

Premedical Course

Biology

Koji Takada, *Professor*

Rie Hiratsuka, *Associate Professor*

General Summary

Our research themes are the mechanisms of heavy metal toxicity, the abnormal behavior of mice in terms of the activity of ubiquitin-specific peptidase 46, and the mechanism by which the generative cell of angiosperm is taken into a pollen tube cell.

Research Activities

Involvement of protein aggregates in cell toxicity of heavy metals

Toxic heavy metals induce the accumulation of protein aggregates in human kidney HK-2 cells. To verify this phenomenon in other human cells, neuroblastoma SH-SY5Y and hepatoma FLC-4 cell lines were used for a series of experiments. We found that water-insoluble ubiquitin-protein conjugates were also accumulated in these cells by exposure to cadmium and confirmed the occurrence of similar protein aggregates detected with fluorescent immunocytochemistry. For the analysis of these aggregates, a novel extraction method using detergents was developed, and a new batch of monoclonal antibody against polyubiquitin was prepared for the affinity purification.

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 that allows for retraction from unavoidable stresses and is implicated in the regulation of the GABAergic system, but the precise function is still unknown. We have identified WD repeat domain 48 (WDR48) and dystrophin myotonia WD repeat-containing protein (DMWD) as the target candidates. These proteins bound equally well to the wild-type and mutant USP46, indicating that the deletion mutation of lysine 92 does not affect the interaction of USP46 with the WD repeat proteins.

Mechanism of engulfment of generative cell by pollen tube cell: Observation with high-pressure freeze fixation method

The purpose of this study was to clarify the mechanism by which the generative cell (GC) of angiosperm is taken into a pollen tube cell. In this study, high-pressure freeze fixation was used during tissue fixation. As a result, a cell membrane and microtubular preservation were improved, and the following items were clarified. (1) The GC gradually comes off after division from the pollen wall; it changes its dome form to a sphere form and gets projected in a pollen tube cell. (2) In the spherical GC, a large number of microtubules

are dispatched to a cell membrane from a nucleus radially. (3) The cell membrane of the pollen tube cell is tucked inside along the bottom of the dome-formed GC and separates the GC.

Publications

Matsumoto M, Matsuura T, Aoki K, Maehashi H, Iwamoto T, Ohkawa K, Yoshida K, Yanaga K, Takada K. An efficient system for secretory production of fibrinogen using a hepatocellular carcinoma cell line. *Hepatol Res.* 2015; **45**: 315-25.
Matsumoto A, Ishibashi Y, Urashima M,

Omura N, Nakada K, Nishikawa K, Shida A, Takada K, Kashiwagi H, Yanaga K. High UBCH10 protein expression as a marker of poor prognosis in esophageal squamous cell carcinoma. *Anticancer Res.* 2014; **34**: 955-61.

Physics

Tsuyoshi Ueta, *Professor*

Katsumi Kasono, *Assistant Professor*

General Summary

1. We have proposed a disordered air rod photonic crystal as a model of a sponge structure inside a barb and have confirmed that the color of birds, such as the kingfisher and the red-franked bluetail, is a structural color owing to the interference of the light within a barb by reproducing the reflection spectrum.
2. We have investigated the influence of optical absorption on the radiation of electromagnetic waves in excited states from an artificially vibrated photonic crystal and have found that it inconceivably even enhances the intensity of higher-mode radiation.
3. Phase transitions, critical phenomena, interacting many-body systems, computer simulation

Research Activities

Numerical study on the structural color of blue birds

The article “Numerical study on the structural color of blue birds by a disordered porous photonic crystal model” by Ueta et al has been selected by the editors of EPL for inclusion in the exclusive “Highlights of 2014” collection. It has been observationally confirmed that the color of some birds, such as the kingfisher and the red-franked 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-franked bluetail; the optical property of the model was numerically analyzed and compared with that of the structural color.

Enhancement of the dynamic Casimir effect within a metallic photonic crystal by dissipation

The influence of the optical absorption of metallic materials on radiation in the excited states from a vibrating metallic photonic crystal has been investigated. We found that the influence of the optical absorption depends on the mode of radiation and on the form of wave functions and that the optical absorption surprisingly even enhances the output in the excited states.

Monte Carlo simulation of the ferromagnetic Potts models

We have made Monte Carlo simulations to study systems with the first-order phase transition. Multigrid cluster update simulations are used to study $q = 4, 10$ ferromagnetic Potts models on square lattices. We calculated the relaxation times of energy and magnetization.

Publications

Ueta T, Fujii G¹, Morimoto G², Miyamoto K³, Kosaku A³, Kuriyama T¹, Hariyama T⁵ (¹Shinshu Univ, ²Rikkyo Univ, ³Dokkyo Med Univ, ⁴Univ Tokyo, ⁵Hamamatsu Univ Sch Med).

Numerical study on the structural color of blue birds by a disordered porous photonic crystal model. *Europhys Lett.* 2014; **107**: 34004.

Ueta T. The dynamic Casimir effect within a vibrating metal photonic crystal. *Appl Phys A Mater Sci Process.* 2014; **116**: 863-71.

Fujii G¹, Ueta T, Mizuno M¹ (¹Shinshu Univ).

Level-set-based topology optimization for anti-reection surface. *Appl Phys A Mater Sci Process.* 2014; **116**: 921-7.

Ueta T, Otani Y¹, Nishimura N¹ (¹Kyoto Univ). Photonic-crystal like approach to structural color of the earthworm epidermis. *Forma.* 2014; **29** (Special Issue): S23-8.

Itoga H, Morikawa R, Miyakawa T, Yamada H, Natsume Y, Ueta T, Takasu M. Shape deformation of vesicles containing hard spheres. *JPS Conference Proceedings.* 2015; **5**: 011002.

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 ¹³C-labeled materials for metabolic and diagnostic research*

¹³C-Labeled biologically active compounds are useful as probes for metabolic and diagnostic research because they can be directly applied to mass spectrometry or infrared spectroscopy without separation or purification. We are now engaged in the synthesis of

^{13}C -labeled galactosyl benzyl glycoside, 16,17- $^{13}\text{C}_2$ -retinol, and 1,4- $^{13}\text{C}_2$ -putrescine. As the new synthetic tools, an automatic liquid-phase synthesizer and an automatic preparative liquid chromatograph were fully utilized.

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 and dimethylsulfoxide.

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 2014.

Publications

Ozawa R. On the collective self-defense right (in Japanese). *Hogakukan Kenpokenkyujoho*. 2014; **11**: 1-24.

Ozawa R. On new trend of the collective self-defense right (in Japanese). *Hogaku Seminar*. 2014; **231**: 96-119.

Ozawa R. Sustainable financial system and constitutional reform (in Japanese). *Ho no Kagaku*. 2014; **45**: 78-83.

Ozawa R. On the future of peace in East-Asia (in Japanese). *Horitsu Jiho*. 2014; **Suppl**: 240-5.

Reviews and Books

Ozawa R. On pursuit of peace by law (in Japanese). In: Kido E, editor. *Heiwa kenkyu nyumon*. Osaka: Osaka University Press; 2014. p. 207-19.

Ozawa R. Prologue, Chapter 1, Chapter 2 (in Japanese). In: Ozawa R, Sakakibara H, editors. *Abe Seiken to jichitai*. Tokyo: Jichitai Kenkyusha; 2014. p. 3-7, 19-26, 43-64.

Human Science

Kazushi Misaki, *Professor*

General Summary

The study of Western philosophy and ethics

Research Activities

Origin of the ego: The intersubjective approach to the subject

René Descartes' "cogito ergo sum," the ego as a subject of thought, is still a popular and paradigmatic image for the human subject: to be a mature human means that one can think independently and autonomously and one can act according to one's own beliefs.

In modern philosophy this image of the ego has been attacked from various positions. One such position, an intersubjective approach, criticizes Descartes' "cogito" as an isolated subject and maintains that an ego can be a subject in only intersubjective relations. Through the recognition of others, one can become and can be a subject. Studies by Donald Winnicott show how important the relationship of the baby with its mother is at the first stage of the ego. George Herbert Mead considers the development of the ego as a process of "ideal roll-taking of others." The goal of this development is the subject that can think from the universal point of view, as Descartes imagined.

Learn from the experience in Auschwitz

From another respect the "inhuman" situations in the concentration camp Auschwitz show various elements needed to be "human." From the experience written about by Viktor Frankl in Auschwitz we can learn the "human conditions" that in ordinary life remain unconscious but essential.

Publications

Misaki K. "Zeitkern" and "Erzählung" — Walter Benjamin on history/memory (in Japanese).

Tetsugaku to Gendai. 2014; **29**: 24-45.

Japanese

Ikuko Noro, *Professor*

General Summary

1) A study of patients' perceptions of shared decision-making and the association with patient satisfaction in the case of chemotherapy

2) A study of the structure of the interview by an experienced psychiatric nurse of patients with mental disease

Research Activities

A study of patient' perceptions of shared decision-making and the association with patient satisfaction in the case of chemotherapy

On the basis of research regarding patients with cancer, Noro et al. (2015) reported that it was not the kind of decision-making process (shared, patient-centered, physician-centered) that affected patients' satisfaction, but the concordance between the actual decision-making process and the process patients had preferred.

Publications

Noro I, Ishizaki M, Kobayashi R. Patients' perceptions of shared decision-making and the association with patient satisfaction in the case of chemotherapy (in Japanese). *Research Survey*

Reports in Information Studies, Interfaculty Initiative in Information Studies, The University of Tokyo. 2015; **31**: 89-113.

Mathematics

Katsuya Yokoi, *Professor*

Yasuko Hasegawa, *Assistant Professor*

General Summary

1. To study dimension theory and topological dynamics
2. To study real analytic automorphic forms and their applications in number theory

Research Activities

1. We studied omega-limit sets, (strong) chain recurrent sets on topological dynamics, and the Conley index theory.
2. One of the main topics of our research has been the explicit construction of automorphic forms. Because the representation theory of Lie algebra has played a fundamental role in the theory of automorphic forms, we showed the algebraic structure of the representation and thereby obtained automorphic forms.

Publications

Hasegawa Y. Fourier expansion of minimal parabolic Eisenstein series. *Suron Josei no Atsumari*

Hokokushu. 2014; **7**: 85-91.

English

Osamu Ohara, *Professor*

Tetsuro Fujii, *Associate Professor*

General Summary

English audio-visual 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 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. Ohara received a Grant-in-Aid for Scientific Research (C) with 8 other professors in different colleges and began a study concerning the evaluation of students joining the English social networking service community making use of materials from the TED (Technology, Entertainment, Design) 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 has published a conversational English textbook for self-study.

Research Activities

Ohara presented a paper at a session in the International Medieval Congress 2014 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 third textbook in the series, *World Trek-English Communication III*, and its instructional aids, *World Trek-English Communication III Teacher's Book* and *World Trek-English Communication III Teacher's Manual*, were published. Fujii also published a self-study English textbook, *Heartfelt English Conversation*, from Kirihara Publishing in Tokyo.

Reviews and Books

Mochizuki M (Reitaku Univ), Aizawa K (Tokyo Denki Univ), Allum P (Rikkyo Univ), Sasabe N (Toritsu Aoyama High), Hayashi Y (Souka High), Fujii T, Miura S (Tsurubunka Univ).

World trek English communication III Teacher's Book. Tokyo: Kirihara Publishing; 2015.

Mochizuki M (Reitaku Univ), Aizawa K (Tokyo Denki Univ), Allum P (Rikkyo Univ), Sasabe N (Toritsu Aoyama High), Hayashi Y (Souka High), Fujii T, Miura S (Tsurubunka Univ).

World trek English communication III. Tokyo: Kirihara Publishing; 2015.

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. In addition, on the occasion of the 230th anniversary of his birth I wrote an essay about him.