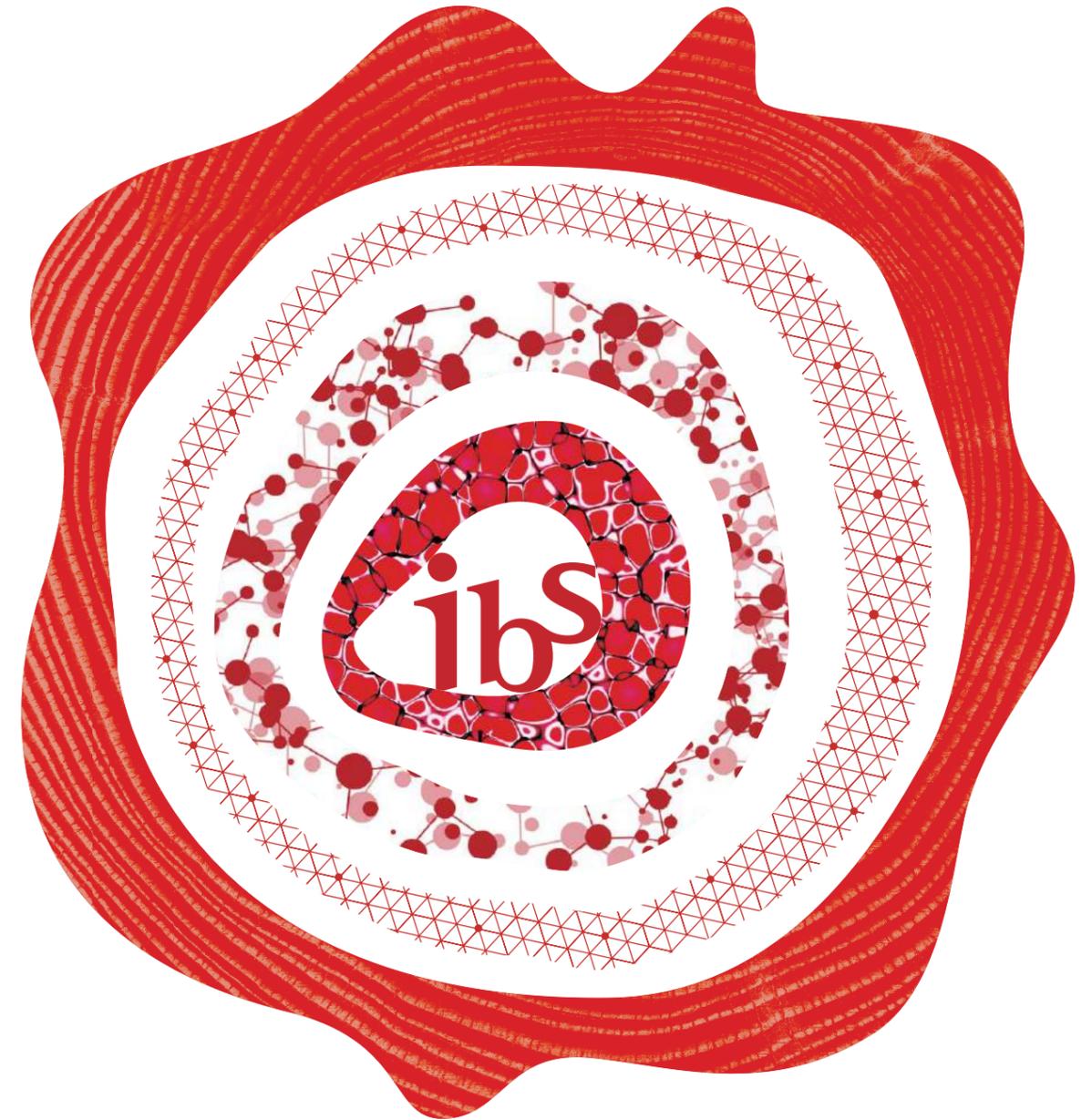


Institute for Basic Science



Institute for Basic Science

ibs Institute for Basic Science

70, Yuseong-daero 1689-gil, Yuseong-gu, Daejeon, 34047
Tel : +82.42.878.8114 <http://www.ibs.re.kr>

IBS Unites Our Hope for the Future

• Creative Possibilities

IBS strives to be at the vanguard of basic scientific exploration.

As a leading scientific institute, IBS will lay the foundation on which future innovation in science and technology is built upon.

We believe this philosophy will act as a catalyst for the global scientific community to push the boundaries of basic science and benefit all of humanity in the coming decades.



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Institute for Basic Science

A Message from the President



IBS will brighten our future through basic science research

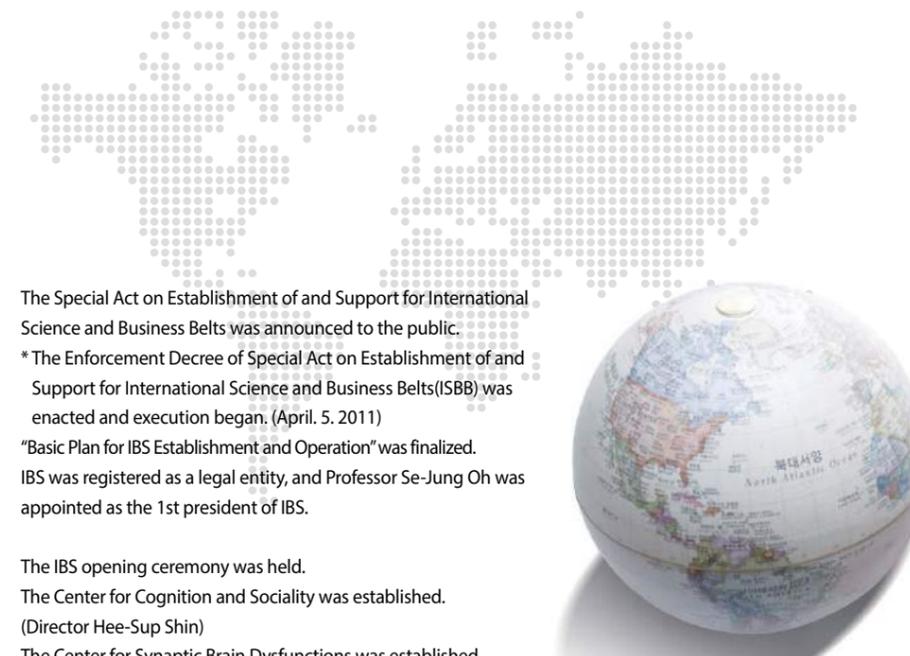
The Institute for Basic Science (IBS) was established in November 2011 with the vision of "Making Discoveries for Humanity & Society." Motivated solely by a driving curiosity about the unknown, IBS Centers specialize in mid and long-term basic science projects that require large groups of researchers.

IBS seeks to ensure excellence in research by selecting leading scientists as Directors and promotes a supportive and nurturing environment that enables scientists to fully engage in research. At IBS Centers, scientists themselves choose research themes that are usually novel concepts in their fields. IBS believes that researchers unleash their creative potential most effectively when they perform adventurous research in an autonomous research environment.

It is our belief that advancement in basic science leads to both economic and intellectual progress of society, creating a brighter future for mankind. IBS' support of basic science will help solve global challenges and offer solutions to fundamental scientific puzzles.

President *Doochul Kim*

Brief History



- 2011**
 - Jan.** The Special Act on Establishment of and Support for International Science and Business Belts was announced to the public.
* The Enforcement Decree of Special Act on Establishment of and Support for International Science and Business Belts (ISBB) was enacted and execution began. (April. 5. 2011)
 - Sep. Nov.** "Basic Plan for IBS Establishment and Operation" was finalized. IBS was registered as a legal entity, and Professor Se-Jung Oh was appointed as the 1st president of IBS.
- 2012**
 - May July~Aug.** The IBS opening ceremony was held. The Center for Cognition and Sociality was established. (Director Hee-Sup Shin)
The Center for Synaptic Brain Dysfunctions was established. (Director Eunjoon Kim)
The Center for Nanomaterials and Chemical Reactions was established. (Director Ryong Ryoo)
The Academy of Immunology and Microbiology was established. (Director Charles D. Surh)
The Center for Self-Assembly and Complexity was established. (Director Kimoon Kim)
The Center for Geometry and Physics was established. (Director Yong-Geun Oh)
The Center for RNA Research was established. (Director V. Narry Kim)
The Center for Correlated Electron Systems was established. (Director Tae Won Noh)
The Center for Nanoparticle Research was established. (Director Taeghwan Hyeon)
 - Dec.** The Center for Catalytic Hydrocarbon Functionalizations was established. (Director Sukbok Chang)
The Center for Plant Aging Research was established. (Director Hong Gil Nam)
The Center for Relativistic Laser Science was established. (Director Chang Hee Nam)
The Center for Integrated Nanostructure Physics was established. (Director Young Hee Lee)
- 2013**
 - June July** The Center for Artificial Low Dimensional Electronic Systems was established. (Director Han Woong Yeom)
The Center for Underground Physics was established. (Director Yeongduk Kim)
The Center for Neuroscience Imaging Research was established. (Director Seong-Gi Kim)
A MOU to build a research hub in the ISBB and an advanced base area to facilitate a creative economy in the Daedeok Special Research and Development Zone was finalized.
* IBS, Daejeon Metropolitan City, the Ministry of Science, ICT and Future Planning, the Daejeon International Marketing Enterprise
 - Aug.** "Basic Plan for ISBB" was modified.
* The construction site for IBS was relocated. (from Dungok town to Doryong town)
 - Oct. Nov.** The Center for Axion and Precision Physics Research was established. (Director Yannis K. Semertzidis)
The Center for Theoretical Physics of the Universe was established. (Director Kiwoon Choi)
The Center for Multidimensional Carbon Materials was established. (Director Rodney S. Ruoff)
- 2014**
 - Jan. Mar. Sep. Dec.** The Center for Soft and Living Matter was established. (Director Steve Granick)
The Center for Genome Engineering was established. (Director Jin-Soo Kim)
Professor Doochul Kim was appointed as the 2nd president of IBS
The Center for Theoretical Physics of Complex Systems was established. (Director Sergej Flach)
The Center for Genomic Integrity was established. (Director Kyungjae Myung)
The Center for Molecular Spectroscopy and Dynamics was established. (Director MinHaeng Cho)
- 2015**
 - July Dec.** The Center for Vascular Research was established. (Director Gou Young Koh)
The Center for Nanomedicine was established. (Director Jinwoo Cheon)

Vision & Mission

Making Discoveries for Humanity & Society

The Institute for Basic Science(IBS) will serve as a model of Korean scientific excellence to join the ranks of the world's leading institutes in basic science research. Through groundbreaking discoveries in basic science research, we will disseminate knowledge that will impact the development of society and benefit the wellbeing of humanity.

Overarching Goals

To rank in the world's top 10 basic science research institutes for research impact by 2030



Mission Activities

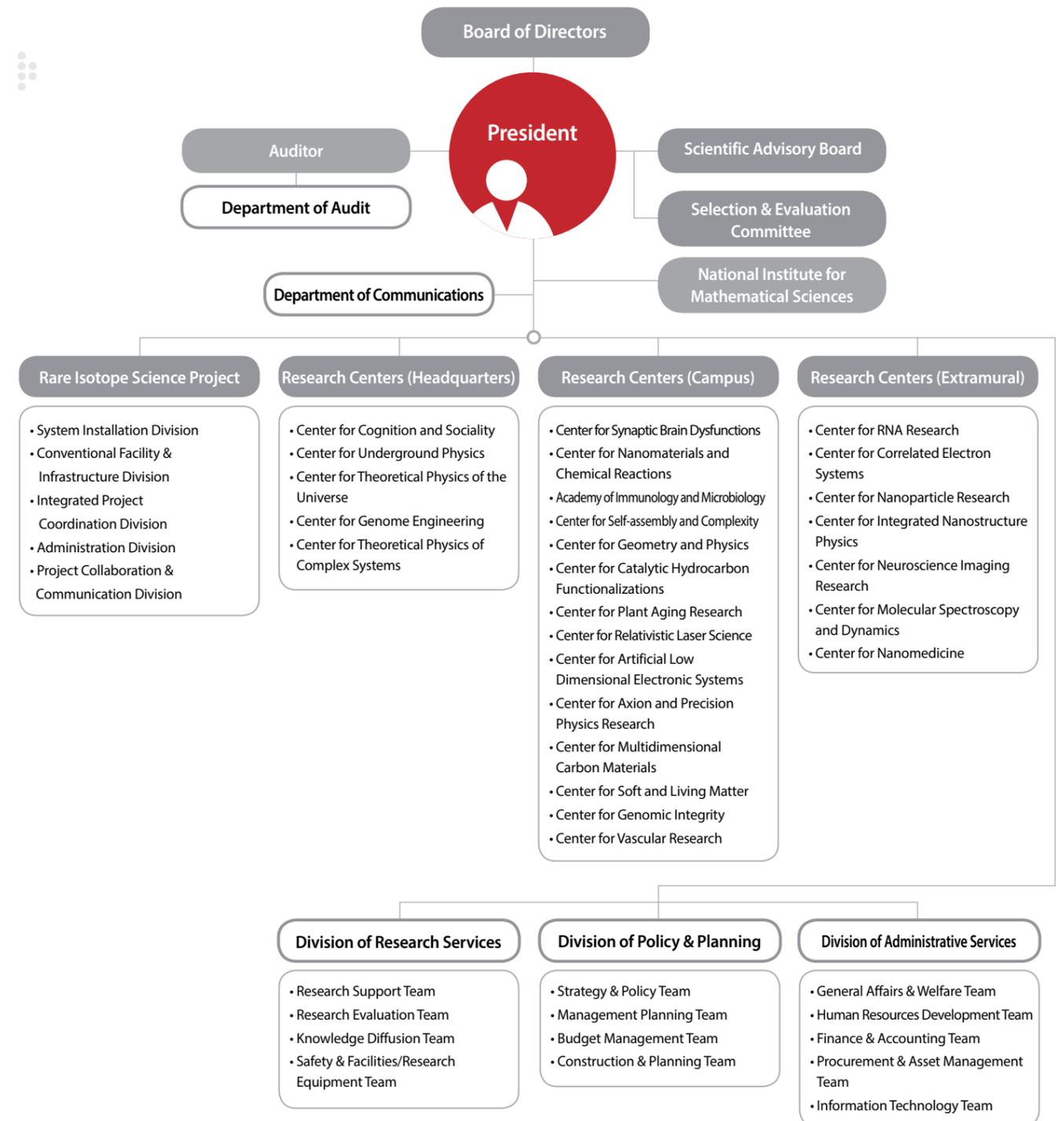
- Drive the development of creative knowledge and discover new areas of study to shape the future
- Attract world-renowned scientists and foster next-generation leaders in research
- Cultivate an environment that maximizes the researchers' autonomy
- Facilitate collaboration and convergence beyond the boundaries of countries and academic disciplines
- Disseminate basic science knowledge and expand its social impact

Guiding Principles



- Excellence** Select researchers and evaluate their outcomes based on world-class, scientific excellence
- Autonomy** Guarantee maximum autonomy in research by focusing more on the researchers rather than on research projects
- Creativity** Give a high priority to innovative research that establishes new perspectives and creates a new paradigm
- Openness** Increase opportunities for researchers to collaborate beyond their nationality, age, gender and scientific affiliations

Organization



Center for Cognition and Sociality

Understanding the human mind and behavior through the study of the brain



Center for Synaptic Brain Dysfunctions

Investigating synaptic proteins to understand psychiatric disorders



Director

Hee-Sup Shin

<http://ccs.ibs.re.kr>

Introduction

What we call the mind is enabled by the brain. How this happens in the brain is what we would like to understand. How consciousness is controlled, how we learn and remember things and events, how the emotion is controlled, how we make decisions when needed these are among the questions we pursue. We are particularly interested in asking these questions in the context of social behavior: where the name, Center for Cognition and Sociality, came from.

We would like to obtain answers to those questions at the levels from molecules to circuits to behaviors. Multidisciplinary approaches and integration of diverse observations are inevitable when we want to obtain meaningful answers to any of those questions. The current list of tools, however, for examining these questions is rather incomplete. We will have to develop new tools that will allow new perspectives on old questions. Open collaboration with scientists from diverse disciplines is an essential component of our strategy. At the same time we will need to sharpen our questions through ceaseless communication with human wisdoms and great minds: only important questions will yield important answers.

The questions we pursue are fundamental and basic. The answers we obtain, however, will go way beyond just the curiosity-satisfying level. Through these endeavors, we believe, important clues to curing various neuropsychiatric diseases as well as approaches to improving human society will be obtained.

Another aim of our center is to help young neuroscientists to grow to their fullest capacity. In the long run, we believe, accomplishing this aim will be the most rewarding experience for our center. We will try to make our center which many top-quality neuroscientists in the future can recall as the place where their dreams for a successful career were realized.



Director

Eunjoon Kim

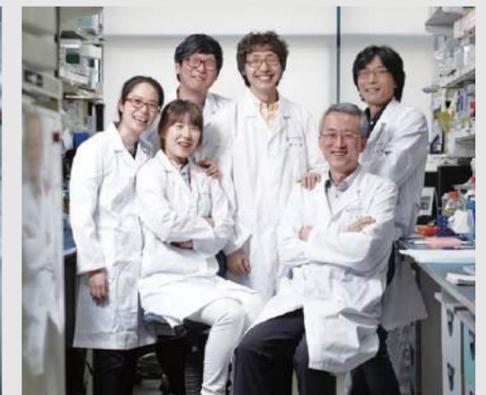
<http://synapse.ibs.re.kr>

Introduction

Neuronal synapses are basic units of neural circuits and brain functions. A large number of proteins including receptors, signaling proteins, and scaffolding proteins participate in the molecular organization and functional coordination of neuronal synapses. We have been studying the molecular mechanisms underlying the formation, differentiation, maintenance, and the dynamic plasticity of neuronal synapses.

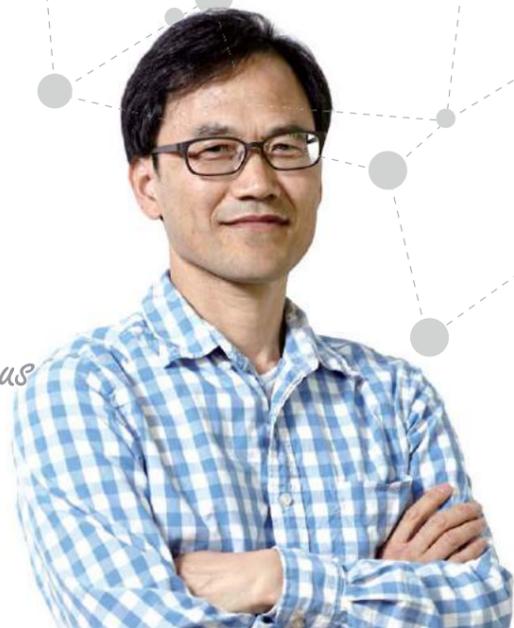
Intriguingly, many synaptic proteins have recently been associated with diverse psychiatric disorders, including attention-deficit/hyperactivity disorder (ADHD), schizophrenia, intellectual disability, and emotional disorders. It is conceivable that defective synaptic proteins would disrupt normal formation and function neuronal synapses and neural circuits, leading to diverse brain dysfunctions.

This emerging association between defective synaptic proteins and brain dysfunctions is now called "synaptopathy". Our center will be exploring key neural mechanisms underlying various forms of synaptopathies. To this end, we will use diverse experimental setups including cultured neurons, brain slices, living brains, and transgenic mice, and employ various approaches including molecular, cell-biological, biochemical, anatomical, imaging, electrophysiological, and behavioral tools and methods. These key mechanisms will help us understand the mechanisms underlying normal brain functions as well as diverse brain dysfunctions.



Center for Geometry and Physics

Creating new mathematics via rendezvous of geometry and physics



Director

Yong-Geun Oh

<http://cgp.ibs.re.kr>

Introduction

The IBS Center for Geometry and Physics (IBS-CGP) aims to help establish and develop the emerging field of symplectic algebraic topology through a collaborative effort by experts in fields such as symplectic geometry, dynamical systems, algebraic geometry and mathematical physics.

Even though Korea has a long and rich intellectual history, its participation in the modern scientific and mathematical communities is relatively new. In particular, institutes dedicated solely to mathematics are very rare, making the IBS-CGP a valuable institution with the potential to serve an important function within the larger Korean scientific community. The center's emphasis on international collaboration will offer a chance for scholars with similar passions to plant ideas together and watch them grow, no matter where they are on the globe, and allow the center to serve as a bridge between Korean mathematicians and the international mathematical community.

The center is located on the intellectually dynamic Pohang University of Science and Technology (POSTECH) campus in Pohang, South Korea. Members and visitors of the center will immediately be immersed in an intellectual network that reaches beyond the peaceful seaside city.



Center for Nanomaterials and Chemical Reactions

Brightening the future of energy by exploring green chemistry and technology



Director

Ryong Ryoo

<http://cncr.ibs.re.kr>

Introduction

Foreseen reduced fossil fuels supplies and the growing environmental concerns provide incentive for developing high yield chemical processes and technologies, while reducing feedstocks energy consumption and pollutants. Research in the Center for Nanomaterials and Chemical Reactions (CNCR) has been focused on nanoscience and chemical reactions using basic science to find comprehensive solutions for the environmental and energy-related problems that face future generations.

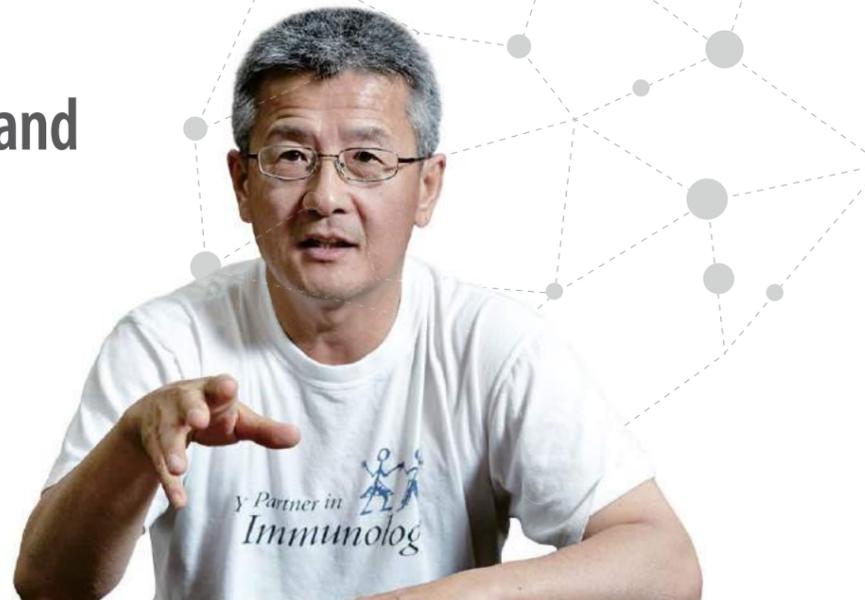
Renewable energy sources result in a significant reduction in both fossil fuel consumption and greenhouse gas emissions. In this context, CNCR has conducted studies on chemical reactions, in which catalysts play a key-role. Being easily separable and reusable, heterogeneous catalysts have played a pivotal role in the conversion of renewable feedstocks. In this regard, nanostructured materials (e.g., nanoparticles and nanoporous material) exhibiting large surface areas have gathered particular attention. In recent years, the field has lived continuous development, and CNCR has been recognized for its many contributions in the domain.

In this context, CNCR aims to study the fundamental formation principles through basic chemical research. The research center has developed high-efficient catalysts and pursued solutions to energy-related and environmental problems by understanding and optimizing green chemical reactions. We will continuously strive to deliver world-beating academic achievements and to contribute greatly to science and technology for the benefit of humankind.



Academy of Immunology and Microbiology

Conquering immune disorders



Director

Charles D. Surh

<http://aim.ibs.re.kr>

Introduction

The immune system is essential to protect the host from invasion by pathogenic microbes and outgrowth of cancerous host cells. It is both powerful and versatile, capable of mobilizing a customized potent response to the vast array of pathogens and tumors. Because of its strength, the activated immune response is tightly regulated and is, upon elimination of the invaders, rapidly extinguished to prevent collateral tissue damage. The immune system thereafter "remembers" the invaders, and is capable of mounting a stronger and quicker response to subsequent invasions by the same pathogen or cancer.

Effective immunity requires a complex network of interactions between multiple types of cells. The primary lymphoid tissues generate immune cells, whose activation is initiated in the secondary lymphoid tissues. Immune cells are also distributed throughout the non-lymphoid tissues and are particularly prominent in the mucosal tissues that are exposed to the environment. Here, these immune cells perform a highly specialized function by providing protection from environmental pathogens, while maintaining operational tolerance to benign antigens and to the massive numbers of commensal microbes that co-exist peacefully with the host.

While many key mechanisms that regulate the immune system have been deciphered, many more have yet to be discovered. The goal of Academy of Immunology and Microbiology (AIM) is to discover several of these unknown fundamental mechanisms. Particular focus will be placed on elucidating the mechanisms by which various populations of lymphocytes develop and function, how these cells are activated and regulated in order to protect the host without causing collateral tissue damage, and how these cells co-exist peacefully with the commensal microbes while conferring protective immunity against pathogenic microbes. These discoveries should reveal novel approaches to enhance immunity against pathogens and cancer and to prevent or ameliorate chronic immune inflammatory diseases, such as autoimmunity, allergies, atherosclerosis and metabolic diseases.



Center for Nanoparticle Research

Proving the economics of science through the study of nanoparticles



Director

Taeghwan Hyeon

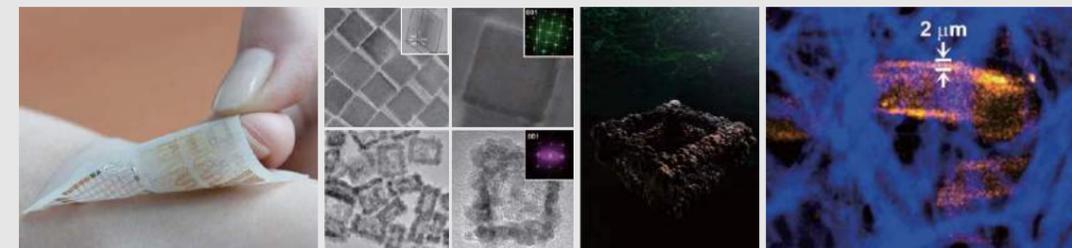
<http://nanomat.ibs.re.kr>

Introduction

Nanoparticles are defined as particles in a range of 1-100 nm in size. 1 nm is one billionth of a meter and roughly one thousandth of a hair radius. They are observed only by electron microscopy techniques. The primary reason that nanoparticles have come to researchers' attention is that their properties can be tuned by changing their sizes and shapes, even though their chemical compositions are identical. For example, the fluorescence wavelength of quantum dots changes based on their particle sizes, and the properties of magnetic nanoparticles vary according to their size range. Over last two decades, these unique charms have driven a lot of scientists to study ways to synthesize uniform nanoparticles in shapes and sizes and to control their properties.

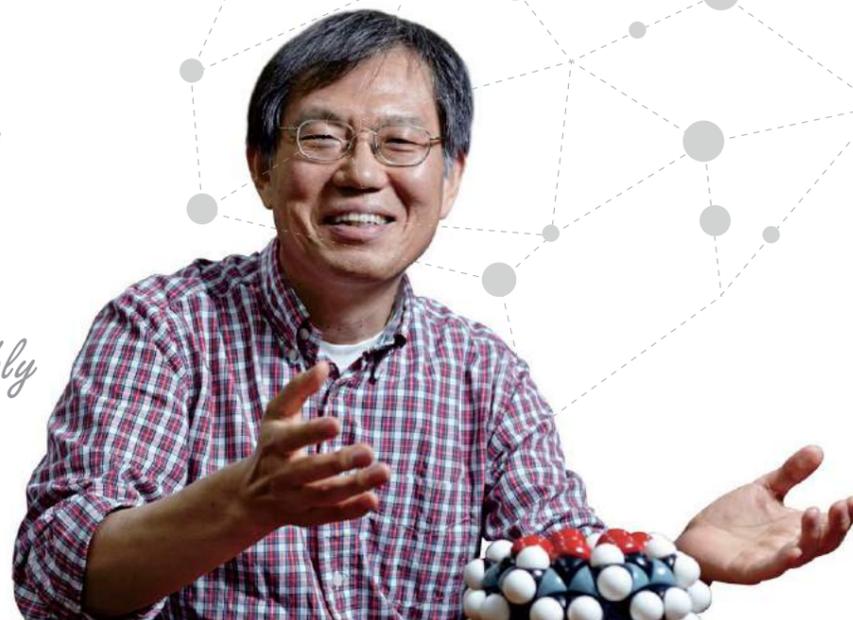
Besides those studies, a lot of efforts to apply nanoparticles in various fields have been made based on marvelous technological advances in the nanoparticle synthesis. As a result, nanoparticles play a significant role in medicine, electronic devices, and energy applications. In medicine, they are often used as contrast agents in diagnostic imaging methods and as drug delivery vehicles. A cancer treatment is another application of nanoparticles. The treatment kills cancer cells by stimulating nanoparticles optically or magnetically, adjacent to cancer tissues. By managing interactions between uniform nanoparticles, they can be self-assembled and aligned in a way to function in microscopic electronic devices. The next generation energy technology, such as solar cells, fuel cells, and energy storage, has a great interest in adopting nanoparticles as their elements.

The research scope of Center for Nanoparticle Research includes all areas related to nanoparticles, such as design and synthesis of nanoparticles, studies on the formation mechanism, and potential applications. Through the technological development in the design and synthesis of uniform nanoparticles, Center for Nanoparticle Research aims to make a paradigm shift in nanotechnology, in which uniform nanoparticles play a key role as a versatile toolbox. The goals would be fulfilled by promoting interdisciplinary research in medicine and energy and by troubleshooting problems of stability, safety, and economic feasibility encountered in applications. The top-notch research teams at the Center focus on the development of wearable devices to realize a remote patient monitoring for personalized treatment. Another research focus is to develop lithium ion batteries containing nanoparticles as their electrode materials and catalysts. The Center for Nanoparticle Research will establish itself as a center for world-class research in the field and foster distinguished scientists to achieve the goals.



Center for Self-assembly and Complexity

Pushing the limits of self-assembly



Director

Kimoon Kim

<http://csc.ibs.re.kr>

Introduction

The CSC primarily focuses on self-assembly under complex environments where several elements are mixed in nature as well as well-refined and limited environments, mainly studied until now, in order to overcome existing limitations in research on self-assembly. Through these studies we want desired properties to be manifested in self-assembly by controlling specific variables, or to create materials with such properties.

If those trials are achieved, it is possible to develop molecular aggregates or materials, unknown until now, having outstanding properties and functions, and these materials can be used with value to diagnose and treat cancers in the early stages, and develop a medium to produce or store clean energy such as hydrogen using solar energy. In addition, the study on self-assembly in complex environments opens up a way to get closer to the understanding of fundamental problems like chemical origins of life via the deeper understanding of self-assembly.

Ultimately, our research will contribute not only to the advancement of basic science, but also to the development of new materials, devices and technologies.



Center for RNA Research

Unraveling the mysteries of genome and life through RNA studies



Director

V. Narry Kim

<http://rna.ibs.re.kr>

Introduction

RNA is a type of biomolecules that constitute all known forms of life. While DNA serves as storage of genetic information, RNA carries and controls genetic information. RNA not only acts as a passive decoder of the information embedded in DNA and relays the information to produce proteins, but also it plays multifaceted roles ranging from producing proteins to acting as an enzyme to regulate cellular activities. Our understanding of RNA is in its infant stages when compared to progresses made in the field of DNA or protein research. But growing attention has been paid to RNA as the diversity of RNA and their cellular functions are realized. In addition, findings of defects in RNA in over 20% of genetic diseases further consolidated RNA biology as an attractive field of research.

The Center for RNA Research is aiming to discover cellular functions of regulatory RNAs. Although the majority of RNAs inside a cell do not code for proteins and play regulatory roles, we have limited understanding of only a handful of them. Even for microRNAs, a relatively well studied ncRNAs, their action mechanism, functions, and evolution remain largely unknown. Our research center is currently conducting research on microRNAs and other regulatory RNAs using cancer, stem cells, neural system and immune cells as model. In addition, our center is running a long-term project to systematically identify novel regulatory RNAs and the proteins that bind to them. These studies will advance our understanding of cellular regulatory mechanisms and provide a conceptual basis for the development of new therapies and diagnostic techniques.

We are a highly interdisciplinary and interactive research center, combining expertise from genetics, biochemistry, bioinformatics, biophysics, analytical chemistry, and nanoscience. We are currently recruiting young scientists with various academic backgrounds and offer them the best research environments and opportunities to realize their potential in full.



Center for Correlated Electron Systems

Identifying diverse physical properties of highly correlated electron systems



Director

Tae Won Noh

<http://cces.ibs.re.kr>

Introduction

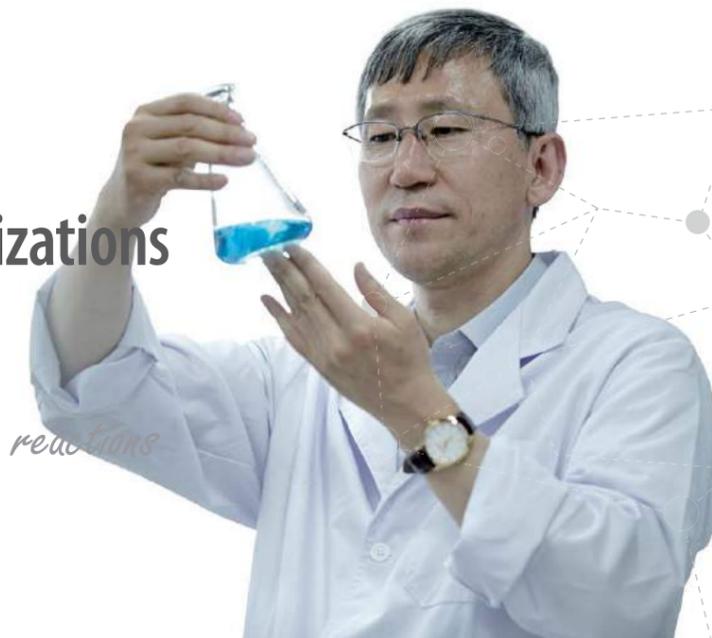
In semiconductors and novel metals, motion of an electron can be simply described as movement in an effective potential. Such a physical description in quantum mechanics results in the band theory, which has provided the basis for many modern technology devices, including transistors. However, there are numerous materials, where interactions among electrons are so strong that their motions cannot be described by the simple effective potential. These materials are called as strongly correlated electron systems. As a consequence, lots of new novel phenomena emerge: to name only a few, high TC superconductivity, ferromagnetism, and ferroelectricity. More interestingly, if we make them in ultrathin films or heterostructures, more exotic phases will emerge at the interfaces. For example, at the interface of two insulators, it has been shown that 2D electron gas can be formed and it has interesting properties including superconductivity and magnetism. We can also discover numerous correlated topological phases, which cannot be realized in bulk form. Therefore, strongly correlated materials and their interfaces have received lots of attention.

We at the Center for Correlated Electrons Systems (CCES) focus on discovering new emergent phenomena in strongly correlated electron systems and their interfaces. We also search for new physical concepts to explain such emergent phenomena. To achieve these goals, we synthesize high quality single crystals, ultrathin films, and atomic-scale-controlled superlattices. Then, we use state-of-the-art experimental techniques, including angle resolved photo emission and neutron spectroscopy, to search for the novel phases. We also perform density functional and other model calculations to obtain understanding on such newly discovered phases, which will lead to new material design concepts. The combined efforts of both experiment and theory groups at the center will enhance our understanding of strongly correlated electron systems and will provide a new paradigm for condensed matter physics.



Center for Catalytic Hydrocarbon Functionalizations

Innovating the chemical industry with the studies of new catalytic reactions



Director

Sukbok Chang

<http://cchf.ibs.re.kr>

Introduction

The main research areas of the Center for Catalytic Hydrocarbon Functionalizations are the development of new catalytic reactions and elucidation of mechanistic details in the C-H bond activation of low reacting molecules such as hydrocarbons. Transition metal catalysis is the central tool in this study to develop and apply.

Hydrocarbons are present abundantly in nature, but cannot be easily exploited as source materials for organic synthesis or chemical processes owing to their low reactivity under mild conditions. To overcome this problem, it is essential to develop an effective and selective catalytic system which will provide the necessary sound basis for chemical reactions, and ultimately offer a wide range of applications, including the synthesis of natural products and useful materials, and bioactive compounds.

By first identifying the basic principles underlying the carbon-hydrogen bond-activation process in low-reactivity organic molecules, the center aims to develop a system that enables mediation via metal catalysts for practical application of reactions in organic chemistry. Our ultimate goal is to develop innovative science and technology (S&T) solutions that go beyond the boundaries established by the chemical-materials industry. We also would like to our goal to the application of the developed catalytic systems for the introduction of useful functional groups in methane-based hydrocarbons. In addition, the center plans to conduct researches for the biomass conversion by developing selective defunctionalization catalytic systems.



Center for Integrated Nanostructure Physics

Developing new 2D+ α nanomaterials and explore unprecedented sciences from such materials



Director

Young Hee Lee

<http://cinap.ibs.re.kr>

Introduction

Understanding of how the nanostructure materials such as quantum dots, nanowires, nanotubes, and graphene are grown from self-assembly of atoms and molecules and their fascinating new nanophysics remain as one of the unconquered frontier sciences. The low dimensional materials can be easily hybridized to reveal multifunctional performance, which has never been realized in conventional approaches. Recent progress in ideal two-dimensional layered structures such as graphene, boron nitride, metal oxide, transition metal dichalcogenides, and their hybridization in vertical direction and/or with zero- and/or one-dimensional nanostructures has opened new exciting research areas in tunneling phenomena, enhanced carrier mobility, charge injection/extraction spectroscopy, and thermoelectrics. Nevertheless, growth control of nanostructures and design of such hybrid structures are very challenging and often difficult task to attain intuition from physics point of view.

Because of this difficulty, researches in nanostructure materials cannot be done in a small laboratory scale and require interdisciplinary collaboration from various disciplines of physics, chemistry, biology, materials science and engineering. Another difficulty arises from measurements. Since sizes of nanomaterials are supposed to be tiny, the signal to noise ratio is low so as to make it difficult to measure unless the resolution of apparatus is improved. Furthermore, hybrid nanostructures require multimodal measurement tools in order to reveal multifunctions. In this regard, it is necessary to develop a new system combined with several apparatus with high spatial resolution and high sensitivity in many cases.

Our goal is to understand physics of low dimensional structures and to push the limit of sensitivity and spatial resolution in the measurements of nanomaterials by designing multi-modal nanoscopy systems. In order to achieve the overall goal, our specific research aims for new and multi-faceted physical properties on the designed nanostructures and their hybridized complexes: Growth of 2D+ α nanostructures, to design their hybrids which reveal multi-functional properties, analysis of nanostructures, carrier dynamics and thermoelectric properties.



Center for Relativistic Laser Science

Exploring ultrahigh intensity laser-matter interactions with femtosecond PW lasers



Director

Chang Hee Nam

<http://corels.ibs.re.kr>

Introduction

The Center for Relativistic Laser Science (CoReLS) was established in December 2012 to explore novel physical phenomena occurring in the relativistic laser intensity regime. The electron motion enters the relativistic regime at a laser intensity of 10^{18} W/cm², while protons behave relativistically at 10^{24} W/cm². To tackle the underlying physics of relativistic laser-matter interactions, the center utilizes a 30-fs petawatt (PW) laser facility developed at Gwangju Institute of Science and Technology (GIST).

It is a challenging task to reveal the physics of relativistic and ultra-relativistic laser-matter interactions. We examine the fundamental physical processes in atoms, molecules, and plasmas occurring in an ultrafast time scale (atto- to zepto-second), and develop high-energy, ultra-short particle (electron, proton, and ion) beams and radiation (X-ray and γ -ray) sources. Sophisticated methods of controlling the spatio-temporal structure of ultra-intense laser pulses are to be developed in order to precisely manipulate relativistic laser-matter interactions. Such developments will allow us to achieve our goals by steering the interaction processes (e.g., relativistic harmonic generation at extreme orders, mono-energetic electron acceleration over GeV, energetic proton generation with narrow bandwidths; strong X-ray and γ -ray generation). In order to achieve the aims of the center, research topics have been divided into five subjects:

1. Laser: Laser technology to generate super-Intense laser intensity over 10^{22} W/cm²
2. Low-density Laser Plasma: Generation and applications of high-energy electron beams, and high field physics
3. High-density Laser Plasma: Generation and applications of energetic proton/ion beams, and laboratory astrophysics
4. Attosecond Science: Exploration of ultrafast atomic and molecular dynamics
5. Theory: Analytic theory and simulation of relativistic laser-matter interactions



Center for Plant Aging Research

Presenting a new paradigm in the studies of senescence and life-history strategies



Director

Hong Gil Nam

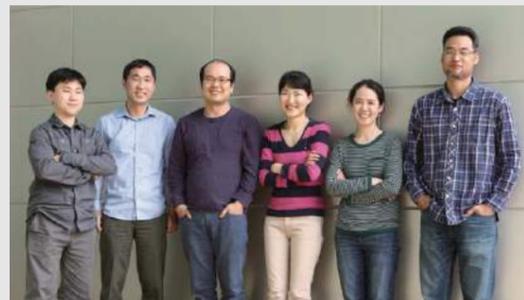
<http://aging.ibs.re.kr>

Introduction

Plant senescence and death represent a very important and unique aspect of life: While most biological studies are concerned with how biogenesis is achieved, plant senescence provides a novel window to the ways in which the orderly, regulated disassembly of cells, organs, and organisms occurs. By means of Comparative Biology of Aging, furthermore, it will lead to discover senescence fundamentals of life including human being, animals, and plants. Plant senescence and death have a biological purpose in the sense that the nutrients derived from the disassembly process are passed on to progeny as a parental investment. In fact, many of the grains we eat are "nutrients" derived from the senescing leaves of crops. The modulation of senescence therefore has huge potential to improve plant productivity. One of biology's unresolved fundamental questions is this: How is time and the aging process incorporated in the developmental cycle of plant senescence?

The overall goal of this project is to gain insight into the system-level senescence and cell-death processes of plants, from the perspective of a life-history strategy. Acquiring such knowledge at molecular, cellular, intercellular, organ, and organismal levels will lead to breakthroughs that significantly improve plant productivity.

This study will provide an unprecedentedly detailed understanding of molecular events that clearly illustrates spatio-temporal multilayered networks and modules on this scientifically interesting and important subject. Furthermore, because plant productivity is highly influenced by senescence, our study can significantly contribute to resolving global problems (e.g., food and energy shortages; excessive carbon dioxide emissions). All organisms undergo aging and eventually die. Life history, senescence, and death are fundamental and philosophical matters for human beings. This study, which creates new paradigms for understanding life history and senescence, may also provide a crucial breakthrough in our understanding of age-dependent senescence and death.



Center for Artificial Low Dimensional Electronic Systems

Exploring the untapped potential of atomic-level, low-dimensional systems



Director

Han Woong Yeom

<http://caldes.ibs.re.kr>

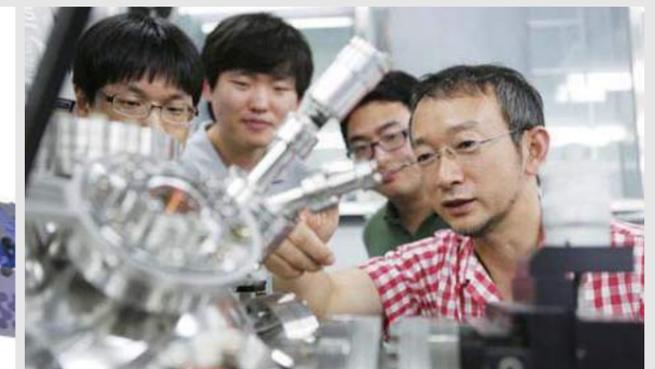
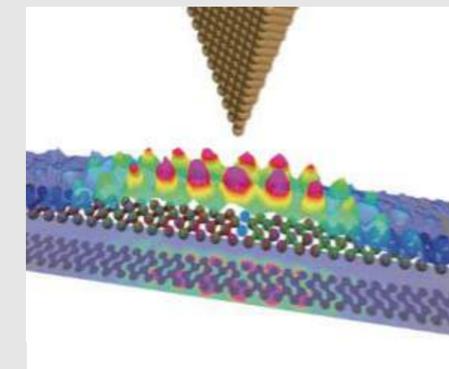
Introduction

CALDES challenges the major physics problems of low dimensional electronic materials that have been the central issues of modern condensed matter physics since 1970's.

In this long pursued discipline with the glory of quantum Hall effects, high temperature superconductors, and graphene, CALDES would pioneer new types of materials with state-of-the-art measurement technologies.

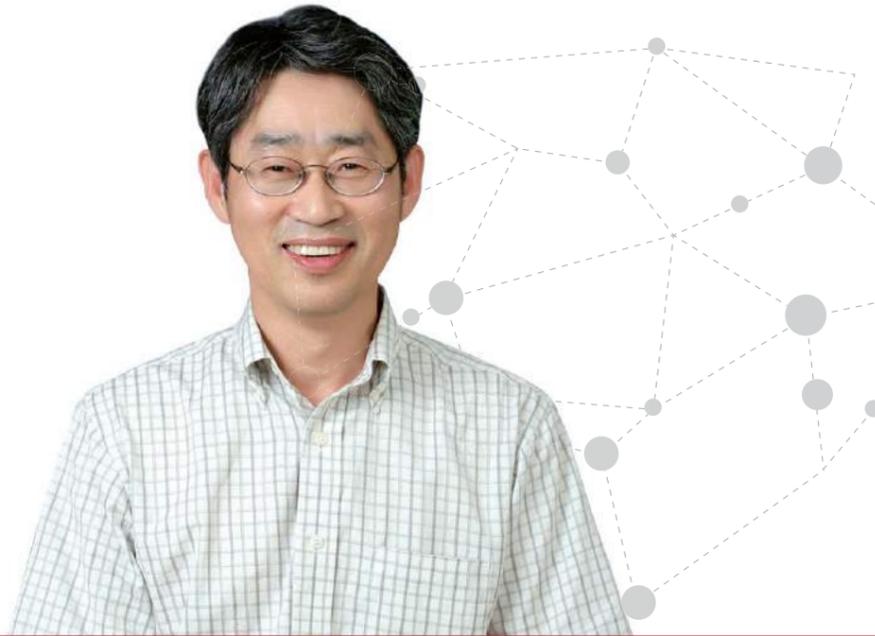
The new materials systems are low dimensional systems controlled and grown in atomic scale precision, such as atomic layers, atomic wires, atomic rods, and their arrays and heterointerfaces. The state-of-the-art measurement technologies include scanning tunneling microscopy below 10 mK and under strong magnetic field, magnetic force and spin-polarized scanning probe microscopy below 500 mK, and ultra bright spin-and angle-resolved photoelectron spectroscopy.

These frontier instruments can address the electronic and spintronic properties of atomic-scale low dimensional systems in truly single atom and single spin precision. With the atomically controlled low dimensional materials under atomically-resolved probes, CALDES investigates and manipulates exotic electronic and spin channels and topological excitations such as solitons, quantum spin Hall edge states, non Fermi liquids, skyrmions, quantum magnets and so on. CALDES aims to establish full understanding of these low dimensional electronic phenomena and to discover new physics and new functionality emerging from atomically designed low dimensional electronic materials.



Center for Neuroscience Imaging Research

*Advancing systems neuroscience
with neuroimaging*



Director

Seong-Gi Kim

<http://cnir.ibs.re.kr>

Introduction

Welcome to IBS Center for Neuroscience Imaging Research (CNIR)!

As you all know, understanding brain structures, function, networks and behaviors is one of sciences last and most daunting challenges. Since the brain has the order of one hundred billion cells, all of which are highly organized into structure and inter-connected for efficient communication, it is extremely difficult and tedious to determine the relationship between structure and function and to investigate the neural circuits of behaviors and underlying physiology in humans and animals. To accelerate the progress of brain research, the CNIR relies on high-tech neuroimaging tools such as magnetic resonance imaging, multi-photon microscope, and electrode arrays to investigate the entire brain or large brain area.

The CNIR consists of multiple inter-related research groups for the integration of experimental approaches from a diversity of disciplines; i) the Physics, Chemistry and Engineering group, which will develop novel methods and materials for brain research, ii) the Computation and Data Analysis group, which will determine signal processing and computation approaches to handle large amount of brain data, and iii) the Neurobiology and Cognitive Neuroscience groups, which will investigate behaviors and diseases in normal and dysfunctional rodents, monkeys and humans.

The CNIR is housed in a new three-story building with ~4,000 square meters and has core facilities including animal and human MRI, two-photon microscope, super high-resolution confocal microscope, computer clusters, electronic and machine shop, histology lab, and rodent and non-human primate animal housing. The major emphasis is to create an open research environment and to encourage synergetic, multi-modal, multi-disciplinary, creative neuroscience research. Consequently, our CNIR is interested in collaborative research with investigators around the world.



Center for Underground Physics

*Searching for dark matter WIMP to
explain the origin of the universe*



Director

Yeongduk Kim

<http://cupweb.ibs.re.kr>

Introduction

We now know that neutrinos are massive. But we do not know their absolute masses nor their natures. Discovering these important unknowns can be related to leptogenesis theories that make attempts to explain particle-antiparticle asymmetry in the universe. Neutrinoless double beta decay experiment is the most practical approach for determining the absolute masses and understanding the nature of neutrinos. We, the Center for Underground Physics (CUP) at the IBS, will perform several phases of AMoRE (Advanced Mo-based Rare process Experiment) experiments that probe the neutrino mass down to 0.03 eV.

Advancing our knowledge of dark matter is necessary in order to understand the origin and structure of the universe, because the universe consists of 26.8% dark matter and 68.3% dark energy. We are running experiments to search directly for WIMPs (Weakly Interacting Massive Particles), which offer the most plausible explanation as to the nature of dark matter. We will develop new detection techniques to search for dark matter, which would provide more sensitive than current running experiments.

We will install detectors with ultra-low noises at about 700 meter-deep underground laboratory in Yangyang in Korea to reduce cosmic ray backgrounds for searching extremely rare events such as neutrinoless double beta decays, dark matter and etc. Since we expect to see only a handful of signal events in a year, the success of the experiments highly relies on reducing backgrounds. We will achieve our goal by growing ultra-low background crystals and by developing low-temperature sensors that have excellent energy resolution and the power to distinguish the signals from huge background events.



Center for Axion and Precision Physics Research

Searching for dark matter axions to explain the formation of the universe



Director

Yannis K. Semertzidis

<http://capp.ibs.re.kr>

Introduction

When Newton realized that a falling apple and the motion of the moon (being in a perpetual falling motion!) follow the same physical law, that of gravity, he revolutionized the way we, humans, looked at the cosmos ever since. However, even though that law still holds (modified by Einstein's General Relativity rules) for distances within the solar system, it seems to fail miserably beyond that. The first indication of it appeared in the 1930's, when the velocities of galaxies within clusters of galaxies seem to be excessive for those galaxies to still be together. It was in the 1970's when Vera Ruth made precise observations of the rotational velocities of the stars within a single galaxy that made the question "Is there Dark Matter?" inevitable! Today there are several different indications, that the Dark Matter is indeed a big part of the energy of our universe, about 27% of it.

Axions are particles that come as a result of a mechanism that was invented to solve an embarrassing problem in strong interactions (those interactions that are responsible of holding the nucleus together, and able to overcome the strong electromagnetic repulsion force between protons). The axion particles are very light, and they fill the cosmos with a density of about half a proton mass per cubic cm. They are everywhere, but because they interact very weakly with anything we know, we can't feel their presence other than their gravitational effect. However, in the presence of a strong magnetic field they interact with it and they create a very weak, oscillating electric field. The (unknown) oscillation frequency is very narrow, which can prove to be a decisive quality for its detection. If we knew the oscillation frequency it would be easy to detect it. However, it could be anywhere between about 200 MHz to 200 GHz.

In our center for axion and precision physics (CAPP) we are going to significantly improve the detection techniques by adopting several different approaches. If they all succeed we will be able to detect the axions even if they are as low as 10% of the dark matter of our universe. Detecting the axions will open up a new era in physics, establishing the field of axionastrophysics and cosmology that will provide a rare glimpse at the early stages of the formation of our universe. The developed techniques may improve our understanding of super-conducting materials, super-conducting amplifiers, and radio-frequency techniques and even possibly discover something completely new and unexpected.



Center for Theoretical Physics of the Universe

Exploring the fundamental laws of nature and the origin of the universe



Director

Kiwoon Choi

<http://ctpu.ibs.re.kr>

Introduction

The IBS Center for Theoretical Physics of the Universe carries out research on particle physics and cosmology, which aims to understand nature at the most fundamental level and answer the questions about the origin of the universe.

The Standard Model of particle physics and Einstein's General Relativity provide an accurate description of almost all known physical phenomena over the scales from the subnuclear to the cosmic. However there are many reasons to believe that the Standard Model and General Relativity are not the final story, but merely a kind of approximation to a more fundamental theory. Astonishingly the most compelling reason comes from cosmic observations: the existence of dark matter and matter-antimatter asymmetry in the universe, which can not be explained by the Standard Model. As another compelling reason, the naturalness argument for electroweak symmetry breaking in the Standard Model suggests a possibility of new physics at energy scales around TeV. The quest for unification and a theory of quantum gravity also lead us to speculate about more fundamental theoretical frameworks such as grand unification and string theory.

The prime theme of our research is new physics beyond the Standard Model of particle physics, which can provide an answer to the following questions:

- What is the dynamical origin of the electroweak symmetry breaking?
- What would account for the hierarchical structure of the Standard Model parameters?
- What is the nature of dark matter in the present universe?
- What physics drives inflationary expansion in the early universe?
- How to unify the fundamental forces of nature?

We are living in a very exciting era for particle physics and cosmology. What is the next fundamental theory that underlies the Standard Model of particle physics? We may be able to uncover it in the near future.



Center for Multidimensional Carbon Materials

Pioneering a new era of carbon materials and allotropes



Director

Rodney S. Ruoff

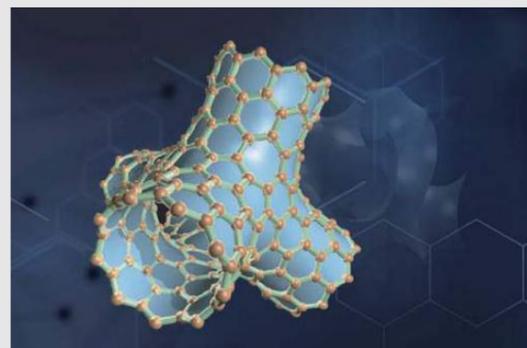
<http://cmcm.ibs.re.kr>

Introduction

Welcome to the IBS Center for Multidimensional Carbon Materials (CMCM)!

The IBS Center for Multidimensional Carbon Materials (CMCM) supports a talented international team of highly collaborative researchers that design, synthesize, and study new forms of carbon and related materials, many of which are expected to have exceptional chemical, physical, biological, and electronic properties. The center is located in a new building at the Ulsan National Institute of Science and Technology (UNIST), nestled in a beautiful area between the port cities of Ulsan and Busan. Members and visitors of the CMCM enjoy an intellectually stimulating environment that fosters dynamic exchange within the center and abroad through its extensive, international network of research institutions and programs.

- Designing, synthesizing and studying new forms of carbon and related materials
 - Conducting research of design, synthesis and properties of carbon materials or carbon-based hybrid materials
 - Conducting interdisciplinary research across chemistry, physics, materials science and other related areas



Center for Soft and Living Matter

Exploring untapped possibilities of diverse soft matter through interdisciplinary research



Director

Steve Granick

<http://softmatt.ibs.re.kr>

Introduction

The subjects encompass the chemistry and physics of biomolecular science; the intellectual complexity of complex materials; the puzzles of understanding structure and dynamical processes of matter far from equilibrium; the mystery of what is life. This IBS Center includes focused research on soft matter, biology, theory, simulation, and light-matter interactions.

Impact on Society

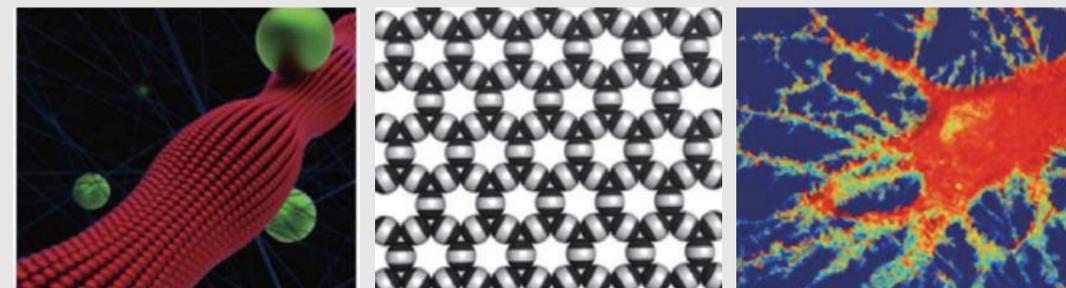
Inadequate understanding of soft and living matter holds back progress in vital societal needs: health issues with ramifications from genetic development to nanomedicine, and environmental issues from climate change and water purity, to affordable energy. Numerous industries revolve around applying these principles: among them, liquid crystals, synthetic polymers, membrane systems, protein assays, and bioengineering.

Competitive Edge

Institutions with soft matter interests elsewhere in the world are under economic stress, and increasingly under pressure to pursue short-term engineering of an applied nature. This is one reason why the broad expertise and sophisticated equipment of this Research Center will have a decisive competitive edge over those other places. Long-term investment can have major impact in this important scientific area where the secular trend elsewhere in the world is to focus on the short-term.

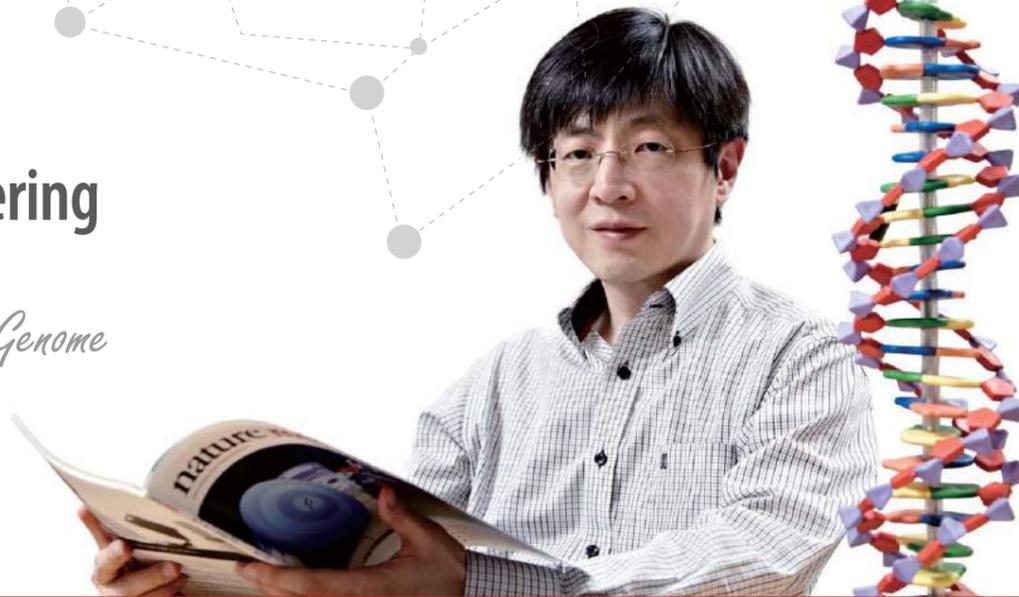
Anticipated Outcomes

The research themes have been selected to avoid duplication with existing research, yet to complement existing research, as clearly the Research Center will benefit from collaborations with existing groups in Korea and globally. The Research Center will establish itself on the forefront of scientific inquiry and wishes to be known for basic, fundamental science, not for technology. It is anticipated that the Research Center will train a new generation of scientists in this intellectual area where scientific excellence can have major impact on society. With hard work and good luck, students and postdocs who pass through the Research Center may one day attain achievements at the highest level.



Center for Genome Engineering

Leading the CRISPR Genome editing revolution



Center for Theoretical Physics of Complex Systems

From Complexity to Universality: investigating new laws of physics



Director

Jin-Soo Kim

<http://cge.ibs.re.kr>

Introduction

We focus on developing programmable nucleases that enable genome editing in plants, animals, and cultured cells including human pluripotent stem cells. These nucleases cleave chromosomal DNA in a targeted manner, producing DNA double-strand breaks (DSBs), whose repair via endogenous mechanisms gives rise to targeted genome modification in cells and whole organisms. For the last ten years or so, we have developed three different types of programmable nucleases, namely, zinc finger nucleases (ZFNs), transcriptional activator-like effector nucleases (TALENs), and RNA-guided engineered nucleases (RGENs) derived from the type II CRISPR/Cas prokaryotic adaptive immune system. These nucleases are now used widely in almost every discipline in biology, biotechnology, and molecular medicine. We have opened websites to help researchers choose unique RGEN target sites suitable for gene disruption (www.rgenome.net) and TALEN sites in 18,740 protein-coding genes and 274 miRNA sequences in the human genome (www.talenlibrary.net).

We will continue our efforts to improve and expand genome editing technologies. In addition, we plan to use these powerful tools to discover new genes associated with various disease phenotypes such as viral replication and cancer and to develop methods of gene/cell therapy for the treatment of both acquired and genetic diseases. We also focus on developing genome-engineered pigs appropriate for organ transplantation and value-added crops.



Director

Sergej Flach

<http://pcs.ibs.re.kr>

Introduction

Today the eyes looking for novel technologies and new generation devices focus on nano-structured materials with unprecedented electrical, mechanical, optical and other properties like graphene, nanotubes, quantum dot arrays, metamaterials, trapped atomic condensates, superconducting networks, plasmonic and nanophotonic structures. There is an increasingly strong demand for new theoretical concepts, approaches and computational tools for uncovering fundamental nonlinear and quantum many-body processes in such systems and designing efficient methods of their control.

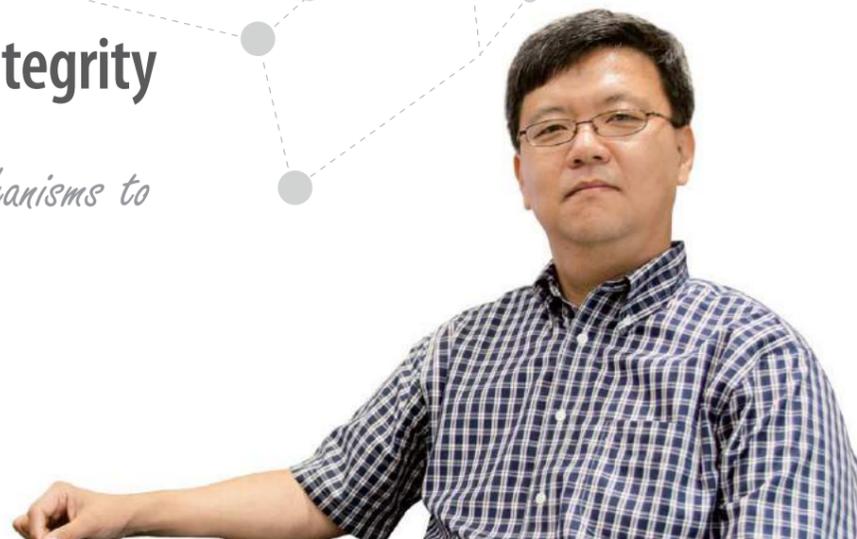
Our center aims to take up the grand challenge and to create a world-class laboratory for the nonlinear classical and quantum dynamics of nano-structured systems, and to conduct cutting edge research on phenomena at the interfaces of applied and computational theoretical condensed matter physics and optics. We aim to cross-fertilize research on exciton-polariton condensates, superconducting networks, quantum dot networks, ultracold atomic gases, optical waveguide networks, topology, frustration, flatband physics, Fano resonant nanoscale devices, artificial gauge fields, quantum ratchets, many body localization, disorder against interactions, artificial quasicrystals, nonintegrability, deterministic chaos, Arnold diffusion, KAM, coherence and decoherence, quantum stochastic dynamics, finite systems, targeted energy transfer, transport in nano structures, nonlinear nanophotonics, topological insulators, and more.

An efficient Visitors and Workshop Program will ensure finest research and training standards thus developing the center into a leading institution able to successfully compete within a quickly globalizing science network. By becoming a meeting hub for the global scientific community the center will offer to young scientists an excellent research environment and connections with the worldwide leaders in a broad variety of emerging research fields.



Center for Genomic Integrity

Identifying DNA repair mechanisms to cure cancer and explain aging



Director

Kyungjae Myung

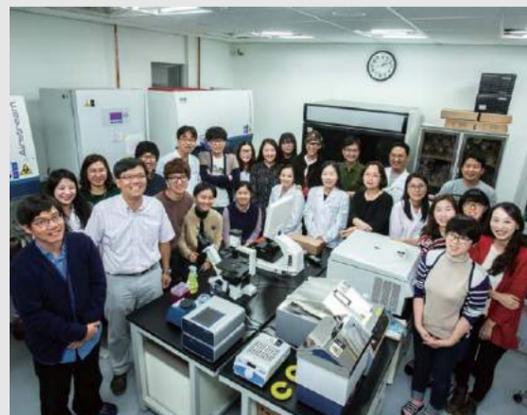
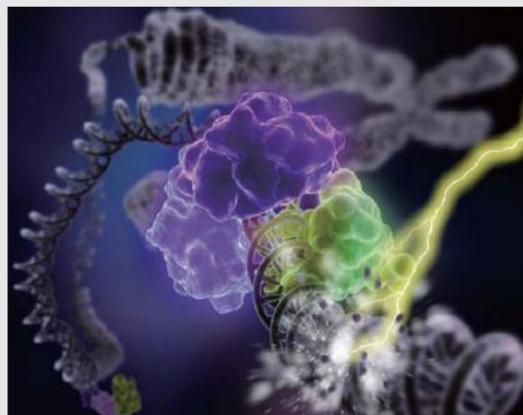
<http://cgi.ibs.re.kr>

Introduction

DNA is a building block for entire genome and encodes genetic codes, which determine almost every aspects of life. In some cases, DNA could be damaged by endogenous asserts such as replication errors and oxidation stresses or exogenous challenges such as radiation or toxic chemicals. If such damage were not properly repaired, cells could die or accumulate mutations that would cause aging and genetic diseases including cancers. Cells equip multiple DNA repair pathways that can sense, transduce signals, and ultimately repair damaged DNA. These pathways sometimes participate other DNA metabolisms including DNA replication, transcription, and recombination.

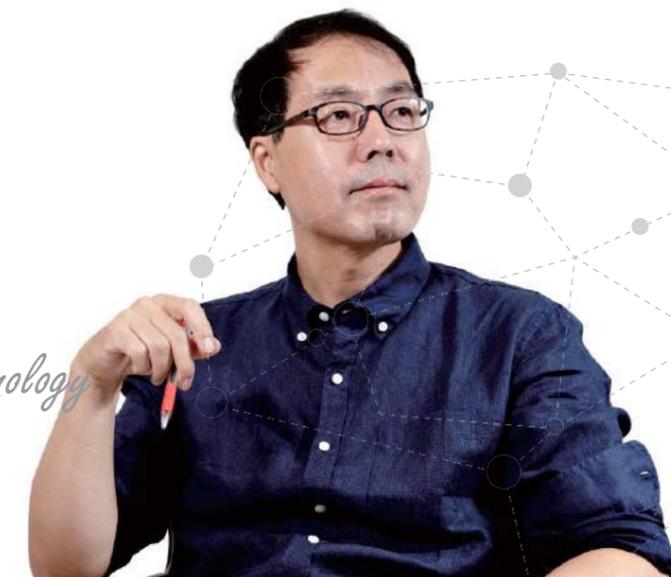
The Center for Genomic Integrity will investigate these multiple DNA repair pathways at the molecular level using small molecules with molecular, cell biological and biochemical techniques and animal models.

We anticipate our research will uncover detail molecular mechanisms of DNA replication, repair, and recombination and come up with potential answers the origin of cancers, aging, and evolution.



Center for Molecular Spectroscopy and Dynamics

Capturing the motion of a molecule by developing a new spectral imaging technology



Director

Minhaeng Cho

<http://cmsd.ibs.re.kr>

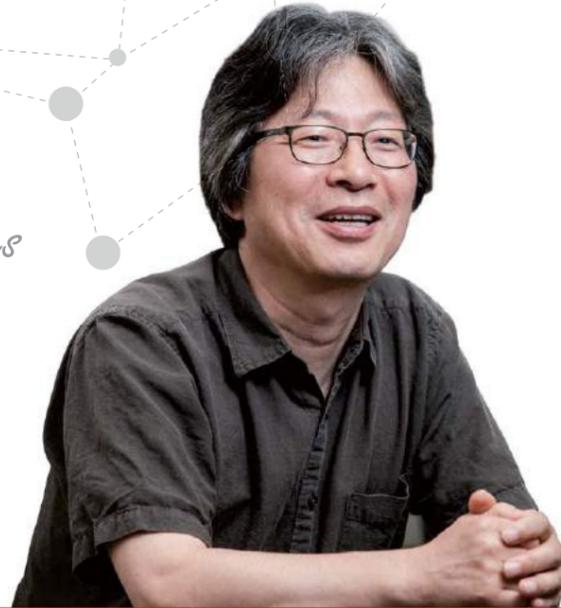
Introduction

IBS Center for Molecular Spectroscopy and Dynamics (CMSD), located in the Seoul campus of Korea University, emphasizes developments of novel time- and space-resolved spectroscopy techniques and their applications to chemically reactive and biologically important systems. CMSD uses ultrashort duration pulses of light to generate stroboscopic movies of the molecular motions that lead to the chemical, biological, and physical transformations of condensed matter. We use a broad range of radiation sources to measure the dynamics of electronic and vibrational degrees of freedom in a wide range of systems, perform quantum chemical and molecular mechanical computations of dynamic systems in condensed phases, and develop novel linear and nonlinear optical imaging and microscopy technologies to monitor time-evolution of chemically and biologically reactive systems in real time.



Center for Vascular Research

Searching for cures for vascular diseases through deep probing research



Director

Gou Young Koh

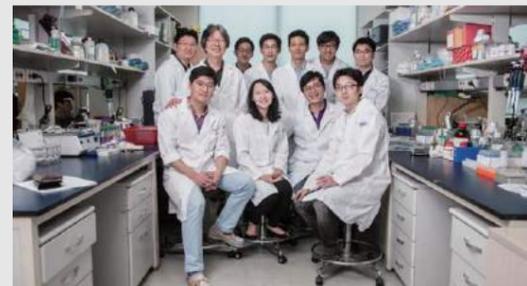
<http://vascular.ibs.re.kr>

Introduction

Endothelial cells (ECs) constitute the inner lining of blood and lymphatic vessels as monolayers and play essential roles in regulating and maintaining the viability of all organs in the human body. The shape and response of ECs differ depending on the organ, location, situation, and stimuli. This diversity and heterogeneity of ECs have been a long-standing interest, because such characteristics are essential in displaying and maintaining diverse functions of different organs and tissues. Despite the significant conceptual advances we have already achieved, a large portion of the characteristics remains to be elucidated to further our understanding of the diversity and heterogeneity of ECs at the molecular level.

Our ultimate goal is to make ground-breaking discoveries, conceptual advances and paradigm shifts in vascular biology through basic and fundamental research. In particular, we will focus on further understanding of "organotypic" EC heterogeneity, angiogenesis, lymphangiogenesis, cardiogenesis, vascular remodeling, and vascular niche with the integration of biomedical science and innovative technology. We will aim to 1) identify novel key regulators and clarify their mechanisms in organotypic endothelial cell heterogeneity, angiogenesis, and vascular remodeling and regeneration, 2) identify novel key regulators and clarify their mechanisms in the interaction between endothelial cells and pericytes, 3) unveil the critical roles of key molecules in organotypic lymphangiogenesis, lymphatic remodeling, and lymphatic functions in the extra- and intra-nodal tissues, 4) identify cardioblasts and clarify their characteristics and effective applications for cardiac regeneration, and 5) undertake creative approaches and develop innovative methods for angiogenesis, lymphangiogenesis, vascular remodeling, and cardiogenesis.

To do so, we will use not only our currently established methods, technologies, reagents and experimental animals, but we will also set up several core facilities for the generation of genetically modified mice, advanced imaging technology, and gene, cell and tissue analyses. Moreover, we will combine and fuse aspects of biomedical sciences and engineering via multi-faceted and multidisciplinary approaches to implement high-quality, creative ideas and take on innovative challenges. Successful achievement of these aims will not only shed light on unexplored paths to understand the regulations of cardiovascular functions in an organ-specific manner, but also enable us to develop new drugs and stem cells to treat cardiovascular diseases, including cancer, diabetic vasculopathy and ischemic heart diseases, as translational medicine.



Center for Nanomedicine

Leading Nanomedicine by Utilizing Nanoscience to Understand Life



Director

Jinwoo Cheon

<http://nanomed.ibs.re.kr>

Introduction

The goal of the Center for Nanomedicine is to establish a foundation for the future convergence of nanomaterials and biological systems. Our center aims to introduce new possibilities to the scientific community by developing 'Evolutionary Nanomaterials' capable of monitoring and understanding biological phenomena with ultimate precision and accuracy. These will eventually provide promising solutions for many challenges in current medical approaches to diagnosis and treatment.

Evolutionary nanomaterials interact and react to external stimuli and environments, including pH, heat, light, radicals, electric/magnetic fields, physical force, and chemical potential. They can be remotely and spatio-temporally used as probes, actuators, or communicators by applying various external stimuli in a controlled manner. These new nanomaterials will be used as new nano-tools and nano-concepts for the next generation imaging and therapeutics.

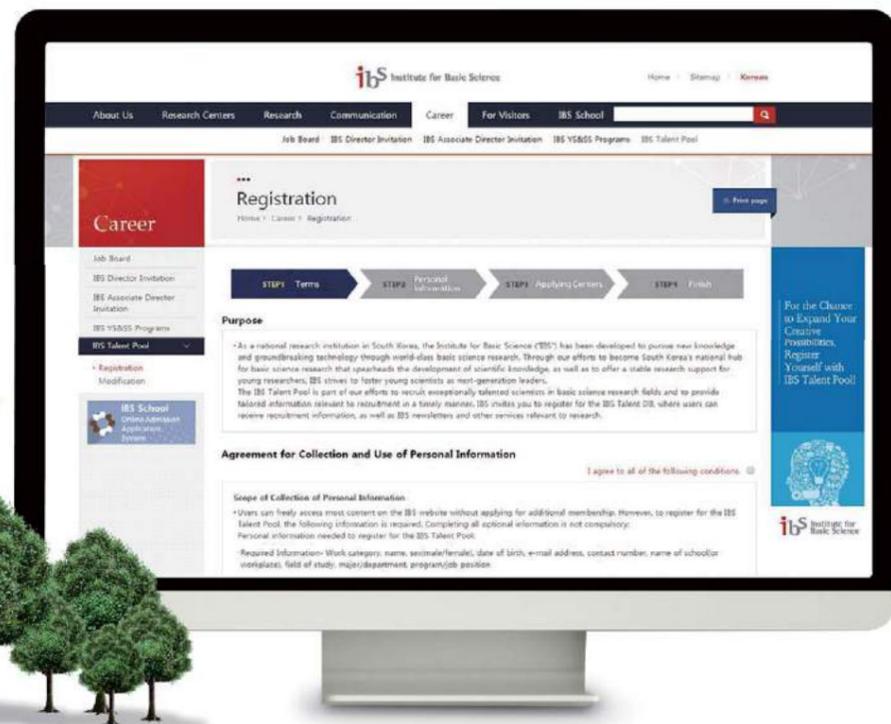
Our center 1) designs nanomaterials and nano-tools with desired high performance characteristics to establish innovative principles for nanomedicine, 2) applies them to nano-bio interface imaging in order to comprehensively understand and identify the principles behind biological phenomena, and 3) manipulates them for digitized ion channel control, on-command drug/gene delivery, and the regulation of biological functions. Some of the long term outcomes of our work will be innovative concepts and tools for ultra-sensitive, high-accuracy, and high-efficiency diagnosis and treatment of diseases. The Center for Nanomedicine seeks to develop this new scientific field on the basis of interdisciplinary research across the related fields of chemistry, physics, bioengineering, and medicine.



IBS Talent Pool



You are the Next - Generation Leader in Basic Science



Purpose of Establishment

As a national research institution in South Korea, the Institute for Basic Science ("IBS") has been developed to pursue new knowledge and groundbreaking technology through world-class basic science research. Through our efforts to become South Korea's national hub for basic science research that spearheads the development of scientific knowledge, as well as to offer a stable research support for young researchers, IBS strives to foster young scientists as next-generation leaders.

The IBS Talent Pool is part of our efforts to recruit exceptionally talented scientists in basic science research fields and to provide tailored information relevant to recruitment in a timely manner. IBS invites you to register for the IBS Talent DB, where users can receive recruitment information, as well as IBS newsletters and other services relevant to research.

Register yourself in the IBS Talent Pool DB for your future job prospects. www.ibs.re.kr/talents

IBS Young Scientist Fellowship (YSF)



Purpose and Background

With the vision of "Making Discoveries for Humanity and Society," the institute for Basic Science (IBS) was founded in 2011 by the Korean government to promote basic sciences in Korea. Twenty-six IBS Research Centers have been launched and each Center is operated by internationally renowned scientists.

This year, the IBS introduces a new program called "Young Scientist Fellowship (YSF)" to play an active role in fostering next-generation basic science leaders. The YSF offers opportunities for young, promising scientists to do their own basic research work in one of the IBS Research Centers while sharing ideas and utilizing our state-of-art infrastructures. We encourage challenging and high-risk basic research within the special nature of each RC.

We hope that the YSF program functions as a stepping stone for our research fellows to be appointed as independent principal investigators at the prestige institutions worldwide.

Eligibility

- Within 5 years of obtaining a PhD or under the age of 40 with a PhD

Benefit and Condition

- The YSF provides KRW 150-300 million per year
- YSF fellows will be appointed for 3 years with possible extension of 2 years
- YSF fellows should be physically relocated to one of the IBS Centers
- Equipment can be transferred to the newly appointed institution upon approval

Selection Process: Two Steps

- Letter of intent
 1. Submission deadline: July 31, 2016
 2. Review and discussion by Evaluation Panel members
 3. Invitation to submit full proposals: August 31, 2016
- Full proposal
 1. Submission deadline: September 30, 2016
 2. Review by Evaluation Panel members
 3. Invitation for an on-site interview: October 31, 2016
 4. Interview and presentation: November 30, 2016
 5. Selection and announcement of final YSF fellows: December 31, 2016

Contact

- Ms. KIM Da Hye
(Tel: +82-42-878-8204; email: kimdahye@ibs.re.kr)
- For details, please visit the IBS homepage at <http://www.ibs.re.kr>





Rare Isotope Science Project

RAON, the name of the heavy-ion accelerator is a Korean word meaning "Happy" or "Joyful".

A Key research facility of the Institute for Basic Science (IBS), the Rare Isotope Science Project (RISP) is intended to realize the key infrastructure of next-generation research on basic sciences in Korea.

The heavy-ion accelerating facility plays an important role in diverse global level research fields including the exploration of the origins of chemical elements, the discovery of and structural study of new isotopes, research on new materials using rare isotopes, and applied medical research. The research results of such basic and applied fields using the heavy-ion accelerator will contribute to the achievement of the important national agenda of Korea to join the club of nations advanced in basic research, such as the U.S, EU, and Japan.

For the successful construction of a world-class and hi-tech heavy-ion accelerator, the RISP is pursuing a systematic and scientific detailed design process by reviewing the technical and comprehensive validity of the conceptual design and is endeavoring to create an efficient environment for the construction of the accelerator by preparing organic cooperative systems at home and abroad and expert training support systems.

As a major rare isotope heavy-ion accelerator, RAON will provide world-class high-strength and high-performance rare isotope beams and produce outstanding research results in basic scientific studies and applied scientific developments that make use of these beams, thus leading global research.



Director **Sunchan Jeong**

RAON, Planned in the Global Context

Since its planning stage, RAON has been designed and constructed in a global context, taking into account the opportunities that lie outside Korea, with a focus on globally open access facility with international participants and contribution rather than on a national facility. RAON will support forefront international research program and these international usage of the facility will be considered to optimize global nuclear science program.

RAON, Tools of Nuclear Physics and Rare Isotope Science

Most of investigation of the structures of nucleons and nuclei involve the use of accelerators that generate high energy beams of particle which strike target or collide each other.

RAON uses heavy ions or heavy elements such as helium, uranium, or carbon element that are heavier than hydrogen. When the heavy-ions travel near the speed of light and collide with their targets, rare isotopes (elements with the same number of protons but a different number of neutrons) can be obtained. At this stage, femtometer - a metric unit of length equal to one quadrillionth of a meter - is able to be studied at the same time.

RAON Research Areas



Nuclear Science



Atomic & Molecular Science



Material Science



Bio & Medical Science

Milestone of RAON

※Source: Construction Management Team, Facility Construction & Infrastructure Division, RISP
 ※This milestone may be modified or be amended under certain circumstances of the project

Contents	2013	2014	2015	2016	2017	2018	2019	2020~21
Site Preparation (LH)			Land compensation and site infrastructure construction (15.4-17.6)					
Civil Engineering and Conventional Facilities Construction			Basic design (14.12-15.12)	Agreement / Notice	Detail design (16.10-17.6)			Building construction (17.7-21.12)
Accelerator System Construction	Design (-13.9)	Prototype manufacture · performance testing of the key component (13.10-17.12)		Manufacturing · installation and commissioning of the accelerator (the main component) (15.5-21.12)				