Project Abstracts

Project No.	**1**
Title	Visualization of cellular viability
Supervisor	Prof. Hitoshi Shiku, Institute of Technology
Venue	Engineering Laboratory Complex Building 405 (Map:Aobayama,C10)
Participants	

Cell is a basic unit to construct our body. Animal cells interact with their environmental materials and the other cells so that cellular functions can be expressed as playing their original roles. In this workshop, cellular functions will be visualized based on fluorescent probe technique, for various culture conditions and drug responses. We also learn methods for cell culturing, passage, aseptic operation and optical microscopy.

Project No.	**2**
Title	
Supervisor	Dr. Miwa Kuri, IRIDeS (International Research Institute of Disaster Science)
Venue	Engineering Laboratory Complex Building 901-2 (Map:Aobayama,C10)
Participants	

The 2012 White Paper on Science summarizes lessons on mainly two points related to earthquake and tsunami science and technology as well as society that were learned from the March 11, 2011 Great East Japan Earthquake. The first point is there was less information on the earthquake and tsunami than was needed by society. The second point is overconfidence in artificial structures caused tremendous human suffering and loss of life. The course will focus on decision making for disaster: self-, mutual- and public.

Project No.	**3**
Title	Water Disinfection and Sustainable Development Goals
Supervisor	Prof. Daisuke Sano, Graduate School of Environmental Studies
Venue	Civil Engineering and Architecture Education and Research Building (Map: Aobayama, F01)
Participants	

A huge number of people are affected by waterborne infectious diseases over the world. In order to overcome the burden of waterborne infectious diseases, one of the Sustainable Development Goals has been set to "Ensure availability and sustainable management of water and sanitatin for all." In this workshop, the participants will learn what the index of water safety is through the mesurement of microorganism counts in water and how water disinfection can contribute to the reduction of microorganisms in water.

Project No.	**4**
Title	Quantitative Measurement of Radioactivity in Soil
Supervisor	Dr. Masashi Kaneta,Department of Physics
Venue	Science Complex B 642 (Map:Aobayama,H03)
Participants	

After the accident of Fukushima Daiichi Nuclear Power Station, people seem to became sensitive to topics of radiation and radioactivity. If you fare those as an unknown and/or unfamiliar object, it can not be said that you have a scientific thinking.

When you consider effects of radiation to a biological body, it nedd to be based on quantitative measurement. It will be one of items for decisions that you have enough knowledge how to identifiy species of radioactive material and how to measure quantity of radioactive nuclide.

You need to have knowledge of physics and mathematics for the measurements. In the field of physics, related topics are elemental particles, nucleus, and intearaction of radiation in material. It is necesarry to have algebra, differential, integral, and statistics for reproducible quatitative measurement.

I would like you to have prior learning what radiation are radioactivity are and how to measure those. You will learn the basic of radiation measurement by experiments in the workshop. Additionally, it is scheduled to measure radioactivity in soil and we will discuss quantitative difference as a function of area.

Project No.	**5**
Title	Let`s think about tsunami disaster mitigation
Supervisor	Dr.Suppasri Anawat,IRIDeS (International Research Institute of Disaster Science)
Venue	International Research Institute of Disaster Science 305 (Map:Aobayama,J31)
Participants	

We will use available information from internet and Google Earth, etc to estimate tsunami characteristics (height, speed and force), predict possible damage and create evacuation map. Disaster resilience plan for a selected target area will be proposed based on a combination of structural measures (seawall, elevated land, etc) and non-structural measures (warning, evacuation, education, etc).

Project No.	**6**
Title	Protein production of rice under dark condition
Supervisor	Prof. Yukihiro Ito,
Venue	
Participants	

Production of useful proteins in plants (plant molecular farming) is expected to be an ideal method because of low production cost compared to production in animals and microorganisms, safety (free from animal/human viruses), long-term storage at room temperature (in case of seeds), etc. However, plant molecular farming is still costly, because plants are grown under artificial conditions using much electricity for light and air-conditioning in an indoor plant cultivation factory. If plants produce a similar amount of proteins even under dark condition, it is very cost-effective. Moreover, since dark condition suppresses photosynthesis protein production, the amount of protein of interest may increase.

In this course, we study protein production of rice under dark condition and effects of nutrition on protein production. This study will contribute cost-effective production of useful proteins in near future.

Project No.	**7**
Title	Analysis of the difference of speech emotion between English and Japanese
Supervisor	Prof. Akinori Ito
Venue	
Participants	

In this theme, we target on the English and Japanese speech. The students first record their speech utterances with intended emotions and analyze the acoustic difference of them. Also a simple emotion recognition experiment is conducted. Specifically, first they have a lecture about the basis of speech signal and information processing. After that, they record their emotional speech in the soundproof room in the laboratory. Next, they extract features such as fundamental frequency and power from the recorded speech, and analyze the difference of them in terms of the emotion and language. Finally they conduct a simple emotion classification experiment based on the Euclidean distance using these features, and discuss the result.

Project No.	**8**
Title	Nitrogen cycle by symbiotic microorganisms
Supervisor	Dr. Kiwamu Minamisawa, Graduate School of Life Science
Venue	Graduate School of Life Sciences Building 103 (Map:Katahira,D05)
Participants	

The nitrogen cycle is one of the important element cycles in terrestrial ecosystems, with agricultural and environmental implications. In the roots of leguminous plants, greenhouse gas nitrous oxide (N2O) is emitted. Leguminous plants host nitrogen-fixing soil bacteria (rhizobia) that can both produce and reduce N2O during denitrification of rhizobia from nitrate to nitrogen, which is biologically an anoxic respiration system. Our interest is to understand how the denitrification capability depends on rhizobial species in soil environments. We plan lectures with these backgrounds and experiments to assay denitrification capabilities of two species of soybean rhizobia."

Project No.	**9**
Title	Visualization and analysis of hidden nano-technologies in our daily life
Supervisor	Dr. Ryotaro Kumashiro,WPI-AIMR (Advanced Institute for Materials Research)
Venue	WPI- AIMR Main Building 2A (Map:Katahira,B01)
Participants	

To observe and visualize fine structures on the inner surface of plastic lids, which commonly used for food containers, in millimeter to sub-micron level. Also to discuss surface structure and its resulting effect. Furthermore, we try to understand visualized-fine-structures in the framework of mathematical and geometrical interpretation, and try to extrapolate the changes in effectiveness caused by external environment such as temperature and pressure.

Contents of practical experiments

- Observing and visualizing fine structures on the inner surface of plastic lids used for food containers (such as yoghurt) by optical, confocal-laser and scanning electron microscopes
- Discussing the interaction between food contained and structures visualized
- Establishing simplified mathematical and geometrical model of functional fine structures
- Extrapolating the changes in effectiveness caused by external environment such as temperature and pressure

Project No.	**10**
Title	Nanoscale Electrochemical Imaging on Cutting-edge Materials with World Leading Resolution
Supervisor	Prof. Akichika Kumatani,WPI-AIMR (Advanced Institute for Materials Research)
Venue	WPI- AIMR Main Building 5A, 2A (Map:Katahira,B01)
Participants	

This project is opened to obtain nanoscale electrochemical imaging by nanoSECCM. The nanoSECCM is one of electrochemical microscopies with world-leading resolution. The high resolution was secured by a nanoscale glass pipette as a probe. You will challenge to create the “nano”-pipettes (~100 nm diameter) at first, and then fill a metal wire electrode and electrolyte inside the pipettes. As materials to investigate, you will prepare one atom thick two-dimensional (2D) materials (e.g. graphene: the Nobel Prize 2010 in physics). By nanoSECCM on 2D materials, you will visualize the electrochemical reaction as nanoscale electrochemical imaging.

Contents of practical experiments

- Fabricate a ~100 nm diameter nano-pipettes
- Fill an wire electrode and electrolyte inside nano-pipette
- Prepare 2D materials including graphene (optional)
- Obtain nanoscale electrochemical imaging by nanoSECCM
- Analyze supporting data by other characterization techniques (optional)
- Summarize the analyzed data after discussion: future plan etc