2015 Annual Report

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KAIST INSTITUTE ANNUAL REPORT

http://kis.kaist.ac.kr
KAIST Institute, 291 Daehak-ro, Yuseong-gu, Daejeon, Republic of Korea

KAIST INSTITUTE

KAIST INSTITUTE

PUBLIC CHARITY AND SOCIAL ACTIVITIES

- Establishment of Chunghi & Byiung Jun Park Korea-US Female Engineer Scholarship
- Establishment of Chunghi & Byiung Jun Park Scholarship Funds for Chuncheon Girls' High School
- Establishment of Marine Scholarship Foundation in Chuncheon Province
- Donation of funds for the construction of Chunghi & Byiung Jun Park Innovation Lecture Room at MIT
- Artemis G. Pazianos M.D. Research Funds provided to Lahey Clinic in the US
- Chunghi & Byiung Jun Park Scholarship Funds provided to MIT
- Establishment of Chunghi & Byiung Jun Park Scholarship Foundation for Seoul National University High School
- Chunghi & Byiung Jun Park Cancer Research and Education Center established at Lahey Clinic
- Chunghi & Byiung Jun Park Development Funds provided to the Department of Engineering, Seoul National University
- Research Funds provided to Tufts University
- Research Funds provided to the University of Connecticut
- Development Funds provided to KAIST for the construction of [Chunghi & Byiung Jun Park KAIST Institutes Building]

CONTRIBUTORS

Donations for the Future of KAIST

Dr. Byiung Jun Park and his wife, Ms. Chunghi Park generously donated 10 million dollars in 2007 for the construction of the KI Building in hopes that KAIST would become the greatest university in the world. Based on their wish, the construction of the KI Building was completed in 2010. At present, around 400 professors, researchers, and graduate students are working in this beautiful research space, fully devoting themselves to the development of impactful innovative technologies.

Byiung Jun (BJ) Park

Dr. Byiung Jun (BJ) Park is a successful entrepreneur and international businessman. Interested in textiles and the mechanical properties of fabric, Dr. Park attended the Rhode Island School of Design for textile engineering, then MIT for his SM degree in Mechanical Engineering, and finally Leeds University for a PhD degree in textile engineering. Dr. Park founded a highly successful company called Merchandise Testing Laboratories (MTL) in Brockton, MA in 1988, which grew to become a global leader in consumer product testing, inspection, and social accountability for products shipped to the US from overseas. Under his leadership, MTL garnered prestigious customers such as Ann Taylor, the Gap, Target, and other noteworthy retailers, manufacturers, and importers with product testing operation locations worldwide. In May 2001, MTL was successfully acquired by the $1.3 billion international quality and safety assurance giant, Bureau Veritas. Dr. Park was a member of KAIST President's Advisory Council from 2007 to 2012, and a member of the KAIST Board Directors from 2009 to 2012.

Chunghi Park Byiung Jun(BJ) Park

HISTORY

2006
- 08 Established KAIST Institute
- 10 Established KIB, KIITC, KIDCS
- 11 Established KIEE, KINC

2007
- 01 Established KIEcoE, KIUSS
- 12 Established KIOST

2010
- 05 Completion of KI B/D

2012
- 01 Closed KIEE, KIEcoE

2013
- 02 Closed KIUSS, Established Saudi Aramco-KAIST CO_2 Management Center

2014
- 09 Established KIDS

2015
- 12 Closed KIDS

2016
- 03 Changed the name of Institute from KIOST to KIHST
  Changed the name of Institute from KIDCS to KIR

CONTENTS

GREETINGS

Sung-Mo Steve Kang,
President of KAIST

"KAIST will Shape the Future Realized by the Fourth Industrial Revolution."

Home to the nation's most extraordinary talents in science and technology, KAIST has continued innovation through ongoing qualitative growth since its foundation and has become a leading research institution in the world.

At the center of its devoted endeavor, the KAIST Institutes (KI) have produced outstanding performance of state-of-the-art convergent research by faculty members and researchers in varying disciplines to contribute to human progress. The major achievements have been published in the KI's Annual Reports as well as in renowned international journals.

In 2016, artificial intelligence emerged as one of the most heated issues worldwide, signaling the arrival of the era of the Fourth Industrial Revolution. This is demonstrated by the trend of automation widely found in a range of industries, including manufacturing, finance, and pharmaceuticals. In preparation for future trends, KI continues to conduct convergent research in a number of areas and is producing remarkable research outcomes each year.

The examples of the KI's innovative technologies include the following: systems biology to treat diseases by exclusively selecting effective ingredients from drugs; and Dr. M, a comprehensive mobile healthcare platform. Biotechnology and healthcare not only promise a significant growth potential, but also shape the future of all humankind. The innovative technologies developed by KI are anticipated to lead the era of the Fourth Industrial Revolution and bring forward a dream society to benefit humanity.

KI is committed to ensuring continuous qualitative growth and innovation and to producing leading research accomplishments to contribute to national and global development. It will also pursue further globalization and diversity to make KAIST a top university and research institution in the world. We humbly ask for your support and interest.

Thank you.

Seeking to Become a World-class Research Hub - KAIST Institute

"We will Do Our Utmost to Develop Impactful Innovative Technologies Going Forward."

Yun C. Chung,
Dean of KAIST Institutes

The KAIST Institute (KI) was established in 2006 and, since its inception, has strived to develop and realize impactful technologies through interdisciplinary studies. To mark its 10th year anniversary, KI has made numerous institutional changes and innovations since last year to make another leap forward. This year, KI will see that those changes take firm root and will strengthen its interdisciplinary research programs. To that end, KI will focus on the following objectives.

First, the five affiliated research institutes under the name of KI have established key research areas to foster in the years ahead. Accordingly, "KI for Design of Complex Systems" has changed its name to "KI for Robotics", and "KI for Optical Science and Technology" is now "KI for Health Science and Technology". Moreover, I-Space is newly established with aims to systematically discover and nurture innovative interdisciplinary research projects. New positions such as KI Fellows, KI Postdocs, and KI Studentships, will be filled from this year as well in order to secure fresh and talented researchers and to support the research activities of participating professors here at KI.

Second, KI will continue to identify and promote future-oriented interdisciplinary research programs that are creative and impactful. For example, KI plans to support several newly identified research projects this year including the following: (1) brain function improvement and treatment technologies by uncovering the genes regulating brain functions by analyzing big data from the human genome; and (2) intelligence super-agents for multifunctional AI robots. KI will also promote the developments of smart mobile healthcare systems, ultrahigh-performance unmanned electric racecars, and techniques to boost up the practical utilization of drones through collaborations with relevant industries.

Third, KI will actively pursue collaboration with domestic and overseas partners in both academia and industry for open innovation. In particular, KI plans to enhance the exchange and cooperation with overseas research institutes for the globalization of KI. The ongoing overhaul of its homepage is also in line with the efforts to facilitate the open innovation that KI pursues.

KI will save no effort to become a hub for global interdisciplinary research by constantly conducting innovative research programs that will contribute to Korea and benefit humankind going forward. For this purpose, KI will continually make strategic and institutional changes along the journey ahead. We appreciate your interest and support.

KAIST Institute Overview

KI for the BioCentury

Mission

KI for the BioCentury plays a central role in the field of bio-fusion research, achieving world-class research outcomes and creating a new growth engine for national development.

Vision

KI for the BioCentury was established with the goal of combining various related disciplines into one core field based on research capacity in bio-fusion. KI for the BioCentury has focused on the development of excellent research capacity by considering global trends and has helped to realize a creative bio-industry through new interdisciplinary research and academic interfaces in order to lead the global market.

Research Areas

· KI for the BioCentury
- -Innovative Drug Screening and Development
- -Systems and Synthetic Biotechnology
- -Bio/Medical Instrument Development

· Cancer Metastasis Control Center (CMCC)
- -R&D of mechanisms, targets, and bio-markers for the metastasis of cancer
- -Establishment of the base for the development of new medicines through the structural analysis of targets to control cancer metastasis
- -Analysis of the effect of natural products on cancer metastasis
  Innovative Technology Center for Novel Biomaterials
- -Design of artificial synthetic genomes for the development of highly

· Efficient Electrobiosynthetic Biosystems
- -Application of synthetic biological systems for the production of value-added chemicals from renewable resources
- -Development of anticancer-specific antibody aptides and verification of anticancer effects

· Core Competence
- -Cancer Metastasis Control
- -Study of Neurodegenerative Diseases
- -Human Microbiome Control

Kim, Sun Chang _KIB Director
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KI for IT Convergence

Mission

KAIST Institute for Information Technology Convergence conducts global-leading multidisciplinary research and industrialization with the aid of information technologies

Vision

· Cultivate global-leading multidisciplinary research groups including full-time researchers, students, and professors
· Create open innovation environments with complementary roles of departments in KAIST

Research Areas

· 5G mobile communications
- -Massive MIMO technology
- -Millimeter-wave technology
- -Fronthaul/backhaul technology
- -Virtualization via NFV and SDN

· IoT/WoT
- -IoT/WoT interworking framework
- -IoT data stream analysis/machine learning for situation awareness
- -Identification and tracking for real-world objects

· Integrated sensors
- -Development of the sensors relevant to Pin/Coded Aperture Gamma Camera and A-Si Flat Panel Detector for Digital Radiography
- -Development of a real-time bio signal-measuring system for a multi-user using the differential radar
- -Development of source technology of a real-time pain intensity measuring sensor, which can be interlocked with the depth of anesthesia
- -Developing the core technology through further study of the medical image sensor
- -Increasing the depth of anesthesia and pain intensity measurement technology through the development of complicated bio-signal-measuring sensors (EEG, EMG, ECG, etc.)

Hong, Songcheol _KIITC Director
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KI for Robotics

Mission
KI for Robotics focuses on the research toward highly intelligent robots that can reliably operate in real world. The Institute promotes synergy on interdisciplinary collaboration between electrical engineering, mechanical engineering, aerospace engineering, civil engineering and computer science.

Vision
· 'Robots that think!'
· Development of intelligent real-time robot operating system for accurate humanoid control
· Development of multiple robot operating system based on intelligent operating architecture
· Research on mobility intelligence for highly autonomous vehicles

Research Areas
· Autonomy for Unmanned Vehicle Systems
-Software architecture that allows multiple developers can simultaneously program
· Research on Multi-agent coordination architecture based on task planning
-Development of mobile robot platforms
-Research on of learning algorithms for AI
· Autonomy level enhancement for mobile agents using learning, adaptation, and perception
-Active real-time SLAM and recognition techniques
-Coordination of multiple/heterogeneous unmanned agents

Oh, Jun-Ho _KIR Director
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KI for the NanoCentury

Mission
With an aim to promote and advance the multidisciplinary nature of nanotechnology, KI for the NanoCentury targets on becoming a glob-ally leading laboratory in various fields of nanotechnology by creatively overcoming the boundaries of different areas.

Vision
· The World-class University Hub of Nano Convergence Research
-Creativity through Interdisciplinary Research
-Fusion Research for Synergistic Effects
-Win-Win through Cooperation

Research Areas
· NT for Climate Change
-Nanotechnology for Environmental Applications, Water, and Energy
-Nanotechnology for Advanced Battery
-Efficient Processes for CO_2 Emission
· NT for Healthcare
-Nanotechnology Systems for Diagnosis of Infections
-Health Electronics and Sensor Technology
· NT for Advanced Opto-Electronics
-Nanotechnology for Advanced Display
-Nanotechnology for Wearable Electronics

Jung, Hee-Tae _KINC Director
heetae@kaist.ac.kr

KI for Health Science and Technology

Mission
Developing high-impact technologies through interdisciplinary collaboration combining expertise in biomedical science and engineering, and leading the healthcare market of the future based on these technologies

Vision
· Developing a variety of advanced technologies in the field of health science and playing a pioneering role in leading the future healthcare industry by creating new value through the combination of these technologies
· Providing a platform for medicine-engineering convergence research to support the development and utilization of healthcare technologies reflecting the needs of the medical fields· Synergizing academia and industry R&D efforts in the field of health science and building an infrastructure to conduct future-oriented interdisciplinary research

Research Areas
· Neuroimaging & Neuromodulation
-Neuroimaging-based brain circuit & network analysis
-Biomarker for brain disorder diagnosis
-Novel neuromodulation technique
-Neuromodulation for brain disorder treatment
· Biophotonis
-Cutting-edge Intravital microscopy / endo-microscopy· Laser-holography-based high-resolution imaging
-Advanced photo-therapy for human disease
-Clinical optical imaging system
· Therapeutic Bioengineering
-Biological analysis of disease environment
-Personalized smart therapy
-High precision monitoring of human disease

Jeong, Yong _KIHST Director
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Saudi Aramco-KAIST CO_2 Management Center

Mission
Research activities of this center have primarily focused on the process of capturing CO_2 and innovative methods of reducing CO_2 emissions. Another important area of research is the transformation of CO_2 into valuable chemicals and materials in an economically-feasible manner.

Vision
· Within 10 years of its establishment, Saudi Aramco-KAIST CO_2 Management Center will become one of the world's most recognized research centers in the field.· By focusing on the conversion of CO_2 into high value-added materials and chemicals, the Saudi Aramco-KAIST CO_2 Management Center will build a unique identity in the landscape of CO_2 research.
· Various technology rights with high potential commercial power will be obtained.
· Commercialization will be promoted through collaboration with Saudi Aramco.

Research Areas
· Advanced materials for CO_2 capture
-Porous solids (MOFs, COFs, COPs)
-Advanced solvents (ILs, Amine-based)
-Functional sorbent
· Efficient processes for CO_2 conversion
-Photo/electro-chemical approach
-Homogenous catalysis
-Mineralization & carbonization
-Carbonization of cement using CO_2
· CO_2 reduction via efficiency improvement
-Auxiliary power units using direct liquid hydrocarbon SOFC
-Supercritical CO_2 based bottoming cycle

Lee, Jay Hyung _CO_2 Center Director
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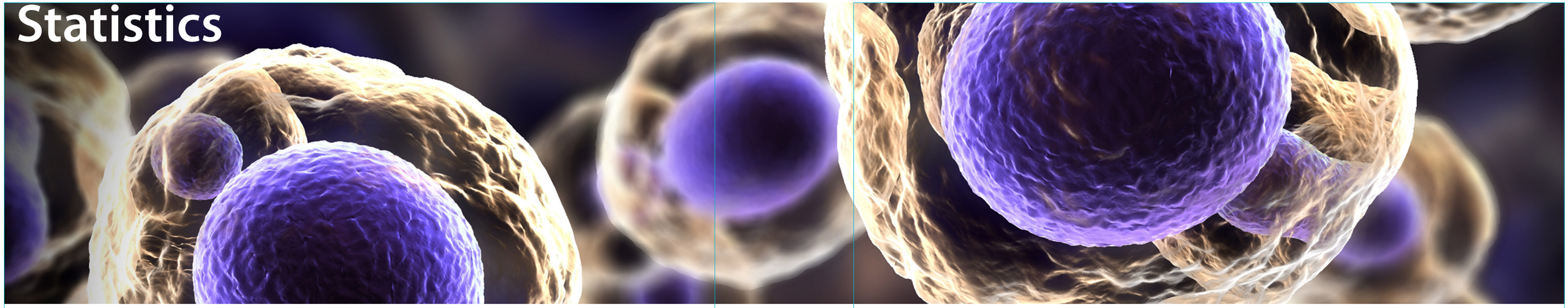
Statistics



Faculty

As of March, 2016

	KIB	KIITC	KIR	KINC	KIHST	CO_2	Total
Professor	30	31	8	89	28	14	200
Adjunct Professor	-	8	-	-	-	-	8
Research Professor	6	6	-	2	-	-	14
Inviting Professor	-	-	-	-	-	-	0
Total	36	45	8	91	28	14	222

Papers - Total (SCI)

	KIB	KIITC	KIR	KINC	KIHST	CO_2	Total
2008	19 (19)	23 (3)	17 (1)	17 (17)	68 (68)	-	144 (108)
2009	16 (16)	20 (6)	2 (0)	7 (7)	139 (34)	-	184 (63)
2010	75 (71)	-	7 (1)	11 (11)	53 (49)	-	146 (132)
2011	7 (0)	-	10 (0)	9 (9)	12 (12)	-	38 (21)
2012	3 (3)	18 (5)	84 (20)	28 (18)	49 (45)	-	182 (91)
2013	15 (14)	34 (10)	87 (17)	75 (71)	42 (34)	-	253 (146)
2014	54 (19)	21 (9)	106 (28)	69 (43)	180 (61)	1 (1)	431 (161)
2015	32 (29)	10 (8)	40 (34)	69 (63)	70 (66)	2 (1)	223 (202)
Total	221 (171)	126 (41)	353 (101)	285 (239)	613 (369)	3 (1)	1,601 (924)

Patents – Total (International)

	KIB		KIITC		KIR		KINC		KIHST		CO_2		Total	
	Pending	Registration	Pending	Registration	Pending	Registration	Pending	Registration	Pending	Registration	Pending	Registration	Pending	Registration
2008	5	4	24 (3)	-	5	-	6	7	6 (4)	-	-	-	46 (7)	11
2009	-	-	5	1	-	-	4	-	13 (5)	3 (3)	-	-	22 (5)	4 (3)
2010	24	3	3	-	-	-	5 (1)	1	15	2 (1)	-	-	47 (1)	6 (1)
2011	1	-	5	-	-	-	1	-	6	-	-	-	13	-
2012	-	-	2	-	13	14	7	-	11 (1)	6	-	-	33 (1)	20
2013	1	-	7	-	20	5(1)	26	12 (1)	28 (6)	3 (2)	-	-	82 (6)	20 (4)
2014	3	5	9	-	6	24	10 (3)	4	31 (10)	3	-	-	59 (13)	36
2015	10	0	8 (1)	0	10 (2)	0	18 (2)	2 (2)	33 (5)	2 (2)	-	-	79 (10)	4 (4)

Funding & Project

Unit : KRW Million

	KIB		KIITC		KIR		KINC		KIHST		CO_2		Total	
	Fund	Projects	Fund	Projects	Fund	Projects	Fund	Projects	Fund	Projects	Fund	Projects	Fund	Projects
2008	4,012	24	11,787	54	1,380	13	5,479	32	250	1	-	-	22,908	124
2009	11,851	49	12,016	63	786	9	17,349	39	782	8	-	-	42,784	168
2010	9,297	44	9,704	46	990	12	6,127	38	1,074	7	-	-	27,192	147
2011	8,205	41	11,469	71	1,956	16	7,116	46	3,856	23	-	-	32,602	197
2012	14,641	75	13,980	76	2,135	17	9,453	62	5,019	21	-	-	45,228	251
2013	10,715	51	9,947	54	1,695	17	9,952	67	4,813	20	670	4	37,792	213
2014	7,955	43	7,907	50	3,057	20	9,877	67	4,776	18	4,173	16	37,745	214
2015	7,633	44	12,130	60	4,104	21	10,238	74	5,329	30	2,127	14	41,561	243
Total	74,309	371	88,940	474	16,103	125	75,591	425	25,899	128	6,970	34	287,812	1,557

* The achievements for academic papers and patents have been made through projects originated in and supported by KI.

RESEARCH HIGHLIGHTS

Optogenetic Control of Endogenous Ca^{2+} Channels in Vivo

" This study proved that the short-term memories of mice nearly doubled when increasing the calcium ion concentration in the hippocampus, the part of the brain in charge of spatial memories. Since this is the first study directly proving a memory increase in mice by the light-induced increment of the calcium ion concentration, researchers in the field of calcium ion-related diseases and amnesia are paying close attention to this case. Based on this study, it is expected that proper treatments for a number of diseases caused by calcium ion concentration problems could be found. Furthermore, if a technology that could adjust the photoreceptors of plant using infrared rays is developed and combined with the result of this study, more useful technologies could be introduced allowing the calcium ion concentration in the cells deep within the human body to be adjusted by penetrating light. "

Nature Biotechnology, cover article in Oct. edition.

Memory Improvement by Light-elevated Concentration of Calcium Ions Proven for the First Time in the World

Calcium ions are involved in almost all vital phenomena, including cell growth, neural transmission, and muscular contraction. Thus, problems in the calcium ion adjustment mechanism lead to a number of diseases such as cognitive impairment, ataxia (a symptom in which a person cannot make certain movements despite no particular problem in the muscles), or cardiac arrhythmia. Medication or electrostimulation has been used as a treatment for such illnesses, but those have severe side effects. Against this backdrop, studies in the field of optogenetics (a biological technique that induces various reactions of a cell using light by introducing a photoreceptor protein of a plant into the animal cell) is in the spotlight as an effective alternative to existing treatments.

Against this backdrop, Professor Heo, Won-Do and his team at KIB took note of optogenetics and proved the improvement in memory by adjustment of the calcium ion concentration for the first time in the world in a study entitled, 'Optogenetic control of endogenous Ca^{2+} channels in vivo'. This optogenetic controlling technology combined the photoreceptor proteins of a plant and STIM1, a gatekeeper protein controlling the on/off of the calcium channel in the human body, and applied blue light to it. By doing so, the calcium ions could penetrate the cells (OptoSTIM1, 'optogenetic remote control'). The calcium ion channel was opened when applying the blue light, while the channel was shut when the light was turned off. The amount of calcium ion induced and residual time can be adjusted by the intensity and exposure time of the light. It was also possible to reduce the calcium ion concentration by cutting off the light. This technology was tested on mice; the mice harboring OptoSTIM1 were divided into two groups, one of which was light illuminated while the other was not. After the light stimulation, an electric shock was given to both groups to see which group had the most vivid fear memories the next day. It was found that the memories in mice with stimulated OptoSTIM1 were more than twice as powerful as those of the other group.

This study took five years in total; until 2011, researchers conducted studies to decide which plant's photoreceptor should be used in convergence with the gatekeeper protein STIM1 and which location would be the most appropriate for activation of the fusion protein in a cell. As the design of the fusion protein was completed, the focus of the study shifted to what reactions of a cell could be induced or adjusted by the in-vivo calcium ions until 2013. Since then to 2015, when this study was published, studies on OptoSTIM1 in-vivo activation by light with human embryonic stem cells, zebrafish, and mice were mostly conducted to examine the universality of this technology.

The 'Optogenetic control of endogenous Ca^{2+} channels in vivo' has been widely acclaimed as a revolutionary research performance; it was introduced in Nature Biotechnology as a cover article in 2015. This technology is expected to be used in treatments for a number of mental disorder such as dementia, Parkinson's disease, and depression, diseases known to be caused by the abnormal calcium ion mechanism. It is also expected that this technology can be used as a platform on which potential substances for new medicines can be discovered in a fast and effective manner by identifying the substances affecting the calcium ion concentration among the vast amount of compounds.

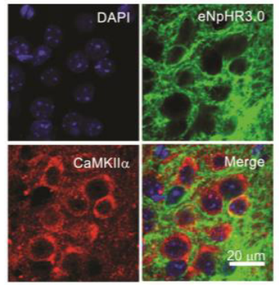
Prof. Heo, Won Do

KAIST Institute for the BioCentury
Dept. of Biological Sciences
Associate Professor

Selective Control of Fear Expression by Optogenetic Manipulation of the Infralimbic Cortex after Extinction

Groundwork Laid for New Anxiety Disorder Therapies by Enhancing the Retrieval of the Extinction Memories

"The emotion of fear is learned and remembered. If a person has experienced a horrifying event at a certain place, that person will experience fear again merely by revisiting that place. However, if that person goes to that place repetitively and finds that no more terrifying experiences occur, that fear will gradually diminish. This is a phenomenon called 'extinction', a process in which conditioned fear responses decline. This study attempted to find the mechanism of how fear memories can be controlled during the retrieval of extinction memories by controlling the expression of fear with the activated neurons inside the infralimbic cortex. This study is meaningful in that it laid the foundation for basic research on potential therapies for PTSD (Post-traumatic Stress Disorder) or anxiety disorder."



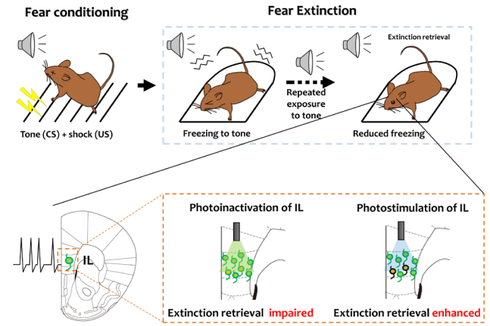
Representative images showing expression of eNpHR3.0-EYFP under hSyn promoter in CaMKII-positive neurons in the infralimbic cortex.

Prof. Han, Jin-Hee

KAIST Institute for the BioCentury
Dept. of Biological Sciences
Associate Professor

Mechanism Discovered that Acts as an 'On/Off switch' for Fear Memories during the Extinction Memory Retrieval

Today, many people are suffering from anxiety disorder due to growing fears of terrorism and many other shocking events that threaten the mental health of human beings. Against this backdrop, 'extinction', a phenomenon where emotional memories such as fear are formed and then weakened, is getting a great deal of attention globally as a method of therapy for the anxiety disorder. The principles of extinction are now employed in the treatments provided in psychiatric clinics. However, the existing studies have not figured out yet that by what kind of mechanism the fear memories are controlled after the extinction.



Optogenetic manipulation of neurons in infralimbic cortex selectively regulates fear expression during extinction retrieval.

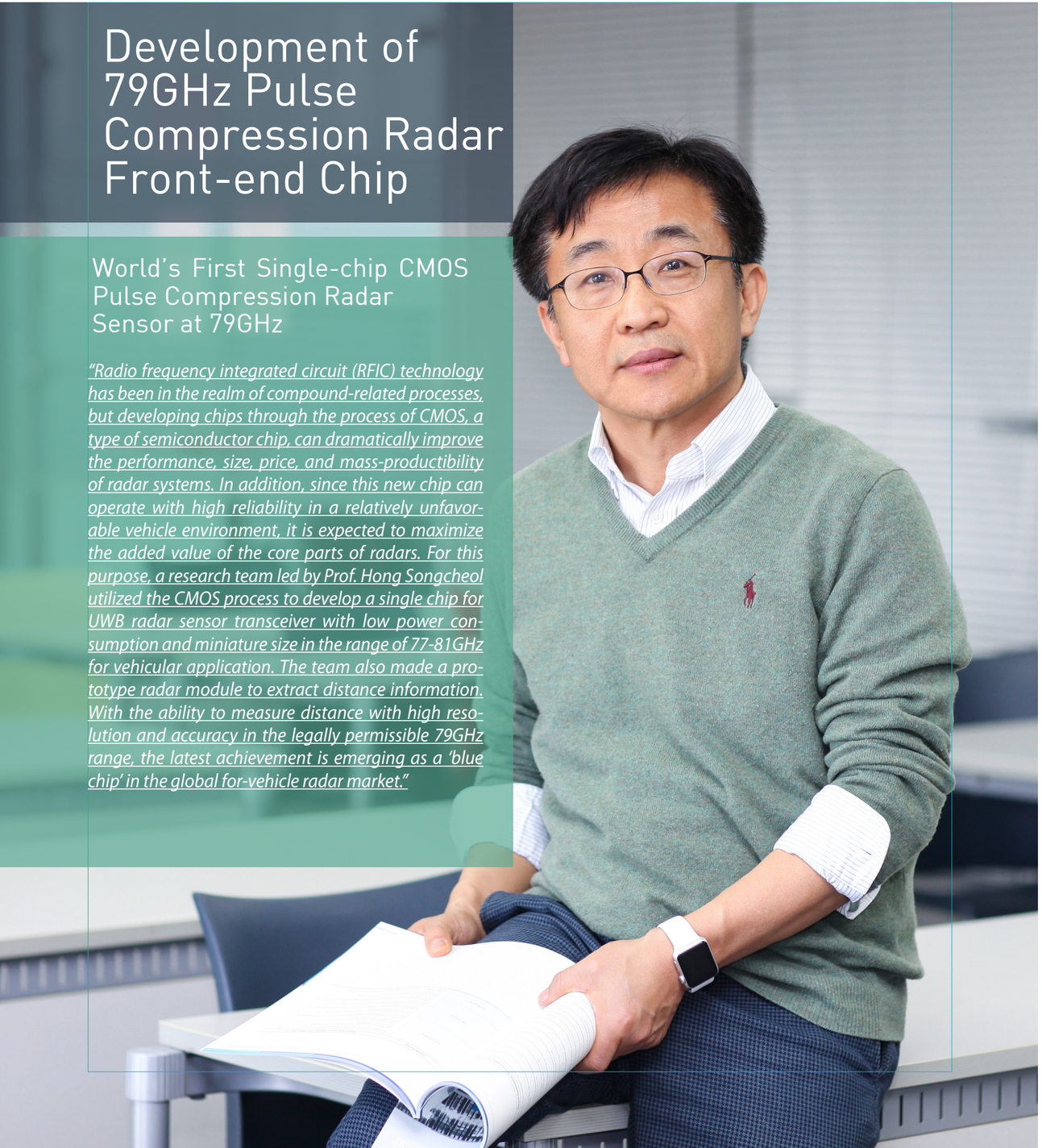
Professor Han, Jin-Hee at the KAIST Institute for the BioCentury (KIB) and his team took one step forward by finding out 'Selective control of fear expression by optogenetic manipulation of infralimbic cortex after extinction.' By doing so, they laid the groundwork for developing new therapies for anxiety disorder, opening up the possibilities to enhance extinction memories or maintain them for a longer period of time.

While the infralimbic cortex, which sits in the medial prefrontal cortex, was known to play an important role, exactly what role it played in the process of the extinction memories expressed remained unidentified. Professor Han's team, however, found out that mechanism through tests on mice using optogenetics, a newly-developed field of science.

The optogenetics is a method to activate the proteins using the light stimulus of a particular wavelength, by allowing halorhodopsin (ion pump protein) or channelrhodopsin2 (ion channel protein) to be expressed in the desired neurons selectively. Through this method, it was confirmed that fear expression is controlled selectively by the neurons inside the infralimbic cortex only when an animal experiences the extinction. Based on this result, strong evidence was obtained showing that the activation of the neurons in the infralimbic cortex is important in the process of the extinction being expressed. It was also officially proven that the expression of fear memories can be selectively controlled via top-down control by the neurons in the infralimbic cortex only after extinction memories are learned.

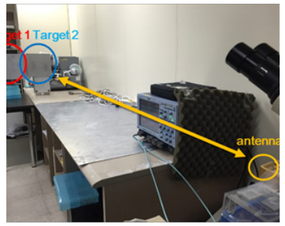
The neural circuits where the fear conditioning memories are stored are closely related to metal disorders such as the anxiety disorder or depression. A study on how those memories are formed, controlled, and adjusted during the extinction process is meaningful, not only for its academic values, but also for the medical, social, and economical significance it holds. Professor Han and his team understood the neurobiological mechanism of formation and storage of memories, one of the most important themes in the field of neuroscience. And they took one step further by finding out the treatment for PTSD, anxiety disorder, and other types of mental disorders. The world is now paying attention to new opportunities for more effective therapies for the mental disorder.

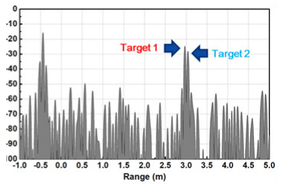
Development of 79GHz Pulse Compression Radar Front-end Chip



World's First Single-chip CMOS Pulse Compression Radar Sensor at 79GHz

"Radio frequency integrated circuit (RFIC) technology has been in the realm of compound-related processes, but developing chips through the process of CMOS, a type of semiconductor chip, can dramatically improve the performance, size, price, and mass-productibility of radar systems. In addition, since this new chip can operate with high reliability in a relatively unfavorable vehicle environment, it is expected to maximize the added value of the core parts of radars. For this purpose, a research team led by Prof. Hong Songcheol utilized the CMOS process to develop a single chip for UWB radar sensor transceiver with low power consumption and miniature size in the range of 77-81GHz for vehicular application. The team also made a prototype radar module to extract distance information. With the ability to measure distance with high resolution and accuracy in the legally permissible 79GHz range, the latest achievement is emerging as a 'blue chip' in the global for-vehicle radar market."





Distance resolution measurement of W-band CMOS radar: It shows ~ 7cm resolution

Prof. Hong, Songcheol

KAIST Institute for IT Convergence
School of Electrical Engineering
Professor

The 79GHz CMOS Radar Chip will Prevail in the Near Future

As one of the most common application areas of radar sensors, the for-vehicle radar market has seen a constant growth rate annually. According to Global Industry Analysts, a US research agency, the global market for radar sensors used exclusively for vehicles is expected to grow at an annual average of 25 percent and was worth USD 46.9 billion in 2015, USD 58.6 billion in 2016, and USD 73.2 billion in 2017. In addition to the speed of growth, the radar sensor technology offers the best performance, receiving increased attention from related industries.

Radar sensor technology has incurred constantly increasing demand, not only in the automobile radar market, but also in varying sectors such as medicine, national defense, transportation, robotics, and drones. In this context, it was necessary to develop state-of-the-art sensor technology by means of independent technical prowess and a stable semiconductor process.

In response to the recent trends, a research team led by Prof. Hong Songcheol at KI-ITC utilized the CMOS process to develop a single chip for UWB (W-band UWB pulse compression) radar transceiver IC with low power consumption and miniature size in the range of 79GHz for application in vehicles. The team also made a prototype radar to extract distance information based on the radar sensor IC. What is significant about this achievement is that the hybrid-type radar sensor currently used in industrial fields was made into a system on a chip (SOC). As the radar becomes considerably smaller and uses less power while realizing outstanding performance, the entire process from chip development to mass-production can be significantly improved.

The achievement can be understood in three aspects. Firstly, by developing a W-band UWB pulse compression radar transceiver based on CMOS with ultra-low power consumption and high output power. Secondly, the CMOS-based W-band UWB radar receiver can have high dynamic range by reducing gain automatically at high input powers. Thirdly, the research team realized the CMOS-based W-band radar system featuring high distance resolution and accuracy. This system is of particularly high significance as the world's first W-band UWB pulse compression radar chip that integrated a transmitter, receiver, and signal generator.

A team led by Prof. Hong developed a 24GHz radar sensor 12 years ago and later successfully developed 26GHz, 77GHz, and 79GHz radar sensors, demonstrating the outstanding level of technology developed domestically in the sector of radar sensors. In particular, the world's first CMOS-based SOC technology emerged as a blue chip in the global radar sensor market and is anticipated to bring further potential for progress.

This research accelerated the realization of single-chip (semiconductor chip with integrated functions for various parts) technology to detect 3D image information and became a precursor of the global radar market based on the outstanding mass-productibility and price competitiveness of the CMOS process. The technology is also anticipated to be applied, not only to the vehicle radar market, but also to a range of fields including national defense, security, automobiles, robotics, environment, medicine, and gesture recognition.

Research on Key Unmanned Systems Technology Based on a Minimally-invasive Approach

Prof. Shim, David Hyunchul

KAIST Institute for Robotics
Dept. of Aerospace Engineering
Associate Professor

Gaining International Attention on PIBOT, a Humanoid Robot that Flies an Airplane

"PIBOT is a humanoid robot that can sit in a normal cockpit and perform the entire flight sequence from takeoff to landing, using regular control sticks and instrument panel. The robot can handle these operations without mistakes once it learns how to use all of the buttons and switches in the cockpit of an aircraft. PIBOT is able to make the airplane land on the runway safely using accurate measurement of the aircraft motion, much more precisely than a human pilot can. This research is the direct outcome by "Key Unmanned Systems Technology with Minimal Invasion" project.

Development of a Humanoid Pilot Robot for Unmanned Aerial Vehicles

The recent series of aircraft crashes has brought a global attention on the safety issues involving the proficiency and qualification of human pilots. Coincidently, Prof. David Hyunchul Shim at the KAIST Institute for Robotics (KIR) proposed an interesting technology called "PIBOT" (PIlot+roBOT) a humanoid robot equipped with machine intelligence. PIBOT technology is a culmination of the recent advances in robotics and unmanned vehicle technology in a minimally-invasive manner.

The methods of developing an unmanned aircraft can be divided into two. One way is to develop a dedicated unmanned aircraft with customized airplane design and built-in actuators. However, this is time-consuming and expensive, and it requires entirely new design and certification process. The other is to automate an existing airplane with additional flight control systems. Although this process does not require additional certification of the aircraft, but the aircraft still needs vast amount of modification on the flight control and various switches and dials.

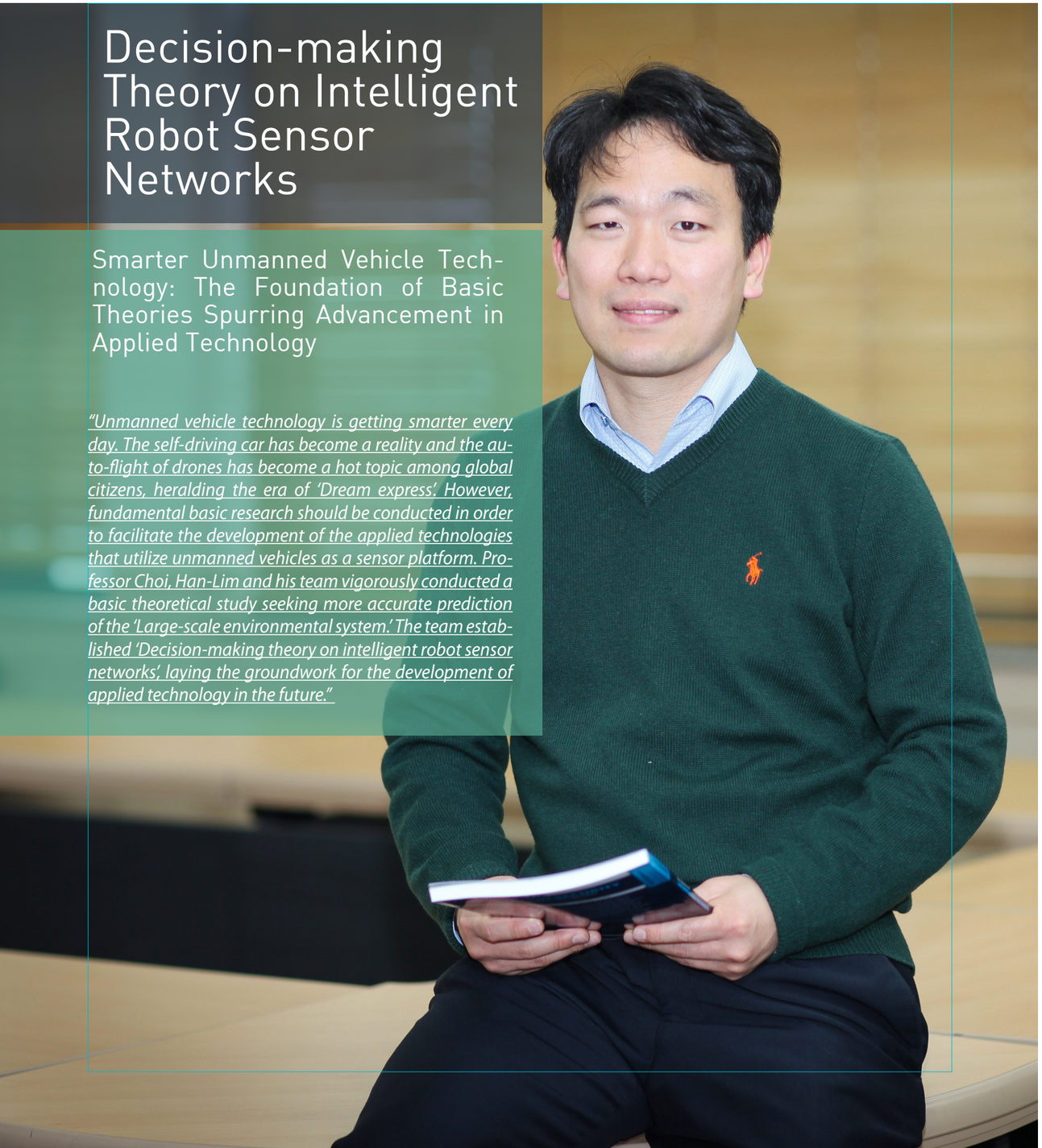
As an alternative to these two existing approaches, Prof. Shim's team has developed a humanoid robot that can be put into the pilot's seat, where the robot manipulates various control apparatus, sticks, dials, and switches. In this manner, the cockpit does not require any modification at all, and therefore the entire automation process can be very easily done by simply putting the robot in the aircraft and specify the type of the craft. The team has carried out a study to validate the feasibility of the proposed system by putting the robot into a series of flight routine in a full-scale aircraft cockpit.

The robot pilot consists of the humanoid robot body and the software to control the aircraft. The robot has two arms, two legs and a set of software that enables the robot to control any assigned vehicle. Powered by the software, the robot understands the airplane's states such as position, velocity, attitude, and various actions to perform. In a typical sequence, the robot starts with turning on the electrical system, starting the engine, taxiing, taking off, climbing, cruising, descending, approaching and landing, and post-landing procedures. PIBOT can handle all of these sequences with a great accuracy and a repeatability beyond a human pilot.

PIBOT receives the information of the host airplane through the network, which is more advantageous than a human pilot, who has to interact with the instrument panel only. During the simulation, the airplane information is transmitted from a flight simulator (X-Plane), and based on the information, PIBOT understands the status of the airplane. PIBOT can also send the commands over network if allowed, but the normal point of access will be conventional mechanical interfaces such as control knobs and sticks.

If the technology to fly planes piloted entirely by computers is advanced further, there will be no need for a real person to perform test flights for the development of a new aircraft. Europe's Airbus asked the research team whether it is possible to use PIBOT for the test flight of its newly-developed E-fan electric aircraft. In wartime, it would be possible to have a robot pilot fly outdated aircrafts for the purpose of reconnaissance over enemy territory, and in small- and medium-sized airplanes that do not have automated flight control, a PIBOT can substitute for the co-pilot, which is economically advantageous. Prof. Shim's PIBOT team has been invited to 2016 "summer Davos", or Annual Meeting of the New Champions 2016 in Tianjin, China, in June. In overall, beyond simple application to unmanned aircraft, PIBOT research has been recognized as one of the ground-breaking technologies for future, where human role can be aided or even replaced with intelligent robots. Stay tuned for further developments... one day the robot may actually fly a real aircraft in not too distant future.

Decision-making Theory on Intelligent Robot Sensor Networks

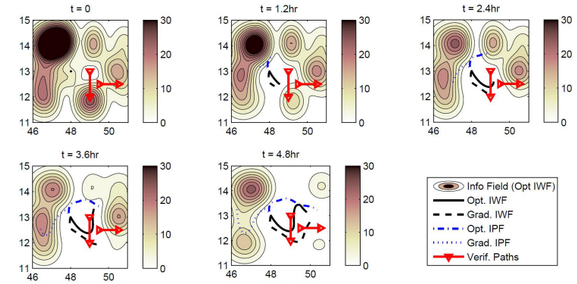


Smarter Unmanned Vehicle Technology: The Foundation of Basic Theories Spurring Advancement in Applied Technology

"Unmanned vehicle technology is getting smarter every day. The self-driving car has become a reality and the auto-flight of drones has become a hot topic among global citizens, heralding the era of 'Dream express'. However, fundamental basic research should be conducted in order to facilitate the development of the applied technologies that utilize unmanned vehicles as a sensor platform. Professor Choi, Han-Lim and his team vigorously conducted a basic theoretical study seeking more accurate prediction of the 'Large-scale environmental system.' The team established 'Decision-making theory on intelligent robot sensor networks', laying the groundwork for the development of applied technology in the future."

Multiple Unmanned Robots with Sensors Predicting Weather Conditions and Other Large-scale Environment Systems

The era of the 'human robot', an advanced version of existing unmanned vehicle technology, is just around the corner. The technological theory for unmanned aerial robots that could measure environmental changes with their sensors was established by Prof. Choi's team. This theory can be applied to the development of a wide array of applied technologies. These robot sensor platforms could measure physical entities of interest such as pressure, temperature, vorticity, and species concentration beyond the reach of current sensing systems. It can also help us handle environmental accidents such as oil spills in the ocean.



Illustrative example of UAV sensing trajectories (Black lines) to reduce forecast uncertainty along the two paths of interest (Red lines) on an idealized weather model (a.k.a. Lorenz-2003 system)

Prof. Choi at KIR established the 'Decision-making theory on intelligent robot sensor networks', by expanding the study on the network routes of multiple unmanned robot sensors, a theme that Prof. Choi was interested in when writing his doctoral thesis at MIT. This theory is about how effectively improve the prediction accuracy of current environmental prediction systems (e.g., numerical weather prediction, regional torrential rains, or yellow dust in the spring) that typically rely on the satellites. The problem is that the weather variable information changing in a vertical direction can be hard to obtain since the satellite data is information obtained from high altitude. Furthermore, the computing speed of the super computer is not fast enough to handle uncertain and subtle phenomena in a precise manner. This technological gap has been filled with information obtained from weather radars on the ground or the Radiosonde, i.e., a weather balloon. Yet, those methods can only be used on the ground, not in the ocean. In this regard, the advancement in unmanned vehicle technology can give us a clue to resolve such limitations.

Prof. Choi and his team established a basic theory for obtaining the maximum amount of information on the system throughout the sensor platform routes by optimizing the moving routes of the sensor platform, as well as a theory for required algorithm development. In a paper published in Automatica, the team formalized the problem of seeking the measurement path in which the mutual information between the measured values and the interested variables can be maximized when the changes in environmental variables by time can be drawn in a linear system, and suggested a solution to that problem as well. In a paper published in IEEE Transactions on Control Systems Technology, a method in which the optimal routes are calculated under the distributed surroundings with multiple sensor platforms employed was suggested based on game theory.

This study was conducted in line with the project, 'Fluid SLAM and Robotic Reconstruction of Local Atmospheric Phenomena' that the team jointly conducted with Dr. Sai Ravela at the Department of Earth, Atmosphere, and Planetary Sciences, MIT with the support of the Air Force Office of Scientific Research (AFOSR) in the United States. The theoretical basis that Prof. Choi and his team laid out is expected to speed up the advancement of the relevant applied technologies, including computational engineering for higher accuracy of the model and technologies for increased autonomy of the unmanned vehicles or more effective sensors.

Prof. Choi, Han-Lim

KAIST Institute for Robotics
Dept. of Aerospace Engineering
Associate Professor

An In-situ Diagnostic System for Infections through Nano-bio-ICT Convergence

Faster Diagnosis and Prevention of Infectious Diseases Threatening the Community

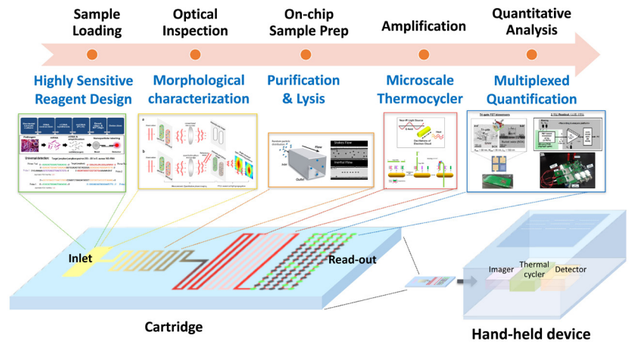
"Influenza, tuberculosis, superbacteria, Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), and many other infectious diseases pose grave threats to industry, the environment, and most importantly, global public health. In order to prevent the spread of such infectious diseases, there is a need for a fast and accurate pathogen detection system that can be used widely by an easier diagnostic procedure. A technology capable of identifying all potential pathogens at once is also urgently needed for diagnosing infections with unidentified causes. From this perspective, 'An in-situ diagnostic system for infections through nano-bio-ICT convergence' is expected to greatly contribute to the community by providing a fast and accurate diagnostic system for infectious diseases."

Ultra-fast, Micro-scale, Nanodiagnostic Sensor Platform Developed as a Next-generation Infection Diagnostic System

While the conventional molecular diagnostic instruments for detecting pathogens show fairly good performance, they are restrictedly used in centralized cores of large, general hospitals or research institutes due to the high cost of the instrument and skill set required for the procedures. Because of these constraints, primary healthcare units such as local clinics or public healthcare centers cannot afford the use of the molecular diagnostic instruments. Meanwhile, point-of-care diagnostic kits available in the market that allows self-diagnosis at home settings are relatively affordable, but lacks the accuracy.

'An in-situ diagnostic system for infections through nano-bio-ICT convergence', conducted by Professor Chung, Hyun Jung's team at KINC and 12 other labs, is one of KI's integrated research projects and is expected to find a solution to this problem. This system is an integrated platform where ultra-high speed micro-scale amplification, highly sensitive plasmonic nanosensing, and imaging-based target analysis are all combined, aiming at developing a next-generation diagnostic system that can be widely used in the society. This study is meaningful in that it established a platform, through the convergence of nano-bio-ICT technologies, that can efficiently detect target substances indicative of the infection, for which the key technologies have been developed and well established.

In general, it is important to label and detect the target substances from the pathogen after pre-conditional processing of the samples such as blood, sputum, urine, or saliva. In this study, an imaging-based approach was used for pre-analysis of the sample before processing. Target substances were then purified from the samples using a microfluidic system, and amplified at a molecular level using a photothermally induced, micro-scale, ultra-fast polymerase chain reaction (PCR) technology. After the process, targets were labeled with ultra-sensitive plasmonic nanoparticles modified with biofunctional ligand substances. By doing so, target signals were detected and stored as data on the multiplexed, microscale nanosensor platform. The gist of this in-situ diagnostic system for infections by nano-bio-ICT convergence is applying different cartridges for each pathogen to the nanodiagnostic sensor platform, based on the aforementioned key technologies.



Schematic of ultra-fast, micro-scale nanodiagnostic sensor platform as a next-generation infection diagnostic system

In this study, experts in biomedical science (Professor Park, Su-Hyung; Shin, Eui-Cheol; and Park, Chan-Kyu) discovered pathogens and biomarkers as targets for infectious diseases, while the researchers in nano-bio technology (Professor Jung, Hee-Tae; Nam, Yoon-Sung; Jon, Sang-Yong; and Park, Ji-Ho) studied the micro-scale ultra-fast PCR technology that could amplify small amounts of molecular target, and the ultra-sensitive labeling using the nanomaterials. Professionals in electronics and ICT (Professor Nam, Yoon-Key; Park, Yong-Keun; Choi, Yang-Kyu; Lee, Won-Hee; and Park, Je-Kyun) made a multiplexed, miniaturized, ultra-sensitive nanosensor and data analysis platform. Thanks to this nano-bio-ICT convergence platform, the diagnostic process, which takes three to four hours or sometimes even days in the past, is significantly shortened to a few minutes.

The current nano-diagnostic sensor system would allow the rapid and accurate detection of the infectious pathogens, which can be widely applied to primary healthcare clinics as well. It is also anticipated that the system will diagnose infectious diseases with unidentified causes by screening large numbers of various types of potentially infectious pathogens simultaneously. It can also be poetntially applied to other diseases such as cancer or cardiovascular diseases, which will greatly contribute to advances in biomedical science and research overall.

Prof. Chung, Hyun Jung

KAIST Institute for the NanoCentury
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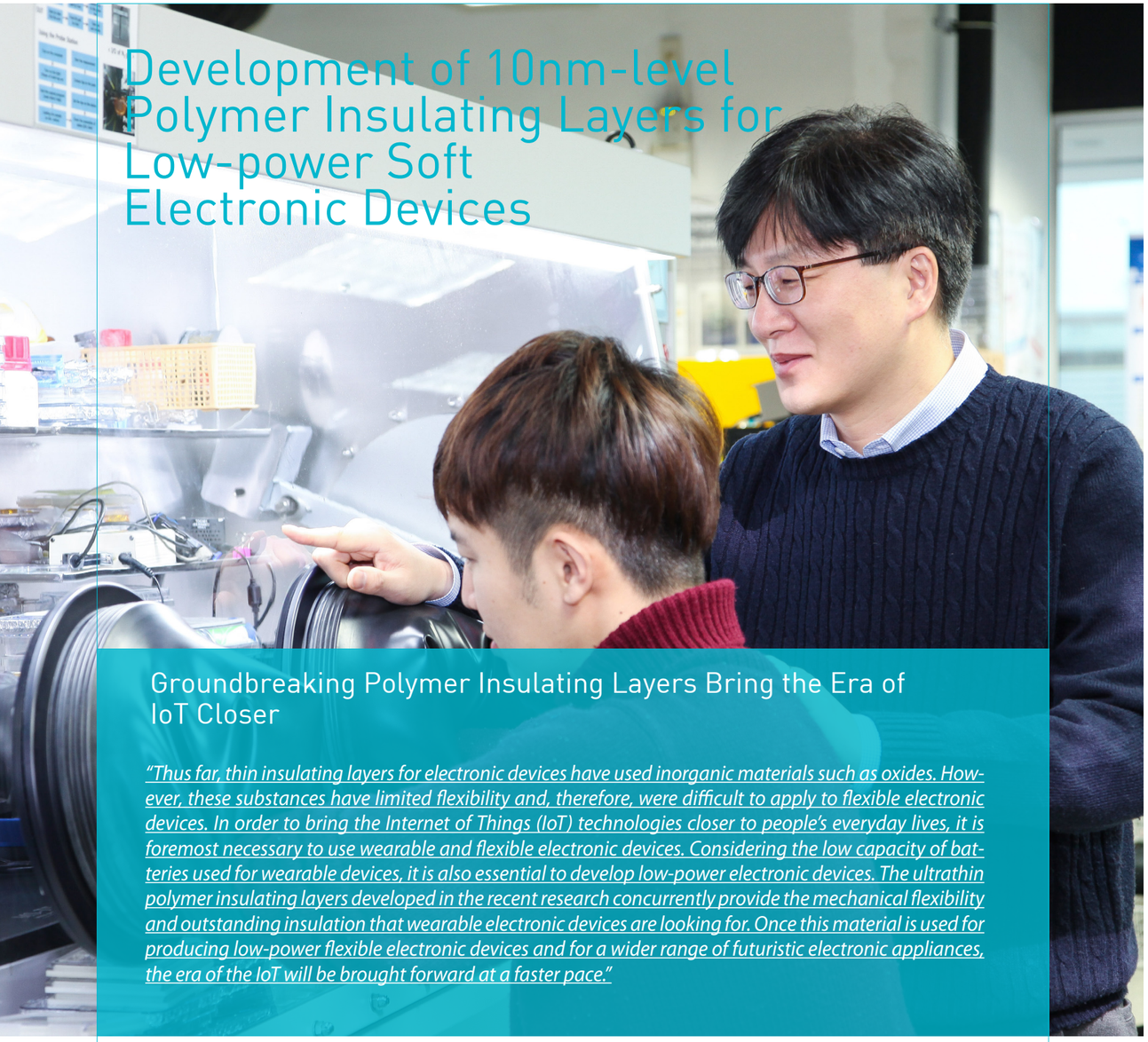
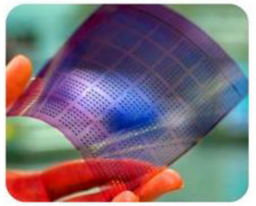
Assistant Professor



Development of 10nm-level Polymer Insulating Layers for Low-power Soft Electronic Devices

Groundbreaking Polymer Insulating Layers Bring the Era of IoT Closer

"Thus far, thin insulating layers for electronic devices have used inorganic materials such as oxides. However, these substances have limited flexibility and, therefore, were difficult to apply to flexible electronic devices. In order to bring the Internet of Things (IoT) technologies closer to people's everyday lives, it is foremost necessary to use wearable and flexible electronic devices. Considering the low capacity of batteries used for wearable devices, it is also essential to develop low-power electronic devices. The ultrathin polymer insulating layers developed in the recent research concurrently provide the mechanical flexibility and outstanding insulation that wearable electronic devices are looking for. Once this material is used for producing low-power flexible electronic devices and for a wider range of futuristic electronic appliances, the era of the IoT will be brought forward at a faster pace."



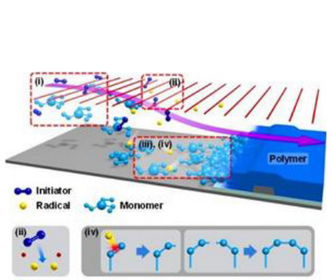
Flexible transistor array made on a large-area plastic substrate

Application for Futuristic Wearable and Flexible Electronic Devices Accelerates the Arrival of Dream Devices

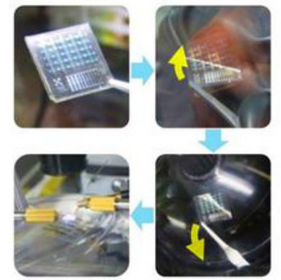
As a substitute for solid, heavy material based on inorganic materials, low-power polymer insulating layers were developed for the use for futuristic wearable and flexible electronic devices, signaling the arrival of the era of the Internet of Things (IoT).

In collaboration with Profs. Im, Sung Gap and Cho, Byung Jin, Prof. Yoo, Seunghyup's group at KINC successfully developed polymer insulating layers that can be down-scaled below 10nm, equivalent to 1/10,000 of a human hair. Published in Nature Materials, a sister journal of the world-famous scientific journal Nature, the developed polymer insulating layers exhibit insulating properties ideal for low-power soft electronic devices. This ultrathin layer prevents electric currents from flowing even when a strong electric field exists. Having participated in the joint research, Prof. Im, Sung Gap compares the developed polymer withstanding such a high field with a very thin plastic vinyl layer holding a huge amount of water without any leakage. The polymer layer can actually resist an extremely strong electric field, equivalent to millions of volts for one-centimeter thickness.

Ultrathin insulating layers are critical elements that enable the operation of transistors, a core unit device constituting most functional integrated circuits today. In general, transistors are comprised of three electrodes, a semiconductor, and an insulator. Among the three electrodes, one called a "gate electrode" plays the role of a knob in a faucet, switching on or off the electric current flowing through the semiconductor. The gate electrode works in such a way because the insulating layer existing between the gate electrode and semiconductor can change the latter's conductivity. In particular, when the insulating layers become thinner, the semiconductor has stronger conductivity at the same gate voltage, ultimately making it possible to develop low-power devices.



Process flow of initiated chemical vapor deposition method used for synthesis of polymer insulators



Demonstration of "stick-on" flexible electronic devices made of polymer insulators

* Photo courtesy of Nature Materials, doi:10.1038/nmat4237

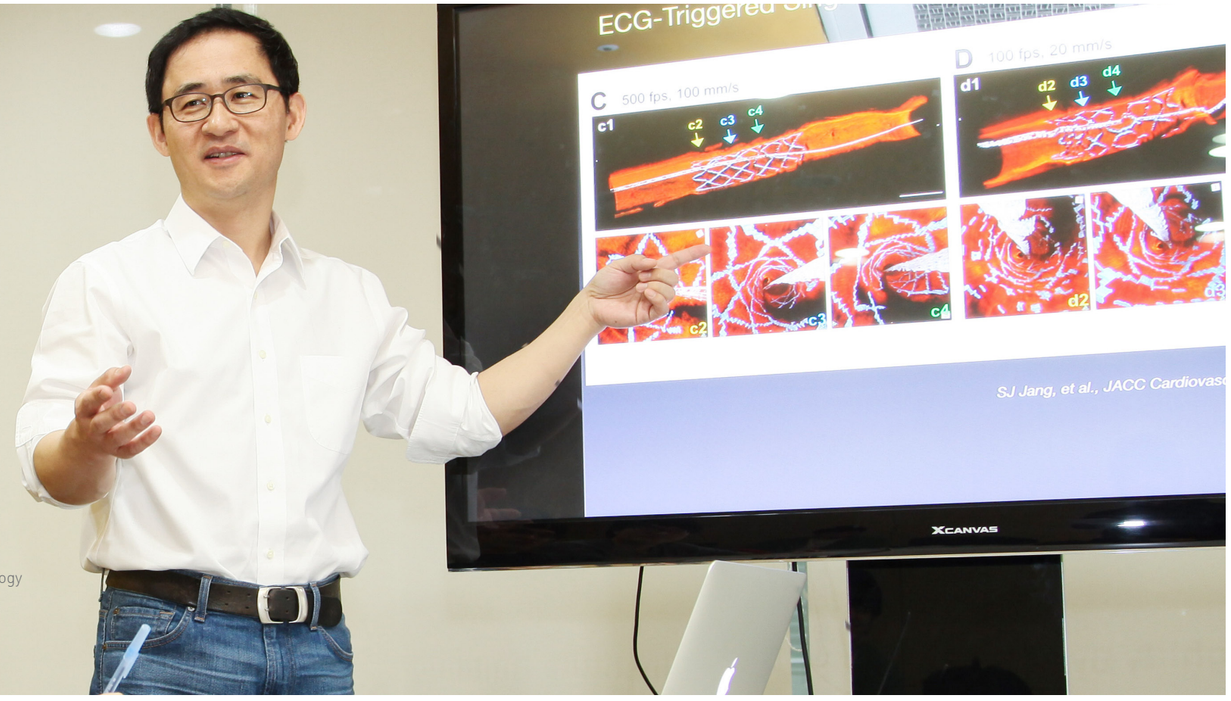
For existing transistor devices, ceramic substances such as oxides have been used to produce high-quality ultrathin insulators. However, ceramic materials are highly susceptible to bending-induced cracks, which makes them inadequate for flexible devices. Against this backdrop, the joint research team turned to the initiated chemical vapor deposition (iCVD) and developed high-quality 10-nm-level polymer insulating layers that can operate transistors at a low voltage. Although the wearable devices available today mostly take the form of smart watches, the ultrathin layers are expected to help develop easily expandable or bendable futuristic electronic devices in the form of patches that attach to human skin, for example. Such devices will enable comprehensive, ongoing monitoring in the medical and healthcare sectors without resorting to heavy or bulky equipment. In addition, displays that can be bent or folded without compromising their outstanding performance are expected to bring a revolutionary transformation to the future display market.

Once technologies are further developed for the customized design of insulating layers for different uses, coupled with realization of creative devices to take advantage of the unique properties of those layers, the ultrathin insulating layers are expected to significantly contribute to the development of low-power flexible electronic devices.

Prof. Yoo, Seunghyup

KAIST Institute for the NanoCentury
School of Electrical Engineering
Professor

Ultra-high-speed Intracoronary Imaging within a Single Heart Beat



Prof. Oh, Wang-Yuhl

KAIST Institute for Health Science and Technology
Dept. of Mechanical Engineering
Associate Professor

The Fastest Three-dimensional High-resolution Intracoronary Endoscopy, Opening up a New Horizon of Cardiovascular Disease Diagnosis

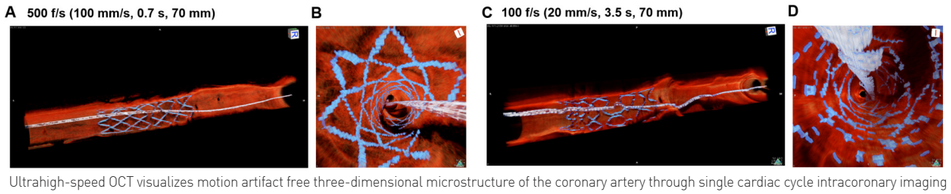
"Intravascular Optical Coherence Tomography (OCT) provides imaging of three-dimensional microstructure of the vessel wall, accurately diagnosing cardiovascular diseases. In order to acquire images of the inside of the vessels, the images have to be taken endoscopically in a couple of seconds immediately after the blood clearing through transparent fluid injection into the vessel. Yet the imaging speed of the existing system is rather slow; as a consequence, images are taken sparsely, resulting in inaccurate diagnosis. The 'Ultra-high-speed intracoronary imaging within a single heart beat', however, is able to take 500 images per second of the interior of blood vessels. The fastest and high-resolution intracoronary OCT technique provides visualization of long coronary artery in full detail. This technique is expected to significantly increase the accuracy of the diagnosis for cardiovascular diseases going forward."

Ultra-high-speed Intracoronary Imaging System Taking 500 Images per Second, Significantly Increasing the Accuracy of Cardiovascular Disease Diagnosis

Most acute myocardial infarction cases are fatal. Normally, the heart muscles get oxygen from the blood flow in coronary arteries, but when the coronary artery narrows to the point of blocking the blood flow, the oxygen is not properly provided to the heart muscles, leading to a sudden stoppage of the heartbeat and, ultimately, death. Therefore early diagnosis of coronary artery diseases based on accurate imaging is essential.

Since the x-ray-based angiography or the intravascular ultrasound, which have been the standard diagnostic imaging tools for the intravascular diseases, have limitation in accurate identification of conditions of the vessels due to their poor resolution, doctors are showing great interest in the new ultra-high-speed and high-resolution intravascular imaging technique.

Against this backdrop, Professor Oh, Wang-Yuhl and his team have continuously conducted the development of ultra-high-speed and high-resolution intracoronary imaging system in close cooperation with hospitals. In 2014, the team successfully took comprehensive images of a 7-centimeter-long aorta of a rabbit at a rate of 350 images per second. In 2015, the team took images of the coronary artery of a pig, which is known to have a similar vessel size with that of humans, with a speed of 500 images per second. This is the fastest high-resolution imaging technology in the world.



Ultrahigh-speed OCT visualizes motion artifact free three-dimensional microstructure of the coronary artery through single cardiac cycle intracoronary imaging

The human heart beats approximately once a second, so there are 4 to 5 heartbeats occurring during the about 5 seconds imaging time of conventional intravascular OCT technique. These heartbeats significantly distort the image quality due to the motion created by the contraction and expansion of the vessel during imaging. Therefore, it is sometimes hard to tell if the vessel actually narrows or if there is just an 'artifact' (a phenomenon where conditions that do not really exist or false images are observed due to errors in the imaging). Since the currently fastest intracoronary OCT takes images for 3 to 5 seconds at the imaging speed of 100 to 180 frames per second, there is a risk of inaccurate diagnosis due to the motion-induced artifacts in images.

The 'Ultra-high speed intracoronary imaging within a single heart beat' is a core technique that could resolve such limitations. Since it automatically identifies the short moment within a single heart beat having the minimal motion and takes ultra-high-speed imaging at a rate of 500 images per second, it provides high-resolution pictures of the interior of the blood vessels without distortions.

Development of Real-time High-resolution Imaging Technology for an Intestinal Lipid Absorption Process

Novel bio-imaging System, Opening a New Horizon for Disease Therapy Studies

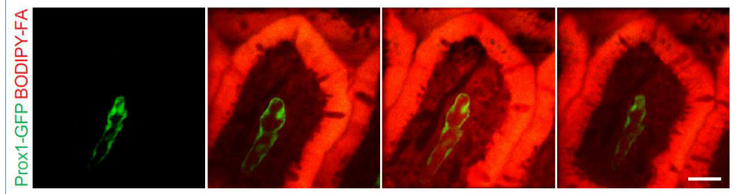
"The small intestine is a major organ in which the digestion of ingested foods and absorption of nutrients occur. Since the small intestine moves constantly inside the body, it was difficult to take cellular-level high resolution images of the same points for a prolonged period of time. Against this backdrop, this study attempted high-resolution imaging of the interior of the intestinal villi moving at a fast speed, using a video-rate confocal scanning laser microscope capable of taking 30 images per second. A new custom-built imaging chamber was used in this study, which could help to minimize the intestinal movement and maintain the temperature and humidity of the extracorporeal small intestine of the lab mice used. This imaging chamber allowed real-time monitoring of the absorption process of various substances in the intestine. The result of this study is expected to contribute to finding new medication delivery mechanisms where the lipid-soluble drugs are absorbed via intestinal lacteals, while the level of hepatotoxicity can be minimized."

Prof. Kim, Pilhan

KAIST Institute for Health Science and Technology
Graduate school of Nanoscience & Technology
Assistant Professor

High-resolution Imaging Technology, Accelerating Advancement in Biomedical Science

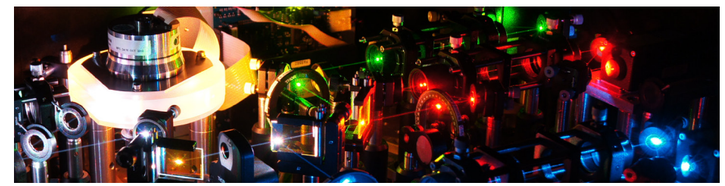
The absorption process occurring in the small intestine is a matter of great interest in the field of oral medication development. Unlike water-soluble medication metabolized in the liver, which has relatively poor efficacy, lipid-soluble drugs can be more effective as they can directly enter systemic circulation when the ingested drug ingredients are absorbed through lacteals along with lipid-soluble nutrients, circumventing the first-pass metabolism in the liver.



Intravital imaging of small intestine, lacteal (green) and fatty acid (red).

In order to achieve optimized medication delivery through the lacteals, it is important to understand the absorption process of the lipid-soluble nutrients such as fatty acids and glycerol. The conventional method in which the samples are taken at specific times, however, has a number of limitations: the cellular-level analysis of the consecutive absorption processes by time was challenging, not to mention the difficulty of taking intestinal images of the same spots for a long time at cellular-level high resolution. For these reasons, a study on real-time high-resolution imaging technology for intestinal lipid absorption conducted by Professor Kim, Pilhan and his team at KIHST, is in the limelight as revolutionary research in the field of biomedical science.

Professor Kim first got interested in biomedical science when he was a researcher at the Harvard Medical School as a Ph.D. in electronic engineering. In 2011, Professor Koh, Gou Young at Graduate School of Medical Science & Engineering (GSMSE), KAIST, suggested a study on lipid absorption at the intestinal villi to Professor Kim. Since Prof. Kim successfully had built a high-speed laser-scanning confocal microscope through his research at that time, they decided to conduct the research jointly, combining basic biology and medical science. When they first started the study, Prof. Koh had transgenic mice that express green fluorescent protein (GFP) in the lacteal of villi. In addition to that, a customized imaging chamber that could help the intestinal imaging process of the mice was built during the course of their joint study. Through this chamber, images were taken of the process in which the red fluorescence-tagged fatty acids were absorbed through the green-fluorescent lacteal in the villi of the mice.
There was a challenge during the study as well: the fatty acids were not constantly absorbed into the intestinal villi when a cover glass was put on the inner wall of the small intestine in the imaging chamber. This problem was solved by exchanging the cover glass with a detachable one. After this fix, images were successfully taken of the process of the fatty acids being smoothly absorbed.



Ultrafast Laser-scanning Confocal Microscope

During the course of this research, Prof. Kim and his team found the cyclical contractility and relaxation of the lacteals for the first time ever, which was quite an unexpected breakthrough. By using a video-rate confocal scanning laser microscope, the influences of the cyclical contraction of the small intestine, which was not captured by the conventional microscope due to constant intestinal movement, on the absorption of the fatty acids was identified. Following these findings, the exact mechanism of how these movements are adjusted was also unveiled.
This study was published in the online edition of The Journal of Clinical Investigation (JCI), (Impact Factor 13.261), one of the most prominent academic journals in the biomedical science field, in Oct 5, 2015. It was also introduced in the Nov, 2015 issue of the JCI This Month as a noteworthy article under the 'Editor's Pick' section. It is expected that the result of this study may accelerate the development of new drugs having higher intestinal absorption rates than conventional oral medication. This study will also greatly contribute to the advancement of the study on small intestinal diseases going forward.

Supercritical Carbon Dioxide Power System and Supercritical CO_2 Generation by Heatsink Temperature

Supercritical Carbon Dioxide Power: A Revolutionary Development in Energy Technology

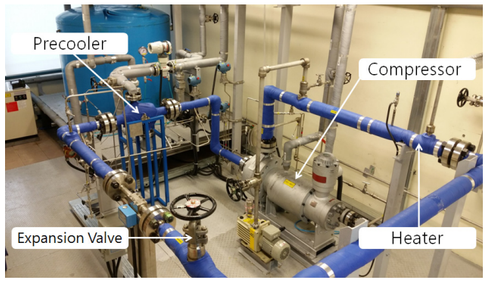
"When a temperature and pressure increase beyond the critical point, a substance enters a supercritical state where a distinction between liquid and gas phases does not exist. The critical temperature and pressure of CO_2 are 31°c and 74 bar, respectively, which are relatively easy to reach. This study started from the idea that those properties of CO_2 can be tapped into power generation. Approximately a 3 to 5 percent increase in generating efficiency is expected when using the supercritical CO_2 power system, where the waste heat is retrieved and used in power generation. Given that only a 1 percent increase in generating efficiency at every power plant in Korea has the same effect as building two nuclear power plants, a small increase in generating efficiency creates a substantial ripple effect from a technological perspective. This study is a future-oriented one in that it holds not only the technical values regarding a patent, but also the potential to provide solutions to the energy problem, one of the most important issues globally."

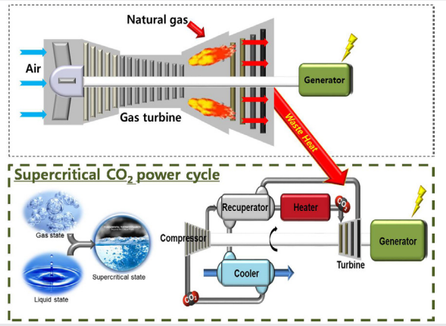
The Next Generation Power Technology with Increased Efficiency and Smaller System Size

An efficient use of energy has been a shared concern among numerous engineers around the globe since the world is now faced with an energy issue. Domestically, the development of more advanced energy technology is urgent because Korea is now importing more than 90 percent of its energy from abroad. Professor Lee, Jeong Ik and his CO_2 research team looked into the 'Supercritical CO_2 Power System', which utilizes carbon dioxide for power generation.

Most of the power generated throughout the world comes from steam turbines using water or a gas turbines generating power by combusting the fuel gas with compressed air. The problem is that those two methods and the material technologies employed have almost reached their limits in terms of increasing the efficiency. With those methods, thermal efficiency, reduction in CO_2 emission, and other performances have very little room for further improvement. Still, those methods have their own strengths: the steam turbine uses less energy than the gas turbine in the water pressurizing process, while the gas turbine has higher efficiency than the steam turbine as it generates power at higher temperature, producing higher output in smaller-sized equipment when compared to the steam turbine.

The 'Supercritical CO_2 power system and its operating method by changes in heatsink temperature (patent)' suggested by Professor Lee's team combines the merits of the two conventional generating methods mentioned earlier; this new system has 3 to 5 percent higher generating efficiency and requires approximately a tenth of the facility size when compared to the conventional methods. The team applied for a patent for this system.





How supercritical CO_2 power cycle works

This study started five years ago from basic research on a generating system employing nuclear energy. It was assumed then by the team that before applying the technology to the nuclear energy, it should first be applied to gas turbines, industrial waste heat recovery including high temperature fuel cells, all of which have relatively lower risk, as preparatory stages for pilot plant establishment and further research on the commercialization. At that time, Saudi Aramco established the 'Saudi Aramco – KAIST CO_2 Management Center' at KAIST in order to conduct research centering on greenhouse gas emission reduction and to develop a supercritical CO_2 power system boasting higher generating efficiency. In response, Professor Lee's team researched the waste heat source at combined cycle power plants, which at that time were recently established in Saudi Arabia. The team is now working on a project titled, 'Development of high efficiency gas turbine combustion system using CO_2 basic cycle' for the third year and plans to proceed with empirical and follow-up studies going forward.

It is expected that the supercritical CO_2 power technology may suggest a key solution to the overall energy problems and can be utilized in a wide array of areas, including turbomachinery design technology, supercritical fluid technology, and technology for natural gas liquefaction and storage in a vessel. It is also expected that the power generation without consuming water can be realized in desert environments in places like Saudi Arabia once the patent-pending research on the system configuration and operation method of the supercritical carbon dioxide generation by heatsink temperature is optimized. Through this technology, a power plant can maintain decent performances in an environment where the difference in temperatures between day and night is great, as in a desert. Furthermore, power generation near urban areas and a reduction in greenhouse gases can also be expected with the increased efficiency and compact size of the generating facilities employing the supercritical CO_2. Thanks to these merits, the supercritical CO_2 power system is highly acclaimed as a revolutionary energy technology for the next generation.

Prof. Lee, Jeong Ik

Saudi Aramco - KAIST CO_2 Management Center
Dept. of Nuclear and Quantum Engineering
Associate Professor

Photoelectrochemical Conversion of CO_2: Development of Photoelectrodes to Produce Chemical Fuel

Prof. Lee, Doh Chang

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Dept. of Chemical and Biomolecular Engineering
Associate Professor

Development of Nanomaterial-based Photoelectrodes: Producing Hydrocarbon Fuel Directly from Carbon Dioxide and Water under Sunlight

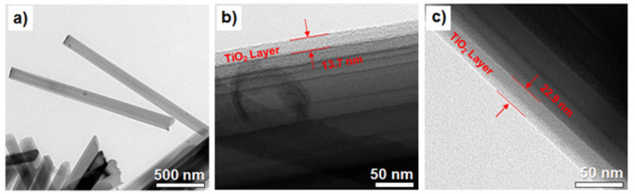
"Plants absorb sunlight and use the energy to produce nutrients from carbon dioxide and water. Optimized as a result of a long evolution process, natural photosynthesis has a low energy conversion efficiency, below one percent, because the efficiency, or lack thereof, is sufficient for the plants to sustain their species. However, it is necessary to improve this efficiency if the goal is not to sustain plant species, but to reduce CO_2 emissions resulting from the use of fossil fuels. In artificial photosynthesis, we aspire to design a photoelectrode that absorbs sunlight and ultimately converts CO_2 into chemical fuel with higher efficiency than that of natural photosynthesis. This research is an outcome of collaborative efforts by five different research teams. It is hoped that the development of a photoelectrode to produce chemical fuel will be a complimentary means to addressing the pressing issue of CO_2 reduction."

Photoelectrode-based Artificial Photosynthesis Now Recognized as Core Technology for CO_2 Reduction

In an attempt to solve the environmental problems faced by humankind, a number of researchers around the world have studied artificial photosynthesis to reduce carbon dioxide, since developing highly efficient photosynthesis can be a key to dealing with environmental challenges. Unlike the natural photosynthesis of plants involving carbon, oxygen, and nitrogen, its artificial counterpart uses inorganic substances such as elements found in stone and rocks. A team led by Prof. Doh Chang Lee at the Saudi Aramco-KAIST CO_2 Management Center took artificial photosynthesis a step further and developed the technology to convert CO_2 by making a nanomaterial-based photoelectrode that absorbs sunlight. This process of CO_2 conversion during artificial photosynthesis involving a photoelectrode enables the production of chemical fuel and reduction of CO_2 as well.

Although the photoelectrode has been studied by many researchers for several decades, the joint research team led by Prof. Lee focused on designing and making photoelectrodes with silicon-based, nano-scale heterostructure composites. This material allows for control the semiconductor absorption range to absorb light, serving as the core technology to maximize energy efficiency.

When the electrode creates electrons or holes by means of light, the electrically-connected electrode generates the CO_2 conversion reaction. Various products come from this process, such as methanol, methane, formic acid, and carbon monoxide, and selectivity of products becomes another important issue. The research team created a hybrid electrode with nanomaterial and developed a nanometer electrode that can positively assist the catalyst reaction. Testing different materials, the team continued the research for two years.



Anti-corrosive electron filter introduced to Si nanowires.

About one year was spent on fine tuning the equipment in order to reliably analyze chemical fuel product as a result of CO_2 conversion. Prof. Jihun Oh was responsible for designing the nanomaterial that constitutes the photoelectrode, and Prof. Il-Doo Kim optimized the surface treatment technology. In addition, Prof. Yoon Sung Nam designed molecular catalysts surrounding ruthenium and derived reactions, and Prof. Dong Ki Yoon studied molecular films and polymer layers that protect the catalyst so that molecular catalyst can be stably adsorbed into the surface. Finally, Prof. Lee led research to observe the effect of optical absorption material upon the surface of the catalyst in action. The collaborative efforts of these five research teams resulted in the creation of an efficient photoelectrode made with nanomaterial.

The technology to develop a photoelectrode aimed at creating chemical fuel was created using the findings of studies on various nanomaterials applied to other types of technologies, and research centered upon semiconductors and metals can be used for a range of electronic devices based on composite material. Furthermore, electrochemical research will help secure a core technology to study batteries and other energy storage devices. Ultimately, the photoelectrode-based artificial photosynthesis system is expected to help address the environmental challenges facing humankind based on its efficiency, which surpasses the one-percent level of natural photosynthesis.

KAIST
‘Smart Mobile Healthcare Innovation’

The Era of the Fourth Industrial Revolution Welcomes Dr. M

In the era of the Fourth Industrial Revolution shaped by convergent technologies, what future societies would look like? One of the answers is smart mobile healthcare services involving a process of analyzing biosignals collected from various sensors and providing real-time users with customized service for health improvement. Over 30 professors at KAIST participated and developed “Dr. M” after conducting collaborative research with domestic businesses and medical institutions.

Prof. Hong, Songcheol

KI I-Space
School of Electrical Engineering
Professor

Core Elements of Dr. M Include Integrated Sensors, IoT, Big Data and Machine Learning, Information Security, and Medicine

Dr. M aims to provide healthcare services by remotely monitoring and diagnosing users’ health information in real time and supporting hospitals and medical professionals. The specific means to realize this technology include the following: sensing biosignals from various sensors; transmitting data to platforms by means of low-power IPv6 (next-generation Internet address system) technology; comprehensively processing data at the IoT platforms and analyzing shared data; providing users with data about disease analysis and prediction; and finding medical knowledge based on such data and discovering new business models.

In order to realize this technology, the Dr. M service platform was introduced based on the convergence of integrated sensors, IoT, big data and machine learning (allowing machines to learn about the data analysis results and predict the future), information security, and medicine. This is the Dr. M testbed of KAIST Institutes.

Dr. M Testbed to Demonstrate IT Convergent Technologies to Shape the Future

KAIST is implementing the Dr. M project in an effort to develop a range of convergent technologies and has established a testbed for research purposes in order to organically connect technologies that are developed and test and evaluate them. Showcased on the ground floor of the KI building, the Dr. M testbed is connected to the Internet via integrated sensors and wireless networking and analyzes big data before diagnosing and providing services based on the mobile healthcare system. Since all integrated sensors are connected wirelessly, this signature technology of the Fourth Industrial Revolution can read users’ physical and health statuses anywhere and anytime.

Also on display are five major research products. First, “K-Patch: Mobile ECG Patch” uses a wearable multi-channel ECG patch to allow convenient heart monitoring anywhere and anytime. Second, with “Stick-on: Nail PPG Sensor,” users can attach a PPG sensor on their nails to conveniently and accurately measure heart rates. Third, “portal exhalation sensor” analyzes various substances found in the exhaled breath to monitor health conditions, and it transmits the data to smartphones. Fourth, “wearable brainwave detector” can measure users’ biometrics based on the EEG analysis and send the result to a head-mounted display. Lastly, “mobile cerebral blood flow detection” technology uses a near-infrared spectrometer to promptly diagnose cerebral hemorrhages.

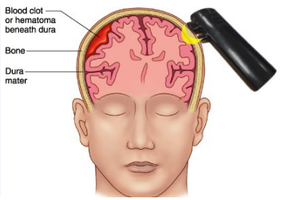
Platforms Connecting the Home, the Hospital, and Data Accelerate Future Technological Innovation

The Dr. M testbed consists of the following: Dr. M Home, Dr. M Hospital, and Dr. M Data Linkage Platform. Dr. M Home provides a virtual environment where users can conveniently use the Dr. M healthcare service in their own homes. This system measures biometrics of users throughout their everyday lives, including sleeping, waking up, and watching television, and then collects and manages the data. In the meantime, the virtual environment realized by Dr. M Hospital enables hospital doctors to readily use various biodata of patients collected from the Dr. M Platform. This will facilitate telemedicine service at hospitals and real-time responses to patients’ emergency situations. Finally, Dr. M Data Linkage Platform collects, stores, and shares biosignal data measured by sensors. Users can view such data through Eagle Eye.

Dr. M is expected to lead the world in the new medical service sector converged with information technology and will contribute to fostering and advancing related industries in Korea.

Dr.M Testbed

Stick-on; Nail PPG sensor



Mobile cerebral blood flow detector

KAIST Institute Research Achievements

Human Microbiome Control

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Cho, Byung-Kwan	Draft genome sequence of the chemolithoautotrophic acetogenic butanol-producing Eubacterium limosum ATCC 8486 (Genome Announcement, 2015. 02)
Paper	Cho, Byung-Kwan	Genome-scale anlaysis reveals a role for NdgR in the thiol oxidative stress response in Streptomyces coelicolor (BMC Genomics, 2015. 02)
Paper	Cho, Byung-Kwan	The architecture of ArgR-DNA complexes at the genome-scale in Escherichia coli (Nucleic Acids Research, 2015. 03)
Paper	Cho, Byung-Kwan	Draft genome sequence of Clostridium aceticum DSM 1496, a potential butanol producer through syn-gas fermentation (Genome Announcement, 2015. 05)
Paper	Cho, Byung-Kwan	Determination of single nucleotide variants in Escherichia coli DH5a using short-read sequencing (FEMS Microbiology Letter, 2015. 05)
Paper	Cho, Byung-Kwan	Reconstruction of acetogenesis pathway using short-read sequencing of Clostridium aceticum genome (Journal of Nanoscience and Nanotechnology, 2015. 05)
Paper	Cho, Byung-Kwan	Comparative genomics reveals the core and accessory genomes of Streptomyces species (Journal of Microbiology and Biotechnology, 2015. 05)
Paper	Cho, Byung-Kwan	Elucidation of the growth delimitation of Dunaliella tertiolecta under nitrogen stress by integrating transcriptome and peptidome analysis (Bioresource Technology, 2015. 07)"
Paper	Cho, Byung-Kwan	Minimal Genome: Worthwhile or Worthless Efforts toward Being Smaller? (Biotechnology Journal, 2015.09)
Paper	Cho, Byung-Kwan	Draft Genome Sequence of Acetobacterium bakii DSM 8293, a Potential Psychrophilic Chemical Producer through Syngas Fermentation (Genome Announcement, 2015. 09)
Paper	Cho, Byung-Kwan	Rational protein engineering guided by deep mutational scanning (International Journal of Molecular Sciences, 2015. 09)
Paper	Cho, Byung-Kwan	Efficient CRISPR/Cas9-Mediated Multiplex Genome Editing in CHO Cells via Balanced High-level Expression of Cas9 Nuclease and sgRNA (Biotechnology and Bioprocess Engineering, 2015. 11)
Paper	Jeong, Ki Jun	Cofactor-Free, Light-Driven Cytochrome P450 Catalysis (Angew Chem Int Ed. Cover article, 2015. 01)
Paper	Kim, Sun Chang	Planococcus faecalis sp nov., a carotenoid-producing species isolated from stools of Antarctic penguins (International Journal Of Systematic And Evolutionary Microbiology, 2015.10)
Paper	Kim, Sun Chang	Efficient CRISPR/Cas9-mediated multiplex genome editing in CHO cells via high-level sgRNA-Cas9 complex (Biotechnology And Bioprocess Engineering, 2015.09)
Paper	Kim, Sun Chang	The WOPR Domain Protein OsaA Orchestrates Development in Aspergillus nidulans (PLOS ONE, 2015.09)
Paper	Kim, Sun Chang	NK cell function triggered by multiple activating receptors is negatively regulated by glycogen synthase kinase-3 beta (Cellular Signalling, 2015.09)
Paper	Kim, Sun Chang	Recombinant Lipase Engineered with Amphipathic and Coiled-Coil Peptides (ACS Catalysis, 2015.09)
Paper	Kim, Sun Chang	STAT1 deficiency redirects IFN signalling toward suppression of TLR response through a feedback activation of STAT3 (Scientific Reports, 2015.08)
Paper	Kim, Sun Chang	Buforin IIb induces endoplasmic reticulum stress-mediated apoptosis in HeLa cells (Peptides, 2015.07)

KI for the BioCentury(KIB)

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Kim, Sun Chang	Improved n-butanol tolerance in Escherichia coli by controlling membrane related functions (Journal Of Biotechnology, 2015.06)
Paper	Kim, Sun Chang	Determination of single nucleotide variants in Escherichia coli DH5a using short-read sequencing (FEMS Microbiology Letters, 2015.06)
Paper	Kim, Sun Chang	Velvet-mediated repression of beta-glucan synthesis in Aspergillus nidulans spores (Scientific Reports, 2015.05)
Paper	Kim, Sun Chang	Reconstruction of Acetogenesis Pathway Using Short-Read Sequencing of Clostridium aceticum Genome (Journal Of Nanoscience And Nanotechnology, 2015.05)
Paper	Kim, Sun Chang	The architecture of ArgR-DNA complexes at the genome-scale in Escherichia coli (Nucleic Acids Research, 2015.03)
Paper	Kim, Sun Chang	A Highly Efficient Recombinant Laccase from the Yeast Yarrowia lipolytica and Its Application in the Hydrolysis of Biomass (PLOS ONE, 2015.03)
Paper	Kim, Sun Chang	Simple Processes for Optimized Growth and Harvest of Ettlia sp by pH Control Using CO_2 and Light Irradiation (Biotechnology And Bioengineering, 2015.02)
Paper	Kim, Sun Chang	Novel Glycosylated VEGF Decoy Receptor Fusion Protein, VEGF-Grab, Efficiently Suppresses Tumor Angiogenesis and Progression (Molecular Cancer Therapeutics, 2015.02)
Patent	Cho, Byung-Kwan	High growth Escherichia coli using glycerol as carbon source (Patent application, 10-2015-0072728, 2015. 05)
Patent	Cho, Byung-Kwan	Porous structure for improving porosity and method of manufacturing the same (Patent application, 10-2015-0063963, 2015. 05)
Patent	Cho, Byung-Kwan	Porous multi-structures and method of manufacturing the same (Patent registration, 10-1563636-0000, 2015. 10)
Patent	Cho, Byung-Kwan	Porous multi-structures and method of manufacturing the same (Patent application, 10-2015-0105764, 2015. 05)
Patent	Jeong, Ki Jun	The activating method for cytochrome P450 using Eosin Y (Patent registration, 10-1570698, 2015, 11)
Patent	Jeong, Ki Jun	synthetic promoter for expressing Corynebacterium (Patent registration, 10-1481142, 2015, 01)
Patent	Kim, Sun Chang	A novel method for glycosylation of ginsenoside using a glycosyltransferase derived from panax ginseng (Patent application, PCT/KR2015/004399, 2015.04)
Patent	Kim, Sun Chang	A novel method for glycosylation of ginsenoside using a glycosyltransferase derived from panax ginseng (Patent application, 10-2015-0061691, 2015.04)
Patent	Kim, Sun Chang	A novel method for glycosylation of ginsenoside using a glycosyltransferase derived from panax ginseng (Patent application, 2012800773174, 2015.05) ¨
Patent	Kim, Sun Chang	A novel method for glycosylation of ginsenoside using a glycosyltransferase derived from panax ginseng (Patent application, 12885824.8, 2015.05)
Patent	Kim, Sun Chang	MULTIMERIC ANTIMICROBIAL PEPTIDE COMPLEX WHICH IS DISPLAYED ON CELL SURFACE (Patent application, 14846637, 2015.09)
Patent	Kim, Sun Chang	A novel glycosyltransferase derived from Dolwoe and use thereof (Patent application, 14857703, 2015.09)
Patent	Kim, Sun Chang	A novel glycosyltransferase derived from Dolwoe and use thereof (Patent application, 15185757, 2015.09)
Patent	Kim, Sun Chang	A novel glycosyltransferase derived from Dolwoe and use thereof (Patent application, 2015-184541, 2015.09)
Patent	Kim, Sun Chang	Pharmaceutical composition for treating and inhibiting metastasis of glioblastoma comprising protopanaxadiols compound (Patent application, 10-2015-0160103, 2015.11)
Patent	Kim, Sun Chang	Porous structure for improving porosity and method of manufacturing the same (Patent application, 10-2015-0063963, 2015.05)
Patent	Kim, Sun Chang	Porous multi-structures and method of manufacturing the same (Patent application, 10-2015-0063962, 2015.05)
Patent	Kim, Sun Chang	A method for production of cinnamaldehyde (Patent application, 10-2015-0067557, 2015.05)
Patent	Kim, Sun Chang	Novel Anticancer Agents Comprising Peptides with Cancer-specific Toxicity (Patent registration, 9067970, 2015. 06)
Patent	Kim, Sun Chang	Novel Anticancer Agents Comprising Peptides with Cancer-specific Toxicity (Patent registration, 2575851, 2015. 03)

Cancer Metastasis Control

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Choi, Chulhee	Mitofusins deficiency elicits mitochondrial metabolic reprogramming to pluripotency (Cell Death and Differentiation, 2015. 12)
Paper	Choi, Chulhee	Label-free characterization of white blood cells by measuring 3D refractive index maps (Biomedical Optics Express, 2015. 10)
Paper	Choi, Chulhee	Evaluation of drug-targetable genes by defining modes of abnormality in gene expression (Scientific Reports, 2015. 09)
Paper	Choi, Chulhee	Vascular proteomics reveal novel proteins involved in SMC phenotypic change: OLR1 as a SMC receptor regulating proliferation and inflammatory response (PLoS ONE, 2015. 08)
Paper	Choi, Chulhee	Identification of novel trans-crosstalk between histone modifications via genome-wide analysis of maximal deletion effect (Genes & Genomics, 2015. 06)
Paper	Choi, Chulhee	Blockade of dual-specificity phosphatase 28 decreases chemo-resistance and migration in human pancreatic cancer cells (Scientific Reports, 2015. 07)
Paper	Choi, Chulhee	Tapered Microtract Array Platform for Antimigratory Drug Screening of Human Glioblastoma Multiforme (Advanced Healthcare Materials, 2015. 02)
Paper	Choi, Chulhee	Cytosolic Irradiation of Femtosecond Laser Induces Mitochondria-dependent Apoptosis-like Cell Death via Intrinsic Reactive Oxygen Cascades (Scientific Reports, 2015. 02)
Paper	Choi, Chulhee	The mitochondrial fusion-related proteins Mfn2 and OPA1 are transcriptionally induced during differentiation of bone marrow progenitors to immature dendritic cells (Molecules and Cells, 2015. 01)
Paper	Choi, Jung Kyoon	Global transcription network incorporating distal regulator binding reveals selective cooperation of cancer drivers and risk genes (Nucleic Acids Research, 2015.05)
Paper	Choi, Jung Kyoon	Intersection of genetics and epigenetics in monozygotic twin genomes (Methods, 2015.11)

KI for the BioCentury(KIB)

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Choi, Jung Kyoon	Global mapping of the regulatory interactions of histone residues (FEBS Letters, 2015.12)
Paper	Heo, Won Do	Optogenetic control of cell signaling pathway through scattering skull using wavefront shaping (Scientific Reports, 2015.08)
Paper	Heo, Won Do	Optogenetic control of endogenous Ca^{2+} channels in vivo (Nature Biotechnology, Cover Article, 2015. 09)
Paper	Jeong, Won Il	Treatment with 4-Methylpyrazole Modulated Stellate Cells and Natural Killer Cells and Ameliorated Liver Fibrosis in Mice (PLOS ONE, 2015. 05)
Paper	Jeong, Won Il	Blockade of Retinol Metabolism Protects T Cell-Induced Hepatitis by Increasing Migration of Regulatory T Cells (MOLECULES AND CELLS, 2015.11)
Paper	Jeong, Won Il	Dual notch signaling in proinflammatory macrophage activation (Hepatology, 2015. 12)
Paper	Jon, Sangyong	Effect of PEG Pairing on the Efficiency of Cancer-Targeting Liposomes (Theranostics, 2015. 04)
Paper	Jon, Sangyong	Conversion of low-affinity peptides to high-affinity peptide binders using a b-hairpin scaffold-assisted approach (ChemBioChem, Cover Articles, 2015. 01)
Paper	Oh, Byung-Ha	Development of a cancer-specific apoptogenic peptide (Cell Death Dis. 6:e1804, 2015. 07)
Paper	Song, Ji-Joon	AUF1 promotes let-7b loading on Argonaute 2. (Genes & Development , 2015)
Paper	Song, Ji-Joon	Human Argonaute2 has diverse reaction pathways on target RNAs. (Molecular Cell, 2015)
Patent	Choi, Chulhee	A method for selective cell death using ultrashort-pulsed laser (Patent registration, 10-1546383-0000, 2015. 08)
Patent	Choi, Chulhee	Photosensitizer encapsulated sub-12 nm size polymeric micelle for diagnosis and treatment of brain tumor (Patent registration, 10-1554564-0000, 2015. 09)
Patent	Choi, Chulhee	Process for preparing exosome comprising target protein (Patent application, 10-2015-0062604, 2015. 05)
Patent	Choi, Chulhee	Anti-cancer adjuvant comprising panaxadiols compound (Patent application, 10-2015-0071477, 2015. 05)
Patent	Choi, Chulhee	Method for screening regulator of mitochondrial fission (Patent application, 10-2015-0071480, 2015. 05)
Patent	Choi, Chulhee	Tissue energy supply capacity and metabolic rate measurement method and device using molecular kinetic analysis of glucose analogue (Patent application, 10-2015-0114664, 2015. 08)
Patent	Choi, Chulhee	Process for preparing exosome loading target protein and method for loading target protein to cytosol by using exosome prepared thereby (Patent application, 10-2015-0120934, 2015. 08)
Patent	Choi, Chulhee	Pharmaceutical composition for treating and inhibiting metastasis of glioblastoma comprising protopanaxadiols compound (Patent application, 10-2015-0160103, 2015. 11)
Patent	Choi, Jung Kyoon	Algorithm for the construction of a regulatory network for more than 10,000 genes and method for the identification of causal genes in drug responses using the same algorithm (Patent application, 10-2015-0063824, 2015.05)
Patent	Heo, Won Do	Fusion proteins capable of inducing protein dimerization by light and uses thereof (Patent registration, 10-1495651-0000, 2015. 02)
Patent	Jeong, Won Il	Preventative and Therapeutic Effects of Ginsenoside F2 on Non-alcoholic Hepatic Steatosis and Insulin Resistance (Patent application, 10-2015-0030031, 2015.03)
Patent	Jeong, Won Il	A method for improvement of drug metabolizing function of human stem cell-derived hepatocytes using hepatic stellate cells (Patent application, 10-2015-0034270, 2015.03)
Patent	Jeong, Won Il	A method for improvement of drug metabolizing function of human stem cell-derived hepatocytes using retinoic acid (Patent application, 10-2015-0034271, 2015.03)
Patent	Jeong, Won Il	A method for selection of functionally matured human stem cell-derived hepatocytes using STRA6 (Patent application, 10-2015-0034365, 2015.03)
Patent	Jeong, Won Il	A method for improvement of drug metabolizing function of human stem cell-derived hepatocytes using hepatic stellate cells (Patent application, PCT/KR2015/002576, 2015.03)
Patent	Jeong, Won Il	Protective Effects of Ginsenoside F2 on Alcohol-Mediated Steatohepatitis (Patent application, US-14838232, 2015.08)
Patent	Jeong, Won Il	Protective Effects of Ginsenoside F2 on Alcohol-Mediated Steatohepatitis (Patent application, JP-2015-171533, 2015.08)
Patent	Jeong, Won Il	Protective Effects of Ginsenoside F2 on Alcohol-Mediated Steatohepatitis (Patent application, EP-15183883.6, 2015.08)
Patent	Jeong, Won Il	Protective Effects of Ginsenoside F2 on Alcohol-Mediated Steatohepatitis (Patent application, CN-2015105595925, 2015.08)
Patent	Jon, Sangyong	"Cyclic beta-hairpin based peptide binders and methods of preparing the same (Patent application, PCT/KR2015/003632, 2015.04)

○ Neurodegenerative Diseases

Paper	Choi, Chulhee	Optogenetic control of cell signaling pathway through scattering skull using wavefront shaping (Scientific Reports, 2015. 08)
Paper	Choi, Chulhee	Characterization of CD8(+)CD57(+) T cells in patients with acute myocardial infarction (Cellular and Molecular Immunology, 2015. 07)
Paper	Han, Jin-Hee	Selective control of fear expression by optogenetic manipulation of infralimbic cortex after extinction (Neuropsychopharmacology, 2015. 10)
Patent	Choi, Chulhee	Segmental analysis and disease diagnosis by representative blood flow dynamics value (Patent registration, 10-1488775-0000, 2015. 01)
Patent	Choi, Chulhee	Disease diagnosis device and method using asymmetry of representative blood flow value (Patent registration, 10-1488767-0000, 2015. 01)
Patent	Choi, Chulhee	Extraction method of features related with diabetic vascular disorders using indocyanine green pharmacokinetic dynamics (Patent application, 10-2015-0140853, 2015. 10)

KI for IT Convergence(KIITC)

5G Mobile Communication

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Cho, Dong Ho	Analysis of Wireless Power Transfer for Adjustable Power Distribution among Multiple Receivers (IEEE Antennas and Wireless Propagation Letters, 2015. 01)
Paper	Cho, Dong Ho	Repetitive element signature-based visualization, distance computation, and classification of 1,766 microbial genomes (Genomics, 2015. 07)
Paper	Cho, Dong Ho	Random Linear Network Coding based on Outdated Channel-State Information (IEEE Communication Letters, 2015. 07)
Paper	Cho, Dong Ho	Random Linear Network Coding based on Non-Orthogonal Multiple Access in Wireless Networks (IEEE Communication Letters, 2015. 07)
Paper	Cho, Dong Ho	Opportunistic Schedulings for Random Linear Network Coding in Time Varying Channels (IEEE Communication Letters, 2015. 09)
Paper	Cho, Dong Ho	Energy Efficient Beamforming and Power Allocation in Dynamic TDD based C-RAN System (IEEE Communication Letters, 2015. 10)
Paper	Cho, Dong Ho	Asynchronous Detection Algorithm for Diffusion-based Molecular Communication in Timing Modulation Channel (IEEE Communication Letters, 2015. 10)
Paper	Cho, Dong Ho	Novel Single-RF MIMO System Based on Repetitive Pulse Width Modulation (IEEE Communication Letters, 2015. 10)
Paper	Cho, Dong Ho	On the Low-Complexity Resource Allocation for Self-Healing with Reduced Message Passing in Indoor Wireless Communication Systems (IEEE Communication Letters, 2015. 11)
Paper	Choi, Jun Kyun	Hybrid Multicast and Segment-based Caching for VoD Service in LTE networks (ETRI Journal, vol. 37, no. 4, pp. 685-695, 2015.08)
Patent	Cho, Dong Ho	Method for Compressing of Control Information, Method for Transceiving of Scanning Information of Radio Communication System and Thereof Apparatus (Patent registration, China, ZLZL201010000097.8, 2015. 02)
Patent	Cho, Dong Ho	Wireless Electric Power Supply Apparatus (Patent registration, 1517609, 2015. 04)
Patent	Cho, Dong Ho	Coreless pickup device (Patent registration, 1482599, 2015. 01)
Patent	Cho, Dong Ho	Handover Method in Communication System based on Beam Division Multiple Access and Mobile Station Performing the Method (Patent registration, 1486758, 2015. 01)
Patent	Cho, Dong Ho	Apparatus and Method for Sensing Frequency Band to Share Operating Frequency Bands in Heterogeneous Communication Systems (Patent registration, 1491972, 2015. 02)
Patent	Cho, Dong Ho	Transmitter and Method for Signal Transmission in Beam Division Multiple Access Communication System (Patent registration, 1548668, 2015. 08)
Patent	Cho, Dong Ho	1/4 Wavelength Slot Antenna (Patent registration, 1544911, 2015. 09)
Patent	Cho, Dong Ho	Method for Selecting Antenna Index Applied on Spatil Modulation Using Pattern, Polarized Wave Antenna (Patent registration, 1563978, 2015. 10)
Patent	Cho, Dong Ho	Adding Up Type Pick Up Apparatus (Patent registration, 1563317, 2015. 10)

IoT/WoT

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Choi, Jun Kyun	A Dynamic Conversion Scheme to Provide Suitable Contents Type for User's Environments on the Web (GCCE 2015, 2015. 10)
Patent	Choi, Jun Kyun	METHOD AND SERVICE SYSTEM FOR IMPROVING PERFORMANCE IN INSTANCE HOSTING ENVIRONMENT (Patent registration, 10-1570619-0000, 2015. 11)
Patent	Choi, Jun Kyun	METHOD AND SYSTEM FOR CONTROLLING DEVICE AND SERVICE BASED INTERNET OF THINGS (Patent registration, 10-1553478-0000, 2015. 09)
Patent	Choi, Jun Kyun	SMART ACCESS POINT APPARATUS AND METHOD FOR CONTROLLING INTERNET OF THINGS APPARATUS USING THE SMART ACCESS POINT (Patent registration, 10-1560470-0000, 2015. 10)

Integrated Sensors

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Hong, Songcheol	Design and Analysis of 239 GHz CMOS Push-Push Transformer-Based VCO With High Efficiency and Wide Tuning Range (IEEE Transactions on Circuits and Systems I: Regular Papers, 2015. 06)
Paper	Hong, Songcheol	A G-Band Standing-Wave Push–Push VCO Using a Transmission-Line Resonator (IEEE Transactions on Microwave Theory and Techniques, 2015. 02)
Paper	Hong, Songcheol	A W-Band 4-GHz Bandwidth Phase-Modulated Pulse Compression Radar Transmitter in 65-nm CMOS (IEEE Transactions on Microwave Theory and Techniques, 2015. 06)
Paper	Hong, Songcheol	A W-Band High-Efficiency CMOS Differential Current-Reused Frequency Doubler (IEEE Microwave and Wireless Components Letters, 2015. 03)
Paper	Hong, Songcheol	A K-Band CMOS UWB Four-Channel Radar Front-End With Coherent Pulsed Oscillator Array (IEEE Transactions on Microwave Theory and Techniques, 2015. 03)
Paper	Park, Inkyu	Fabrication of heterogeneous nanomaterial array by programmable heating and chemical supply within microfluidic platform ((Nature)Scientific Reports, 2015. 01)
Paper	Park, Inkyu	Focused energy field (FEF) method for the localized synthesis and direct integration of 1D nanomaterials on microelectronic devices (Advanced Materials, Front Cover Paper, 2015. 02)
Paper	Park, Inkyu	Self-heated silicon nanowires for high performance hydrogen gas detection (Nanotechnology, 2015. 02)
Paper	Park, Inkyu	Multiplexed gas sensor based on heterogeneous metal oxide nanomaterial array enabled by localized liquid-phase reaction (ACS Applied Materials & Interfaces, 2015. 05)
Paper	Park, Inkyu	Ultra-Stretchable and Skin-Mountable Strain Sensors Using CNTs-Ecoflex Nanocomposite (Nanotechnology, 2015. 08)
Paper	Park, Inkyu	Nanotextured polymer substrate for flexible and mechanically robust metal electrodes by nanoimprint lithography (ACS Applied Materials & Interfaces, 2015. 05)
Paper	Yoo, Hyung-Joun	A 0.7-MHz-10-MHz CT+DT Hybrid Baseband Chain With Improved Passband Flatness for LTE Application (IEEE Transactions on Circuits and Systems I – Regular Papers, 2015.01)
Paper	Yoo, Hyung-Joun	Multi-standard Hybrid PLL With Low Phase-Noise Characteristics for GSM/EDGE and LTE Applications (IEEE Transactions on Microwave Theory and Techniques, 2015.10)
Patent	Hong, Songcheol	Differential Radar System using two different signals (Patent application, PCT/KR2015/013599, 2015. 12)
Patent	Hong, Songcheol	Apparatus for generating terahertz wave using Landau level laser (Patent registration, 10-1530545-0000, 2015. 06)

KI for IT Convergence(KIITC)

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Patent	Hong, Songcheol	ASK/FSK simultaneous modulation and demodulation method by using charateristic of a varactor using in an oscillator (Patent registration, 10-1526903-0000, 2015. 06)
Patent	Hong, Songcheol	DIRECT ENVELOPE DETECTION METHOD OF RECEIVER FROM RESONANCE ANTENNA USING MAXIMUM VOLTAGE TRANSFER TECHNIQUE AND RECEIVERS THEREOF (Patent registration, 10-1529635-0000, 2015. 06)
Patent	Park, Inkyu	Biopsy needle with sensing electrode array and method for manufacturing the same (Patent application, 10-2015-0047014, 2015. 04)
Patent	Park, Inkyu	Method for manufacturing of microscale pattern array of sensor element by electrohydrodynamic printing and gas sensor array made by the same (Patent application, 10-2015-0094063, 2015. 07)
Patent	Park, Inkyu	Piezocapacitive type pressure sensor with porous dielectric layer (Patent application, 10-2015-0124360, 2015. 09)
Patent	Yoo, Hyung-Joun	NOx Gas Sensor (Patent registered, 10-1484551, 2015.01)
Patent	Yoo, Hyung-Joun	Method of detecting ignition and extinguishment condition of gas stove based on carbon dioxide gas concentration change (Patent registered, 10-1550772, 2015.09)
Patent	Yoo, Hyung-Joun	Impedance magnitude and phase measurement circuit using sampling scheme (Patent application, 10-2015-0140696, 2015.10)
Patent	Yoo, Hyung-Joun	Method of operating three-electrode gas sensor (Patent application, 10-2015-0147558, 2015.10)

KI for Robotics(KIR)

Mobile Intelligence for Vehicular Robots

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Kim, Jin Whan	Precision navigation and mapping under bridges with an unmanned surface vehicle (Autonomous Robots, 2015. 01)
Paper	Kim, Jin Whan	Passive target tracking of marine traffic ships using onboard monocular camera for unmanned surface vessel (Electronic Letters, 2015. 06)
Paper	Kim, Jin Whan	Coordinated motion control in task space of an autonomous underwater vehicle-manipulator system (Ocean Engineering, 2015. 05)
Paper	Kim, Jin Whan	Integral Sliding Mode Controller for Precise Maneuvering of Autonomous Underwater Vehicle in the Presence of Unknown Environmental Disturbances (International Journal of Control, 2015. 03)

AI for Cooperative Robots

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Shim, Hyun Chul	Dynamics and Simulation of the Effects of Wind on UAVs and Airborne Wind Measurement (TRANSACTIONS OF THE JAPAN SOCIETY FOR AERONAUTICAL AND SPACE SCIENCES, 2015. 06)
Paper	Shim, Hyun Chul	Development of an Aircraft Auto-landing Guidance System using Time Delay Control, and Simulation with Crosswind and Aileron Fault (TRANSACTIONS OF THE JAPAN SOCIETY FOR AERONAUTICAL AND SPACE SCIENCES, 2015. 01)
Paper	Shim, Hyun Chul	Design of an aerial combat guidance law using virtual pursuit point concept (PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS PART G-JOURNAL OF AEROSPACE ENGINEERING, 2015. 04)
Paper	Shim, Hyun Chul	SLPA*: Shape-Aware Lifelong Planning A* for Differential Wheeled Vehicles (IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, 2015. 04)
Paper	Shim, Hyun Chul	An Autonomous Driving System for Unknown Environments Using a Unified Map (IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, 2015. 08)
Paper	Shim, Hyun Chul	Recursive Path Planning Using Reduced States for Car-Like Vehicles on Grid Maps (IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, 2015. 10)
Paper	Shim, Hyun Chul	Vision-Based Sense-and-Avoid Framework for Unmanned Aerial Vehicles (IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS, 2015. 10)
Paper	Shim, Hyun Chul	Image-based Visual Servoing Framework for a Multirotor UAV using Sampling-based Path Planning (American Institute of Aeronautics and Astronautics, 2015. 01)
Paper	Shim, Hyun Chul	A Flight Test for Neutralization of Enemy Position Using Intelligent Cooperative System of Heterogeneous Unmanned Vehicle System (The Korean Society for Aeronautical and Space Sciences, 2015. 04)
Paper	Shim, Hyun Chul	A Trajectory-Tracking Controller Design Using L1 Adaptive Control for Multi-Rotor UAVs (IEEE International Conference on Unmanned Aircraft Systems Association, 2015. 06)
Paper	Shim, Hyun Chul	Decentralized Information-theoretic Task Assignment for Searching and Tracking of Moving Targets (IEEE International Conference on Unmanned Aircraft Systems Association, 2015. 06)
Paper	Shim, Hyun Chul	Mono-Vision Based Satellite Relative Navigation Using Active Contour Method (J. of The Korean Society for Aeronautical and Space Sciences, 2015. 10)
Paper	Shim, Hyun Chul	A 2.5D SLAM-aided Navigation Research for Indoor Flight of UAVs and Flight Tests (The Korean Society for Aeronautical and Space Sciences, 2015. 11)
Paper	Shim, Hyun Chul	A Study on Autonomous Flight Control System for a Fixed-wing Aircraft using a Pilot Robot (The Korean Society for Aeronautical and Space Sciences, 2015. 11)
Patent	Shim, Hyun Chul	Velocity profile generating device and method for generating the same (Patent registration, 10-1562895-0000, 2015. 10)

KI for Robotics(KIR)

Other Areas

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
paper	Lee, Dai Gil	Surface crack closing method for the carbon composite bipolar plates of a redox flow battery (Composite structures, 2015.1)
paper	Lee, Dai Gil	Development of a damage tolerant structure for nano-composite radar absorbing structures (Composite structures, 2015.1)
paper	Lee, Dai Gil	Corrugated carbon/epoxy composite bipolar plate for the vanadium redox flow battery (Composite structures, 2015.1)
paper	Lee, Dai Gil	Optimum design method of a nano-composite radar absorbing structure considering dielectric properties in the X-band frequency range (Composite structures, 2015.1)
paper	Lee, Dai Gil	Surface modification of carbon fiber phenolic bipolar plate for the HT-PEMFC with nano-carbon black and carbon felts (Composite structures, 2015.1)
paper	Lee, Dai Gil	Composite sandwich endplates with a compliant pressure distributor for a PEM fuel cell (Composite structures, 2015.1)
paper	Lee, Dai Gil	Smart cure cycle for reducing the thermal residual stress of co-cured E-glass/carbon/epoxy composite structure for a vanadium redox flow battery (Composite structures, 2015.2)
paper	Lee, Dai Gil	Radar absorbing composite structures dispersed with nano-conductive particles (Composite structures, 2015.4)
paper	Lee, Dai Gil	Pressure-resisting capability of the knot area of the primary barrier for a LNG containment system (Ocean Engineering, 2015.2)
paper	Lee, Dai Gil	Gasket-integrated carbon/silicone elastomer composite bipolar plate for high-temperature PEMFC (Composite structures, 2015.9)
paper	Lee, Dai Gil	Cryogenic impact resistance of chopped fiber reinforced polyurethane foam (Composite structures, 2015.11)
paper	Lee, Dai Gil	Dynamic and Static Characteristics of Polypropylene Pyramidal Kagome Structures (Composite structures, 2015.11)
paper	Lee, Dai Gil	Manufacturing of the carbon/phenol composite bipolar plates for PEMFC with continuous hot rolling process (Composite structures, 2015.11)
paper	Lee, Dai Gil	Method for exposing carbon fibers on composite bipolar plates (Composite structures, 2015.12)
paper	Lee, Dai Gil	Development of the light weight carbon composite tie bar (Composite structures, 2015.12)
paper	Lee, Dai Gil	Durability of graphite coated carbon composite bipolar plates for vanadium redox flow batteries (Composite structures, 2015.12)
paper	Lee, Dai Gil	Composite structures for proton exchange membrane fuel cells (PEMFC) and energy storage systems (ESS): Review (Composite structures, 2015.12)
paper	Lee, Dai Gil	Carbon fiber/polyethylene bipolar plate-carbon felt electrode assembly for vanadium redox flow batteries (VRFB) (Composite structures, 2015.12)
Patent	Lee, Dai Gil	COMPOSITE SEPARATOR FOR POLYMER ELECTROLYTE MEMBRANE FUEL CELL AND METHOD FOR MANUFACTURING THE SAME (Patent registration, 14605300, 2015.01)
Patent	Lee, Dai Gil	Elastomer bipolar plate for the fuel cell & storage system (Patent registration, 10-2015-0064668, 2015.05)
Patent	Lee, Dai Gil	COMPOSITE SEPARATION PLATE FOR FUEL CELL AND METHOD FOR MANUFACTURING THE SAME (Patent registration, 10-2015-0066124, 2015.05)
Patent	Lee, Dai Gil	Carbon felt integrated bipolar plate for the energy conversion & storage system (Patent registration, 10-2015-0069972, 2015.05)
Patent	Lee, Dai Gil	COMPOSITE SEPARATION PLATE FOR FUEL CELL AND METHOD FOR MANUFACTURING THE SAME (Patent registration, 2015-009180, 2015.09)
Patent	Lee, Dai Gil	Manufacturing method of the aluminum composite hybrid propeller shaft with increased dynamic performance and productivity (Patent registration, 10-2015-0129518, 2015.09.14)

KI for the NanoCentury(KINC)

NT for Climate Change

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Jung, Hee-Tae	Direct observation of highly ordered dendrimer soft building blocks over large area (Nano Letters, 2015. 10)
Paper	Kim, Bumjoon Kim, Taeksoo	Flexible, Highly Efficient All-Polymer Solar Cells (Nature Communications, 2015, 06)
Paper	Kim, Hee-Tak	Interlocking membrane/catalyst layer interface for high mechanical robustness of hydrocarbon-membrane-based polymer electrolyte fuel cells (Advanced Materials, Cover Article, 2015. 05)
Paper	Lee, Jung-Yong Park, Jeong Young	Enhancing the Internal Quantum Efficiency and Stability of Organic Solar Cells via Metallic Nanofunnels (Advanced Energy Materials, 2015. 05)
Patent	Kim, Hee-Tak	MEMBRANE-ELECTRODE ASSEMBLY FOR FUEL CELL AND FUEL CELL SYSTEM (Patent application, 10-2015-0000762, 2015. 01)

NT for Healthcare

Paper	Lee, Haeshin	Role of Dopamine Chemistry in the Formation of Mechanically Strong Mandibles of Grasshoppers (Chem. Mater., 2015. 07)
Paper	Nam, Yoonkey	Agarose-assisted micro-contact printing for high-quality biomolecular micro-patterns (Macromolecular Biosciences, Cover Article, 2015. 05)
Patent	Lee, Haeshin	Hemostatic needle coated with crosslinked chitosan which is functionalized with catechol group and oxidized catechol (Patent registration, 10-1576503, 2015, 12)
Patent	Nam, Yoonkey	Method for modulating neural activity comprising laser irradiation to nanoparticle attached neuron (Patent registration, 10-1519451, 2015. 05)

NT for Advanced Opto-Electronics

Paper	Bae, Byeong-Soo	Ultraviolet Light Stable and Transparent Sol-gel Methyl Siloxane Hybrid Material for UV Light Emitting Diode (UV LED) Encapsulant (ACS Applied Materials & Interfaces, 2015. 01)
Paper	Cho, Yong-Hoon Kim, Yong-Hyun	Is the chain of oxidation and reduction process reversible in luminescent graphene quantum dots? (Small, Frontispiece Page, 2015. 08)
Paper	Choi, Sung-Yool	Metal-Etching-Free Direct Delamination and Transfer of Single-Layer Graphene with a High Degree of Freedom (Small, Cover Article, 2015.02)
Paper	Im, Sung Gap Yoo, Seunghyup Cho, Byung Jin	Synthesis of ultrathin polymer insulating layer by initiated chemical vapor deposition for low-power soft electronics (Nature Materials, 2015. 03)
Paper	Jeon, Seokwoo Cho, Yong-Hoon	Extraordinary strong fluorescence evolution in phosphor on graphene (Advanced Materials, 2015. 12)
Paper	Kim, Sang Ouk	Synergistic Concurrent Enhancement of Charge Generation, Dissociation, and Transport in Organic Solar Cells with Plasmonic Metal-Carbon Nanotube Hybrids (Advanced Materials, 2015. 03)
Paper	Yoon, Dong Ki	In-plane switching mode for liquid crystal displays using a DNA alignment layer (ACS Applied Materials & Interfaces, 2015. 06)
Patent	Bae, Byeong-Soo	PRODUCING METHOD OF TRANSPARENT SILOXANE (Patent application, 10-2015-0100784, 2015. 04)
Patent	Choi, Sung-Yool	Method for manufacturing MoS2 nanosheet, agent for the same, and MoS2 nanosheet manufactured by the same (Patent registration, 10-1580211, 2015.12)
Patent	Kim, Sang Ouk	Method for forming a pattern using light source (Patent application, 10-2015-0115131, 2015. 08)
Patent	Yoo, Seunghyup	Slit-type vapor jet printing nozzle unit and deposition apparatus and method of thin film using the same (Patent application, 10-2015-0109965, 2015. 08)
Patent	Yoon, Dong Ki	Method for preparing DNA template for nanostructure fabrication (Patent application, 10-2015-0082789 2015. 06)

KI for Health Science and Technology(KIHST)

Neuroimaging and Neuromodulation

Paper	Jeong, Bum Seok	White matter connectivity and Internet gaming disorder (Addction Biology, 2015. 04)
Paper	Jeong, Yong	Sparse SPM: Group Sparse-dictionary learning in SPM framework for resting-state functional connectivity MRI analysis (NeuroImage, 2016.01)

Biophotonics

Paper	Kim, Pilhan	Intravtial imaging of intestinal lacteal unveils lipid drainage through contractility (Journal of Clinical Investigation, 2015. 11)
Paper	Oh, Wangyuhl	Prospectively ECG-triggered single cardiac cycle high-speed three-dimensional intracoronary optical coherence tomography (JACC: Cardiovascular Imaging, in press)
Paper	Park, YongKeun	One-wave optical phase conjugation mirror by actively coupling arbitrary light fields into a single-mode reflector (Physical Review Letters, 2015. 10)

Therapeutic Bioengineering

Paper	Park, Ji-Ho	Liposome-Based Engineering of Cells to Package Hydrophobic Compounds in Membrane Vesicles for Tumor Penetration (Nano Letters, 2015. 05)
Patent	Park, Ji-Ho	Effective Method for Transfering Genes into Cells Using Photothermal Effects of Gold Nanoparticles (Patent application, PCT/KR2015/013658)

Saudi Aramco-KAIST CO_2 Management Center

Development of CO_2 Capture and Conversion Process

Paper / Patent	Head Researcher	Research Achievements (Representative Papers / Patents)
Paper	Lee, Jay H.	Optimization of the Various Modes of Flexible Operation for Post-Combustion CO_2 Capture Plant (Computers and Chemical Engineering, 75, pp.14-27, 2015)
Patent	Han, Jong-In	A method for the production of sodium carbonate through the combination process of ammonia scrubbing and electrolysis (Patenet application, PCT/KR2015/008405, 2015. 08)

CO_2 Reduction by Enhancing Energy Efficiency

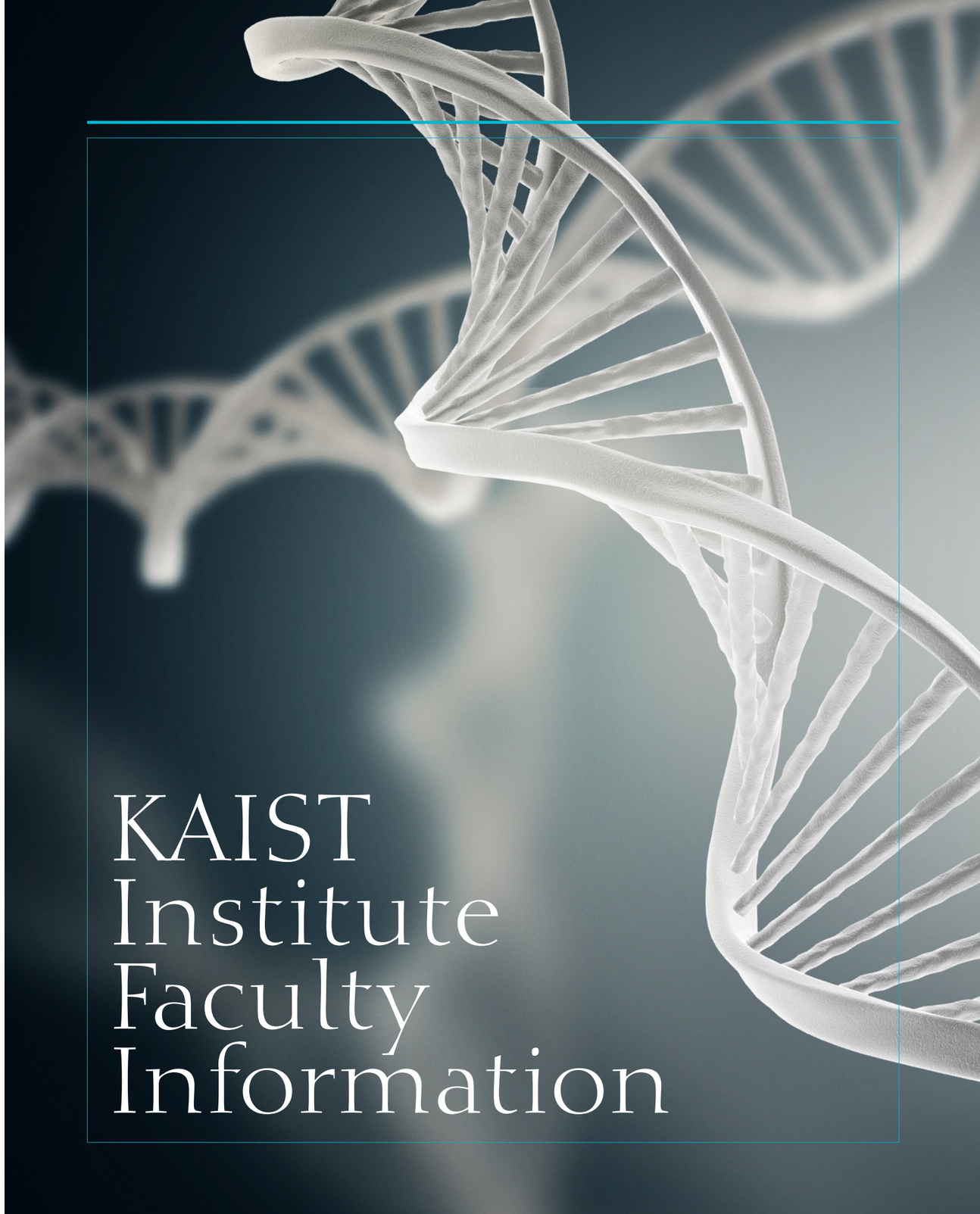
Paper	Jang, Kitae Jang, In Gwun	Traffic Signal Optimization for Oversaturated Urban Networks: Queue Growth Equalization (IEEE Transactions on Intelligent Transportation Systems, Vol.16(4), 2121-2138)
Paper	Lee, Jeong Ik	Investigation of the bottoming cycle for high efficiency combined cycle gas turbine system with supercritical carbon dioxide power cycle (ASME Turbo expo 2015, GT2015-43077, 2015. 06)
Patent	Lee, Jeong Ik	Generation system using supercritical carbon dioxide and method of driving the same by heat sink temperature (Patenet application, 10-2015-0183901, 2015. 12)
Patent	Lee, Jeong Ik	Generation system using supercritical carbon dioxide and method of driving the same by temperature differential of heat source (Patenet application, 10-2015-0183901, 2015. 12)

Solar Energy-based CO_2 Conversion

Paper	Lee, Doh Chang	Direct Cd-to-Pb Exchange of CdSe Nanorods into PbSe/CdSe Axial Heterojunction Nanorods (Chemistry of Materials, 2015. 07)
Paper	Lee, Doh Chang	Self-organization of nanorods into ultra-long range two-dimensional monolayer end-to-end network (Nano Letters, 2015. 12)
Paper	Lee, Doh Chang	Controlled Vortex Formation and Facilitated Energy Transfer within Aggregates of Colloidal CdS Nanorods (Chemistry of Materials, 2015. 04)
Patent	Lee, Doh Chang	Method of preparing Anisotropic Heterojunction Nanostructure and the Nanostructure thereof (Patent application, 10-2015-0063207, 2015. 05)
Patent	Song, Hyunjoon	Zinc based catalyst particle having core-shell structure and methanation of carbon dioxide using the same (Patent application, 10-2015-0109310, 2015. 08)

CO_2 Conversion Technology

Paper	Han, Sang Woo	Mechanistic Study on C-C Bond Formation of a Nickel(I) Monocarbonyl Species with Alkyl Iodide: Experimental and Computational Investigations (Organometallics, 2015. 09)
Paper	Lee, H.K.	Microstructural densification and CO_2 uptake promoted by the carbonation curing of belite-rich Portland cement (Cement and Concrete Research, 2016. 04)
Paper	Lee, H.K.	Strength development of alkali-activated fly ash exposed to carbon dioxide-rich environment at early age (Journal of the Korean Ceramic Society, 2016. 01)
Paper	Lee, H.K.	Heavy metal leaching, CO_2 uptake and mechanical characteristics of carbonated porous concrete with alkali-activated slag and bottom ash (International Journal of Concrete Structures and Materials, 2015.09)
Paper	Lee, H.K.	The influence of sodium hydrogen carbonate on the hydration of cement (Construction and Building Materials, 2015.09)
Patent	Han, Sang Woo	Metal catalysts for selective formation of cyclic carbonates and process for preparing cyclic carbonate using the same (Patent application, 10-2015-0132290, 2015. 09)



KI for the BioCentury(KIB)

Human Microbiome Control

Name	Education	Research Interests	Website	Remark
Kim, Sun Chang (Dept. of Biological Sciences, Professor)	Univ. of Wisconsin, Food Microbiology, Molecular Genetics, Ph.D. 1985	Synthetic Biology, Genome Engineering, Antimicrobial Peptides(AMPs)	http://bs.kaist.ac.kr/~mbtlab/	Director
Cho, Byung-Kwan (Dept. of Biological Sciences, Associate Professor)	Seoul Nat'l Univ., Biochemical Engineering and Biotechnology, Ph.D. 2003	Synthetic Biology, Genome and Transcriptome Engineering, Electrobiosynthesis	https://sites.google.com/a/kaist.edu/biochem-molbiol-lab/	
Jeong, Ki Jun (Dept. of Chemical and Biomolecular Engineering, Associate Professor)	KAIST, Chemical and Biomolecular Engineering, Ph.D. 2001	Protein Engineering, Antibody Engineering, Protein Display and HTS	http://mdrl.kaist.ac.kr/	
Kim,Joon (Graduate School of Medical Science and Engineering, Associate Professor)	Univ. of California at Irvine, Anatomy and Neurobiology, Ph.D. 2006	Molecular Genetics, Cell Biology, Neuroembryology	http://bcbd.kaist.ac.kr	
Kim, Hail (Graduate School of Medical Science and Engineering, Associate Professor)	Yonsei Univ., Biochemistry and Molecular Biology, M.D./Ph.D. 2002	Diabetology, Beta Cell Biology, Serotonin Biology	https://sites.google.com/site/hsparkmsbl/	
Lee, Sang Yup (Dept. of Chemical and Biomolecular Engineering, Professor)	Northwestern Univ., Chemical Engineering, Ph.D. 1991	Metabolic Engineering, Biochemical Engineering, DNA chip	http://mbel.kaist.ac.kr/	
Park, Hee Sung (Dept. of Chemistry, Associate Professor)	KAIST, Chemical Engineering, Ph.D. 2000	Biochemistry, Chemical Biology	http://proteineng.kaist.ac.kr	
Park, Hyun Gyu (Dept. of Chemical and Biomolecular Engineering, Professor)	KAIST, Chemical Engineering, Ph.D. 1996	Nucleic Acid Bioengineering, Biochips & Biosensor, Electrochemical Diagnosis	http://ssbl.kaist.ac.kr/	
Cho, Suhyung (KI for the BioCentury, Research Associate Professor)	Seoul Nat'l Univ., Biochemical Engineering and Biotechnology, Ph.D. 2005	Transcription Processing, Regulation, RNA Synthetic Biology, Regulatory Genomics	http://biocentury.kaist.ac.kr/	
Lee, Jun Hyoung (KI for the BioCentury, Research Associate Professor)	KAIST, Molecular Biotechnology, Ph.D. 2010	Synthetic Biology	http://biocentury.kaist.ac.kr/	

Cancer Metastasis Control

Han, Yong Man (Dept. of Biological Sciences, Professor)	KAIST Molecular Biology, Ph.D. 1993	Differentiation of Embryonic Stem Cells, Induced Pluripotent Stem Cells	http://stemcell.kaist.ac.kr/	
Heo, Won Do (Dept. of Biological Sciences, Associate Professor)	Gyeongsang Nat'l Univ., Biochemistry, Ph.D. 1999	Bio-Imaging, Cell Signaling, Neuroscience	https://sites.google.com/site/heolab/	
Jeong, Won-il (Graduate School of Medical Science and Engineering, Associate Professor)	Kyungpook Nat'l Univ., College of Veterinary Medicine, D.V.M./ Ph.D. 2004	Pathology, Cell Engineering	http://web.kaist.ac.kr/~llr/	
Jon, Sangyong (Dept. of Biological Sciences, Professor)	KAIST, Chemistry, Ph.D. 1999	Targeted Therapy, Drug Delivery System, Nanoparticle Based Vaccine	http://www.bionanolab.co.kr/	
Kim, Ho Min (Graduate School of Medical Science and Engineering, Associate Professor)	KAIST, Biological Sciences, Ph.D. 2005	Molecular Structure Biology, X-ray Crystallography, Electron Microscope	http://gsmse.kaist.ac.kr	
Kim, Jaehoon (Dept. of Biological Sciences, Assistant Professor)	Rockefeller Univ., Biochemistry and Molecular Biology, Ph.D. 2007	Biochemistry, Molecular Biology	http://molneuro.kaist.ac.kr/contents/	
Kim, Mi Young (Dept. of Biological Sciences, Assistant Professor)	Cornell Univ., Molecular Biology and Genetics, Ph.D. 2004	Metastasis, Epigenetics, Stem Cell	https://sites.google.com/site/bglabkorea/	
Kim, Seyun (Dept. of Biological Sciences, Assistant Professor)	Johns Hopkins Univ. of Medicine, Dept. of Biological Chemistry, Ph.D. 2007	Metabolism Signaling Network	http://pbil.kaist.ac.kr	
Lee, Gyun Min (Dept. of Biological Sciences, Professor)	Univ. of Michigan, Chemical Engineering, Ph.D. 1990	Cell Engineering, Proteomics, Cell Therapy	http://bs.kaist.ac.kr/~acelab/	
Lee, Jie Oh (Dept. of Chemistry, Professor)	Harvard Univ. Biochemistry, Ph.D. 1995	Structural Immunochemistry	http://cafe.naver.com/advbio.cafe	
Lee, Younghoon (Dept. of Chemistry, Professor)	Univ. of Missouri Biochemistry, Ph.D. 1984	Regulation of Gene Expression, RNA Biology, Chemical Biology	http://rnase.kaist.ac.kr	
Oh, Byung-Ha (Dept. of Biological Sciences, Professor)	Univ. of Wisconsin-Madison Biophysics, Ph.D. 1989	Chronosome Codensation, Infection and Immunity	http://struct.kaist.ac.kr/	
Song,Ji-Joon (Dept. of Biological Sciences, Associate Professor)	Watson School of Biological Sciences, Cold Spring Harbor Laboratory, Structural Biology, Ph.D. 2005	Histone Methyltransferases, Chromatin Assembly, Nucleosome Recognition, Neurodegenerative Disease	https://sites.google.com/site/songkaist/	
Cho, Carol (KI for the BioCentury, Research Assistant Professor)	Univ. of California, San Francisco, Biochemistry, Ph.D. 2011	Biochemistry, Biological sciences	http://biocentury.kaist.ac.kr/	
Lim, Eun Jin (KI for the BioCentury, Research Assistant Professor)	The Catholic Univ. of Korea, Neurobiology, Ph.D. 2008	Neurobiology	http://biocentury.kaist.ac.kr/	

Neurodegenerative Diseases

Choi,Chulhee (Dept. of Bio and Brain Engineering, Professor)	Yonsei Univ., ,Microbiology/Immunology, M.D./Ph.D. 1999	Neurobiology, Molecular and Cellular Biology, Computational Cell Biology, Neuroimmunology, Tumor Immunology	http://ccbio.kaist.ac.kr	
Choi, Jung Kyoon (Dept. of Bio and Brain Engineering, Associate Professor)	KAIST, Biology, Ph.D. 2004	Omics, Genome/Epigenome Engineering	http://omics.kaist.ac.kr	
Han, Jin-Hee (Dept. of Biological Sciences, Associate Professor)	Seoul Nat'l Univ., Neuroscience, Ph.D. 2004	Neurobiology, Neural Circuit, Synaptic Physiology, Animal Behavior	https://sites.google.com/site/neuralcircuitandbehaviorlab/	
Jung, Min Whan (Dept. of Biological Sciences, Professor)	Univ. of California, Irvine, Psychobiology, Ph.D. 1990	Decision Making, Episodic Memory, Interval Timing	https://sites.google.com/site/systemsneurolaboratory/	
Kim, Daesoo (Dept. of Biological Sciences, Associate Professor)	POSTECH, Life Science, Ph.D. 1998	Behavioral Neuroscience, Movement Disorders	https://sites.google.com/site/mcikaist/	
Kim, Eunjoon (Dept. of Biological Sciences, Professor)	Michigan State Univ., Pharmacology and Toxicology, Ph.D. 1994	Neuroscience, Molecule Neuroscience	https://sites.google.com/site/seyunkimlab/	
Kim, Jin Woo (Dept. of Biological Sciences, Associate Professor)	KAIST, Biological Sciences, Ph.D. 1999	Developmental Neurobiology, Neuro-regeneration, Retinal Degeneration,	https://sites.google.com/site/kaistjhkim/	
Lee,Seung-Hee (Dept. of Biological Sciences, Assistant Professor)	Seoul Nat'l Univ., School of Biological Sciences, Ph.D. 2007	Neurobiology, Neurophysiology, Neuromodulatory systems	https://sites.google.com/site/leelab2013/	
Park, Chankyu (Dept. of Biological Sciences, Professor)	Washington State Univ., Microbiology, Ph.D. 1985	Molecular Physiology	https://sites.google.com/site/ckparkhome/	
Chae, Sujin (KI for the BioCentury, Research Assistant Professor)	Seoul Nat'l Univ., Biomedical Biochemistry, Ph.D. 2009	Behavioral Epigenetics	http://biocentury.kaist.ac.kr/	
Kang, Kyung Hwa (KI for the BioCentury, Research Associate Professor)	Chung-ang Univ., Molecular Cell Biology, Ph.D. 2000	Moelcular Mechanism	http://biocentury.kaist.ac.kr/	

KI for IT Convergence(KIITC)

5G Mobile Communications

Name	Education	Research Interests	Website	Remark
Hong, Songcheol (School of Electrical Engineering, Professor)	Univ. of Michigan, Electrical Engineering, Ph.D. 1989	Integrated High frequency sensor, 5G communication	http://weis.kaist.ac.kr	Director
Cho, Dong Ho (School of Electrical Engineering, Professor)	KAIST, Electrical Engineering, Ph.D. 1985	5G mobile communication, Wireless power transfer, System biology	http://umls.kaist.ac.kr/	
Han, Dongsu (School of Electrical Engineering, Assistant Professor)	Carnegie Mellon Univ, Computer Science, Ph.D. 2012	Computer systems in the networked environment	http://ina.kaist.ac.kr/~dongsuh/	
Kang, Joonhyuk (School of Electrical Engineering, Associate Professor)	Univ. of Texas at Austin, Ph.D. 2002	The digital communication techniques for advanced wireless communication systems	http://artlab.kaist.ac.kr	
Lee, Yong-Hoon (School of Electrical Engineering, Professor)	Univ.of Pennsylvania, Ph.D. 1984	Communication Signal Processing	http://kalman.kaist.ac.kr	
Lim, Chun-Taek (Dept. of Nuclear&Quantum Engineering, Associate Professor)	KAIST, Electrical & Electronics Engineering, Ph.D. 1990	LED, SmartGrid, Nuclear reactor instrumentation	http://tesla.kaist.ac.kr/	
Park, Dong-Jo (School of Electrical Engineering, Professor)	Univ. of California, Los Angeles, Communication, Ph.D. 1984	Wireless communications signal processing, adaptive signal processing, optimization techniques, image processing and target tracking	http://armi.kaist.ac.kr	
Sung, Dan-Keun (School of Electrical Engineering, Professor)	Univ. of Texas at Austin, Electronic & Computer Engineering, Ph.D. 1986	Communication system, 5G, SmartGrid, M2M, Heterogeneous Network (HetNet)	http://cnr.kaist.ac.kr	
Gil, Gye-Tae (KI for Information Technology Convergence, Research Associate Professor)	KAIST, Electrical Engineering, Ph.D. 2004	Communication signal processing, Advanced Multi-user MIMO technology, Adaptive filter design	http://itc.kaist.ac.kr	
Lee, Ju Yong (KI for Information Technology Convergence, Research Associate Professor)	KAIST, Electrical Engineering, Ph.D. 2003	5-th Generation Wireless Communication	http://itc.kaist.ac.kr	

IoT/WoT

Choi, Jun Kyun (School of Electrical Engineering, Professor)	KAIST, Electrical Engineering, Ph.D. 1988	Energy-saving network, Internet of Things, Knowledge engineering	http://mnlab.kaist.ac.kr	
Daniel Pieter Saakes (Dept. of Industrial Design, Assistant Professor)	Delft Univ. of Technology, Industrial Design Engineering, Ph.D. 2010	End-user Design, Decentralized Fabrication, Visualization and Display Technology	http://mid.kaist.ac.kr/	
Kang, Byeong-Hoon (School of Computing, Associate Professor)	UC Berkeley, Computer Science, Ph.D. 2004	Malware, Rootkit	http://gsis.kaist.ac.kr/cysec/index.html	
Kim, Dae-Shik (School of Electrical Engineering, Professor)	Max-Planck-Institute for Brain Research, Brain Systems Research, Ph.D. 1994	Systems neuro science, Neuro robotics, Brain decodes	http://brain.kaist.ac.kr	
Kim, Daeyoung (School of Computing, Professor)	Univ. of Florida, Ph.D. 2001	Realtime and Embedded Systems, Internet of Things	http://www.resl.kaist.ac.kr/	
Kim, Heeyoung (Dept. of Industrial&Systems Engineering, Assistant Professor)	Georgia Institute of Technology, Ph.D. 2011	statistics and data mining	http://istat.kaist.ac.kr/	
Kim, Hye-jin (School of Business and Technology Management, Assistant Professor)	The Pennsylvania State Univ., Business Administration, Ph.D. 2013	Machine Learning and Data Mining for Understanding Consumer Preferences, Human Emotion Recognition	http://ms.kaist.ac.kr/	
Kim, Jihee (School of Business and Technology Management, Assistant Professor)	Stanford Univ., Management Science and Engineering, Ph.D. 2013	Economic Growth, Development Macroeconomics Income, Wealth Inequality	http://www.jiheekim.net	
Kim, Yongdae (School of Electrical Engineering, Professor)	Univ. of Southern California, Computer Science, Ph.D. 2002	Network and Distributed System Security, Applied Cryptography	http://syssec.kaist.ac.kr/~yongdaek/	
Lee, Doheon (Dept. of Bio and Brain Engineering, Professor)	KAIST, Computer Science, Ph.D. 1995	Bio/Medical Informatics, Neuroinformatics, Systems Biology	http://biosoft.kaist.ac.kr	
Lee, Sung-Hee (Graduate School of Culture Technology, Associate Professor)	UCLA, Computer Science, Ph.D. 2008	Computer Graphics/Animation, Humaoid Robot, HCI	http://motionlab.kaist.ac.kr/cglab/	
Sean M. Flynn (Dept. of Business and Technology Management, Assistant Professor)	New York Univ., Economics, Ph.D. 2013	Applied Microeconomics, Entrepreneurship, Venture Capital, Industrial Organization	http://homepages.nyu.edu/~smf354	
Shin, Jinwoo (School of Electrical Engineering, Assistant Professor)	MIT, Computer Science, Ph.D. 2010	Network Algorithms, Statistical Inference and Equilibrium Analysis	https://sites.google.com/site/mijirim/	
Yang, Hyun-Seung (School of Computing, Professor)	Purdue Univ., School of Electrical and Computer Engineering, Ph.D.1986	Visual Computing, Infomation Service	http://mind.kaist.ac.kr/2_prof/professor.htm	
Yi, Mun-Yong (Dept. of Industrial&Systems Engineering, Professor)	Univ. of Maryland, Information Systems, Ph.D. 1998	Business Intelligence, Human-Computer Interaction, Intelligent Agent, Knowledge Engineering and Management, Semantic Information Retrieval	http://kslab.kaist.ac.kr/	
Jung, Sungkwan (KI for Information Technology Convergence, Research Associate Professor)	KAIST, Electrical Engineering, Ph.D. 2007	IoT/M2M, Web, UI	http://itc.kaist.ac.kr	

Integrated Sensors

Hong, Songcheol (School of Electrical Engineering, Professor)	Univ. of Michigan, Electrical Engineering, Ph.D. 1989	Integrated High frequency sensor, 5G communication	http://weis.kaist.ac.kr	Director
Cho, Gyuseong (Dept. of Nuclear&Quamtum Engineering, Professor)	Univ. of Califinia Berkeley, Nuclear Engineering, Ph.D. 1992	Radiation image sensor, Medical diagnosis equipment, Radiation detector	https://radiation.kaist.ac.kr	
Cho, Seungryong (Dept. of Nuclear&Quantum Engineering, Associate Professor)	The Univ. of Chicago, Medical Physics, Ph.D. 2009	Medical imaging, Radiation therapy	http://mirlab.kaist.ac.kr/	
Jun Tani (School of Electrical Engineering, Professor)	Sophia Univ., Electrical Engineering, Ph.D. 1995	Neuro-robotics, Complex systems, Cognitive science	http://neurorobot.kaist.ac.kr/	
Lee, Soo-Young (School of Electrical Engineering, Professor)	Polytechnic Univ. of New York, Electro Physics, Ph.D. 1984	Artificial Brain, Machine Intelligence, Cognitive Information Processing	http://cnsl.kaist.ac.kr/	
Park, Chong-Ook (Dept. of Materials Science Engineering, Professor)	Ohio State Univ., Materials Science, Ph.D. 1985	Chemical sensors	http://mse.kaist.ac.kr/~copark	
Park, Inkyu (Dept. of Mechanical Engineering, Associate Professor)	Univ. of California at Berkeley, Mechanical Engineering, Ph.D. 2007	Micro/nano sensors for Healthcare/Environment monitoring, Multiscale Manufacturing, Reliability Evaluation and Innovation in Micro/Nanoscale	http://mintlab1.kaist.ac.kr/	
Park, Sung-Hong (Dept. of Bio and Brain Engineering, Assistant Professor)	Univ. of Pittsburgh, Bioengineering, Ph.D. 2009	Magnetic Resonance Imaging, Neuroimaging, Bio-signal processing	http://mri.kaist.ac.kr/	
Yoo, Hyung-Joun (School of Electrical Engineering, Professor)	KAIST, Physics, Ph.D. 1994	Sensor communications, RF systems for mobile communications	http://codes.kaist.ac.kr/	
Chang, Ho-Jong (KI for Information Technology Convergence, Research Assistant Professor)	Chungnam Nat'l Univ., Electronics Engineering, Ph. D., 2014	Medical Device Biosignal Measurement	http://itc.kaist.ac.kr	
Lee, Byung-Cheon (KI for Information Technology Convergence, Research Associate Professor)	Chung-ang University, Pharmacy, Ph.D. 1998	Primo vascular system	http://itc.kaist.ac.kr	
Yoo, Sang-Sun (KI for Information Technology Convergence, Research Assistant Professor)	KAIST, Electrical Engineering, Ph.D. 2012	Sensor communications, RF systems for mobile communications	http://codes.kaist.ac.kr	

KI for Robotics(KIR)

RTOS for Humanoid Robots

Name	Education	Research Interests	Website	Remark
Oh, Jun Ho (Dept. of Mechanical Engineering, Professor)	Univ. of California, Berkeley, Mechanical Engineering, Ph.D. 1985	Control System for Humanoid, Telescope Mount System, Sensor & Measurement	http://hubolab.kaist.ac.kr	Director

Mobile Intelligence for Vehicular Robots

Kim, A Young (Civil&Environmental Engineering, Assistant Professor)	Univ. of Michigan, Mechanical Engineering, Ph.D. 2012	SLAM, Navigation, Perception	http://irap.kaist.ac.kr	
Kim, Jin Whan (Dept. of Mechanical Engineering, Assistant Professor)	Stanford Univ., Aeronautics and Astronautics (with Ph.D. minor in Electrical Engineering), Ph.D. 2007	Vehicle intelligence, Vehicle dynamics and control, Marine robotics	http://morin.kaist.ac.kr	
Kim, Jun Mo (Electrical Engineering, Assistant Professor)	MIT, Electrical Engineering, Ph. D. 2005	Machine learning, Deep learning, Computer vision	http://siit.kaist.ac.kr	

Mobile Intelligence for Vehicular Robots

Jo, Sung Ho (School of Computing, Associate Professor)	Univ. of Michigan, Mechanical Engineering, Ph.D. 2012	SLAM, Navigation, Perception	http://irap.kaist.ac.kr	
Kim, Jong Hwan (Electrical Engineering, Professor)	Stanford Univ., Aeronautics and Astronautics (with Ph.D. minor in Electrical Engineering), Ph.D. 2007	Vehicle intelligence, Vehicle dynamics and control, Marine robotics	http://morin.kaist.ac.kr	
Shim, Hyun Chul (Dept. of Aerospace Engineering, Associate Professor)	MIT, Electrical Engineering, Ph. D. 2005	Machine learning, Deep learning, Computer vision	http://siit.kaist.ac.kr	

KI for the NanoCentury(KINC)

NT for Climate Change

Name	Education	Research Interests	Website	Remark
Jung, Hee Tae (Dept. of Chemical & Biomolecular Engineering, Professor)	Case Western Reserve Univ., Macromolecular Science & Engineering, Ph.D. 1998	Molecular Assembly, Soft-nanolithography, Opto-electronic Materials & Devices	http://ooem.kaist.ac.kr	Director
Ali Coskun (Graduate School of EEWS, Associate Professor)	METU, Organic Chemistry, Ph.D. 2007	Organic and Supramolecular Chemistry, Materials Science	http://alicoskun.kaist.ac.kr	
Cho, EunAe (Dept. of Materials Science and Engineering, Associate Professor)	KAIST, Materials Science and Engineering, Ph.D. 2002	Fuel Cell, Battery, Electrolysis	http://ecsm.kaist.ac.kr	
Choi, Jang Wook (Dept. of Physics, Assistant Professor)	California Institute of Technology, Chemistry & Chemical Engineering, Ph.D. 2007	Nano Energy-material, Energy Storage & Conversion	http://nest.kaist.ac.kr	
Choi, Minkee (Dept. of Chemical & Biomolecular Engineering, Associate Professor)	KAIST, Chemistry, Ph.D. 2007	Nanoporous Material Design, Energy and Environmental Catalysis, Gas Storage	http://neutron.kaist.ac.kr	
Choi, Siyoung (Dept. of Chemical & Biomolecular Engineering, Associate Professor)	UCSB, Chemical Engineering, Ph.D. 2011	Transport science (Rheology and Mass transfer), Fluids in Porous Media, Lipid Bilayers Membranes	https://mpcomplexfluids.wordpress.com/	
Chung, Sung-Yoon (Graduate School of EEWS, Associate Professor)	KAIST, Materials Science & Engineering, Ph.D. 2001	Materials Physics and Defect Chemistry for Energy Storage	http://sites.google.com/site/atomicscaledefects	
Han, Myung Joon (Dept. of Physics, Associate Professor)	Seoul Nat'l Univ., Physics, Ph.D. 2007	Condensed Matter Theory	https://sites.google.com/site/myungjoonhan	
Han, Sang Woo (Dept. of Chemistry, Professor)	Seoul Nat'l Univ., Chemistry, Ph.D. 2000	Noble Metal Nanocrystals and Their Designed Assembly	http://ntl.kaist.ac.kr	
Han, Seung Min Jane (Graduate School of EEWS, Associate Professor)	Stanford Univ., Materials Science & Engineering, Ph.D. 2006	Mechanical Properties of Nano-Structured Energy Materials	http://mpnano.kaist.ac.kr	
Hong, Soon Hyung (Dept. of Materials Science and Engineering, Professor)	Northwestern Univ., Materials Science & Engineering, Ph.D. 1984	Design, Processes & Properties of Composite Materials	http://composite.kaist.ac.kr	
Jang, Dong Chan (Dept. of Nuclear and Quantum Engineering, Assistant Professor)	Univ. of Michigan, Materials Science & Engineering, Ph.D. 2006	Nanomechanics and Radiation Materials Science	http://sth528.wix.com/nanomechalab	
Jung, WooChul (Dept. of Materials Science and Engineering, Assistant Professor)	MIT, Materials Science & Engineering, Ph.D. 2010	Solar Fuels, Fuel Cells, Electro-catalysis	http://seml.kaist.ac.kr	
Jung, Yousung (Graduate School of EEWS, Associate Professor)	UC Berkeley, Chemistry, Ph.D. 2005	Advanced Materials High-Throughput Computational Design	http://qchem.kaist.ac.kr	
Kang, Jeung Ku (Graduate School of EEWS, Professor)	Stanford Univ., Materials Science & Engineering, Ph.D. 2002	Artificial Photosynthesis for Regeneration of Sustainable Fuel from CO_2 and H_2O, Energy Storage, New multiscale Simulation Method	http://nanosf.kaist.ac.kr	
Kim, Bumjoon (Dept. of Chemical and Biomolecular Engineering, Associate Professor)	UC Santa Barbara, Chemical Engineering, Ph.D. 2006	Organic Solar Cells, Polymer/Inorganic Hybrid Materials, Polymer Nanomaterials	http://pnel.kaist.ac.kr	
Kim, Do Kyung (Dept. of Materials Science and Engineering, Professor)	KAIST, Materials Science & Engineering, Ph.D. 1987	Nano Ceramics for Energy and Structural Applications	http://mse2.kaist.ac.kr/~ncrl/	
Kim, Hee-Tak (Dept. of Chemical and Biomolecular Engineering, Associate Professor)	KAIST, Chemical Engineering, Ph.D. 1999	Fuel Cells, Lithium Batteries & Redox Flow Batteries, Nano Fabrications	http://eed.kaist.ac.kr/	
Kim, Hyungjun (Graduate School of EEWS, Associate Professor)	California Institute of Technology, Chemistry, Ph.D. 2009	Multiscale Simulation, Materials Design, Atomistic Modeling	https://sites.google.com/site/mdesign1754/	
Kim, Il-Doo (Dept. of Materials Science and Engineering, Associate Professor)	KAIST, Materials Science & Engineering, Ph.D. 2002	Inorganic Nanomaterials for Energy and Nanoelectronics	http://advnano.kaist.ac.kr	

KI for the NanoCentury(KINC)

Name	Education	Research Interests	Website	Remark
Kim, Ji Han (Dept. of Chemical & Biomolecular Engineering, Assistant Professor)	Univ. of Illiniois, Electrical and Computer Engineering, Ph.D. 2009	Carbon Capture, Methane/Hydrogen Storage, Materials Genome Project	http://molsim.kaist.ac.kr/	
Kim, Yong-Hoon (Graduate School of EEWS, Associate Professor)	Univ. of Illiniois, Physics, Ph.D. 2000	Nanostructures, Nanosurfaces, Nanointerfaces	http://nanofun.kaist.ac.kr/yhklab	
Lee, Doh Chang (Dept. of Chemical & Biomolecular Engineering, Associate Professor)	The Univ. of Texas at Austin, Chemical Engineering, Ph.D. 2007	Quantum Dots, Photocatalysis, QLED	http://dclee.kaist.ac.kr/	
Lee, Jae Woo (Dept. of Chemical & Biomolecular Engineering, Professor)	Carnegie Mellon Univ., Chemical Engineering, Ph.D. 2000	Hydrogen Storage in Chemical Hydrides, Interfacial Science for Methane Hydrate Formation/dissociation with Surface Active Agents, Gas Hydrate Inhibition for Gas/oil Flow Assurance	http://efdl.kaist.ac.kr	
Lee, Jay Hyung (Dept. of Chemical & Biomolecular Engineering, Professor)	California Institute of Technology, Chemical Engineering, Ph.D. 1991	Model Predictive Control, Approximate Dynamic Programming for Stochastic MDPs, Real-Time Optimization	http://lense.kaist.ac.kr	
Lee, Jung-Yong (Graduate School of EEWS, Associate Professor)	Stanford Univ., Electrical Engineering, Ph.D. 2009	Renewable Energy, Nanomaterials	http://adec.kaist.ac.kr	
Oh, Ji Hun (Graduate School of EEWS, Assistant Professor)	MIT, Materials Science & Engineering, Ph.D. 2010	Nanomaterials, Solar Energy Conversion	http://les.kaist.ac.kr	
Park, Inkyu (Dept. of Mechanical Engineering, Associate Professor)	California Univ., Mechanical Engineering, Ph.D. 2007	High Performance Bio/Chemical & Physical Sensors based on Functional Nanostructures, Micro/Nanomanufacturing Processes and Systems, Mechanics & Reliability of Micro/nanoscale Structures and Systems	http://mintlab1.kaist.ac.kr	
Park, Jeong Young (Graduate School of EEWS, Associate Professor)	Seoul Nat'l Univ., Physics, Ph.D. 1999	Surface Science, Nanoscience and Catalysis	http://scale.kaist.ac.kr	
Ryu, Ho Jin (Dept. of Nuclear and Quantum Engineering, Associate Professor)	KAIST, Materials Science & Engineering, Ph.D. 2000	Nuclear Fuel Development and Fuel Cycle Materials Research	https://sites.google.com/site/fuelcyclematerials	
Shin, Byungha (Dept. of Materials Science & Engineering, Assistant Professor)	Harvard Univ., Applied Physics, Ph.D. 2007	Inorganic Thin Film Solar Cells, Organic-inorganic Hybrid Photovoltaic Materials, Electronic Materials	http://energymatlab.kaist.ac.kr	
Song, Hyunjoon (Dept. of Chemistry, Professor)	KAIST, Chemistry, Ph.D. 2000	Surface Plasmon Monitoring, Photoactive Energy Catalysts, Electroactive Materials	http://small.kaist.ac.kr	
Woo, Seong Ihl (Graduate School of EEWS, Professor)	Wisconsin-Madison Univ., Checmical Engineering, Ph.D. 1983	Combinatorial Method, Fuel Cell, Solar Cell, Catalysis, Biomanss Conversion, Olefin Polymerization, Transparent Electrode, Semiconductor & Energy Materials	http://ncml.kaist.ac.kr	
Jeong, Hyung Mo (KI for the Nanocentury, Research Assistant Professor)	KAIST, Materials Science and Engineering Ph.D. 2014	Development of Energy Storage & Conversion Systems	http://nanocentury.kaist.ac.kr	

NT for Healthcare

Name	Education	Research Interests	Website	Remark
Cho, Young Ho (Dept. of Bio and Brain Engineering, Professor)	California Univ., Mechanical Engineering, Ph.D. 1990	MEMS (Micro Electro Mechanical Systems), Nanoactuators, Optical & Bio MEMS	http://mems.kaist.ac.kr	
Chung, Hyun Jung (Graduate School of Nanoscience and Technology, Assistant Professor)	KAIST, Bioengineering, Ph.D. 2010	Nanobiomedicine	https://sites.google.com/site/nanobiomedlab/	
Kim, Bongsoo (Dept. of Chemistry, Professor)	California Univ., Chemistry, Ph.D. 1990	Advanced Plasmonic Materials, Medical Nanobio Technology Employing Noble Metal Nanowire, Self-Assembled Monolayer(SAM) using 2-Dimensional Gold Nanostructure	http://nanowire.kaist.ac.kr	
Kim, Hak-Sung (Dept. of Biological Sciences, Professor)	Université de Technologie de Compiègne, Biochemical Engineering, Ph.D. 1985	Molecular Evolution, Biomolecular Recognition	http://bel.kaist.ac.kr	
Kim, Pilhan (Graduate School of Nanoscience and Technology, Assistant Professor)	Seoul Nat'l Univ., Electrical Engineering, Ph.D. 2005	Advanced In Vivo Cellular Imaging System, Systemic Cellular Visualization of Animal Model for Human Disease High-speed, Nano-scale Visualization of Organic and Inorganic Materials	http://ivmvl.kaist.ac.kr	
Kim, Pilnam (Dept. of Bio and Brain Engineering, Assistant Professor)	Seoul Nat'l Univ., Mechanical Engineering, Ph.D. 2009	Space of the Dynamics of Organism Architectures and Biological Patterns.	http://pilnam.kaist.ac.kr	
Kim, Woo Youn (Dept. of Chemistry, Associate Professor)	POSTECH, Chemistry, Ph.D. 2009	Molecular Electronics and Spintronics, Ultrafast DNA Sequencing, Electron Transfer at Solid-molecule Interfaces	http://wooyoun.kaist.ac.kr	
Kim, Yong Woon (Graduate School of Nanoscience and Technology, Assistant Professor)	POSTECH, Physics, Ph.D. 2002	Theoretical Biophysics, Soft Matter Theory, Nonequilibrium Phenomena		
Kim, Yong-Hyun (Graduate School of Nanoscience and Technology, Associate Professor)	KAIST, Physics, Ph.D. 2003	Quantum Nano-bio Materials Science/simulation, First-principles Electronic Structure and Molecular Dynamics Calculations for Nano-bio and Energy Materials	http://qnmsg.kaist.ac.kr	
Lee, Haeshin (Dept. of Chemistry, Associate Professor)	Northwestern Univ., Biomedical Engineering, Ph.D. 2008	Generalized Strategy for Functionalization of any Material Surfaces Inspired by Mussel Adhesion Adhesive Anti-bacterial, Anti-fungal Compounds Nanoparticle Synthesis Protein Therapeutics Development of Synthetic Gecko Adhesives Biointerphases	http://sticky.kaist.ac.kr	
Lee, Wonhee (Graduate School of Nanoscience and Technology, Assistant Professor)	California Institute of Technology, Applied Physics, Ph.D. 2008	Development of Microfluidic Calorimeters and Applications for Cell Biology High-throughput Self-assembly of Nano-, Microparticles using Inertial Microfluidics	http://mfbsl.kaist.ac.kr/	
Nam, Yoon Sung (Dept. of Materials Science & Engineering, Associate Professor)	MIT, Biological Engineering, Ph.D. 2010	Peptide-based Nanomaterials, Nucleic acid-based Nanomaterials, Solar Fuel Cells	http://nabi.kaist.ac.kr/	
Nam, Yoonkey (Dept. of Bio and Brain Engineering, Associate Professor)	Univ. of Illiniois, Electrical Engineering, Ph.D. 2005	Neural Microsystems and Instrumentation, Neural Interfacing, Neuron-on-a-chip	http://neuros.kaist.ac.kr	
Park, Chan Beum (Dept. of Materials Science & Engineering, Professor)	POSTECH, Biochemical Engineering, Ph.D. 1999	Biomaterials for Energy and Medicine	http://biomaterials.kaist.ac.kr	
Park, Je-Kyun (Dept. of Bio and Brain Engineering, Professor)	KAIST, Biotechnology, Ph.D. 1992	Nanobiotechnology, Integrative Bioengineering, Microfluidics, Lab-on-a-chip	http://nanobio.kaist.ac.kr	
Park, Ji Ho (Dept. of Bio and Brain Engineering, Associate Professor)	California Univ., Materials Science, Ph.D. 2009	Biomaterials, Cancer Nanotechnology	http://openwetware.org/wiki/Park_Lab	
Park, Su-Hyung (Graduate School of Medical Science and Engineering, Assistant Professor)	POSTECH, Biological Sciences Ph.D. 2008	Infectious Disease, Viral Immunology, Vaccine		
Shin, Jennifer H. (Dept. of Mechanical Engineering, Associate Professor)	MIT Mechanical Engineering, Ph.D. 2004	Cell Mechanics, Cellular Mechanobiology, Microfluidics, Biological Locomotio	http://softbm.kaist.ac.kr	
Sohn, Jong-Woo (Dept. of Biological Sciences, Assistant Professor)	Seoul Nat'l University, College of Medicine, Physiology, Ph.D. 2008	Central Serotonin System, Autonomic Neuroscience	https://sites.google.com/site/sohnlab2014/	

KI for the NanoCentury(KINC)

NT for Advanced Opto-Electronics

Name	Education	Research Interests	Website	Remark
Bae, Byeong-Soo (Dept. of Materials Science and Engineering, Professor)	Univ. of Arizona, Materials Sci. & Engineering, Ph.D. 1993	Optical and Display Materials, Sol-Gel Technology	http://www.sol-gel.net/	
Cho, Byung Jin (Dept. of Electrical Engineering, Professor)	KAIST, Electrical Engineering, Ph.D. 1991	Nano IC Technology	http://nit.kaist.ac.kr	
Cho, Sungjae (Dept. of Physics, Assistant Professor)	Univ. of Maryland at College Park, Physics, Ph.D. 2011	Quantum Transport in Topological Materials, Quantum Phase Transitions in Thin Films, Spin Transport	http://qtak.kaist.ac.kr	
Cho, Yong-Hoon (Dept. of Physics, Professor)	Seoul Nat'l Univ., Physics, Ph.D. 1997	Semiconductor Physics	http://qnp.kaist.ac.kr	
Choi, Hyoung soon (Dept. of Physics, Associate Professor)	Northwestern Univ., Physics, Ph.D. 2007	Experimental Condensed Matter Physics at Low Temperatures	http://ult.kaist.ac.kr	
Choi, Sung-Min (Dept. of Nuclear and Quantum Engineering, Professor)	MIT, Nuclear Engineering, Ph.D. 1998	Neutron Scattering Studies of Nano-Materials and Superconductivity Nuclear Magnetic Resonance Imaging and Spectroscopy	http://egcl.kaist.ac.kr	
Choi, Sung-Yool (Dept. of Electrical Engineering, Associate Professor)	KAIST, Chemistry, Ph.D. 1998	Graphene & 2D Materials and Applications, Soft Electronics	http://mndl.kaist.ac.kr	
Im, Sung Gap (Dept. of Chemical & Biomolecular Engineering, Associate Professor)	MIT, Chemical Engineering, Ph.D. 2009	Biomaterials, Surface-Cell Interaction, Chemical Vapor Deposition of Functional polymers, Surface Function-alization, Conducting Polymers	http://ftfl.kaist.ac.kr	
Jeon, Duk Young (Dept. of Materials Science and Engineering, Professor)	Lehigh Univ., Physics, Ph.D. 1988	Semiconductor Physics, Display Materials	http://display.kaist.ac.kr	
Jeon, Seokwoo (Dept. of Materials Science and Engineering, Associate Professor)	Univ. of Illinois, Urbana-Champaign, Materials Science & Engineering, Ph.D. 2006	Flexible Nanoelectronics, Advanced Photonic Materials	http://fdml.kaist.ac.kr	
Jung, Yeon Sik (Dept. of Materials Science and Engineering, Associate Professor)	MIT, Materials Science & Engineering, Ph.D. 2009	Self-assembly, Nanofabrication, Memory Devices, Energy Capture and Storage Materials	http://funnano.kaist.ac.kr	
Kim, Chun-Gon (Dept. of Aerospace Engineering, Professor)	KAIST, Aeronautical Engineering, Ph.D. 1987	Smart Composites, Stealth Structures	http://smartech.kaist.ac.kr	
Kim, Eun Seong (Dept. of Physics, Associate Professor)	Pennsylvania State Univ., Physics, Ph.D. 2004	Low Temperature Physics	http://supersolid.kaist.ac.kr	
Kim, Sang Ouk (Dept. of Materials Science & Engineering, Professor)	KAIST, Chemical Engineering, Ph.D. 2000	Soft Nanomaterials, Carbon Nanotubes & Graphene, Energy & Catalysis	http://snml.kaist.ac.kr	
Kim, Sang Youl (Dept. of Chemistry, Professor)	Rensselaer Polytechnic Institute, Chemistry, Ph.D. 1989	New Polymerization Reactions and Methods, Polymeric Materials with controlled Architecture, Design & Synthesis of Functional Macromolecules	http://macro.kaist.ac.kr	
Kim, Shin-Hyun (Dept. of Chemical & Biomolecular Engineering, Associate Professor)	KAIST, Chemical & Biomolecular Engineering, Ph.D. 2009	Functional Microparticles, Soft Microcapsules, Soft Photonic Materials	http://isml.kaist.ac.kr	
Kim, Taek-Soo (Dept. of Mechanical Engineering, Associate Professor)	Stanford Univ., Mechanical Engineering, Ph.D. 2010	Micro-Nano System	http://aptf.kaist.ac.kr	
Lee, Hansuek (Graduate School of Nanoscience and Technology, Assistant Professor)	Seoul Nat'l Univ., Electrical Engineering, Ph.D. 2008	Light Matter Interactions and Opto-mechanics in Nano-Structures and their Applications	https://sites.google.com/site/hleelab/	
Lee, Hee Chul (Dept. of Electrical Engineering, Professor)	Tokyo Institute of Technology, Electronic Engineering, Ph.D. 1989	Semiconductors, Infrared Detectors, Ferroelectric RAM, High Dielectric Thin Film	http://irislab.kaist.ac.kr	
Lee, Hyuck Mo (Dept. of Materials Science and Engineering, Professor)	MIT, Metallurgy, Ph.D. 1989	Thermodynamic Calculation for Pb-free Solder, Synthesis of Metal Nano Materials for Printed Electronics and its Applications, Structural Stability and Catalytic Property of Nano Materials	http://triangle.kaist.ac.kr	
Lee, Jeong Yong (Dept. of Materials Science and Engineering, Professor)	Univ. of California, Materials Science & Engineering, Ph.D. 1986	Electron Microscopy	http://hrtem.kaist.ac.kr	
Lee, Jhinhwan (Dept. of Physics, Assistant Professor)	Seoul Nat'l Univ., Physics, Ph.D. 2002	Scanning Probe Microscopies Strongly Correlated Electron Systems Nanoscale and Low Dimensional Electron Systems	http://ltspm.kaist.ac.kr	
Lee, Keon Jae (Dept. of Materials Science & Engineering, Associate Professor)	Illinois Univ., Materials Science & Engineering, Ph.D. 2006	Flexible Nano-materials and Electronic Systems (Flexible & Implantable Bioelectronics, LED, Energy Harvesting & Battery, Memory)	http://fand.kaist.ac.kr	
Oh, IlKwon (Dept. of Mechanical Engineering, Professor)	KAIST, Mechanical Engineering, Ph.D. 2001	Underwater Actuators (Artificial Muscles & Electro-Active Polymers), Acoustic Metamaterials for Sonar Applications, Vibration and Noise Control, Graphene Nano-Materials	http://sdss.kaist.ac.kr	
Park, Byong Guk (Dept. of Materials Science & Engineering, Associate Professor)	KAIST, Materials Science & Engineering, Ph.D. 2003	Magnetic Materials and Devices	http://nanospin.kaist.ac.kr	
Park, O Ok (Dept. of Chemical & Biomolecular Engineering, Professor)	Stanford Univ., Chemical Engineering, Ph.D. 1985	Optoelectronic Devices, Colloidal Crystals & Soft Lithography, Metal Nanocrystals	http://stereo.kaist.ac.kr	
Ryu, Seunghwa (Dept. of Mechanical Engineering, Assistant Professor)	Stanford Univ., Physics, Ph.D. 2011	Mechanics and Materials Science at Nanoscale, Development of Multiscale Simulation Methods, Interaction of Chemistry and Mechanics	https://sites.google.com/site/seunghwalab	
Seo, Min-Kyo (Dept. of Physics, Associate Professor)	KAIST, Physics, Ph.D. 2009	Surface Plasmon based Sub-wavelength Optics, Electrically Activated Surface Plasmonic Devices, Optical Antennas for Near-field Optics	http://swol.kaist.ac.kr	
Seo, Myungeun (Graduate School of Nanoscience and Technology, Assistant Professor)	KAIST, Chemistry, Ph.D. 2008	Polymer Synthesis	http://nanopsg.kaist.ac.kr	
Shin, Jonghwa (Dept. of Materials Science & Engineering, Assistant Professor)	Stanford Univ., Electrical Engineering, Ph.D. 2008	Nanophotonics, Metamaterials, Energy and Information Devices	http://apmd.kaist.ac.kr	
Shin, Jung Hoon (Graduate School of Nanoscience and Technology, Professor)	California Institute of Technology, Applied Physics, Ph.D. 1993	Semicondurtor Physics	http://spl.kaist.ac.kr	
Yang, Chan-Ho (Dept. of Physics, Associate Professor)	POSTECH, Physics, Ph.D. 2005	Complex Oxide Heterostructures and Multiferroics	http://oxide.kaist.ac.kr	
Yoo, Seunghyup (Dept. of Electrical Engineering, Professor)	Univ. of Arizona, Optical Sciences, Ph.D. 2005	Development of a Novel Device Architecture and Process for Organic/ Printed Electronics in the Areas of Display/lighting, Energy, Low-cost Electronics.	http://ioel.kaist.ac.kr	
YOON, DONG KI (Graduate School of Nanoscience and Technology, Associate Professor)	KAIST, Chemical & Biomolecular Engineering, Ph.D. 2007	Novel Bio-vehicles and Organic Nanodevices including Photovoltaics, OLED, etc. Soft Nanomaterials; Liquid Crystals, Supramolecules, Polymers, Particles, etc.	http://yoon.kaist.ac.kr	
Yu, Kyoungsik (Dept. of Electrical Engineering, Associate Professor)	Stanford Univ., Electrical Engineering, Ph.D. 2004	Nanophotonics, Optoelelctronics, MEMS	http://yu.kaist.ac.kr	
Kim, Yong Joo (KI for the Nanocentury, KI Fellow)	MIT, Materials Scienceand Engineering, Ph.D. 2013	Macromolecule theory, Self-assembly	http://nanocentury.kaist.ac.kr	

KI for Health Science and Technology(KIHST)

Neuroimaging and Neuromodulation

Name	Education	Research Interests	Website	Remark
Jeong, Yong (Dept. of Bio and Brain Engineering, Associate Professor)	Yonsei Univ., Neurophysiolog Ph.D. 1997	Brain Science, Clinical Neuroscience, Neuroimaging	http://ibrain.kaist.ac.kr/	Director
Bae, Hyeon-Min (School of Electrical Engineering, Associate Professor)	Univ. of Ilinois, Electrical Engineering, Ph.D. 2004	Near infrared spectroscopy, Ultrasound, renal denervation	http://nais.kaist.ac.kr	
Cho, Seungryong (Dept. of Nuclear and Quantum Engineering, Associate Professor)	Univ. of Chicago, Medical Physics, Ph.D. 2009	Medical imaging, Image-guided therapy, Tomographic image reconstruction	http://mirlab.kaist.ac.kr/	
Jeong, BumSeok (Graduate School of Medical Science and Engineering , Associate Professor)	Ulsan Univ., Psychiatry, Ph.D. 2002	Clinical Neuroscience, Neuroimaging, Neuromodulation	https://sites.google.com/site/kaistclinicalneurosciencelab/	
Jo, Sungho (School of Computing, Associate Professor)	MIT, Electrical Engineering & Computer Science, Ph.D. 2006	Brain-Computer Interface, Neuromorphic Computing, Neurobotics	http://isnl.kaist.ac.kr/	
Kim, Daesoo (Dept. of Biological Sciences, Associate Professor)	POSTECH, Life Science, Ph.D. 1998	Behavior, Neurological disorders, optogenetics	https://bs.kaist.ac.kr/~brain	
Kim, Junmo (School of Electrical Engineering, Assistant Professor)	MIT, Electrical Engineering & Computer Science, Ph.D. 2005	Medical Image Analysis, Deep Learning, Computer Vision	http://siit.kaist.ac.kr	
Lee, Hyunjoo Jenny (School of Electrical Engineering, Assistant Professor)	Stanford Univ., Electrical Engineering, Ph.D. 2012	brain ultrasound modulation, neural probe, biosensors	https://sites.google.com/site/kaistbmm/	
Lee, Jeong-Ho (Graduate School of Medical Science and Engineering, Assistant Professor)	Yonsei Univ., Pharmacology Ph.D. 2009	Neuroscience, Human Genetics, Brain connectivity	https://sites.google.com/site/jeongholeelab/	
Lee, Sang Wan (Dept. of Bio and Brain Engineering, Assistant Professor)	KAIST, Electrical Engineering, Ph.D. 2009	neuroimaging, computational neuroscience, brain-inspire AI	http://aibrain.kaist.ac.kr	
Lee, Sue Hyun (Dept. of Bio and Brain Engineering, Assistant Professor)	Seoul Nat'l Univ., Biological Sciences, Ph.D. 2008	Cognitive neuroscience, Neuroimaging, Brain stimulation	http://memory.kaist.ac.kr/	
Paik, Se-Bum Dept. of Bio and Brain Engineering, Assistant Professor)	Univ. of California at Berkeley, Physics, Ph.D. 2009	Computational Neuroscience, Neural Network Simulation, Visual Perception	http://vs.kaist.ac.kr/	
Park, ChulSoon (School of Electrical Engineering, Professor)	KAIST, Materials Science and Engineering, Ph.D. 1985	Neuromodulation, Blood Glucose Sensing	http://microlab.kaist.ac.kr	
Park, Jinah (School of Computing, Associate Professor)	Univ. of Pennsylvania, Computer and Information Science, Ph.D. 1996	Medical Image Data Analysis and Visualization, Virtual Reality and Interaction	http://cgv.kaist.ac.kr/	
Park, Sung-Hong (Dept. of Bio and Brain Engineering, Assistant Professor)	Univ. of Pittsburgh, Bioengineering, Ph.D. 2009	magnetic resonance imaging, neuroimaging, medical imaging	http://mri.kaist.ac.kr/	
Ye, JongChul (Dept. of Bio and Brain Engineering, Professor)	Purdue Univ., Electrical Engineering, Ph.D. 1999	biomedical imaging, biomedical signal processing, biophotonics	http://bispl.weebly.com/	

Biophotonics

Name	Education	Research Interests	Website	Remark
Choi, Chulhee (Dept. of Bio and Brain Engineering, Professor)	Yonsei Univ., Microbiology, Ph.D. 1999	Cell Biology, Biomedical Imaging, Drug Delivery	http://ccbio.kaist.ac.kr/	Director
JEONG, KI-HUN (Dept. of Bio and Brain Engineering, Associate Professor)	Univ. of California, Bioengineering Ph.D. 2005	Nanobiophotonics, biophotonic sensing/imaging/manipulation, nano/microscale biomimetics	http://biophotonics.kaist.ac.kr/	
Kim, Pilhan (Graduate school of Nanoscience & Technology, Assistant Professor)	Seoul Nat'l Univ., Electrical Engineering, Ph.D. 2005	Bio-imaging, Intravital microscopy, Cellular-level flurescence imaging	http://ivmvl.kaist.ac.kr	
Oh, Wangyuhl (Dept. of Mechanical Engineering, Associate Professor)	KAIST, Physics, Ph.D. 1997	Cardiovascular Imaging, Multi-functional Microscopy, Cellular/Molecular Imaging	http://bpil.kaist.ac.kr/	
Park, YongKeun (Dept. of Physics, Associate Professor)	Harvard-MIT Health Science and Technology, Medical Physics and Medical Engineering, Ph.D. 2010	bioimaging, holography, cellular imaging	https://bmol.kaist.ac.kr	

Therapeutic Bioengineering

Chung, HyunJung (Graduate school of Nanoscience & Technology, Assistant Professor)	KAIST, Biological Sciences, Ph.D. 2010	nanomedicine, molecular diagnostics, drug delivery	http://nanomedicine.kaist.ac.kr	
Kim, Pilnam (Dept. of Bio and Brain Engineering, Assistant Professor)	Seoul Nat'l Univ., Mechanical Engineering, Ph.D. 2009	Organ-on-a-chip, in vitro disease model, Implantable/Injectable scaffold	http://www.pilnam.kaist.ac.kr/	
Lee, Wonhee (Graduate school of Nanoscience & Technology, Assistant Professor)	California Institute of Technology, Applied Physics, Ph.D. 2008	Tissue engineering, Biosensor, Microfluidic cell manipulation	http://mfbsl.kaist.ac.kr/	
NAM, YOONKEY (Dept. of Bio and Brain Engineering, Associate Professor)	Univ. of Illinois, Electrical Engineering, Ph.D. 2005	Neural Microsystems and instrumentation, Neuron-on-a-chip, Neural cell patterning	http://neuros.kaist.ac.kr/	
Nam, YoonSung Dept. of Materials Science & Engineering, Associate Professor)	MIT, Biological Engineering, Ph.D. 2010	Phage display, Nanobiosensors, Cell-based biosensor	http://nabi.kaist.ac.kr/	
Park, Je-Kyun (Dept. of Bio and Brain Engineering, Professor)	KAIST, Biotechnology, Ph.D. 1992	Healthcare Devices, Organ function-on-a-chip, 3D cell culture and Assays	http://nanobio.kaist.ac.kr/	
Park, Ji Ho (Dept. of Bio and Brain Engineering, Associate Professor)	Univ. of California, San Diego Materials Science, Ph.D. 2009	Biomaterials, Drug Delivery, Nanomedicine	http://openwetware.org/wiki/Park_Lab	

Saudi Aramco-KAIST CO_2 Management Center

Development of CO_2 Capture and Conversion Process

Name	Education	Research Interests	Website	Remark
Lee, Jay-Hyung (Dept. of Chemical engineering, Professor)	California Institute of Technology, Chemical Engineering, Ph.D. 1991	Model Predictive Control, Approximate Dynamic Programming, Production Scheduling	http://lense.kaist.ac.kr	Director
Choi, Jang Wook (Graduate School of EEWS, Associate Professor)	California Institute of Technology, Chemical Engineering, Ph.D. 2007	Energy Storage, Rechargeable Battery, CO_2 capture	http://nest.kaist.ac.kr	
Han, Jong-In (Dept. of Civil and Environmental engineering, Associate Professor)	Univ. of Michigan, Environmental engineering, Ph.D. 2002	Algae-based biodiesel Pretreatmenf of cellulosic biomass, Electrical conversion of exhaust,	http://ebtel.kaist.ac.kr	
Im, Sung Gap (Dept. of Chemical and Biomolecular Engineering, Associate Professor)	MIT, Chemical engineering, Ph.D. 2009	membranes, surface treatment, insulating layer	http://ftfl.kaist.ac.kr	
Kim, Jihan Kim (Dept. of Chemical and Biomolecular Engineering, Assistant Professor)	Univ. of Illinois at Urbana-Champaign, Electrical Engineering, Ph.D. 2009	Molecular Simulations, Multi-scale Modeling, Materials Design	http://molsim.kaist.ac.kr	

CO_2 Reduction by Enhancing Energy Efficiency

Bae, Choong Sik (Dept. of Mechanical Engineering, Professor)	Imperial College, Mechanical Engineering, Thermofluids, Ph.D. 1994	Internal Combustion Engine Combustion, Thermofluids Experiments, Laser diagnostics and instrumentation	http://engine.kaist.ac.kr	
Jang, Kitae (Cho Chun Shik Graduate School for Green Transportation, Assistant Professor)	Univ. of California, Berkeley, Civil and Environmental Engineering, Ph.D. 2011	Traffic Operation and Control, Sustainable Transportation, Traffic Safety	http://tops.kaist.ac.kr	
Lee, Jeong Ik (Dept. of Nuclear and Quantum Engineering, Associate Professor)	MIT, Nuclear Science and Engineering, Ph.D. 2007	Nuclear enegy and system engineering, Power conversion and propulsion, Supercritical CO_2 power cycle	http://npnp.kaist.ac.kr	

Solar Energy-based CO_2 Conversion

Lee, Doh Chang (Dept. of Chemical and Biomolecular Engineering, Associate Professor)	Univ. of Texas at Austin, Chemical Engineering, Ph.D. 2007	Photocatalysis, Quantum dot display, Self-assembly	http://dclee.kaist.ac.kr	
Song, Hyunjoon (Dept. of Chemistry, Professor)	KAIST, Inorganic and Organometallic Chemistry, Ph.D. 2000	Plasmon Nanocrystals, Photochemical Catalysts, Electroactive Materials	http://small.kaist.ac.kr	

CO_2 Conversion Technology

Han, Sang Woo (Dept. of Chemistry, Professor)	Seoul Nat'l Univ., Physcial Chemistry, Ph.D. 2000	Nnaocatalysts, Solar energy conversion, Plasmonics	http://ntl.kaist.ac.kr	
Jung, Yousung (Graduate School of EEWS, Associate Professor)	UC Berkeley, Chemistry, Ph.D. 2005	Atomistic materials design for CO_2 capture and conversion, Energy storage materials, Computational methods developments	http://qchem.kaist.ac.kr	
Lee, H.K. (Dept. of Civil and Environmental Eng., Professor)	Univ. of California, Los Angeles, Ph.D. 1998	Construction Materials, Structural Analysis	http://samlab.kaist.ac.kr	
Lee, Jae Woo (Dept. of Chemical & Biomolecular Engineering, Professor)	Carnegie Mellon Univ., Chemical Eng. Ph.D. 2000	CO_2 Conversion, H2 Storage, Biomass Conversion	http://efdl.kaist.ac.kr	

KAIST INSTITUTE

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