1. Experiment Title
   Analysis of blood circulation in the space

2. Principal Investigator
   Professor Shunichi Takeda, M.D., PhD
   Department of Radiation Genetics, Graduate School of Medicine and Faculty of Medicine,
   Kyoto University

3. Outline of Experiment

   The goal of our study is to develop the method to prevent zero-gravity dependent sickness, such as atrophy of the muscle. To achieve this goal, you need to know how muscle cells recognize mechanical stress. However, molecular mechanisms underlying the recognition remained to be elusive. Similarly, although cardiac myocytes and blood vessel endothelial cells are known to monitor blood pressure, no sensor molecules were identified. Professor Ogura discovered a few novel molecules responsible for sensing mechanical stress. Genes encoding these sensor molecules can be selectively inactivated in the Medaka fishes, using the gene disruption system developed by Takeda's group. Furthermore, you can express a dominant-positive sensor mutant, which might suppress the sick phenotype caused by zero-gravity. Likewise, our study will contribute to the development of a medicine that affects mechanical stress receptors, and thereby prevents the muscular atrophy of astronauts.

   To investigate the function of the mechanical stress receptors, we will firstly analyze blood circulation, because large amounts of data can be obtained from small *N* number experiments. Additionally, Medaka fishes have a number of advantages in the physiological study of blood circulation. First, you can observe the dynamics of individual cells with time, in various tissues including the heart, the endothelium of blood vessels, and blood, because the whole body is transparent up to five days after hatching. Moreover, you can change the blood pressure simply by changing water pressure. In our proposed project, we will monitor the dynamics of individual cells in the cardiovascular system under the zero-gravity condition as well as high-G during the launch of the rocket. A collaborator, Professor Ogura has already set up machinery to monitor the dynamics of blood circulation in zebra-fishes in his laboratory. We will use a specific strain of Medaka, which is developed by Professor Ijiri, and tolerant to "space travel" sickness.

   Within a few years, we will develop reliable machinery to precisely monitor the cardiovascular system of living fishes in the spacecraft. In addition, we will generate gene-manipulated Medaka fishes, in order to understand the role of mechanical stress receptors in cardio-vascular as well as musculo-skeletal system.

4. Experiment Facility
   Aquatic Habitat (AQH)
   Multi-purpose small payload rack (MPSR)