

## Organization of Chemistry Department (School of Science)

Laboratory	Full/Associate Prof.	Research Field
Molecular Architecture	Prof. Kentaro TANAKA Assoc. Prof. Yasuyuki YAMADA	Aim of our research is development of molecular architectures with functional hierarchies and emergent properties in the interdisciplinary field among coordination chemistry, supramolecular chemistry and bio-inspired chemistry.
Inorganic Chemistry	Prof. Mizuki TADA Assoc. Prof. Yasuhiro OHKI	Catalysis and coordination chemistry. Design of homogeneous/heterogeneous catalysts using metal complexes and metal nanoclusters. Fuel cell chemistry. Advanced characterization of structures of solid catalysts and reaction mechanism.
Bioinorganic Chemistry	Prof. Yoshihito WATANABE Assoc. Prof. Osami SHOJI	Our research activity focuses on reaction mechanisms of metalloenzymes in molecular level majorly based on the coordination and organic chemistry. Artificial enzymes functionalized with non-natural metal ions or metal complexes are another research interest.
Organic Chemistry	Prof. Kenichiro ITAMI Assoc. Prof. Hideto ITO Designated Assoc. Prof. Kei MURAKAMI	Our group has centered on catalyst-enabling synthetic chemistry, aiming at solving challenging problems for realizing super-efficient chemical synthesis and producing as-yet unexplored molecules of significant interest in various fields.
Functional Organic Materials	Prof. Shigehiro YAMAGUCHI Assoc. Prof. Aiko FUKAZAWA Assoc. Prof. Masayasu TAKI	Main group chemistry, organometallic chemistry, organic electronic materials. Development of new reactions based on the characteristic features of main group elements. Design and synthesis of new functional organic materials and their application to organic electronics and bio-imaging.

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Noyori Laboratory	Prof. Ryoji NOYORI Prof. Susumu SAITO	We are developing novel organic synthesis and new catalysis along the interface of homogeneous and heterogeneous catalysts. In particular, control of hydrogenation, dehydrogenation, hydrogen transfer, hydration, and dehydration involving biomass-related inert compounds (amide, carboxylic acid and ester), water, H <sub>2</sub> , NH <sub>3</sub> , and CO <sub>2</sub> are our keen interest. Our catalysts are so diverse in their structures, which are consisted of main group elements, transition metals and their combinations. Chemical substances of pharmaceutical and industrial importance are among the target materials in our organic synthesis. Using UV and visible light as well as solar energy for promoting otherwise inaccessible catalysis that does not produce salt waste byproducts is also our current strong concern, in which artificial photosynthesis using H <sub>2</sub> O and CO <sub>2</sub> under solar energy is an ongoing project. These projects have ripple effects on opening a new avenue for sustainable development goals (SDGs).
Bioorganic Chemistry	Prof. Hiroshi ABE	We are working on medicinal chemistry and oligonucleotide therapeutics. Medicinal chemistry is the research fields for developing mainly small molecule drugs. As a new type of drugs, we have designed and developed several covalent inhibitors, one of efficient drugs. Furthermore, improved inhibitors have been designed through the detailed biochemical analysis such as enzyme kinetics, X-ray crystallography, and computational simulation. Our second research field is oligonucleotide therapeutics, where the oligonucleotides are used as active molecules for disease treatment. Oligonucleotides potentially possess various functions depending on their sequences. For its application to medicines, we have introduced artificial units into nucleic acid or modified those structure. In addition to those pharmaceutical projects, we are also engaged in development of new chemical and biological methodologies for imaging, diagnosis and production of biofunctional molecules.
Nano-Structured Materials	Prof. Hisanori SHINOHARA Assoc. Prof. Ryo KITAURA	The main research topics of our laboratory have been centered on the fabrication, characterization and application of the so-called nanocarbons which include fullerenes, metallofullerenes, carbon nanotubes and graphene-related materials. Two-dimensional atomic layered materials such as transition metal di-chalcogenides (TMDC) are also main research themes of the present laboratory. We are interested in both the fundamental and application aspects of such nanocarbon and atomic layered nanomaterials.

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Photo-Physical Chemistry	Prof. Akiyoshi HISHIKAWA	Our laboratory aims (i) to seek and clarify new phenomena in chemistry by state-of-art spectroscopic techniques, and (ii) to control chemical reactions by using strong laser pulses as the reaction fields.
Advanced Materials	Prof. Kunio AWAGA Assoc. Prof. Michio M. MATSUSHITA	Our research is directed towards exploring exotic multi-functional phenomena derived from the interaction between fundamental electronic properties (conductivity, magnetism, optical transitions, etc.) in characteristic chemical species, such as organic radicals, metal-organic composite clusters and nanoparticles.
Quantum Chemistry	Prof. Takeshi YANAI	Our group focuses on theoretical and computational investigation to describe chemical nature and reactivities of molecular systems by means of quantum chemistry (QC) calculations. Computing-based theoretical approaches have been growing into a method that can now provide information compensating experiment-based understanding with a substantial level of reliability and accuracy. Our interests are directed to the development of new methods that expand the domain of applications and to chemical systems to figure out elusive details of their complex phenomena.
Organic Synthesis Group	Prof. Masato KITAMURA	Organic Synthesis Group focuses on i) the development of highly efficient catalytic reactions in terms of reactivity, selectivity, productivity, environmental benignity, and atom economy, ii) understanding of the mechanism, and iii) the application to the catalytic stereoselective total synthesis of pharmaceutically important compounds.
Physical Inorganic Chemistry Group	Assoc. Prof. Hideo D. TAKAGI	<p>We study Reaction Mechanisms of Inorganic and Organometallic Complexes in Solution, by precise kinetic/equilibrium measurements and analyses on the basis of physical principles such as symmetry rules.</p> <p>Syntheses and structural analyses of metal complexes with various phosphorous donor ligands are also included in the studies of this Group.</p> <p>Current research projects include the photo-induced electron transfer reactions between the triplet excited state of Zn(II)-tetraphenylporphyrin and cobalt(III)-sepulchrate in various <u>ionic liquids</u>, and electron transfer reactions involving copper(II/I) couple in various <u>molecular liquids</u>.</p>