

## 1. Experiment Title

***In-situ* observation of growth mechanisms of protein crystals and their perfection under microgravity**

## 2. Principal Investigator

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## 3. Outline of Experiment

It has been emphasized in the literature that the protein crystal perfection increases in microgravity conditions. However, the precise mechanism responsible for such observation is yet to be understood from the fundamental point of view. Our objective is to elucidate the correlation of growth mechanisms at various levels of supersaturation and defects induced during growth. It is well-known that micro-defects are closely related to the crystal perfection, and occur by the incorporation of impurities such as protein dimers. However, under microgravity conditions, these impurities have lesser probability of incorporating onto the crystal surface because there is no buoyancy-induced convection. Thus it is important to study the crystal growth behavior and defect mechanisms in microgravity conditions.

We are planning to use lysozyme as a model protein and observe the growing crystal surfaces by Michelson interferometer. The growth rates of nano-steps can be calculated from the observation of crystal surfaces as a function of supersaturation. In addition, a Mach-Zehnder interferometer will be employed for the observation of concentration gradients and related transport phenomena in the vicinity of the crystal. The crystal defects will also be checked by newly developed molecular layer etching method.

## 4. Experiment Facility

Solution Crystallization Observation Facility (SCOF)