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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

1. The effect of the musical ensemble on 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. Physiological effects of an irregular work schedule on care workers

We measured sleep patterns and the depth of sleep of care workers who have an irregular schedule by using an actigraph. We also measured the circadian rhythm of the autonomic nervous function of these care workers by using Holter ECG and the frequency-analysis method. The sleep pattern and the circadian rhythm were compared.