

Premedical Course

Biology

Osamu Terasaka, *Professor*

Rie Hiratsuka, *Assistant Professor*

General Summary

The main research subject of our laboratory is the reproductive system of seed plants. Our research is now focused on the relation between pollen tube growth and the programmed cell death of pollen tube conducting tissue.

Research Activities

Nonformation of plasmodesmata is involved in prothallial cell death during Gymnosperm pollen development

In the development of gymnosperm pollen, a small prothallial cell is cut off from the main body of the spore through unequal cell division. In *Ginkgo biloba*, two prothallial cells were produced; the first (p1) died, and the second (p2) survived. Immediately after formation, a nucleus with regularly dispersed chromatin and some organelles was included in both p1 and p2. Subsequently, p1 degraded rapidly and exhibited a uniformly high electron density. Vacuole development and collapse, a main trigger of cell death in plants, was not observed. The cell walls of p1 and its sister cell, the embryonal cell, became thickened, and no plasmodesmata formed between them. However, the walls of p2 and its sister cell, the antheridial initial, were thin with some plasmodesmata between them. In *Pinus thunbergii*, 2 prothallial cells also formed in the pollen; however, both cells died in a manner similar to that of p1 of *G. biloba*. They were TUNEL-positive and did not form plasmodesmata. In pollen of *P. thunbergii*, surviving prothallial cells were induced artificially by centrifugal treatment that perturbed the polarity or inequality or both of division in normal pollen mitosis. Some of these cells formed plasmodesmata with adjoining sister cells. These results suggest that cell death in prothallial cells is not “vacuolar cell death” and that nonformation of plasmodesmata, which facilitates the transport of materials between cells, affects prothallial cell death.

Publications

Terasaka O, Hiratsuka R. A new pattern of phragmoplast growth brings about asymmetric cell

division in the pollen of *Ephedra*. *Nihon Kafun Gakkai Kaishi*. 2011; **57**: 5-15.

Physics

Tsuyoshi Ueta, *Professor*

Katsumi Kasono, *Assistant Professor*

General Summary

1. Since 1998, by introducing lattice vibration in photonic crystals artificially, we have investigated the direct interaction between an incident light and lattice vibration and have found that the incident light is amplified. We have proposed a metal photonic crystal as a system for enhancing the dynamic Casimir effect, and have been investigating the properties of the dynamic Casimir effect within a metal photonic crystal.
2. Phase transitions, critical phenomena, interacting many-body systems, computer simulation.

Research Activities

The photon-phonon interaction within a lattice-vibrating photonic crystal

In 2011, the phenomenon of photon-phonon interaction has been investigated within metal photonic crystals, and the very strong resonance amplification of an incident light has been found. We have presented our results at the International Conference on Materials for Advanced Technologies 2011 and have also published a paper in a journal.

Monte Carlo simulations of the ferromagnetic Potts models

We calculated the discontinuity of magnetization 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, dice, and triangular lattices. The results show that discontinuity of magnetization has no universality between the different lattices.

Publications

Fujii G¹, Matsumoto T¹, Takahashi T¹, Ueta T¹ (Nagoya Univ). Finite-element analysis of lasing modes within photonic random media. *J Phys B At Mol Opt Phys.* 2012; **45**: 085404. Epub 2012 Mar 30.

Fujii G¹, Matsumoto T¹, Takahashi T¹, Ueta T¹ (Nagoya Univ). Study on transition from photonic-crystal laser to random laser. *Opt Express.* 2012; **20**: 7300-15.

Fujii G, Matsumoto T, Takahashi T, Ueta T. A study on effect of filling factor for laser action in dielectric random media. *Appl Phys A Mater Sci Process.* 2012; **107**: 35-42. Epub 2012 Jan 6.

Ueta, T. Two-dimensional electron systems in magnetic fields: the current equipartition law. *Advances in Condensed Matter Physics.* 2011; **2011**: 104843.

Ueta T. Amplification of light in one-dimensional vibrating metal photonic crystal. *Appl Phys A*

Mater Sci Process. 2012; **107**: 55-9. Epub 2011 Dec 24.

Fujii T, Matsumoto T, Takahashi T, Yamada T, Ueta T. Study on electric intensity dependency of laser action in randomly distributed dielectric rod (in Japanese). *Denkigakkai Ronbunshi C.* 2012; **132**: 89-95.

Ueta T. FDM Analysis of quantum transport properties in microwave with mathematica (in Japanese). *Keisan Suri Kogaku Ronbunshu.* 2011; **11**: 7-12.

Fujii G, Matsuda H, Matsumoto T, Takahashi T, Yamada T, Ueta T. Finite element analysis for laser action in honeycomb photonic crystals with random dangling bonds (in Japanese). *Keisan Suri Kogaku Ronbunshu.* 2011; **11**: 89-94.

Ueta T. Lattice vibration frequency dependence of amplification of light in a 1D metal photonic crystal (in Japanese). *Nihon Kikai Gakkai Keisan*

Rikigaku Koenkai Ronbunshu. 2011; **24**: 1309.
Fujii G, Matsumoto T, Takahashi T, Yamada T, Ueta T. A study on the transition from photonic-

crystal laser to random laser (in Japanese). *Nihon Kikai Gakkai Keisan Rikigaku Koenkai Ronbunshu*. 2011; **24**: 1303.

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

Theoretical analysis of molecular interactions of Cu(II) bis(diarylpropanedionedioate) complexes with benzene ligands

Aene-polyfluoroarene interaction was found between the Cu(II) bis[3-oxo-1,3-bis(pentafluorophenyl)prop-1-en-1-olate] complex and benzene as the guest molecule. Density function theory (DFT) calculation suggested a weak interaction was present between the fluorine-containing aryl diketonate complexes of a specific conformation and the guest molecule. However, DFT calculation is not able to evaluate molecular interactions precisely. Second-order Møller-Plesset (MP2) calculations are more reliable, although the computation time for such a large molecule is long. To reduce MP2 computation time, more concise model complexes, acetylacetonate and hexafluoroacetylacetonate, were used. The MP2 calculation predicted Cu²⁺- π interaction in the fluorinated complex more precisely, although MP2 calculations of large complexes with fluorinated aryl ligands would take several years.

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 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 salts are the most effective among the carboxylate salts of amino acids tested for coupling with butoxycarbonate-amino acid active esters in an organic solvent, such as dimethylformamide or dimethylsulfoxide.

Publications

Hori A¹, Kikuchi T¹, Miyamoto K¹, Okano T, Kachi-Terajima C², Sakaguchi H¹ (Kitasato Univ, ²Toho Univ). Transformation of a cull thiazolo-1,2,4-triazine derivative from a metastable

coordination network to a monomer in solution and vapor conditions. *Eur J Inorg Chem.* 2011; **2011**: 3059-66.

Social Science (Law)

Ryuichi Ozawa, *Professor*

General Summary

Problems of constitutional law in present-day Japan

Research Activities

I presented “Reexamination of Constitutional Principles of Finance” at a symposium of the Japan Association of Public Finance Law (May 28, 2011).

Publications

Ozawa R. Democratic Party's government and parliamentary democracy (in Japanese). *Nihon no Kagakusha.* 2011; **46**(7): 47-53.

Ozawa R. Democratic Party's government and future parliamentary democracy (in Japanese). *Gyozaisei Kenkyu.* 2011; **80**: 22-31.

Ozawa R. Posting at private apartment house and law (in Japanese). *Horitsujiho.* 2012; **84**(2): 69-73.

Japanese). In: Kashiwabara H. *Jichitai populism wo tou.* Tokyo: Jichitai kenkyusha; 2012. p. 73-102.

Ozawa R. Why Diet can't deal with? (in Japanese) In: Mori H, Shirafuji H, Aikyou K, editors. *3.11 to kenpo.* Tokyo: Nihon Hyoronsha; 2012. p. 69-77.

Ozawa R. Reexamination of constitutional principles of finances (in Japanese). In: Nihon Zaisei-hogakkai, editor. *Zaisei kenpo no saikento.* Tokyo: Zenkoku Kaikeishokuin Kyokai; 2012. p. 32-46.

Reviews and Books

Ozawa R. Future of Diet and local parliament (in

Human Science

Takao Fukuyama, *Professor*

General Summary

The study of Western philosophy and ethics

Research Activities

Essential Encounter

An encounter provides an impact, 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? 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 keep a proud-hearted attitude.

Japanese

Ikuko Noro, *Professor*

General Summary

Development of suitable documents for patients written in Japanese

I conducted studies to develop suitable documents for patients written in Japanese as a member of the "Project for Patient-Friendly Documents," which is a part of "Empirical Research and Action Research for the Development of the Patient-Professional Relationship in a New Paradigm Aiming at 'Thinking Health Together'," supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology.

A study of the effects on patients of the comprehensibility of oral explanation and physician attitudes during informed consent

A survey was performed to investigate how physicians' attitudes during verbal explanations of informed consent, as well as the comprehensibility of those explanations, affect understanding, emotion, and decision-making in patients of varying ages.

Research Activities

Development of suitable documents for patients written in Japanese

First, our project group developed "A Manual for Physicians to Write Suitable Documents

for Patients,” in which important points were explained for writing comprehensible documents for patients. Second, we asked 30 physicians to write documents by referring to the manual. Third, we performed a survey to investigate how patients and physicians assessed these documents. I presented the results at the “Thinking Health Together” Symposium held at Rikkyo University in November 2011.

A study of the effects on patients of the comprehensibility of oral explanation and physician attitudes during informed consent

Our research revealed that patients’ understanding was affected primarily by the comprehensibility of verbal explanations. However, the level of understanding was also affected by physician attitudes, which were also the primary factor affecting patients’ emotions during the encounter. Effects on decision-making varied with age: young patients’ decision-making was affected by comprehensibility, whereas decision-making by middle-aged and older patients was affected more by physician attitude. Both comprehensible explanations and a friendly attitude are crucial for appropriate informed consent. I presented these results at the Medical Communication Symposium held at University of Tokyo in October 2011.

Reviews and Books

Noro I, Abe K, Ishikawa H. The Roter Method of Interaction Process Analysis System (RIAS) (in Japanese). 2nd ed. Nagoya: Sankeisha; 2011.

Mathematics

Katsuya Yokoi, *Professor*

Hiroshi Shiraishi, *Assistant Professor*

General Summary

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

Research Activities

- I. We summarized the properties of nonperiodic points in an infinite omega-limit set of interval maps. We studied omega-limit sets of nonautonomous discrete dynamic systems.
- II. We discussed a resampling procedure in the estimation of optimal portfolios when the financial returns are a class of time-varying autoregressive conditional heteroskedasticity processes. On the basis of the bootstrap method, we constructed a mean-variance optimal portfolio estimator and derived its asymptotic property.

Reviews and Books

Yokoi K. Non-periodic points in an infinite omega-limit set: a theorem of Sarkovskii (in Japa-

nese). *Kyoto University, Kyoto Daigaku Suri Kaiseki Kenkyusho Kokyuroku*. 2012; **1781**: 108-10.

English

Osamu Ohara, *Professor*

Tetsuro Fujii, *Associate Professor*

General Summary

English audiovisual education and the history of the English language (Ohara)

English Language communication and education: Material analysis and development (Fujii)

Ohara continued his study of graphology and morphology in the letters of the Celys and the Stonors of the fifteenth century. Ohara also continued a study of how to make useful digital images and XML files of fifteenth century manuscripts, especially of the *Stonor Letters*.

Fujii joined a project team to compile English textbooks for high school English classes: English Communication I, II, and III. In addition to compiling the textbooks, Fujii is working on teacher's manuals and exercise materials. He studied example sentences in English learners' dictionaries and identified the types of sentences that are conducive to learning.

Research Activities

Ohara visited the National Archives in the United Kingdom and studied the *Stonor Letters*. Making use of the results of the study, Ohara continued his research of the graphemes of the letters of the Stonors.

Fujii analyzed and collected authentic English materials to meet the level and the needs of high-school textbooks based on current teaching methodologies, 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. The first textbook in the series, *World Trek—English Communication I*, received approval from the Ministry and is to be used in high schools from April 2013.

Fujii presented about learner-friendly example sentences in dictionaries in “The Usability of Example Sentences Found in English Dictionaries” at the 13th Japan Association of College English Teachers - English Dictionary Research Workshop in Tokyo in March 2012.

First Foreign Languages

Yoshiaki Shirasaki, *Professor*

General Summery

1. I have continued educational activities for the purpose of verbal and nonverbal communication. These activities are also connected with the aim of developing moral and philosophical abilities in the field of intellectual relationships.
2. I have also studied Friedrich Schiller. This is a sort of paradigm innovation for this classic and ideological poet. Lang regarded Schiller to be a classical poet, and he was most productive writer of romantic operas. This is the reason I have continued this study.