

# KIST, Platform of The 4th Industrial Revolution

KIST 2066,  
Beyond the M.I.R.A.C.L.E.



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the day of issue | May 2017





Just as a thick forest  
begins with a single tree,  
the expansive development of Korean science and technology  
began with a single research institute,  
KIST, established more than a half-century ago.  
Since then, KIST has evolved into  
a vast, multi-faceted organization that is  
gaining global recognition as one of the world's premier research institutes.  
KIST is dedicated to its mission of using science and technology  
to improve the lives of people all over the world.

Founding Purpose

KIST was established in 1966 with the primary goals of developing creative, original, and cutting edge technologies; improving Korea’s scientific and technological capacities, and participating in the active transfer of these technologies. Initially, KIST focused on developing technologies suitable for industrialization, and these technologies contributed greatly to the modernization of Korea and fostered remarkable economic growth throughout the nation.

Over the course of time, KIST has produced premier S&T talents and spun-off numerous specialized research institutes. Such achievements cemented KIST’s status as Korea’s leading S&T institute. By applying the years of accumulated R&D expertise, KIST is now expanding its role and taking on large-scale, long-term, interdisciplinary R&D projects typically too challenging for universities or private companies. KIST is working hard to continually advance the field of science and technology, both domestically and internationally.

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North access road to KIST





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#### KIST Embarks on a New 50 year Journey to Improve People's Lives and Develop the National Economy

By preparing for the future, the Korea Institute of Science and Technology (KIST) is working to increase the quality of life for people all over the world. KIST was founded in 1966 as Korea's first S&T research institute. Since then, it has continually played a leading role in national development. Many government-funded research institutes have been modeled after KIST, making KIST the national think tank for Korean science and technology.

2017 is a banner year for our institute. Last year, KIST celebrated its 50th anniversary, and we are preparing for next 50 years by getting ready to meet head on such global challenges as aging societies and energy-food shortages while ushering in a new future via convergence research and open cooperation.

In addition, KIST is working to insure that our research will translate into greater competitiveness for Korean businesses. We believe that science and technology provides a solid foundation for firmly establishing Korea's economic development. Given that KIST was born with help from foreign aid, we believe it time to return the favor by disseminating the KIST model for science based official development assistance (ODA) and thereby contribute to the betterment of the international community while also enhancing Korea's global status.

As KIST prepares to tackle the next 50 years, all of us here are dedicated to working even harder to create a new future for human society.

**Dr. Byung Gwon Lee**  
President of KIST

05

## KIST 2066, Beyond the M.I.R.A.C.L.E.

Going beyond the success of the past half-century and the limitations of current research, we will create a new miracle for the future.

### M aterials

**Pioneering next generation materials**  
(post-silicon, carbon-based composite materials)

### I formation

**Leading the post-digital era** (quantum computing, neuromorphic chips)

### R obotics

**Realizing the future coexistence of humans and robots** (AI, humanoids, media)

### A griculture

**Leading the future agricultural revolution** (smart farms, natural products)

### C arbon

**Leading climate change response**  
(renewable energy, energy networks)

### L ife

**Preparing for super aging societies through bio-medical technology**  
(dementia, bio sensors, bionics)

### E nvironment

**Realizing a sustainable "Green City"**  
(environmental welfare, secure water resources)



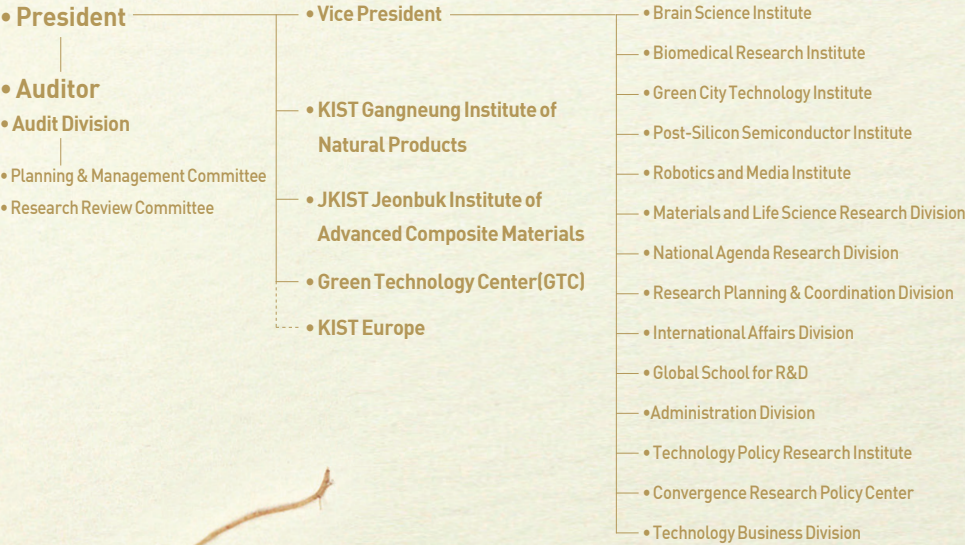
# KIST 2066, Beyond the M.I.R.A.C.L.E.

In 1966, KIST was established to develop Korean science and technology. The results have been remarkable advancements in Korean science and technology, as well as the exponential growth of the Korean economy.

Vision

Over the past half century, KIST has been at the forefront of the Korea's remarkable development. KIST plans on continuing and even outpacing its prior success during the next 50 years as an internationally esteemed institute.

Organization



History of KIST

## 1960~1970s

- February 1966 Founded and formally registered
- October 1969 Held building-completion ceremony
- October 1969 Completed POSCO technology planning
- February 1971 Developed Korea's first desktop computer and pocket-sized calculators
- November 1971 Filed first U.S. patent registration #3,622,914
- July 1972 Developed Korea's first technicolor TV
- October 1975 Developed Sejong No. 1, the first Korean mini-computer
- February 1976 Developed copper-clad steel wire manufacturing technology
- June 1978 Developed polyester film
- April 1979 Developed pneumonia vaccination

## 1980s

- January 1981 Integrated with the newly established Korea Advanced Institute of Science and Technology (KAIST)
- May 1983 Developed synthesizing liver fluke treatment
- November 1983 Developed CFC replacement materials
- March 1984 Developed optical fiber technology
- July 1987 Developed artificial heart-lung medicine
- May 1988 Developed synthetic diamonds
- September 1988 Performed doping test for the Seoul Olympic Games
- July 1989 Developed prototype for PFC artificial blood
- June 1989 Diverged from KAIST and re-established as the Korea Institute of Science and Technology (KIST)

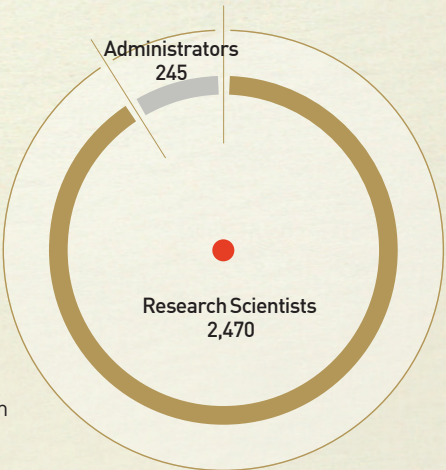
## 1990s

- March 1993 Developed lyocell (rayon) manufacturing techniques
- November 1993 Developed artificial kidneys
- June 1994 Developed VCR head drums
- November 1994 Developed anaerobic contact aeration-type sewage treatment equipment
- July 1995 Developed platinum anticancer candidate substance
- February 1996 Opened KIST Europe
- December 1996 Developed the extremely sensitive linear positioning motor
- July 1999 Invented Centaur, Korea's first humanoid robot

## 2000~Present

- August 2000 Developed the hydrogen hydrogen fuel cell vehicle
- February 2002 Became the first institute to investigate R-type calcium channels, the fear-affecting gene
- February 2003 Developed MiRo (capsule-type endoscope)
- May 2003 Established KIST Gangneung Branch
- January 2005 Developed the network-based humanoid
- January 2008 Established KIST Jeonbuk Branch
- July 2008 Developed dye-sensitized solar cell (DSSC) manufacturing technology
- September 2009 Became the world's first institute to develop spin-transistor technology (core of the next-generation semiconductor industry)
- November 2010 KIST's English-teaching robot was cited in TIME's 50 Best Inventions of 2010
- November 2010 Developed intracellular messenger secretion and mechanism from glia cells
- January 2012 Developed mGRASP for mapping mammalian synaptic connectivity
- November 2013 Developed the flexible memory cell array
- December 2014 Developed the next generation micro surgical robot
- October 2015 Developed the Alzheimer's Diagnosis Blood Test system
- February 2016 50<sup>th</sup> Anniversary of KIST
- February 2017 Ranked as the 6<sup>th</sup> most innovative public research institution in the world by Reuters for two years in a row

No. of Staff



※Total : 2,715 (As of Feb. 2017)



INTERNATIONAL COOPERATION

GLOBAL OPEN RESEARCH



- **Overseas Centers**
  - KIST Europe (Saarbrücken, Germany)
  - Indo-Korea Science and Technology Center (Bangalore, India)
- **Joint Laboratory**
  - KIST-UBC (Vancouver, Canada)
  - KIST-DFCI (Boston, USA)
- **Global Research Laboratories**
  - KIST-ENEA (Italy)
  - KIST- Johns Hopkins Univ. (US)

KIST Europe

TEL : +49-[0]681-9382-0

• Environmental Safety Group • Bio Sensor & Materials Group • Smart Convergence Group

KIST Europe, located in Germany, has served as a bridge between Korean and European R&D institutes and industries since 1996. Furthermore, it provides guidance and assistance to Korean companies seeking to establish their businesses in Europe and vice versa. KIST Europe carries out open research programs in the fields of environment, energy, and integrative bio- and nanoengineering.



● Institutions in Partnership with KIST

- Bulgaria**
  - Bulgarian Academy of Sciences (BAS)
- Canada**
  - University of Waterloo
  - University of British Columbia (UBC)
- China**
  - Shanghai Academy of Science and Technology/Shanghai Industrial Technology Institute (SAST/SITI)
  - Science and Technology Department of Sichuan Province
- Czech**
  - Charles University, Prague
  - Czech Technical University, Prague
- Denmark**
  - DHI, Denmark
- Ethiopia**
  - Adama Science and Technology University (ASTU)
- France**
  - CNRS
  - University of Grenoble Alpes (UGA)
  - Laboratoire d'Electronique et de Technologies de l'Information (LETI)
- Germany**
  - Technische Universitat Berlin
  - Forschungszentrum Karlsruhe GmbH
  - Fraunhofer-Gesellschaft (FhG)
  - Helmholtz Centre for Infection Research (HZI)
  - Saarland University
- Indonesia**
  - Universitas Indonesia (UI)
- Italy**
  - Institute for Advanced Energy Technologies (ITAE)
- Japan**
  - Institute of Physical and Chemical Research (RIKEN)
  - Tohoku University
  - Tokyo Institute of Technology
- Mongolia**
  - Mongolia Academy of Science (MAS), Institute of Chemistry and Chemical Technology (ICCT)
  - Mongolia National Olympic Committee (MNOC)
- Portugal**
  - University of Minho
- Swiss**
  - Swiss Federal Laboratories for Materials Science and Technology (EMPA)
- Thailand**
  - Asian Institute of Technology (AIT)
- Ukraine**
  - V. N. Karazin Kharkiv National University
  - NTUU KPI (National Technical University of Ukraine Kyiv Polytechnic Institute)
- Uruguay**
  - National Research and Innovation Agency
- USA**
  - National Institute of Biomedical Imaging & Bioengineering (NIBIB)
  - Stony Brook University (SBU)
  - Dana Faber Cancer Laboratory (DFCI)
  - National Cancer Institute (NCI)
- Vietnam**
  - The Ministry of Science and Technology of the Socialist Republic of Vietnam (MOST)
- World Bank**
  - PASET (The Partnership for skills in Applied Sciences, Engineering and Technology)



VKIST (Vietnam-Korea Institute of Science and Technology)



PROGRAMS FOR STUDENTS

CULTIVATION OF FUTURE S&T LEADERS

KIST School, UST

KIST School was founded in March of 2017 to educate S&T professionals as future leaders of their respective societies.

Our three innovative S&T programs reflect what we believe to be important future trends:

- Division of Bio-Medical Science & Technology
- Division of Energy & Environment Technology
- Division of Nano & Information Technology

These programs offer multi-disciplinary courses and several different professors for each course to help educate students to the fullest. In addition, KIST's campus is equipped with state-of-the-art facilities and cutting-edge equipment that provide further learning opportunities for students. And students at KIST School are given opportunities to participate in actual R&D projects, receive firsthand experience at real industrial sites, and undergo research-oriented education and training within their respective disciplines.



KIST School Students



UST Commencement Ceremony

Programs for Outstanding Postdoctoral Research Fellows

KIST offers postdoctoral programs that provide students with valuable R&D experience. These postdoctoral programs adds another dimension to KIST's expertise such as fostering top-level researchers and reinforcing fundamental research capabilities.

KIST-Academia Collaborative Education Program

This premier S&T educational program was established as a joint project that takes advantage of KIST's research expertise and universities' educational expertise. The program differs from conventional master's and doctoral programs due to its unique research-oriented curriculum. Students first complete the basic coursework at their original universities then join in research projects at KIST. KIST researchers serve as student co-advisor along with an academic advisors from their universities. This collaborative program develops students into top-notch S&T professionals with solid applied skills and strong theoretical knowledge.



Community Outreach Programs for Students

The 'KIST Science Tour' is designed to enable young people to experience the research field. We also provide lectures to local communities and to students who need information to develop S&T careers. We also participate in various scientific and cultural promotional programs. Furthermore the real-world applications of 'KIST High School Science Camp' and 'internship program' allow students to experience science and technology. Students can also apply to the 'Science Leadership Camp for Junior High School Students' and 'Science Drawing Competition' to develop the kind of S&T talents that will help them to realize their dreams.

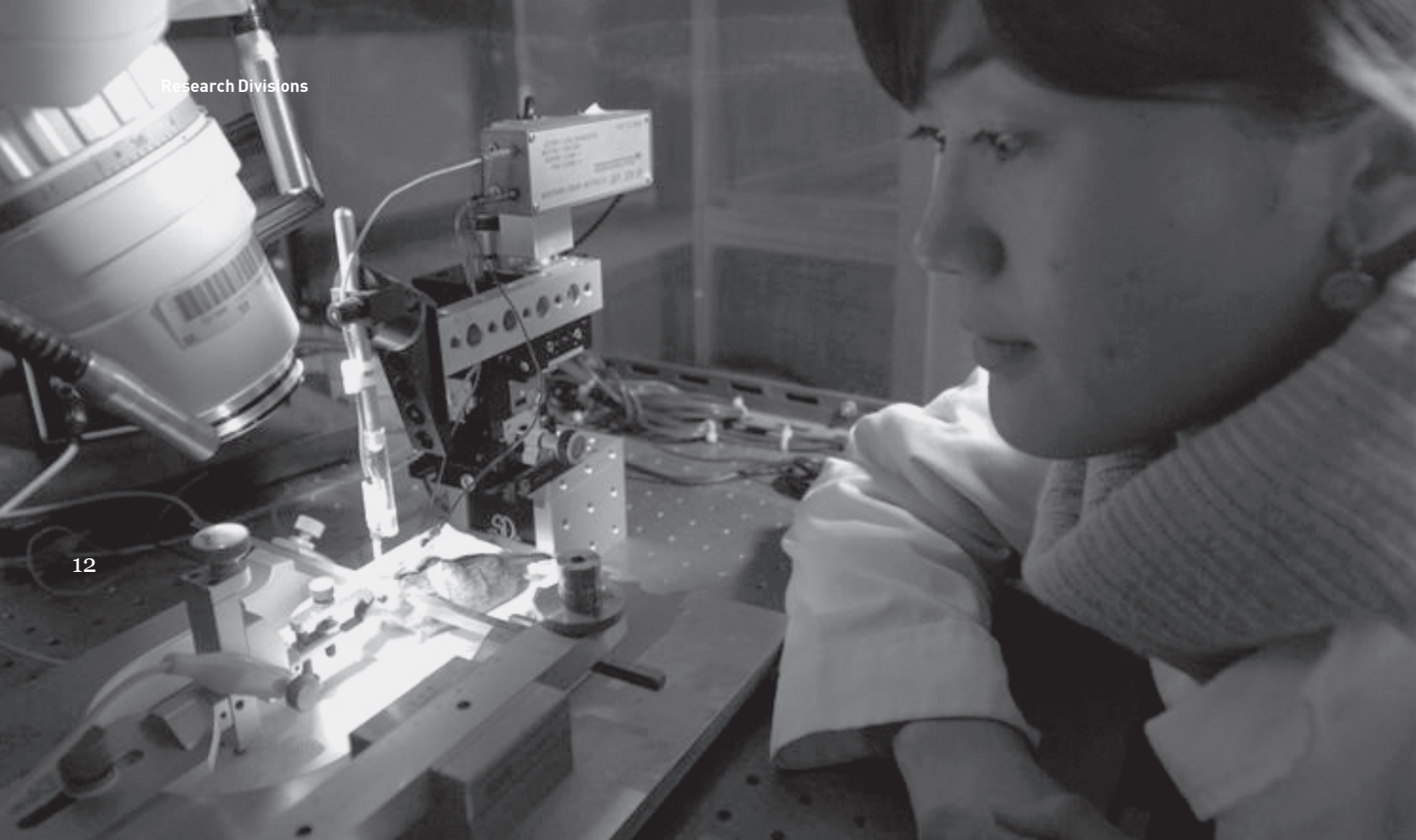


KIST Science Tour



Science Leadership Camp for High School Students





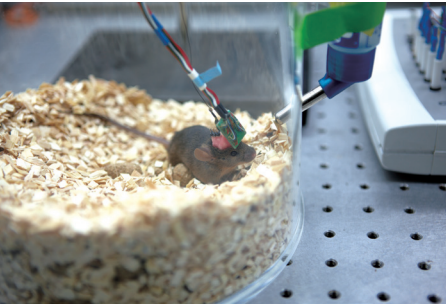
Brain Science Institute

Research Support Team : +82-2-958-7033

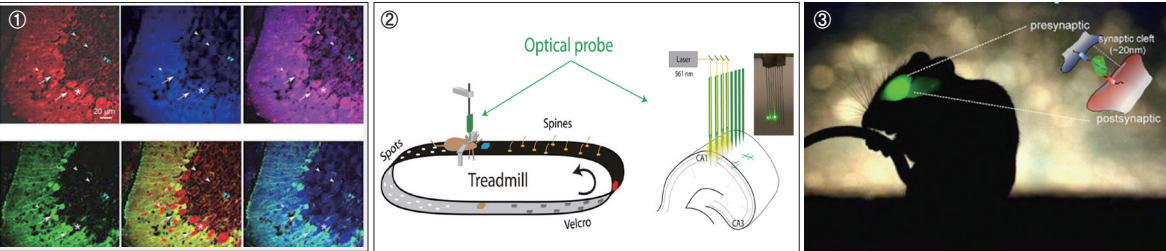
- Center for Neuroscience
- Center for Functional Connectomics
- Center for Neuro-Medicine
- Center for BioMicrosystems
- Center for Glia-Neuron Interaction
- Sensory Research Center

Hub of Brain Science Research; Working to Unlock the Secrets of the Human Brain

The human brain is a highly complex system often dubbed a “miniature universe.” Its many mysteries have yet to be unveiled. The Brain Science Institute specializes in convergence brain research of such fields as neuroscience, nano-engineering, medicine, genetics, and more. The institute aims to comprehend the neural mechanism responsible for controlling human behavior, as well as to discover methods of correcting brain dysfunction. The primary goals of the Brain Science Institute are to unravel the mysteries of the brain and become the hub of global brain science research.



- ① Study of glia in brain functions
- ② Investigation of information gain mechanisms underlying place cell
- ③ Mapping synaptic connectivity using mGRASP



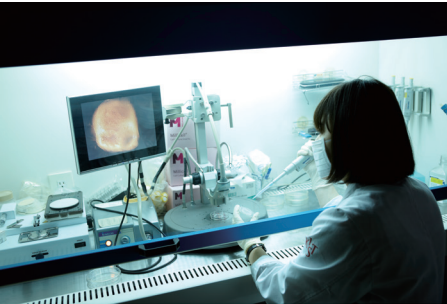
Biomedical Research Institute

Research Support Team : +82-2-958-5602

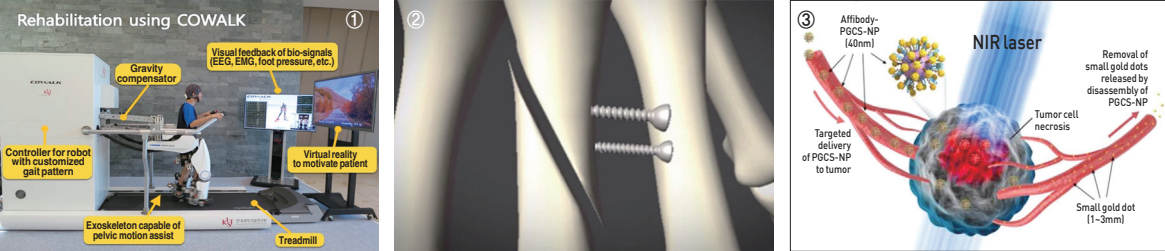
- Center for Bionics
- Center for Biomaterials
- Center for Theragnosis

Seeking Ways to Improve Quality of Life

With the rapid aging of global populations, it has become vital to find ways to improve quality of life. The Biomedical Research Institute is responsible for developing cognitive and motor rehabilitation technology for the elderly and the disabled. Additionally, it develops cutting-edge devices and materials to be used for replacing human tissue and organs, and it produces innovative medical technology for detecting hard-to-diagnose diseases. The Biomedical Research Institute is at the forefront of Korea’s healthcare and medical welfare research.



- ① COWALK (a robot system for rehabilitating stroke survivors)
- ② Successful clinical studies of biodegradable Mg alloy implants – Shifting the paradigm of conventional bone fixation devices
- ③ Proteinticle-gold nano-composite for targeted and photothermal cancer therapy







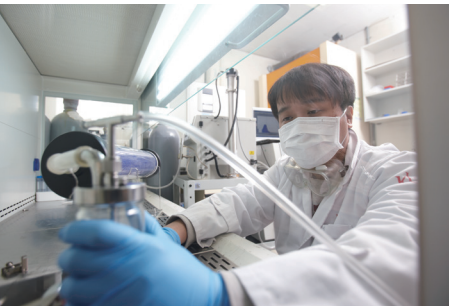
Green City Technology Institute

Research Support Team : +82-2-958-5802

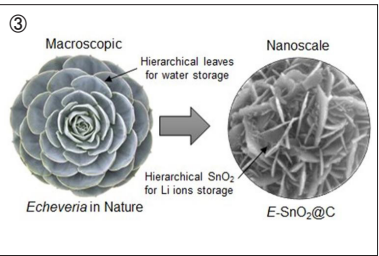
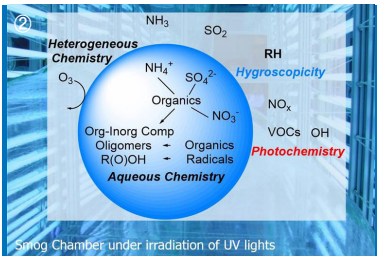
- Center for Water Resource Cycle Research
- Center for Environment, Health and Welfare Research
- Center for Urban Energy Research
- Center for Energy Convergence Research
- Center for Appropriate Technology
- Center for Eco-friendly Energy

Building Energy-Independent Cities Using Green City Technologies

There has been strong global interest in creating a new capitalistic paradigm for zero-carbon economy ever since the year 2000 energy crisis. In contrast to the linear metabolism system which releases harmful urban waste directly into the environment, the cyclic metabolism system of the future converts city wastes to environmentally friendly materials prior to release. Utilization of the linear metabolism system is expected to ultimately create a zero-carbon city. The Green City Technology Institute is developing green technologies in areas such as water resources, human health and welfare, urban energy systems, energy convergence, and integrated risk assessments areas that will help create self-sustaining green cities.



- ① Green algae reduction technology based on high stream
- ② Investigation into secondary aerosol formation mechanism
- ③ Biomimetic electrode materials for LIB



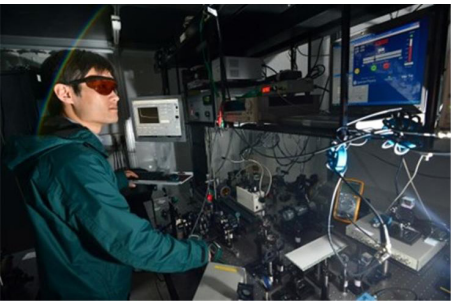
Post-Silicon Semiconductor Institute

Research Support Team : +82-2-958-5102

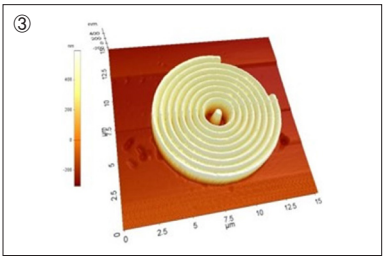
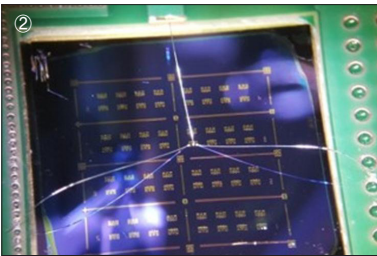
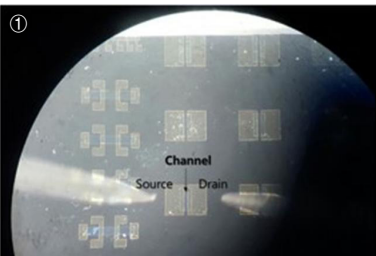
- Center for Electronic Materials
- Center for Spintronics
- Center for Opto-Electronic Materials and Devices
- Center for Quantum Information

Leading the Fourth Industrial Revolution by Inventing Next-Generation Semiconductor

Technological development on silicon semiconductors has reached a plateau. KIST's Post Silicon Semiconductor Institute is researching new materials for semiconductors whose physical characteristics and functions are 100 times better than those of silicon- based semiconductors. We are also focusing on the development of leading technology for the Fourth Industrial Revolution including neuromorphic chips that copy the human brain's neural network and quantum computing through photons and atomic defects. The Institute plans to great contribute to Korea's economy by developing inventions with high marketability, such as oxide semiconductors, spin electronic devices, optoelectronic convergence devices and attachable electronic devices for humans.



- ① Thin film transistor
- ② Ultra-fast spintronics communication device
- ③ Diamond optical structure for diamond point defect-based atom-photon quantum interface implementation



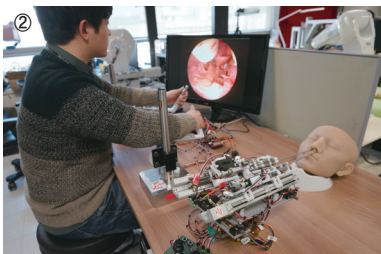




## Robotics and Media Institute

Research Support Team : +82-2-958-5302

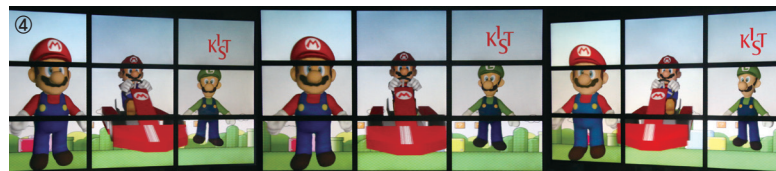
•Center for Imaging Media Research •Center for Robotics Research •Robot Research Platform Initiative •Lunar Exploration Program



### Leading Korea's Robotics Research and Conducted Studies

The institute develops convergence source technologies such as intelligence control, smart sensors, artificial intelligence and next-generation media for robots, media, and ICT. The mission of the institute is to become a global leader in robotics and media research. The Center for Imaging Media Research was established in 1997 and has conducted research on post source technology such as virtual reality, ubiquitous computing, multi-modal interaction, electromagnetic wave exploration and 3D imaging with a focus on human-media interaction.

- ① A life-care robot for people with dementia
- ② Microsurgical robot for endonasal surgery
- ③ Network-based humanoid robot, Mahru
- ④ 100" large-scale autostereoscopic 3D Tiled display system for multiple viewers



## Materials and Life Science Research Division

Research Support Team : +82-2-958-5402

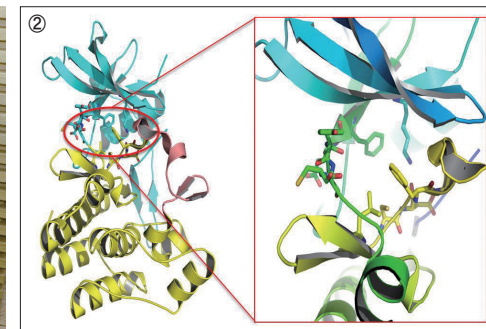
•Materials Architecturing Research Center •High Temp. Energy Materials Research Center •Nanophotonics Research Center •Molecular Recognition Research Center  
•Chemical Kinomics Research Center •Computational Science Research Center •Nanomaterials Technology Development Center •Center for Heritage Science

### New Materials for a Better Future

The scientific trend for the 21st century is technological convergence. The convergence of different technological systems is an engine for future growth, increased creativity and retrofitted knowledge, technology and industries. Future Convergence Research Division aims to reinforce national competitiveness and contribute to KIST's positioning as the global leader in technological convergence research by interlinking biotechnology, nanotechnology, and information technology.



- ① SCR DeNOx catalysts for marine engines
- ② Novel anti-cancer drug candidate to fight acute myeloid leukemia
- ③ Ceramic regenerative fuel cells







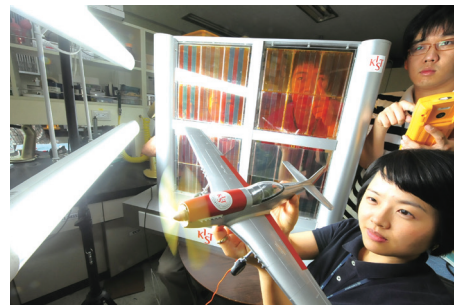
## National Agenda Research Division

Research Support Team : +82-2-958-6255

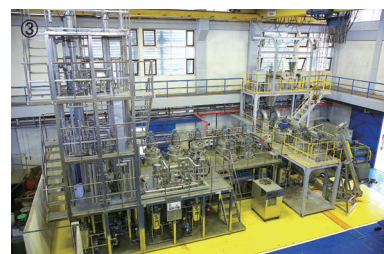
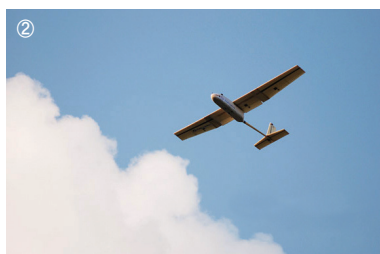
•Fuel Cell Research Center •Clean Energy Research Center •Sensor System Research Center •Photo-electronic Hybrids Research Center

### Enhancing Korea's Global Status through Technological Innovation

The modern world faces many global challenges, such as climate change and the need for sustainable growth. The National Agenda Research Division was established to advance green technologies in Korea. It is responsible for the development of carbon cycles and original sensor system technology. Its four research centers are designed to maximize the core strengths of such renewable energy sources as bio energy, carbon energy, photo energy, and systems in order to advance safety related technologies and prevention of disasters through convergence research projects jointly led by its centers.



- ① The development of intelligent blocks and an interactive 'smart' toy system
- ② A hydrogen generator powered by ammonia borane for an unmanned aerial vehicle(UAV)
- ③ Pilot Production of Bioethanol from Lignocellulosic Agricultural Waste in Indonesia



## KIST Gangneung Institute of Natural Products

Administration Team : +82-33-650-3416

•Natural Products Research Center •Natural Constituents Research Center  
•Systems Biotechnology Research Center •Convergence Research Center for Smart Farm Solution

### An Institute with Fresh Ideas!

KIST Gangneung was established in May 2003 inside the Gangneung Science Industrial Complex. The institute has become the regional leader in scientific and technological innovation and has produced a great deal of research outcomes, technology transfers, outstanding theses, and patents. KIST Gangneung strives to become a nationally recognized institute specializing in the development of fundamental technologies related to natural products, supporting technology transfers to SMEs, and successfully commercializing said technologies. Additionally, the institute aspires to become a leading think-tank for the Gangneung Region. The first 10 years of KIST Gangneung has resulted in a solid foundation for eaping forward in S&T innovation over the next 10 years.



- ① Development of functional ingredient extraction technique from wild sea cucumber grown in the eastern coast of Korea
- ② Industrial-scale production of fucoxanthin with antiobesity and antiinflammatory activity
- ③ Commercialization of nutra- and pharmaceutical products for anti-cancer and renal protective effects







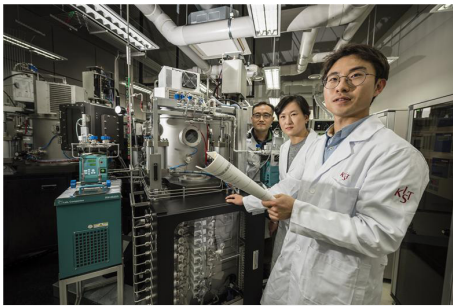
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### KIST Jeonbuk Institute of Advanced Composite Materials

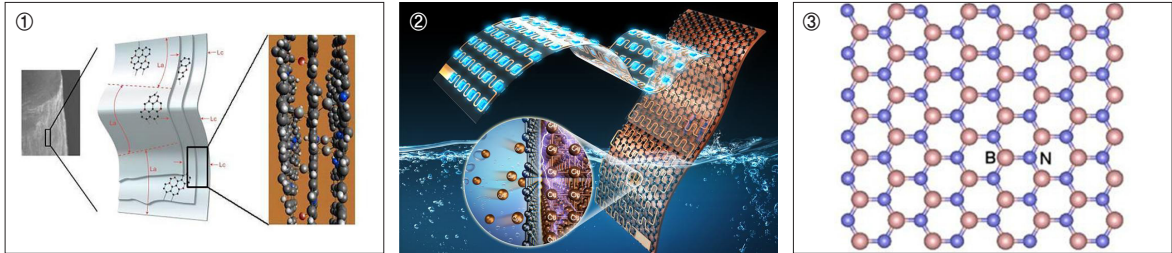
•Applied Quantum Composites Research Center •Carbon Composite Materials Research Center •Multifunctional Structural Composite Research Center

Administration Team : +82-63-219-8102

**Developing World-class Composite Material Technology**  
KIST Jeonbuk leads the development of composite materials in Korea under the regional strategic industrial growth initiatives. The institute researches and develops new source materials and trains professionals in the field of composite materials. Composite materials are lightweight, elastic, durable, and extremely versatile due to their unique electronic properties. As such, they are often considered one of the crowning new materials of the 21st century. KIST Jeonbuk is restless in its efforts to develop innovative, dynamic composite materials, including carbon composites, and to ultimately become the R&D hub for advanced industries.



- ① Strengthened PAN-based carbon fibers obtained by slow-heat-rate carbonization
- ② A graphene superficial layer for the advanced electroforming process
- ③ Facile synthesis of highly crystalline and large areal hexagonal boron nitride from borazine oligomers



R&D ANALYSIS CENTERS

## CUTTING-EDGE INFRASTRUCTURE AND COLLABORATIVE RESEARCH NETWORKS

### Doping Control Center

Established in 1984, the Doping Control Center is a world-renowned research center that was accredited by the International Olympic Committee (IOC) upon its establishment, and by the World Anti-Doping Agency (WADA) in 1999. The center was responsible for doping tests during the 1986 Seoul Asian Games and the 1988 Seoul Olympic Games. It is unceasing in its R&D endeavors, development of new methods for testing for prohibited drugs, and analyses of steroid hormones, blood, and DNA. It is continuously strengthening its collaborations with overseas doping centers and researchers in related fields. The center is proud to serve its nation, to take up the important role of preventing sports doping both domestically and internationally, to contribute to the health and well-being of athletes, and to provide comprehensive doping tests for large-scale international sports events.

Doping Control Center

- Development of new analytical methods for banned drugs
- Research and analysis of steroids and peptide hormones
- Research on blood and DNA doping

### Advanced Analysis Center

The Advanced Analysis Center is regarded as a top analytical facility in Korea. Its role is to support internal research activities at KIST, as well as Korea's advanced research programs in universities, research institutes, and the industrial sector. Equipped with state-of-the-art infrastructure and excellent analytical instruments and techniques in compliance with domestic and international standards, the center provides analytical services and support for organic and inorganic chemical analyses, surface chemical analysis, nanostructure analysis, protein analysis, and other related analytical testing. It also pursues open management by providing regular, ongoing instrument training programs and direct access to qualified researchers from Korea and abroad.

Advanced Analysis Center

- Control and analysis of environmentally hazardous materials
- Control of indoor/outdoor air quality and handling of REACH-approved materials
- Safety protocols for food, medical, and pharmaceutical items
- Chemical analysis of materials at the ppt-level
- Fine surface and structural analysis of biopolymers
- Nanoanalysis and surface characterization of nano devices, materials, and powders
- Advanced analytical instruments at KIST include the Titan TEM, 900MHz NMR, AMS (Accelerator Mass Spectroscopy), soft and hard X-ray synchrotron beamlines, and USANS (Ultra Small Angle Neutron Scattering)

21



It did not take long for a research  
institute from a small Asian country to  
gain global recognition.  
KIST, the prime mover for  
Korea's technological development,  
has emerged as one of the most acclaimed  
research institutes in the world.  
KIST continues to discover new advances in  
science and technology and  
to achieve groundbreaking results,  
thereby building a brighter future for  
Korea and beyond.

CONTACT INFORMATION

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