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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 electrocardiographic recording using 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 have been performed aboard the International Space Station. Using the transparent medaka strain Sukesuke (SK2), we established a method of detecting the heartbeat and observing heart-rate variability with live imaging under a stereomicroscope. However, because there is no evidence that the live-imaging data is coincident with electrocardiographic (ECG) data, 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).

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 on 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.

Physioepidemiological study of health

Many previous studies of wellness medicine and occupational health have been performed with epidemiological methods. However, we analyzed physiological data (e.g., ECG) and used epidemiological methods. We believe that mental stress and human health can be evaluated objectively with both physiological methods and epidemiological methods.

1. The effect of the musical ensemble on the human health: We evaluated the effect of a musical ensemble on autonomic nervous function through use of a respiratory function test and a circulatory function test. Respiratory and circulatory functions were observed to synchronize in the musicians of the ensemble. We believe that this result might lead to the development of a novel musical therapy.
2. Mental stress in care workers: Our questionnaire survey revealed that the stress of care workers was significantly higher than that of nurses. However, direct measurements with Holter ECG monitoring as they performed their duties revealed no significant difference in stress between care workers and nurses. We speculate that care workers are less able to deal with stress because they have had few opportunities to learn about stress-management.