Premedical Course

Biology

Koji Takada, *Professor* Rie Hiratsuka, *Associate Professor*

General Summary

Our research themes are to understand the mechanisms of heavy metal toxicity and the abnormal behaviors of mice in terms of the ubiquitin-conjugating system, and the reproductive system of plants, particularly pollen development in Japanese cedar.

Research Activities

Involvement of protein aggregates in cell toxicity of heavy metals

Intracellular protein aggregates are accumulated by exposure to the toxic heavy metals. Effects of cadmium (Cd) on proteins in kidney HK-2 cells were analyzed. After the cells were cultured with $CdCl_2$ for up to 12, 24 and more than 48 hours, the median effective concentrations for cytotoxicity were estimated to be 200, 85, and 70 μM, respectively. Amounts of the aggregates, quantified with the enzyme-linked immunosorbent assay for polyubiquitin, were low during exposure to up to 40 μM Cd, which produced no toxic effects. In contrast, by the exposure to more than 70 μM Cd, the aggregates were augmented in the cells, and prolonged accumulation was observed only in the sublethal condition.

How ubiquitin-specific peptidase 46 regulates mouse immobile behavior

Ubiquitin-specific peptidase 46 (USP46) is a member of a family of deubiquitinating enzymes that selectively cleave ubiquitin or ubiquitin chains from target proteins and stabilize them or modify their functions. Previous studies have shown that USP46 is involved in the immobile behavior which allows for retraction from unavoidable stresses. To identify the targets of USP46 in neuronal cells, two cell lines expressing wild-type or mutant USP46 fused with FLAG peptide were constructed, and several proteins, including WD repeat domain 48 and dystrophia myotonica WD repeat-containing protein, were obtained from the cells via immunoprecipitation with the FLAG antibody-agarose and liquid chromatography/tandem mass spectrometry analysis.

Histological study of pollen development in male sterile Cryptomeria japonica

Cryptomeria japonica pollinosis, caused by the Cry j 1 and 2 proteins, affects more than 20% of the Japanese population. To investigate the mechanisms causing male sterility of *C. japonica* (Shindai 8), histological information was collected. At the end of October, Cry j 1 and 2 were detected in the microspores. In mid-November, each microspore divided normally to form a small generative cell and a large tube cell. However, following the division, the pollens underwent cell death, with vacuole expansion, organelle deg-

radation, and defective cell walls. The allergens disappeared in the dying cells.

Publications

Sugimoto S, Iwamoto T, Takada K, Okuda K, Tajima A, Iwase T, Mizunoe Y. Staphylococcus epidermidis Esp degrades specific proteins associated with Staphylococcus aureus biofilm formation and host-pathogen interaction. *J Bacteriol.* 2013; **195:** 1645-55.

Iwase T, Tajima A, Sugimoto S, Okuda K, Hironaka I, Kamata Y, Takada K, Mizunoe Y. A simple assay for measuring catalase activity: a visual approach. *Sci Rep.* 2013; **3:** 3081.

Physics

Tsuyoshi Ueta, *Professor*

Katsumi Kasono, *Assistant Professor*

General Summary

1. We have proposed a metal photonic crystal with lattice vibration as a system enhancing the dynamic Casimir effect, and have been investigating the properties of the dynamic Casimir effect within a metal photonic crystal.
2. Computer simulation of phase transitions, critical phenomena, and interacting many-body systems.

Research Activities

Numerical study of the structural color of blue birds

The color of some birds, such as the kingfisher and the red-flanked bluetail, is a structural color owing to the interference of light within a sponge structure inside a barb. In this study, we considered the air rod photonic crystal to which disorder is introduced into the translation vectors and the radius as a model of the structural color of the red-flanked bluetail; the optical property of the model was numerically analyzed and compared with that of the structural color.

Monte Carlo simulation of the ferromagnetic Potts models

We calculated the discontinuity of magnetization m at the transition temperature of the first-order phase transition. Cluster Monte Carlo simulations were used to study 10 state ferromagnetic Potts models on the kagome, 4-8, generalized square lattices. It appears that m has no universality between the different lattices.

Publications

Fujii G[1], Watanabe H[2], Yamada T[2], Ueta T, Mizuno M[1] ([1]Akita Pref Univ, [2]Koto Univ.). Level set based topology optimization for optical cloaks. *Appl Phys Lett.* 2013; **102:** 251106.

Ueta T. Enhancement of the dynamic Casimir effect within a metal photonic crystal. *Proceedings of SPIE.* 2013; **8771**: 17-8.

Fujii G[1], Ueta T, Mizuno M[1] ([1]Shinshu Univ). Finite element analysis for laser action in porous random media. In: Proceedings of Metamaterials

2013: 7th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics; 2013 Sep 16–19; Bordouex, France. Piscatway: IEEE; 2013. p. 334–6.
***Fujii G*[1], *Watanabe H*[2], *Yamada T*[2], *Ueta T, Mizuno M*[1] (*[1]Akita Pref Univ, [2]Nagoya Univ).** Level set based topology optimization for optical cloaks containing a large scattering object. In: Proceedings of 10th WCSMO 2013: 10th World Congress of Structural and Multidisciplinary Optimization; 2013 May 20–24; Orlando, USA. Lisboa: ISSMO; 2013. p. 5283.

Chemistry

Takashi Okano, *Professor* Chikao Hashimoto, *Associate Professor*

General Summary

The research of this laboratory is focused on synthesis-oriented organic chemistry, including the synthesis of bioactive compounds and fluorine-containing materials; the development of new methods for peptide synthesis; and the computer-assisted analysis of materials and synthetic reactions.

Research Activities

Synthesis of ^{13}C-labeled materials for metabolic and diagnositic research

^{13}C-Labeled biologically active compounds are useful as probes for metabolic and diagnotic research because they can be directly applied to mass spectrometry or infrared spectroscopy without separation or purification. We are engaged in the synthesis of ^{13}C-labeled galactosyl benzyl glycoside and $^{13}C_{20}$-retinol. Galactose pentaacetate was reacted with α-^{13}C-benzyl alcohol in the presence of boron trifluoride etherate to produce its α-glycoside. Although the synthesis of $^{13}C_{20}$-retinol has already been reported, the reproducibility was not satisfactory, and a new synthetic route was explored.

Synthesis of N-protected peptide acids using amino acid–alkaline earth metal salts

The protection of a carboxyl group by a metal ion saves the time needed for the incorporation and removal of the protecting group and prevents side reactions caused by the use of esters. The syntheses of *N*-protected peptide acids in organic solvents using alkaline earth metal-carboxylate salts of an amino acid were investigated. We found that the amino acid–Ca carboxylate salt is the most effective of the carboxylate salts of the amino acids tested for coupling with Boc–amino acid active esters in an organic solvent, such as *N*,*N*,-dimethylformamide or dimethylsulfoxide.

Publications

***Hashimoto C, Sugimoto K*[1], *Takahashi Y*[1], *Kodomari M*[1] (*[1]Shibaura Inst Techol).** An efficient method for the synthesis of phenacyl ester-protected dipeptides using neutral alumina-supported sodium carbonate 'Na2CO3/n-Al2O3'. *J Pept Sci.* 2013; **19:** 659–62.

Reviews and Books

Okano T. Heterocyclic synthesis via catalysis of

N-heterocyclic carbenes: very classical and very modern chemical species. *Heterocyclic Communications.* 2013; **19:** 311-26.

Social Science (Law)

Ryuichi Ozawa, *Professor*

General Summary

Problems of constitutional law in present-day Japan

Research Activities

Ozawa published the following articles and books from research activities in 2013.

Reviews and Books

Ozawa R. Kenpou wo Manabi Ikashi Mamoru. Tokyo: Gakushu no Tomosha; 2013.
Ozawa R. The disposition of HLW and law & democracy (in Japanese). In: Hirowatari S, Asakura M, Imamura Y, editors. Nihon shakai to shimin hogaku. Tokyo: Nihon Hyoronsha; 2013. p. 211-28.
Ozawa R, Tanaka T, Yamaguchi N. Shimin ni senkyo wo torimodose! (in Japanese). Tokyo: Ohtsuki Shoten; 2013.

Human Science

Takao Fukuyama, *Professor*

General Summary

The study of Western philosophy and ethics

Research Activities

Essential Encounter
An encounter provides an effect, which derives from meeting others whom we had longed for. Such others awaken us to the subject and possibility of our lives and help us to realize them. But how do the others help us? They help us because they show us concrete values, which are not described in the abstract but are in vivid action. From this encounter arises a new communion. We give something to a person, who then gives us something else in return.

Value of attitude
The ethics of responsibility also provides a kind of answer about one's views of life and

death. Viktor Frankl, the founder of logotherapy, proposed the concept of attitudinal value. When a person is bedridden, he cannot act freely, but he can consider the feelings of others. Frankl thought that the attitudinal value is the most important of all values. Frankl suffered a cruel fate at the Auschwitz concentration camp. He had nothing free there, but he could maintain a proud-hearted attitude.

Japanese

Ikuko Noro, *Professor*

General Summary

1. To study patients' perception of shared decision-making
2. To study the validity of applying the Roter Interaction Analysis System to analyze communication between nurses and patients with mental disease

Research Activities

To study patients' perception of shared-decision making
Based on the research on the perception of patients with cancer on shared decision-making, we reported that: 1) patients who perceived the decision-making process as shared collected and received more information from their physicians than did patients who perceived their decision-making as physician-centered, and 2) the differences among decision-making processes did not affect patients' satisfaction; however, patients whose preferred decision-making and perceived decision-making processes matched were more satisfied than were patients whose processes did not match.

The validity of applying the Roter Interaction Analysis System to analyze communication between nurses and patients with mental disease
We used the Roter Interaction Analysis System to analyze conversations between nurses and patients with depression or with schizophrenia. We found that 1) the utterances of patients with depression or schizophrenia were almost as many as those of nurses, and 2) nurses asked few questions of patients, but the nurses frequently showed agreement.

Publications

Noro I, Kawano M. Analyzing depression patient-nurse communication and schizophrenia patient-nurse communication by using Roter Interaction Analysis System (RIAS) (in Japanese). *Seishin Kango ni okeru Discourse Bunseki Kenkyu Kaishi.* 2014; **2:** 15-21.

Reviews and Books

Noro I. Documents for informed consent (in Japanese). In: Ishizaki M, Noro I, editors. The prospect of medical communication. Tokyo: Shinohara Shuppanshinsha; 2013. p. 117-24.

Mathematics

Katsuya Yokoi, *Professor*
Hiroshi Shiraishi, *Assistant Professor*

General Summary

1. To study dimension theory and topological dynamics
2. To consider the asymptotic behavior of estimators of optimal portfolios when the return processes are various stochastic processes.

Research Activities

1. We studied omega-limit sets and (strong) chain recurrent sets on topological dynamics.
2. We examined the estimation of optimal portfolios when the return processes are continuous-time stochastic processes. We also examined the estimation of optimal portfolios with a large number of assets.

Publications

Yokoi K. Recurrence properties of a class of nonautonomous discrete systems. *Bulletin of the Belgian Mathematical Society-Simon Stevin*. 2013; **20:** 689-705.

English

Osamu Ohara, *Professor*
Tetsuro Fujii, *Associate Professor*

General Summary

English audiovisual education and digital medieval English study (Ohara)
English Language communication and education: material analysis and development (Fujii)
Ohara continued his study of graphology and morphology in the letters of the the Stonors in the fifteenth century. Ohara also continued to investigate how to make useful digital images and XML files of fifteenth century manuscripts, especially of the *Stonor Letters*. The results of this investigation were discussed in papers read at an international conference.
Fujii joined a project team to compile English textbooks for high-school English classes: *English Communication I, II*, and *III*. Along with the textbooks, Fujii has been writing their exercise materials and teacher's manuals. In addition, he studied commonality between English and Japanese and identified the types of English vocabulary that is conducive to learning.

Research Activities

Ohara presented a paper at a session in the International Medieval Congress 2013 held at the University of Leeds in the United Kingdom.
Fujii analyzed and collected authentic English materials to meet the level and the needs of high-school textbooks based on current teaching methods, theories, and research findings on learning English as a foreign language. These materials were used to compile textbooks following the revised teaching guidelines set out by the Ministry of Education, Culture, Sports, Science and Technology. Officially approved by the Ministry, the second textbook in the series, *World Trek — English Communication II*, and its instructional aids, *World Trek — English Communication II Teacher's Book* and *World Trek — English Communication I Teacher's Manual*, were published.
Fujii presented about common words and collocations between English and Japanese in "Investigating similarities between English and Japanese" at the 9th yearly conference held by the Association for Japanese and English Language and Culture in Tokyo in June.

Reviews and Books

Mochizuki M[1], Aizawa K[2], Allum P[3], Sasabe N[4], Hayashi Y[5], Fujii T, Miura S[6] ([1]Reitaku Univ, [2]Tokyo Denki Univ, [3]Rikkyo Univ, [4]Toritsu Aoyama High, [5]Soka High, [6]Tsurubunka Univ).
World Treck English Communication II. Tokyo: Kirihara Shoten; 2014.

Mochizuki M[1], Aizawa K[2], Allum P[3], Sasabe N[4], Hayashi Y[5], Fujii T, Miura S[6] ([1]Reitaku Univ, [2]Tokyo Denki Univ, [3]Rikkyo Univ, [4]Toritsu Aoyama High, [5]Soka High, [6]Tsurubunka Univ).
World Treck English Communication II: Teacher's book. Tokyo: Kirihara Shoten; 2014.

First Foreign Languages

Katsumi Suzuki, *Associate Professor*

General Summary

German contemporary literature

Research Activities

I am working on the topic of "the modern German literature of nonnative writers in German-speaking areas," especially the works of Ilija Trojanow, who was born in Bulgaria and now lives in Vienna. His novel *The Collector of Worlds* deals with the 3 different worlds of India, Arabia, and Africa. I had done research on his discourse about India and Africa and the cultural background of this discourse. I have already published the results. I continue researching his discourse about Arabia and studying Arabic culture. In addition to this work, I am translating a book by Johann Ludwig Burckhart, who introduced the Islamic world to the people of Europe in the early 19th century.