrocardiography (ECG), we are developing, in collaboration with the Japan Aerospace Exploration Agency, an ECG technique using medaka. The medaka was placed in a damp sponge, and bipolar-lead ECGs were recorded under unanesthetized conditions with needle electrodes inserted through the skin. Wave-form analysis was performed with PowerLab data acquisition software (AD Instruments Japan, Tokyo, Japan).

In this study, we recorded clear ECG data. Because the data quality might depend on the needle position, a technique for precise needle insertion should be developed.

2. Research of visual stimulus and posture control

Information for maintaining body direction and movement of the body center for maintaining posture are determined by visual input factors, equilibrium vestibular input factors, and somatosensory factors from the whole body (including muscles, tendons, joints, and skin). Visual information becomes the main factor in outer space because vestibular and somatosensory inputs are reduced owing to low or absent gravity. The objective of this research is to analyze changes in posture induced by visual stimuli.

3. Outreach activities for aerospace medicine

Our outreach activities aim to promote public understanding of science and to provide information to the public and include publishing books and holding public talks, lectures, and discussions. Recently, public outreach has become important in science. We have been starting outreach activities for aerospace medicine.

Results of physioepidemiological study

Many previous studies of wellness medicine and occupational health have been performed with epidemiological methods. However, in this study physiological data (e.g., ECG) were analyzed with epidemiological methods. Mental stress and human health can be evaluated objectively using both physiological and epidemiological methods.

1. We studied the risk of cardiovascular disease due to smoking. We measured spontaneous platelet aggregation and whole-blood fluidity before and after smoking. Thrombophilia increased after smoking.
2. Mental stress in nurses during nursing practice. We directly measured the mental stress of nurses using a Holter ECG monitor while they practiced nursing. Their stress increased when patients died and when nurses supported bone marrow puncture. Moreover, when nurses were unskilled or were busy, their stress increased.