

List of Dissertation Abstract (Environment and Natural Sciences Life Sciences Course)

Name	Supervisor	Title	Abstract
Akiho GOTO	Takashi AMEMIYA	Synthesis and characterization of silver nanoparticles with the use of natural fat -Green chemistry by using natural oils and fats-	Silver nanoparticles with the use of natural oils and fats were produced by non-aqueous heat decomposition. By this experiment, it is thought that the silver particles were protected by a cover of fatty acid base. In the past, the silver nanoparticles were synthesized successfully with the use of single fatty acids. In the present study, it was verified that the silver nanoparticles were composed with natural fat for example olive oil, palm oil canola oil. Specifically, it was observed high coat ability and viscous property in silver nanoparticle with olive oil.
Keita AKAZAWA	Takashi AMEMIYA	Gold nanoparticle formation by photochemical reaction of recycling reductants	Gold nanoparticles (AuNPs) are used in various fields such as catalysts, medicals, and biosensors. Synthesis of AuNPs by reduction in liquid creates by-products including oxidized forms of reductants. These oxidants have to be reduced in order to reuse them as reductants. Hydroquinone (HQ) is suitable as a reusable reductant because benzoquinone (BQ: the oxidized form of HQ) can be reduced to HQ simply by photochemical reductions. We thus focused on HQ/BQ redox cycles. In our system, the more AuNPs were introduced before the reaction, the smaller AuNPs were obtained. In this study, we propose a new method of controlling the size of AuNPs.
Takuma ASANO	Takashi AMEMIYA	Extra cellular pH dependency of glycolytic oscillations in HeLa cervical cancer cells.	Acidic extracellular pH (pHe) is a feature of tumor tissue. Extracellular acidosis improves cancer growth and proliferation. Glycolytic oscillations reflect the feature of cancer metabolism. Therefore, relationships between cancer metabolism and pHe were investigated by glycolytic oscillations. We found the ratio of oscillatory cells was changed by pHe. The oscillatory ratio was high around pHe 7, and highest at pHe 7.2. However, the oscillatory ratio had high deviations. There's no correlation between the oscillatory ratio and the periods. Thus, we conclude that pHe does not influence on reaction rates but affects glucose uptakes.
Shuto ABE	Kazuyuki HIRATSUKA	Evaluation of transcription factor and systematic regulation of gene expression by dCas9/sgRNA system in plant cells	dCas9/sgRNA system is known as a transcription regulation technique by DNA targeting of CRISPR/Cas9. In this study, we applied dCas9/sgRNA system to transcription regulation in plant cells and discovered a new transcription activator which function on this system. In addition, we attempted transactivation of any genes and developed new techniques for expanding applicability of this system. Knowledge obtained by this study will contribute to planned modification techniques for higher plants.

Momoko ABE	Kazuyuki HIRATSUKA	Characterization of Novel Plant Activators Identified by High-throughput Screening Using Luminescence Reporter Genes	Plants are exposed to various kinds of pathogens at all times, but they have unique disease response mechanism and Systemic Acquired Resistance (SAR) is one of the famous mechanisms. The chemicals that enhance the SAR is called as Plant activator and they are widely noticed by many researchers recent years, however, it takes so much time and they are rarely detected from among enormous amount of materials. We have developed the high-throughput screening system (HTS) using luminescence reporter gene, then, I found some candidates for novel plant activator and their characterization through some tests.
Kazuki ISHIDA	Kazuyuki HIRATSUKA	Study on the screening system to plant Biostimulants	We developed the gene-expression monitoring system with luciferase reporter fused promoter region of a target gene. This system is applied to high-throughput screening for new bioactive compounds. However, it takes time and effort to produce transformed plants, so further higher throughput was required. Therefore, in this research we tried to develop a new system using wild-type.
Shigeto OSUMI	Shinya MATSUMOTO	Two crystal polymorphs of a chlorinated diketo-pyrrolo-pyrrole derivative with hexyl group on amino position	Diketo-pyrrolo-pyrrole (DPP) derivatives have been studied as a candidate for opto-electronic materials in addition to their commercial importance as an organic pigment. Some DPP derivatives are also reported to have crystal polymorphs with different solid-state properties. Hydrogen bonds and conformational flexibility are known as a parameter contributes to polymorphic occurrence of molecular crystals including organic dyes. Recently it has been found that modification with chlorine and bromine is also expected to promote polymorphic expression. We made an attempt to investigate polymorph occurrence on a chlorinated DPP derivative with a hexyl substituent on one amino group. We obtained two types of crystals in different colors and confirmed that these are crystal polymorphs by SCXRD. Their crystal structures and optical properties are reported in this paper.
Daichi OMATA	Kiyoshi HONDA	Organophotoredox promoted [4+2] cycloaddition of o-quinone methides under green light irradiation	An intermolecular oxa-[4+2] cycloaddition reaction promoted by a thioxanthylum organophotoredox catalyst under irradiation with green light has been developed. The reaction of ortho-quinone methides with styrenes smoothly affords the desired cycloadducts. In particular, styrenes bearing electron-donating groups are efficiently transformed in this reaction. This method represents a sustainable way to carry out oxa-[4+2] cycloaddition reactions using only a catalytic amount of a photo-catalyst and visible light.

Yui KAMEYAMA	Takashi AMEMIYA	Influence of alcohols on glycolytic oscillations and their synchronization	Glycolytic oscillations are known to synchronize by acetaldehyde and so on. We found alcohol promotes the synchronization of glycolytic oscillations. Therefore we quantitatively evaluated the influence of alcohol. Our results demonstrate that synchrony is changed by alcohol chain length and the concentration.
Junna KAWAGUCHI	Shinya MATSUMOTO	Occurrence of polymorphs and pseudopolymorphs of a diketopyrrolo-pyrrole derivative with propyl group on amino position.	We made an attempt to obtain polymorphs of <i>N</i> -monopropylated diketopyrrolopyrrole dye and obtained eight different kinds of crystals using various solvent conditions in crystallization. The obtained crystals showed several differences in colour and shape. After analysing their crystal structures, we found three differently coloured polymorphs and five pseudopolymorphs with same red colour. In this paper, physical properties of eight crystals were investigated based on the crystal structures.
Nobuyuki KAWACHI	Shinichi OGATA	Localization of the exogenous subunits of Complex IV of mitochondrial electron transport chain	ATP is synthesized in the electron transport system in mitochondria in cells, and the subunit protein of complex IV has an important role to control its activity. In order to analyze its function, this study explores the subcellular localization of the expressed exogenous subunit protein and the conditions necessary to show localization similar to the endogenous protein.
Takuya KIKUCHI	Shinya MATSUMOTO	The investigation of the black solids prepared from fluoran dye, bisphenol-S type developers and sensitizers	Bisphenol-S (BPS) derivatives have been used as color developer in high performance thermal paper. The derivative 1 which has two allyl groups is known to have high color sensitivity and excellent image stability as compared with those of BPS. We have studied crystal structure of 1 and a common fluoran dye ODB2 in order to interpret this developer characteristics in terms of molecular structure. We attempted to crystallized BPS with ODB2 and investigated amorphous black solids of these developers and ODB2. Furthermore, we focused on sensitizers in order to interpret the influence of sensitizers on physicochemical properties of thermal paper.
Yuko KISHI	Shinya MATSUMOTO	Phase transition behavior of thin films of several 2,5-diamino-3,6-dicyanopyrazine dyes having monosubstituted benzyl groups	Organic dyes are used as functional materials such as recording materials and electronic materials. When used in these applications, organic dyes are often used in a thin film state. Therefore, examining the physical properties and structure of the dye in a thin film state is important for a functional material. In this study, we have prepared vacuum deposited films of several monosubstituted benzyl derivatives of this dye. The prepared films of the tested derivatives were found to be amorphous. These amorphous films can be transformed to crystalline films by heat or solvent vapor treatment. In this paper, we also report the structural features and spectroscopic properties of these thin films.

Mami KISHIMOTO	Kiyoshi HONDA	Synthesis of new organophotoredox catalysts and their application to radical cation Diels-Alder reaction	Photoredox catalysts can be used to carry out a wide variety of organic transformations. Although these attractive catalysts have efficiently used under visible light irradiation, they need to use high energy light source such as blue light (400-500 nm). Now, we report green light-driven radical cation Diels-Alder reaction catalyzed by thioxanthium-based organophotoredox catalysts. These catalysts present high excited-state reduction potentials, and they are able to efficiently activate dienophiles under green light irradiation afforded the targeted radicalcation Diels-Alder cycloadducts in good yields. The present photoredox catalytic system provides a sustainable synthetic process.
Norihito KOWADA	Shinichi OGATA	Attempt to isolate mutant related to DNA repair process by transgenic Arabidopsis thaliana	Our genes are constantly damaged by radiations and chemical substances. Since these damages affect life activities, we have various mechanisms against them. Now, we focused on a DNA double strand break (DSB) and homologous recombination (HR) as a repair mechanism for DSB. Although HR is an important repair mechanism for DSB, the process from damages to HR is not completely revealed. We try to reveal it by using transgenic Arabidopsis thaliana.
Hideaki SAITO	Kazuyuki HIRATSUKA	Identification of a compound that induces Arabidopsis VSP1 gene promoter using bioluminescence monitoring system	Plant defense activator attracting attention recent years is a low toxicity and environmentally friendly pesticide that is hard to appear drug resistant bacteria. I searched for plant defense activator that acts on JA signaling pathway. Especially, I used priming effect that plants stimulated compound or pathogen show stronger resistance to secondary stimulation. As a result, a candidate compound S1 acting on JA signaling pathway was discovered. Further, a detailed experiment was conducted on the candidate compound S1.
Rina SAKAMAKI	Takashi AMEMIYA	Basic research on arrest of proliferation in prostate cancer cells by suppression of gene expression and inhibition of catabolic pathway	Recently, the number of prostate cancer patients is sharply rising in Japan. There are several treatments of prostate cancer, but each treatments has some kind of demerit. Development of effective treatments is needed currently. In this study, the effects of suppression of gene expression and inhibition of catabolic pathway on prostate cancer cells (DU145) were investigated. We used the KIF22 siRNA to suppress gene expression and exposed DU145 cells to oxamic acid to inhibit catabolic pathway. Our results suggest that the combination of knocking down KIF22 gene and exposure of oxamic acid decrease the number of DU145 cells.

Masato SEKI	Kiyoshi HONDA	Synthesis of chiral hydroxamic acids containing 1,1'-spirobiindane core and their application to catalytic asymmetric epoxidation of <i>o</i> -allylphenols as ligands	Chiral natural products containing 3-chromanol or coumaran core structures are well known compounds, some of which exhibit various attractive bioactivities. Although several methods of preparing them have been reported, the progress of the study on asymmetric epoxidation of <i>o</i> -allylphenol, followed by ring opening-closing reaction for preparing 3-chromanols and coumarans has been rather slow. We synthesized spiro-CHA and spiro-HA containing 1,1'-spirobiindane core. Furthermore, We performed that the asymmetric epoxidation of <i>o</i> -allylphenol catalyzed by HA-metal complexes, followed by intramolecular cyclization under acid conditions, gave 3-chromanols and their enantiomeric excesses were determined by chiral HPLC.
Masataka TAKASHIKA	Hiroyuki OTANI	Synthesis, structure, properties and multifunction of π -expanded cyclic oligothiophene 6-mers	Two π -extended macrocyclic oligothiophene 6-mer, 6T4A-Ph and 6T4A-H, linked with four triple and two double bonds were synthesized by using a modified McMurry reaction. In addition, I investigated structure, physical properties, and function of those oligothiophene 6-mers. Phenyl substituted 6-mer 6T4A-Ph has easily form polymorphs involving solvents. The yellow fibers prepared from CS ₂ /Acetone exhibited vapochromism and showed shape changes. Those functions can be repeated several times by vapor-induced quasi-reversible. Furthermore, unsubstituted 6-mer 6T4A-H forms a π -dimer having a planar structure and shows organic field-effect transistor behavior.
Keiko TANAKA	Kazuyuki HIRATSUKA	Studies on Screening and Characterization of a Novel Rapid-response-type Plant Activator	Compound X identified using the HTS system shows affinity for bacteria-derived SA receptors and can induce resistance, as a plant activator such as acibenzolar-S-methyl and salicylic acid. It was found to have an interesting feature of inducing the expression of the PR-1a gene promoter. The details of the gene expression induction pattern of Arabidopsis thaliana by compound X treatment and the induction of the expression of defense response-related genes in rice leaf sheath were investigated.
Nao TAMAKI	Hiroyuki OTANI	Synthesis, structure and properties of the D- π -A tropolone dyes for dye sensitized solar cells	Tropolone forms chelate complexes with various divalent transition metal ions via the carbonyl oxygen and vicinal hydroxy group. Structural analysis and electronic structural analysis of D-A biphenyl type tropolone dye, D- π -A tolan type tropolone dye, and D- π -A terphenyl type tropolone dye that has thiophenyl as a spacer were carried out by DFT calculations. Comparing these results, the effect of the π -spacer on the properties of the tropolone dye was demonstrated. In addition, two new type D- π -A π -expanded tropolone dyes having ethynylthiophenyl as a spacer were synthesized. Furthermore, I investigated absorption properties, in solution and in the solid state, and redox behavior.

Yuki NAKAMURA	Hiroyuki OTANI	Synthesis, Structure and Properties of Anthracene Cyclic Dimer Linked with Biphenylene Unit or Troponoid Complex Unit	Anthracene cyclic dimer linked with two biphenyls 1 was synthesized by using the electron-transfer oxidation of Lipshutz cuprate, derived from 1, 8-bis(4-bromophenyl)-10-mesitylanthracene. In addition, anthracene cyclic dimer linked with two troponoid complexes 2 was prepared by mixing 1,8-bis(2-dodecylaminotropon5-yl)ethynyl]-10-dodecylanthracene, as a precursor, with a divalent transition metal ion (Cu ²⁺ or Ni ²⁺). Both anthracene cyclic dimer 1 and 2 can be employed in constructing a macrocyclic framework having a small inner cavity. I investigated the structure, physical properties, and complex formation behavior of those anthracene cyclic dimers.
Ryota NAKAMURA	Hiroyuki OTANI	Synthesis, Structure and Aggregation Induced Emission of Benzo-Annulated Cyanostilbene derivatives	It has been reported that 1-cyano-trans-1, 2-bis- (4'-methylbiphenyl) ethylene as a 1-cyanostilbene derivatives shows an unusual effect of aggregation induced emission (AIE). Herein, I synthesized four new benzo-annulated 1-cyanostilbene derivatives, 1-naphtyl derivative 1, 2-naphtyl derivative 2, 9-anthryl derivative 3, and 9-phenanthryl derivative 4. In addition, I investigated structure, optical properties, and polymorphs of those. Interestingly, molecules 1 and 3 were non-emissive when dissolved in a good solvent but became luminescent when aggregated in the crystal state. Furthermore, molecules 1 and 2 became highly luminescent when aggregated in the lamellar crystal state. These results indicate that 1, 2, and 3 are molecules showing AIE effect. On the other hand, molecule 4 was higher luminescent when dissolved in a good solvent than when aggregated in the crystal state. 4 was molecule showing aggregation-caused quenching (ACQ) effect.
Shingo HASHIMOTO	Kazuyuki HIRATSUKA	Activity evaluation of silencing suppressor derived from several plant viruses	Various plant viruses have the function of performing efficient gene expression while avoiding the host defense response such as RNA silencing and they can be applied to the high efficiency of expression and expression of foreign genes in plant cells. Efficient utilization of IRES (Internal Ribosomal Entry Site) and RNA Silencing Suppressor (RSS) derived from the plant virus-derived factor, We created platform plants that are the basis of material production.
Atsuo FUJIWARA	Shinichi OGATA	Studies on runnel drainage derived sheath bacterium ATCC BAA-2725 strain and polysaccharide elimination enzymes related to sheath formed by ATCC BAA-2725 strain	<i>Sphaerotillus</i> is a filamentous bacterium found in the aquatic environment. Bacteria of the genus <i>Sphaerotillus</i> form a microtube called a sheath outside the bacterial cells, and rod-like cells are contained in it. ATCC BAA-2725 strain is <i>Sphaerotillus</i> bacterium isolated from runway drainage system. For this strain having a special habitat environment, we investigated carbon source utilization and sheath elongation pattern and compared it with conventional <i>Sphaerotillus</i> bacteria. In addition, detailed analysis was also performed on the substrate specificity of DssA, a polysaccharide elimination enzyme that specifically degrades the sheath formed by <i>Sphaerotillus</i> bacteria.

Keigo MISHIMA	Hiroyuki OTANI	Synthesis, Structure, and Properties of π -extended Macrocyclic Oligothiophene 7- mer and 14-mer	π -Extended macrocyclic oligothiophene 7mer 7T6A-14Bu and giant macrocyclic oligothiophene 14mer 14T12A-28Bu, containing 3,4-dibutylthiophene as a constituent, were synthesized using the McMurry coupling reaction of linear oligothiophene 7mer dialdehyde. The molecular structure of 7T6A-14Bu and 14T12A-28Bu was revealed by X-ray crystal structure analysis. Interestingly, 14T12A-28Bu formed various polymorphs from solution, reflecting a disklike structure with partial rigidity. Furthermore, 14T12A-28Bu formed CT complex with chloranil in solution and in the solid state and gave complex with TCNQ in the solid state.
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