ACTIVITIES OF JOINT USAGE/RESEARCH CENTER

JURC Cooperative Research Subjects 2013

(1 April 2013 ~ 31 March 2014)

STARTING-UP SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

Diagnostics of Li-Ion Batteries with Laser-Accelerated Protons
KATO, Yoshiaki, The Graduate School for the Cretion of New Photonics Industries
Host in JURC SAKABE, Shuji

Development of Negative Thermal Expansion Material Based on a Perovskite $BiNiO_3$
AZUMA, Masaki, Materials and Structures Laboratory, Tokyo Institute of Technology
Host in JURC SHIMAKAWA, Yuichi

Development of Iron Catalysts Ligated by Silyl-Perturbed Low-Coordinated Phosphines
ITO, Shigekazu, Graduate School of Science and Engineering, Tokyo Institute of Technology
Host in JURC OZAWA, Fumiyuki

Optical Functionalities of Silicon Photonic Crystals
TAKAHASHI, Yasushi, Research Organization for the 21st Century, Osaka Prefecture University
Host in JURC KANEMITSU, Yoshihiko

Synthesis of Sugar-Acetylenes by Iron-Catalyzed Cross-Coupling and Study on Their Stimulus-Response Luminescence
ORITA, Akihiro, Department of Applied Chemistry, Okayama University
Host in JURC NAKAMURA, Masaharu

Mechanistic Studies on the Iron Catalyzed Carbon-carbon Bond Forming Reactions Based on the Solution-phase X-ray Absorption Spectroscopy
NAGASHIMA, Hideo, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC NAKAMURA, Masaharu

Development of Ruthenium-Complex-Bound Amino Acids and Peptides and Their Application to Oxidative Degradation of Wooden Biomasses
WATANABE, Takashi, Research Institute for Sustainable Humanosphere, Kyoto University
Host in JURC NAKAMURA, Masaharu

Co-clustering of Biological Datasets for Personalized Medicine
SHIGA, Motoki, Informatics Course, Department of Electrical, Electronic and Computer Engineering, Faculty of Engineering, Gifu University
Host in JURC MAMITSUKA, Hiroshi

Finding Frequent Similar Regions from Genome Sequences
NAKAMURA, Atsuyoshi, Graduate School of Information Science and Technology, Hokkaido University
Host in JURC MAMITSUKA, Hiroshi

Analysis and Control of Complex Bipartite Networks
JOSE, C. Nacher, Department of Science, Toho University
Host in JURC AKUTSU, Tatsuya

Probabilistic Methods for Analysis on Protein Interaction Networks
MARUYAMA, Osamu, Institute of Mathematics for Industry, Kyushu University
Host in JURC AKUTSU, Tatsuya

Pathway Database for Human Gut Microbiome
YAMADA, Takuji, Graduate School of Bioscience and Biotechnology, Tokyo Institute of Technology
Host in JURC GOTO, Susumu

Interaction of Concentrated Polymer Brush Grafted Fibers with Cells
YOSHIKAWA, Chiaki, World Premier International (WPI) Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS)
Host in JURC TSUJII, Yoshinobu

Chitin Nanofiber Polymer Brush for Novel Soft Materials via Self-assemble Approach
IFUKU, Shinsuke, Graduate School of Engineering, Tottori University
Host in JURC TSUJII, Yoshinobu

Novel Synthesis of Photoacoustic Contrast Agent Using Functional Metal Nanoparticle
ISHIHARA, Miya, National Defense Medical College
Host in JURC TERANISHI,Toshiharu

Development of Novel Endosomal Escaping Peptides
KOGURE, Kentaro, Department of Biophysical Chemistry, Kyoto Pharmaceutical University
Host in JURC FUTAKI, Shiroh

Role of Water in Motor Function of F1 Protein
IKEGUCHI, Mitsunori, Graduate School in Nanobioscience, Yokohama City University
Host in JURC MATUBAYASI, Nobuyuki

Analysis of Molecular Structure in a Monolayer of Fluorinated Amphiphilic Molecules
SONOYAMA, Masashi, Graduate School of Engineering, Gunma University
Host in JURC HASEGAWA, Takeshi

Analysis of Molecular Adsorption of Water and Protein on a Stereo-Controlled Acrylamide Polymers
KATSUMOTO, Yukiteru, Graduate School of Science, Hiroshima University
Host in JURC HASEGAWA, Takeshi

Studies on Highly Efficient and Colorful Dye-sensitized Solar Cell Device Using Designed Anthocyanin
YOSHIDA, Kumi, Department of Complex Systems Science, Guraduate School of Information Science, Nagoya University
Host in JURC MURATA, Yasujiro

Investigation of Extraction Behaviors of Metal Ions in Liquid-liquid Extraction Systems Using a Novel Multidentate Ligand
MUKAI, Hiroshi, Faculty of Education, Kyoto University of Education
Host in JURC SOHRIN, Yoshiki

Study on Intermolecular Contacts of Halogen and/or Chalcogen Atoms in Organic Crystals
TSUZUKI, Seiji, Nanosystem Research Institute, The National Institute of Advanced Industrial Science and Technology (AIST)
Host in JURC SATO, Naoki

Elucidation of Crystallization Process of Polyurea
MATSUBA, Go, Department of Polymer Science and Engineering, Faculty of Science and Engineering, Yamagata University
Host in JURC KANAYA, Toshiji

Studies on Crystallization Process of Poly(lactic acid)/Nanofiber Composites
KAWAI, Takahiko, Department of Production Science and Technology, Graduate School of Engineering, Gunma University
Host in JURC KANAYA, Toshiji

EXPANDING SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

X-Ray Structure Analysis of Reaction Mechanism of Catabolic Enzymes
OIKAWA, Tadao, Faculty of Chemistry, Materials and Bioengineering, Kansai University
Host in JURC HATA, Yasuo

Research and Development on Future Accelerator toward ILC Projct
HAYANO, Hitoshi, Accelerator Laboratory, High Energy Accelerator Research Organization
Host in JURC IWASHITA, Yoshihisa

Development for Fundamental Physics with Neutrons
KITAGUCHI, Masaaki, Graduate School of Science, Nagoya University
Host in JURC IWASHITA, Yoshihisa

Development of Fluorescent Organosilicon Compounds and Elucidation of Emission Mechanism
MAEDA, Hajime, School of Chemistry, College of Science and Engineering, Kanazawa University
Host in JURC TOSHIMITSU, Akio

Development of Methods for Discrimination and Syntheses of Chiral Molecules with Phosphoroselenoic Acid Derivatives Bearing a Binaphthyl Group
MURAI, Toshiaki, Faculty of Engineering, Gifu University
Host in JURC TOSHIMITSU, Akio

Synthesis of Novel Heterocyclic Compounds Based on High Dienophilicity of Chalcogen Multiple Bonds
SEGI, Masahito, School of Chemistry, College of Science and Engineering, Kanazawa University
Host in JURC TOSHIMITSU, Akio

Bulk Hetero Junction Photovoltaic Devices Composed of Novel Donar Polymer and Novel Fullerene Derivatives
IE, Yutaka, The Institute of Scientific and Industrial Research, Department of Soft Nanomaterials, Nanoscience and Nanotechnology Center, Osaka University
Host in JURC MURATA, Yasujiro

Reactivity of an Ethynyl Cation on the Tetrairon Core as a Lewis Acid
OKAZAKI, Masaaki, Graduate School of Science and Technology, Hirosaki University
Host in JURC OZAWA, Fumiyuki

Construction of Fullerene Organization via Molecular Recognition
HAINO, Takeharu, Graduate School of Science, Hiroshima University
Host in JURC YAMAGO, Shigeru

Synthesis of Cyclic π-Conjugated Molecules and Their Properties
SUZUKI, Toshiyasu, Institute for Molecular Science, National Institute of Natural Sciences
Host in JURC YAMAGO, Shigeru

Spin Dynamics in Group-IV Semiconductor Nanostructures
FUKATSU, Susumu, Graduate School of Arts and Science, The University of Tokyo
Host in JURC TAYAGAKI, Takeshi

Development and Application of Functional Evaluation System in Genome and Metagenome
TAKAMI, Hideto, Institute of Biogeoscience, Japan Agency for Marine-Earth Science and Technology
Host in JURC GOTO, Susumu

Synthesis, Structure and Electronic Properties of Carbazolophane-Polymers
TANI, Keita, Division of Natural Science, Osaka Kyoiku University
Host in JURC TSUJII, Yoshinobu

Development of Novel 3-Dimensional π-Extended Molecules Directed toward Electronic Materials
SUGA, Seiji, Graduate School of Natural Science and Technology, Okayama University
Host in JURC MURATA, Yasujiro

The Mechanism of Action of Aplyronine A
KIGOSHI, Hideo, Faculty of Pure and Applied Sciences, University of Tsukuba
Host in JURC UESUGI, Motonari

Development of Self-cleavable Peptide Linkers
HAYASHI, Yoshio, Department of Medicinal Chemistry, Tokyo University of Pharmacy and Life Sciences
Host in JURC FUTAKI, Shiroh

Contribution of Constraint Release Mechanism to Dielectric and Viscoelastic Relaxation of Entangled Type-A Polymers
URAKAWA, Osamu, Graduate School of Science, Osaka University
Host in JURC MATSUMIYA, Yumi

Making of the Vertical Cross Section of Particulate Bioactive Trace Metals in the Japan Sea
NAKAGUCHI, Yuzuru, Faculty of Science and Engineering, Kinki University
Host in JURC SOHRIN, Yoshiki

STARTING-UP SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Synthesis and Functions of Multi-Bridged Naphthalene Oligomers
KURAMOCHI, Koji, Graduate School of Life and Environmental Sciences, Kyoto Prefectural University
Host in JURC KAWABATA, Takeo

Study on the Regulatory Mechanism of Plant Epidermal Cell Differentiation
TOMINAGA, Rumi, Interdisciplinary Research Organization, University of Miyazaki
Host in JURC AOYAMA, Takashi

Dynamics of the Transcription Factor ARR1 Responding to Cytokinin
KIM, Jong-Myong, Plant Science Center, RIKEN
Host in JURC AOYAMA, Takashi

Promotion of Wound Healing by a Synthetic Cell-adhesion Molecule
NISHIKAWA, Makiya, Graduate School of Pharmaceutical Sciences, Kyoto University
Host in JURC UESUGI, Motonari

Study for Tunnel Magnetoresistive Effect and Local Magnetism of Magnetic Tunnel Junctions Using Co_2MnSn Heusler Alloy Electrodes Prepared by Atomically-controlled Alternate Deposition
TANAKA, Masaaki, Department of Engineering Physics, Electronics and Mechanics, Nagoya Institute of Technology
Host in JURC ONO, Teruo

Development of Methods to Measure Four Wave-mixing Process in Vacuum
HONMA, Kensuke, Graduate School of Science, Hiroshima University
Host in JURC SAKABE, Shuji

Complementary Analyses of Water Structures in Biological Systems by Broadband Dielectric Spectroscopy with Other Observation Techniques
YAGIHARA, Shin, Department of Physics, School of Science, Tokai University
Host in JURC ASAMI, Koji

Identification and Functional Analysis of Bacterial Proteins Involved in Metal Metabolism
KURATA, Atsushi, Department of Applied Biological Chemistry, Faculty of Agriculture, Kinki University
Host in JURC KURIHARA, Tatsuo

Prepararion of Oxide Glass Scintillator
YANAGIDA, Takayuki, Kyushu Institute of Technology
Host in JURC MASAI, Hirokazu

EXPANDING SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Development of Novel Inducers of Cellular Anti-oxidative Stress Response by Inhibition of Cystine/Glutamate Antiporter xCT and γ-Glutamyltranspeptidase (GGT)
SATO, Hideyo, Department of Food and Applited Life Sciences, Faculty of Agriculture, Yamagata University
Host in JURC HIRATAKE, Jun

Exploration of Pyroelectricity in Charge-ordered Perovskite
TAKAHASHI, Ryota, Institute for Solid State Physics, The University of Tokyo
Host in JURC KAN, Daisuke

Entanglement Relaxation of Novel Tadpole-shaped Polymers
TAKANO, Atsushi, Graduate School of Engineering, Nagoya University
Host in JURC WATANABE, Hiroshi

Development of Organic Optoelectronics Based on Material Design Guided by Microwave Conductivity Technique
SAEKI, Akinori, Graduate School of Engineering, Osaka University
Host in JURC WAKAMIYA, Atsushi

Search for Biologically Active Compounds from a Synthetic Library of Nitogen Heterocycles with Chiral Tetrasubstituted Carbon
ISHIBASHI, Masami, Graduate School of Pharmaceutical Sciences, Chiba University
Host in JURC KAWABATA, Takeo

Efficient Synthesis of π-Conjugated Polymers via Direct Arylation
KANBARA, Takaki, Graduate School of Pure and Applied Sciences, Tsukuba Research Center for Interdisciplinary Materials Science, University of Tsukuba
Host in JURC OZAWA, Fumiyuki

The Control of the Antiphase Boundary in Ferrimagnetic Spinel Ultrathin Films
NAGAHAMA, Taro, Laboratory of Advanced Materials Chemistry, Graduate School of Engineering, Hokkaido University
Host in JURC ONO, Teruo

New Optoelectronic Properties Arising from Nanoparticle Arrays Fabricated on 1 nm Periodic Uneven Structure
ONOE, Jun, Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology
Host in JURC TERANISHI,Toshiharu

Intense THz Emission for Nonlinear Interaction Physics
NAGASHIMA, Takeshi, Institute of Laser Engineering, Osaka University
Host in JURC HASHIDA, Masaki

Enzymatic Production of Chiral Amine Compounds
MIHARA, Hisaaki, Department of Biotechnology, College of Life Sciences, Ritsumeikan University
Host in JURC KURIHARA,Tatsuo

Development of Artificial Receptor-ligand Systems to Regulate Cellular Uptake of Therapeutic Molecules
NAKASE, Ikuhiko, Nanoscience and Nanotechnology Research Center, Osaka Prefecture University
Host in JURC FUTAKI, Shiroh

Adsorption Behavior of Cesium Ion on Soil Using Solid State NMR
ONO, Yuji, Fukushima Agricultural Technology Centre
Host in JURC TOKUDA, Yomei

R&Ds for Precision Measurement of Muon g-2 / EDM
MIBE, Tsutomu, Institute of Particle and Nuclear Studies, High Energy Accelerator Research Organization
Host in JURC IWASHITA, Yoshihisa

SUBJECTS FOCUSING OF JOINT USAGE OF JURC/ICR FACILITIES

Synthesis and Structure of Main Group Element-Protected Metal Nanoparticles
FUJIHARA, Hisashi, Department of Chemistry, Fuculty of Science and Engineering, Kinki University
Host in JURC TOKITOH, Norihiro

Synthesis and Structure of Color-tunable Organotelluronium Salts
MINOURA, Mao, School of Science, Kitasato University
Host in JURC TOKITOH, Norihiro

Experimental Electron Density Distribution Analysis of Small Cyclic Heavier Main Group Element Compounds
HASHIZUME, Daisuke, Materials Characterization Support Unit, RIKEN Center for Emergent Matter Science, RIKEN
Host in JURC TOKITOH, Norihiro

Syntheses and Properties of Novel Aromatic Compounds Containing Phosphorus Atoms
NAGAHORA, Noriyoshi, Department of Chemistry, Faculty of Science, Fukuoka University
Host in JURC SASAMORI, Takahiro

Physicochemical Properties of Novel Aromatic Compounds with Heteroatoms
SAITO, Masaichi, Department of Chemistry, Graduate School of Science and Engineering, Saitama University
Host in JURC TOKITOH, Norihiro

Multinuclear-NMR-study for Morphology Control of Alternating Metal-oxo Oligomers
TAKAHASHI, Masahide, Graduate School of Engineering, Osaka Prefecture University
Host in JURC KAJI, Hironori

Structure and Function of Polymer for Solar Cell
SATO, Toshifumi, Graduate School of Engineering, Hokkaido University
Host in JURC KAJI, Hironori

AFM Observation of the Heterobimetallic Supramolecular Polymers Placed on the Graphite Substrate via a Pulse Valve
TAKAJO, Daisuke, Graduate School of Science, Osaka University
Host in JURC KURATA, Hiroki

Nano-electron Spectroscopic Study of Helium Bubbles in Si
MIYAMOTO, Mitsutaka, Interdisciplinary Faculty of Science and Engineering, Shimane University
Host in JURC KURATA, Hiroki

Fabrication of Metal Nano-ring by Soft-template Method
KAWAI, Takeshi, Faculty of Engineering, Tokyo University of Science
Host in JURC KURATA, Hiroki

SUBJECTS ENCOURAGING JOINT PROGRAM

Electronic States and Local Structures in Transition Metal Oxides Using Synchrotron Radiated X-rays
MIZUMAKI, Masaichiro, Japan Synchrotron Radiation Research Institute, SPring-8
Host in JURC SHIMAKAWA, Yuichi

The Ninth International Workshop for East Asian Young Rheologists
TAKAHASHI, Yoshiaki, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC WATANABE, Hiroshi

JURC Publications

(until 31 May 2013)

Understanding the Substrate Specificity of Conventional Calpains

Sorimachi, H.; Mamitsuka, H.; Ono, Y., *Biological Chemistry*, **393,** 853-871 (2012).

Abstract

Calpains are intracellular Ca(2+)-dependent Cys proteases that play important roles in a wide range of biological phenomena via the limited proteolysis of their substrates. Genetic defects in calpain genes cause lethality and/or functional deficits in many organisms, including humans. Despite their biological importance, the mechanisms underlying the action of calpains, particularly of their substrate specificities, remain largely unknown. Studies show that certain sequence preferences influence calpain substrate recognition, and some properties of amino acids have been related successfully to substrate specificity and to the calpains' 3D structure. The full spectrum of this substrate specificity, however, has not been clarified using standard sequence analysis algorithms, e.g., the position-specific scoringmatrix method. More advanced bioinformatics techniques were used recently to identify the substrate specificities of calpains and to develop a predictor for calpain cleavage sites, demonstrating the potential of combining empirical data acquisition and machine learning.

This review discusses the calpains' substrate specificities, introducing the benefits of bioinformatics applications. In conclusion, machine learning has led to the development of useful predictors for calpain cleavage sites, although the accuracy of the predictions still needs improvement. Machine learning has also elucidated information about the properties of calpains' substrate specificities, including a preference for sequences over secondary structures and the existence of a substrate specificity difference between two similar conventional calpains, which has never been indicated biochemically.

Characterization of Thiol-functionalized Oligo(phenylene-ethynylene)-Protected Au Nanoparticles by Scanning Tunneling Microscopy and Spectroscopy

Koo, H.; Kano, S.; Tanaka, D.; Sakamoto, M.; Teranishi, T.; Cho, G.; Majima, Y., *Appl. Phys. Lett.*, **101,** 083115 (2012).

Abstract

The electrical properties of Aunanoparticles protected by thiol-functionalized oligo(phenylene-ethynylene) (OPE), 1,4-bis-(3-mercapto-phenylethynyl)benzene have been investigated by scanning tunneling microscopy(STM) and scanning tunneling spectroscopy (STS). The STM and scanning electron microscopy images of chemisorbed OPE-protected Aunanoparticles on Au(111) surface were similar, and the densities were almost identical. OPE-protected Aunanoparticles exhibited stochastic conductance switching behaviors, and current-voltage (I–V) and log I–Vcharacteristics by STS at 100 K showed Coulomb blockade behaviors. The charging energy of Aunanoparticles was as high as 0.57 eV when the core diameter was 2.1 nm. Our results are significant for single-electron transistor memory applications.

Selective Synthesis and Crystal Structure of [10]Cycloparaphenylene

Kayahara, E.; Sakamoto, Y.; Suzuki, T.; Yamago, S., *Org. Lett.*, **14,** 3284-3287 (2012).

Abstract

[10]Cycloparaphenylene ([10]CPP) was selectively synthesized in four steps in 13% overall yield from commercially available 4,40-diiodobiphenyl by using mono-I–Sn exchange, Sn–Pt transmetalation, I–Pd exchange, and subsequent oxidative coupling reactions. The single-crystal X-ray structure of [10]CPP is described.

Current-Induced Magnetic Domain Wall Motion in a Co/Ni Nanowire with Structural Inversion Asymmetry

Koyama, T.; Hata, H.; Kim, K.-J.; Moriyama, T.; Tanigawa, H.; Suzuki, T.; Nakatani, Y.; Chiba, D.; Ono, T., *Applied Physics Express*, **6,** [033001-1]-[033001-3] (2013).

Abstract

The authors have investigated the current-induced magnetic domain wall (DW) motion in perpendicularly magnetized Co/Ni nanowire with structural inversion asymmetry (SIA). In this system, DW motion to the direction of electric current flow, not electron flow, and high DW velocity up to 110 m/s were confirmed, which have never been observed in Co/Ni systems without SIA. In addition, we found that the DW velocity showed a strong dependence on the perpendicular magnetic field in the range of ±100 Oe. These results suggest that DW in the Co/Ni nanowire with SIA moves in the steady mode, not in the precessional mode.

X-Ray Observation of a Helium Atom and Placing a Nitrogen Atom inside $He@C_{60}$ and $He@C_{70}$

Morinaka, Y.; Sato, S.; Wakamiya, A.; Nikawa, H.; Mizorogi, N.; Tanabe, F.; Murata, M.; Komatsu, K.; Furukawa, K.; Kato, T.; Nagase, S.; Akasaka, T.; Murata, Y., *Nat. Commun.*, **4,** [1554-1]-[1554-5] (2013).

Abstract

X-ray diffraction study of $He@C_{60}$ is demonstrated as the clear observation of a single helium atom inside C_{60}. In addition, the close packing of a helium atom and a nitrogen atom inside fullerenes was realized by the use of two stepwise insertion techniques, i.e. ''molecular surgery'' to synthesize the fullerenes encapsulating a helium atom followed by ''nitrogen radio-frequency plasma'' methods to generate the fullerenes encapsulating both helium and nitrogen atoms. The ESR analysis revealed that the encapsulated helium atom gives a small but detectable influence on the electronic properties of the highly reactive nitrogen atom coexisting inside the fullerenes, indicating the new usage of helium for controlling electronic properties of reactive species.