YONSEI RESEARCH

YONSEI UNIVERSITY
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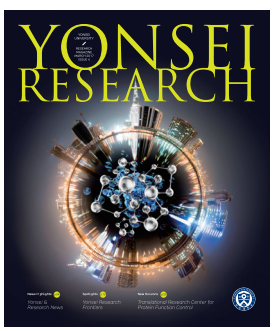
Contents



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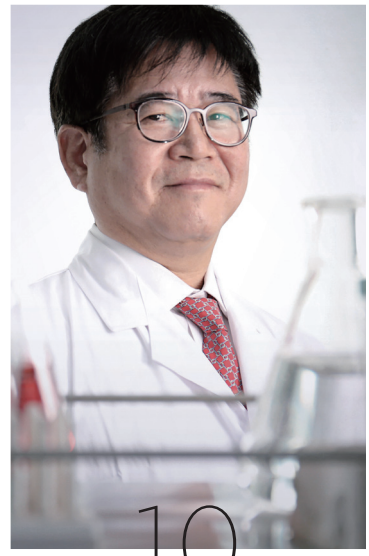
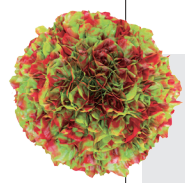
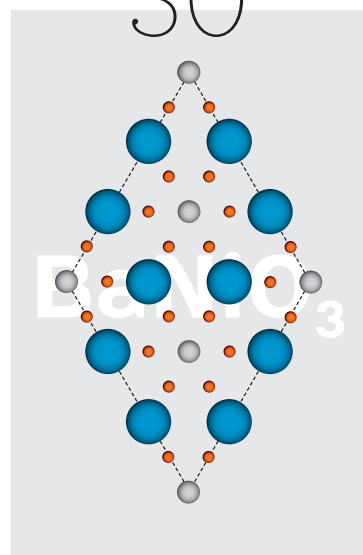
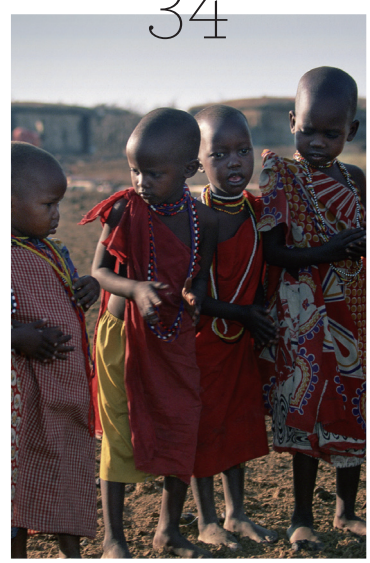








Welcome to Yonsei, Where Truth and Freedom Abound

I am very pleased to invite you to explore the innovative and inspiring discoveries of our academic researchers at Yonsei.

Yonsei University opened the door to modern higher education over one century ago. It has since then emerged as the nation's top private university and ranks among the world's most prestigious universities. It is a place where scholars ask and answer profound questions for a new future. The scope of research at Yonsei University is broad and diverse, including the fields of medicine, biochemistry, human health, engineering, materials science, chemistry and neuroscience, not to mention the areas of the humanities and social sciences.

Moreover, Yonsei is a place where high-quality research across all academic areas goes on actively and trains the new generation-researchers. Since the strength of a university's research will depend on how different areas of knowledge are brought together, Yonsei pursues a variety of initiatives to energize networks between fields and across campuses. And we thrive in a new research environment that increasingly transcends disciplinary boundaries through various policies to support research network at Yonsei.

Based on these efforts, Yonsei is making outstanding research accomplishments. Yonsei's research funds amount to $ 260 million, and achieves roughly 4,800 publications in renowned international academic journals.

As President, I will facilitate opportunities for communication in order to create a university where there is fluid movement across different disciplines and fields of study as well as across campuses, and effective cooperation between different administrative units.

By moving forward, Yonsei University will strive to create world-renowned research accomplishments to contribute to the history and future of humanity.

Throughout *Yonsei Research Magazine* you will find interesting stories about researchers of Yonsei, who are dedicated to advancing knowledge and making changes in the world. I hope you enjoy the issue 4 of *Yonsei Research Magazine*.

Yong-Hak Kim
President of
Yonsei University

MORE
www.yonsei.ac.kr/eng

Professor Yong-Hak Kim Elected 18th President of Yonsei

Four-Year Term Begins February 1, 2016

Sociology Professor Yong-Hak Kim has been elected Yonsei's eighteenth president. President Kim spoke "I have many thoughts on the role that Yonsei University should play in today's society and what society demands from the university, especially as Yonsei has been at the forefront of modernization in Korea since its establishment." He said "I hope that Yonsei University becomes a university that people respect, a university that is respected, by demonstrating unity through mutual respect and sharing the spirit of our founders." His main goal is to have "Yonsei University provide a strong philosophy and firm foundation for today's centerless society." To achieve the goal Kim has revealed three central issues: a dramatic change in education system in preparation for the age of 100, a response to the network society, and a preparation for the emergence of empathy civilization. In addition, he announced the sharing of common values rooted in the founding spirit of Yonsei, various institutional reforms, and the reorganization of university governance in a middle up-down manner through decentralization.

Celebrating Yonsei's 131st Anniversary

Vision for the Next Century

Yonsei recently celebrated the 131st anniversary of its founding, while laying out its vision for the next 100 years. On May 14, a commemoration ceremony was held in Centennial Hall, which was attended by students, faculty, and alumni members. During his speech at the ceremony, Yonsei President Yong-Hak Kim revealed plans to change the direction of education, research, and community engagement at Yonsei. All of these changes aim to foster global leaders for the coming century. Central to President Kim's vision are the "3Cs": Christianity, Creativity, and Connectivity.

Commemorating 100th Anniversary of Horace G. Underwood's Death

On October 12, Yonsei University commemorated the 100th anniversary of Horace G. Underwood's death with a ceremony in Centennial Hall on the Sinchon Campus. Approximately 800 guests were in attendance, including members of the Underwood family, previous winners of the Underwood Missionary Award, representatives of Saemoonan Presbyterian Church, which was founded by Horace Underwood, and officials from the National Council of YMCAs of Korea and the Christian Literature Society of Korea.

60th Anniversary of Yonhi and Severance Merger

Pioneering Integrated Research in Biomedicine

January 5 marked the sixtieth anniversary of the merging of Yonhi College and Severance Medical College in 1957, which created today's Yonsei University. Yonsei is a national leader in the development of new drugs and medical technology, clinical and health research, and biological interdisciplinary studies thanks to the integrated research network that links Severance Medical School with the College of Life Science and Biotechnology, College of Engineering, College of Science, and a number of innovative research centers.

Discussing the Future of University Education

Future Education Society Forum

On July 25, Yonsei President Yong-Hak Kim attended the Future Education Society Forum, which was held in the Yonsei-Samsung Library. At the forum, he discussed the role of universities in nurturing talent with World Bank Group President Jim Yong Kim. Other distinguished participants included U.S. Ambassador to Korea Mark Lippert, Elsevier Chairman Young-suk Chi, and Sungkyunkwan University President Kyu Sang Chung. In his speech for the forum, President Yong-Hak Kim emphasized the need for "universities to spearhead future education by understanding that providing knowledge alone in a fast-changing society is no longer useful." He also highlighted the importance of "divergent thinking" in education to enable individuals to make new creations by applying existing knowledge.

World Class Universities Share Educational Innovations

3rd OSE Center Seminar

On September 22, the Open Smart Education (OSE) Center hosted a seminar in cooperation with the University of Hong Kong and Kyoto University. The theme was "Educational Innovations," and the seminar's goal was to help develop a new educational vision for Yonsei, specifically by implementing an on/off-line integral information platform and conceiving futureoriented policies. Hong Kong has agreements with two of the world's largest Massive Open Online Course (MOOC) platforms, edX and Coursera. The university offers a number of MOOCs and flipped classrooms through its newly-established Technology-Enriched Learning Initiative (TELI) Center. Kyoto also has an agreement with edX, and it offers several MOOCs in life science and biology.

Danish Prime Minister Receives Honorary Degree

Prime Minister of Denmark Lars Løkke Rasmussen was awarded an honorary doctorate degree in political science from Yonsei. He received the honor due to his commitment to economic and political development in Denmark, as well as his advocacy for expanding cooperation between Yonsei and Europe. Having a law degree from the University of Copenhagen, Prime Minister Rasmussen was deeply involved with a number of political, economic, and social issues while working in the Ministry of Interior and Health and, later, as the Minister of Finance. Alongside his political career, he served as council chairman of the Global Green Growth Institute (GGGI).

Yonsei MOOCs Introduce Korean Language to the World

Online Courses Attract Students from around the World

Yonsei has begun offering online Korean language courses through Coursera, the world's largest Massive Open Online Course (MOOC) platform. The courses have already attracted students from around the world. Yonsei is a leader in Korean-language education and Korean Studies. Through the online courses, students have access to fun and informative lessons as well as innovative online content; one of the MOOC's unique contents is the Consonant and Vowel Combination Program, which aid students in improving pronunciation. Overall, these MOOCs are part of Yonsei's ongoing commitment to sharing Korean language and culture with the world. Professor Kang Seung-hye's 'First Step Korean' was opened on February 5. Each week, between 1,200 and 1,500 new students register; thus far, more than 20,000 have enrolled in the course. Student evaluations have been overwhelmingly positive.

Yonsei Launches Next Generation Giga Wi-Fi

With the installation of a new, state- of-the-art wireless network nearing completion, the members of Yonsei University will soon be able to enjoy uninterrupted internet access from anywhere on the Yonsei campus. This next generation wireless network will make Yonsei the most advanced "smart" campus in the nation. The new network includes more than 2,500 wireless access points spread throughout the campus. The extensive coverage provided by the network will create a more conducive environment for mobile-based learning, as wireless access is now available in all lecture rooms.

Yonsei, First Korean University to Offer Brain Coaching to Boost Start-Up Success

Brain Coaching: Brains Hardwired for Particular Career Paths

Yonsei University is set to be the first Korean university to provide 'Brain Coaching' in order to assist students in finding jobs and boost start-up success. Brain Coaching entails a customized, one-on-one program to help students identify a suitable business career-path based on the hardwiring of her or his brain. For underclassmen, Brain Coaching assists them in devising blueprints for a career related to their major, while upperclassmen receive help with successful job-finding strategies based on their brain information data. Ideally, the university believes, Brain Coaching will help to maximize start-up success rates by indicating how students can most effectively work in teams and which organizational roles would best suit them.

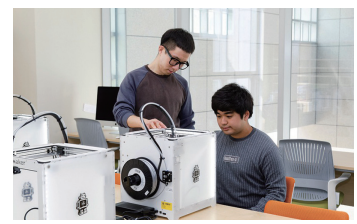
Yonsei Main Gate Underpass Reborn as Student Venture Space

Opening of 'Seoul Start-Up Café', Space for Start-Up Project Planning

Yonsei University and the Seoul Metropolitan Government (SMG) have jointly launched the 'Seoul Start-Up Café'—Sinchon Branch by renovating the underpass connecting the main gate and Sinchon. The Start-Up Café is designed to promote youth start-up ventures, offering a space for networking and the sharing of ideas among university students and members of the general public. It also provides consultations and training programs for aspiring entrepreneurs. The project to reshape the largely disused underpass was the result of cooperation between the university, SMG, and the Seodaemun-gu Office. Yonsei is providing the administrative staff for the Start-Up Café, and their role is to assist in organizing start-up related training activities, such as mentoring by specialists and model presentations for investors.

New Design Garage will Foster Start-Ups

Space to be Used for Training and Developing Start-Up Ideas



Yonsei recently opened the "Design Garage" in the newly-finished College of Business Administration Building. The space is dedicated to promoting new start-ups. The Design Garage is equipped with four three-dimensional printers and seven computers, including the iMac. The space will be open to start-up student clubs, giving students the opportunity to learn by trial manufacturing new products. At the same time, College of Business Administration courses related to start-ups will be taught there, including "New Product Marketing."

International Campus to become Research Hub for Materials

Joint Research Lab with Germany's Fraunhofer, Future Development of Ceramic Materials Integration Technology

A new joint research laboratory in the field of materials has opened on the International Campus in Songdo. Global Research Lab for Fraunhofer IKTS, YICT, and KIMS (GRL-FYK) is part of the Ministry of Science, ICT and Future Planning (MSIP)'s Premium Talent Development Project, and it represents a partnership between Yonsei Institute of Convergence Technology (YICT), Germany's Fraunhofer Ceramic Technologies and Systems (IKTS), and the Korea Institute of Materials Science (KIMS). GRL-FYK is designed to facilitate the global sharing of research results and the transfer of technologies.

Lymphoma Radiation Oncology Symposium

Joint Symposium with International Lymphoma Radiation Oncology Group

On April 2, the Yonsei Cancer Center's Department of Radiation Oncology and the International Lymphoma Radiation Oncology Group (ILROG) jointly hosted the Malignant Lymphoma Modern Radiation Treatment Academic Symposium. Participating in the symposium were ILROG Chairman Dr. Joachim Yahalom (Memorial Sloan Kettering Cancer Center), ILROG Vice Chairwoman Dr. Lena Specht (Copenhagen University), Professor Seo Chang-ok (Yonsei College of Medicine), and a number of other noted specialists and doctors.

6th International Scholars' Day

On June 14, the Office of International Affairs (OIA) hosted the 6th International Scholars' Day dinner, which honors Yonsei's Sinchon, Wonju, and Yonsei University Health System (YUHS) faculty from abroad with a banquet at the Presidential Reception Hall. Altogether, the event hosted over 100 guests, including President Yong-Hak Kim, senior staff and the evening's guests of honor, Yonsei's international faculty. The evening's program was presided over by Associate Dean for International Affairs, Prof. John Frankl and was accentuated by welcoming remarks and warm encouragement from President Yong-Hak Kim and an eloquent salutation by Prof. Anthony Adler of UIC, followed by a serenade by a men's quartet from the College of Music and a raffle drawing. Yonsei University currently hosts nearly 360 international faculty (including professors and research fellows). The OIA hosts International Scholars' Day every year to foster an inclusive environment for international faculty and cultivate a sense of Yonsei pride while encouraging internationalization through educational exchange between faculty members.

Groundbreaking Ceremony for Y-IBS Hall

will be Hub of Nanomedicine and Interdisciplinary Research

On September 9, the groundbreaking ceremony for the Yonsei-IBS Institute (Y-IBS) took place on the Sinchon Campus. Once completed, Y-IBS Hall will embody a "Center without Barriers," housing the Center for Nanomedicine and serving as a hub for creative and collaborative interdisciplinary research. The building will be situated between the Science Research Center and the Advanced Science and Technology Center. It will be four stories tall and have one underground level, with a total area of around 4,300m^2. Y-IBS Hall is scheduled for completion in 2017. At the groundbreaking ceremony, Yonsei President Yong-Hak Kim said: "Y-IBS Hall will be the optimal hub for IBS and interdisciplinary research in the fields of nanoscience and biomedical science. It will serve as an exemplary example of providing a liberal research environment that encourages a creative research culture."

Nobel Laureate Randy Schekman Appointed Yonsei Distinguished Professor

will also Serve as a Member of Y-IBS Advisory Board

Prof. Randy Schekman, winner of the 2013 Nobel Prize for Physiology or Medicine, has been named a distinguished professor in the College of Life Science and Biotechnology at Yonsei University as well as a member of Yonsei-IBS Advisory Board. He will serve in these capacities for the next three years, while also delivering several special lectures at the university.

Brian Kobilka, Recipient of 2012 Nobel Prize in Chemistry, Delivered Special Lecture

On August 31, Dr. Brian Kobilka, the 2012 Nobel Prize winner for chemistry, delivered a special lecture at Severance Hospital entitled "Developing New and Better Drugs—Structures of GPCRs (G protein-coupled receptors)." Dr. Kobilka, who also serves as a professor in the Stanford University School of Medicine, was awarded the Nobel Prize for his pioneering work on the structure of GPCRs. GPCRs are essential for communication between cells located in different parts of the body. The lecture provided an opportunity for students, faculty, and researchers to meet the Nobel laureate in person and gain motivation for pursuing scientific excellence. Dr. Kobilka said: "This lecture focuses on the relationship between human health and disease, which can be explained by my research regarding structural information regarding GPCRs."

Korea's First Open Health Research Network Launched

Medical Industrialization to Accelerate through Convergence Research

Yonsei University Health System (YUHS) has created Korea's first Health Research Network (Y-HRN), which allows its members convenient access to the medical research being conducted throughout Yonsei. Profiles of researchers and their research are available on Y-HRN, enabling users to share information and learn what research projects are being undertaken in the Colleges of Medicine, Dentistry, Nursing, Public Health, and related Yonsei departments. Not only is the network expected to invigorate joint research within Yonsei, it is also intended to facilitate new networks with external partners. In addition it will contribute not only to the growth of the convergence research ecosystem and medical industrialization, but also to the development of more active global collaborative research.

BRIDGE Project Rates Yonsei VERY GOOD

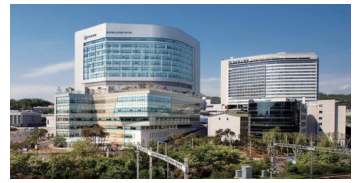
45 Billion Won in Support over Three Years

Yonsei received a "Very Good" rating from the Beyond Research Innovation and Development for Good Enterprises (BRIDGE) project. The BRIDGE project is administered by the Ministry of Education, and its goal is to facilitate the practical development of innovative ideas and patents from universities. In particular, the project supports the planning of business models, the manufacturing of prototypes, and the development of professional human resources. For each of the next three years, the Ministry of Education will give out 45 billion won in funding for the project.

Yonsei Ranked 50th Worldwide in Number of U.S. Patents

Research System Emphasizes University-Industry Collaboration

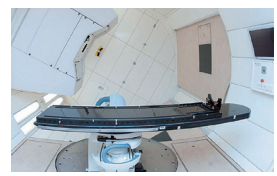
Yonsei is ranked fiftieth in the list of the "Top 100 Worldwide Universities Granted U.S. Utility Patents in 2015" released by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). The NAI and IPO have published their rankings annually since 2013 using data from the U.S. Patent and Trademark Office.



Yonsei Re-Designated as Research Hub Hospital

IPR and Technology Transfers Increase Following Reorganization

Severance Hospital has once again been designated as a research hub hospital. It first received the designation in 2013; since then, Yonsei University Health System (YUHS) has reformed the industry-university research collaboration unit, transforming it into an independent bio-healthcare research administration unit with an expanded business capacity. Following the reforms, the hospital's intellectual property rights (IPR) and technology transfer performance has improved. Last year, the unit signed a technology transfer agreement with ATGen worth 20 billion Korean won and was nominated as an excellent medical healthcare Technology Licensing Office (TLO). This year, YUHS plans to expand its efforts to invigorate convergence research between the hospital, industry, and medical equipment and IT researchers by establishing an industrial convergence medical center.



Yonsei Cancer Hospital Takes Off

Patient-Centered Treatment, Continuous Development of New Treatment Technology

Yonsei Cancer Hospital, which opened April 30, 2014, has been named Korea's top cancer hospital. At Medical Asia Awards ceremony on April 28, the hospital was honored for attracting international patients and bolstering global cooperation among cancer hospitals. Cancer Hospital President Sung-hoon Roh was also given the Minister of Health and Welfare Award for promoting excellence in Korean medical service through patient-centered treatment and a spirit of community service. Since opening two years ago, Yonsei Cancer Hospital has grown rapidly, treating nearly 2,000 outpatients and performing an average of fifty-five operations each day. Within the hospital, there are thirteen centers that specialize in different types of cancer. At the same time, the hospital continues to develop new treatment technologies.

Strengthened Convergence Research Will Lead the Future of Yonsei

→ ***Please tell us about your vision and philosophy as a senior vice president for research affairs at Yonsei.***

Future studies are likely to be characterized by a convergent nature that goes beyond the borders of different study fields. For Yonsei University to become a future leader, the top priority—in my view—is to reinvigorate convergence research areas.

I am determined to extend my highest efforts toward strengthening the interorganizational network and enhancing the value of the creative assets of our institution so that it surpasses the traditional domain of universities in academic development. And I will strengthen international research collaborations and support their revitalization by establishing the Yonsei Frontier Lab as a platform for bringing distinguished research institutions and researchers together to explore the viability of research collaborations.

→ ***Please share with us the research strategies of Yonsei University in response to the changes in our time.***

One of the characteristics of Yonsei University is that diverse studies coexist on the same campus. Specially, it is a unique advantage of our university that we have the hospital on campus.

Convergence research, which clears the border between study fields and includes biomedical convergence research, has become increasingly more important. We will support work in other research areas, such as convergence research studies in the humanities and social sciences, by applying big medical data from our university hospital. Further, we will support medical, natural science, and engineering convergence. I am confident that this extension of convergence research to diverse study fields will generate unprecedented research outcomes.

→ ***The Graduate School of Yonsei publicly declared the goal of fostering "internationally competent creative convergence human resources." What concrete efforts are being made to achieve it?***

Since I assumed the office as the dean of the graduate school in 2016, "networks" and "innovation" have been common objectives of the various policies executed according to the vision of our school (i.e., "to foster internationally competent creative convergence human resources"). We plan to continue expanding policies designed within the basic foundation of "research innovation through networks" and "innovation initiated upon the connection of heterogeneity."

To establish the foundation of the convergence research environment for graduate students, we have selected and are supporting 10 teams from the Yonsei Junior Convergence Group. Currently, we are seeing various convergence results and outcomes from which we will diversify multidimensionally to include more in-depth research, start-ups, and social contributions.

We started supporting international research collaborations to strengthen the international network for excellent researchers in our institution. For example, we initiated Project IV for the establishment of an international infrastructure, which is a measure to consolidate the current activities of international collaborations into regular collaborations.

→ ***What are the plans and which ones are currently in progress to expand university-industry cooperation?***

Yonsei Technology Holdings has been receiving much attention for its success. Last year, for example, the company realized a tangible return on investment to become the first technology holding company among domestic universities. We founded a subsidiary based on our excellent technological assets; it is the outcome of our continued development and management of technologies coupled with corresponding investments.

In addition, our university is playing a pivotal role in the BRIDGE project (Beyond Research Innovation and Development for Good Enterprises). Yonsei University receives annual project funds of $650,000.

PROFILE

2016 -
Senior Vice President for Research Affairs and Dean of Graduate School, Yonsei University

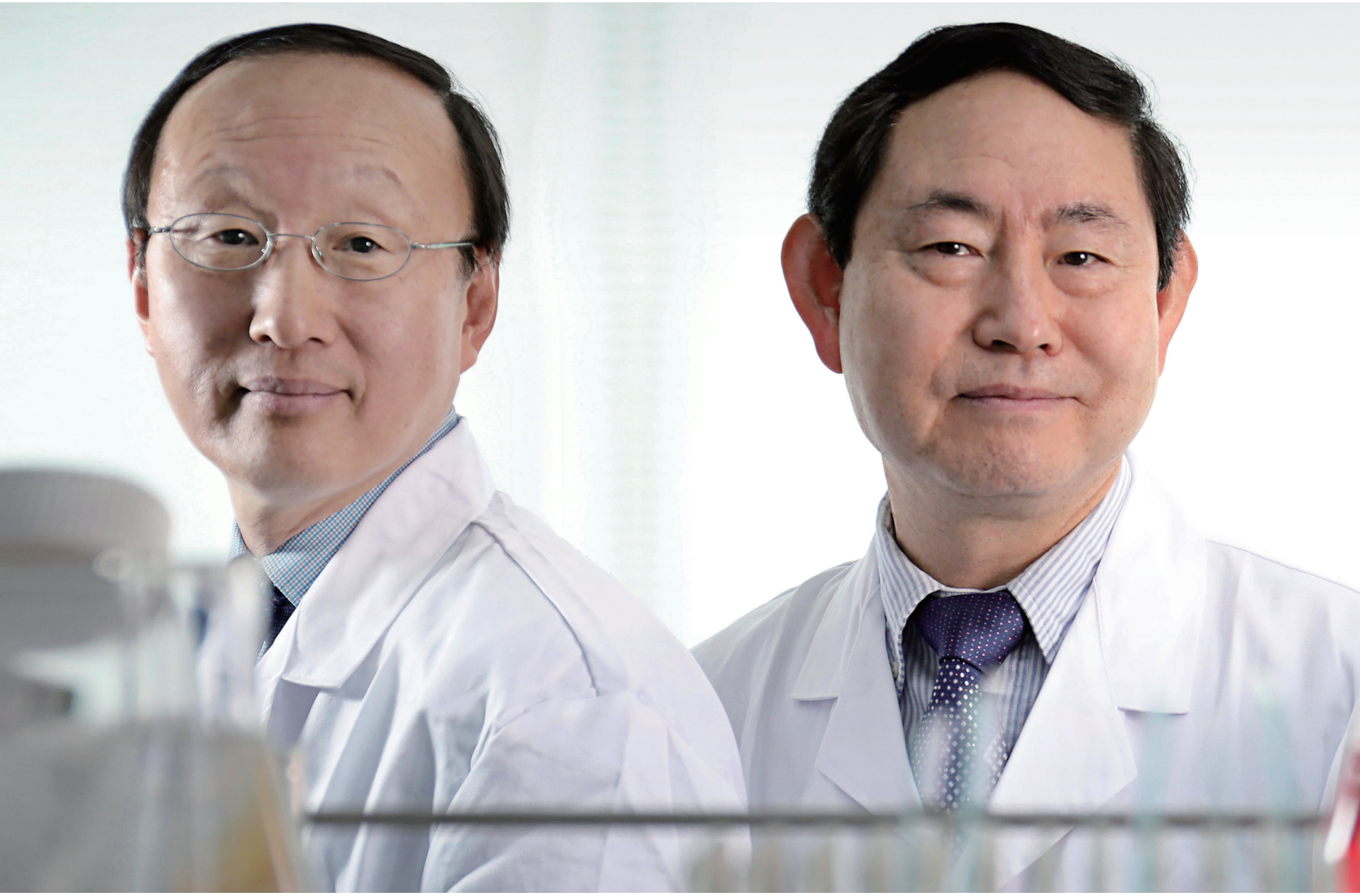
2010 - 2012
Vice President for Library / CIO, Yonsei University

2007 -
Board Member, KT&G Scholarship Foundation

1990
Iowa State University, Ph.D.

Moon-Gun Choi

Senior Vice President for Research Affairs and
Dean of Yonsei University Graduate School



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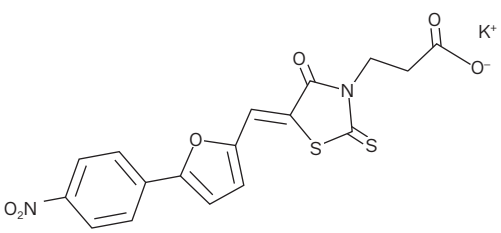
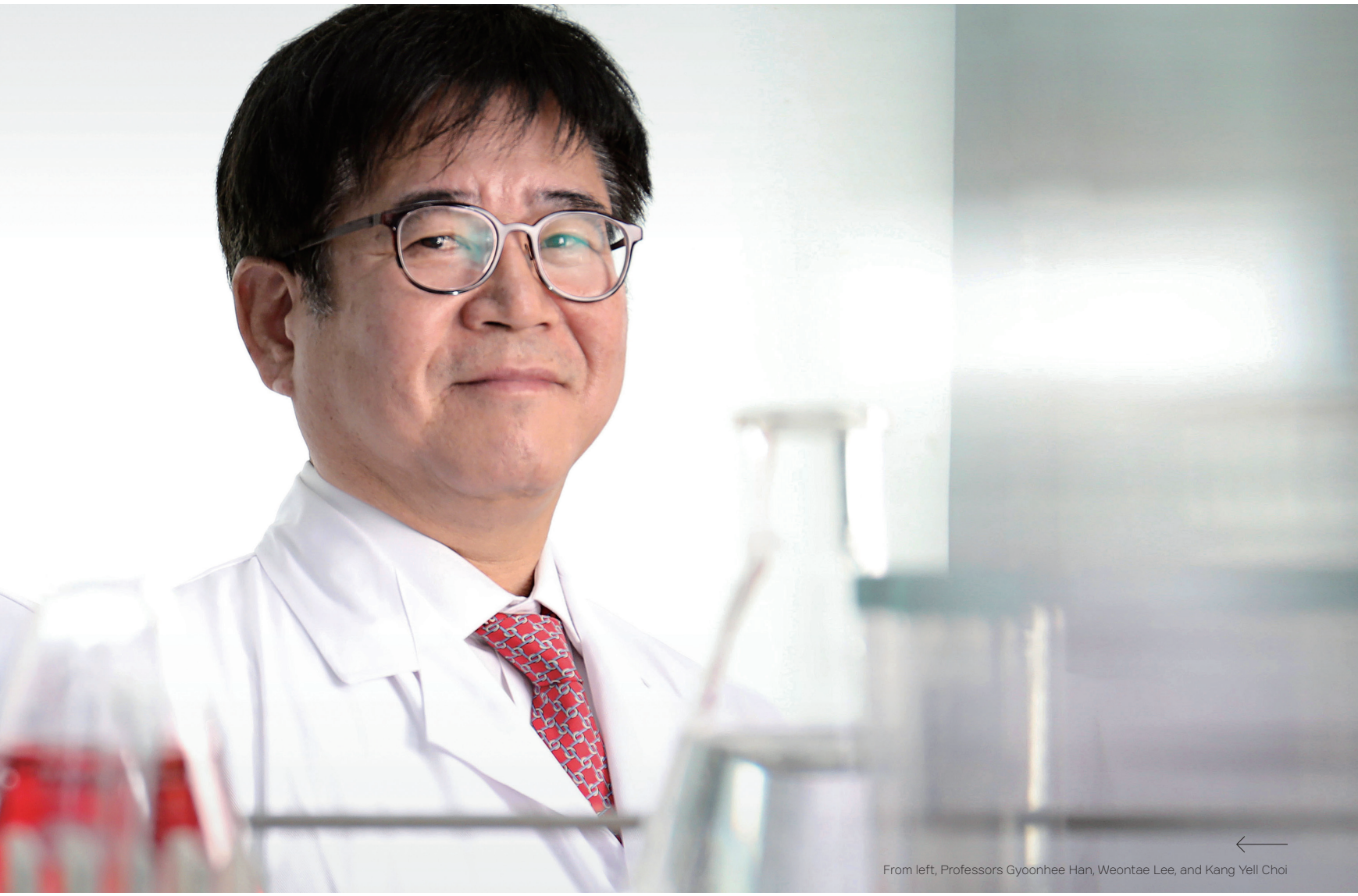


Professor Kang Yell Choi's Research Team

Identifies and Characterizes Small Molecules that Suppress Growth of Cancers via Degrading both β-catenin and Ras



From left, Professors Gyoonhee Han, Weontae Lee, and Kang Yell Choi

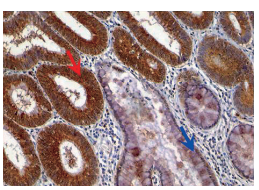
→ A research team led by Professors Kang Yell Choi in the Yonsei's Department of Biotechnology has identified small molecules that inhibit growth of colorectal cancer (CRC) cells via degrading both β-catenin and Ras. The small molecules inhibiting the Wnt/β-catenin pathway were selected by screening of several small-molecule libraries. Among the 40 compounds initially identified by their inhibitory effects on the Wnt/β-catenin pathway reporter activity, KY1220 was selected as a compound that efficiently degrades both β-catenin and Ras without showing cytotoxicity. KY1220 effectively inhibited transformation of CRC cells with activated Wnt/β-catenin and Ras/ERK pathways by adenomatos polyposis coli (*APC*) and *K-Ras* mutations. By collaboration with Prof. Gyoonhee Han from the Department of Biotechnology and Pharmacology, several hundreds of derivatives were obtained, and KYA1797K, a functionally improved compound retaining druggablity, was obtained.

KYA1797K effectively suppresses the growth of CRC cells with activated Wnt/β-catenin and Ras/ERK pathways. The RGS domain of axin was identified as a target for KYA1797K and molecular structure of RGS-axin-KYA1797K was determined by collaboration with Prof. Weontae Lee in the Department of Biochemistry.

They further characterized that KYA1797K activates GSK3β by modulation of the β-catenin destruction complex. The activated GSK3β induces phosphorylation of both β-catenin and Ras, which is required for their polyubiquitin-dependent proteasomal degradation, via recruitment of the β-TrCP E3 linker protein. KYA1797K effectively suppressed growth of CRC in the xenograft mice transplanted with the CRC cells harboring both *APC* and *K-Ras* mutations. The effectiveness of KYA1797K was further shown by using the genetically engineered $Apc^{min/+}/Kras^{G12D}LA2$ mice harboring both *APC* and *K-Ras* mutations.

Their findings were published June 14, 2016 in the online edition of *Nature Chemical Biology* (1st author; Pu-Hyeon Cha). The title of the article is "Small-molecule binding of the axin RGS domain promotes β-catenin and Ras degradation." This study suggests that destabilization of both β-catenin and Ras via targeting axin is a potential therapeutic strategy for treatment of CRC and other types of cancers activated Wnt/β-catenin and Ras pathways.

β-catenin



Ras

Immunohistochemical Staining for β-catenin and Ras in Colorectal Cancer Patient Tissues

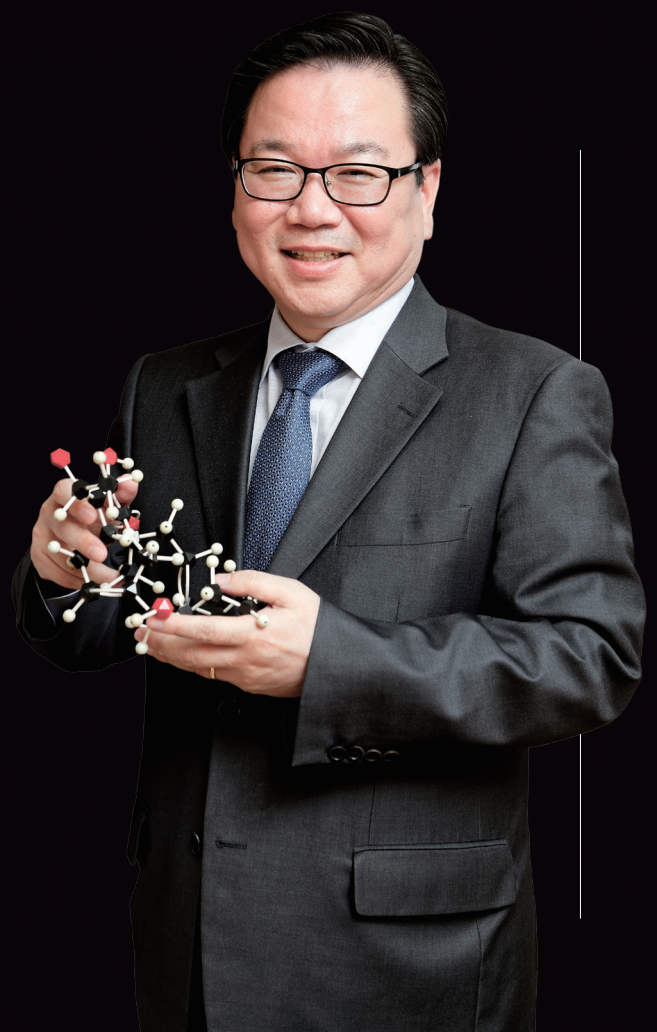
Professor Ho Jeong Kwon's Research Team

Published A Review Article in Target Protein Identification Methods for Label-Free Natural Products

02

→ A group of Yonsei researchers, led by Biotechnology Professor Ho Jeong Kwon, published a review article in May on the latest advances in target protein identification methods for label-free natural products. The piece appeared in the journal *Natural Product Reports*, a publication of the Royal Society of Chemistry, UK, and it is entitled "Advances in identification and validation of protein targets of natural products without chemical modification." (Nat. Prod. Rep., 2016, 33, 719).

In their review, Prof. Kwon and his coauthors examine report a number of new strategies that have been recently developed and applied to identify the target proteins of natural products and synthetic small molecules without chemical modification of the natural product. Prof. Kwon's group, indeed, have identified and validated a number of target proteins of natural products such as FK506, curcumin, terpestacin, depudecin, and resveratrol that were published over 170 SCI journals and 40 patent registrations. Ultimately, they argue that the "integration of newly developed technologies will provide new insights and highlight the value of natural products for use as biological probes and new drug candidates."



Professor Boyoun Park's Research Team

Provides Clue to Treatment of Intestinal Infections

03

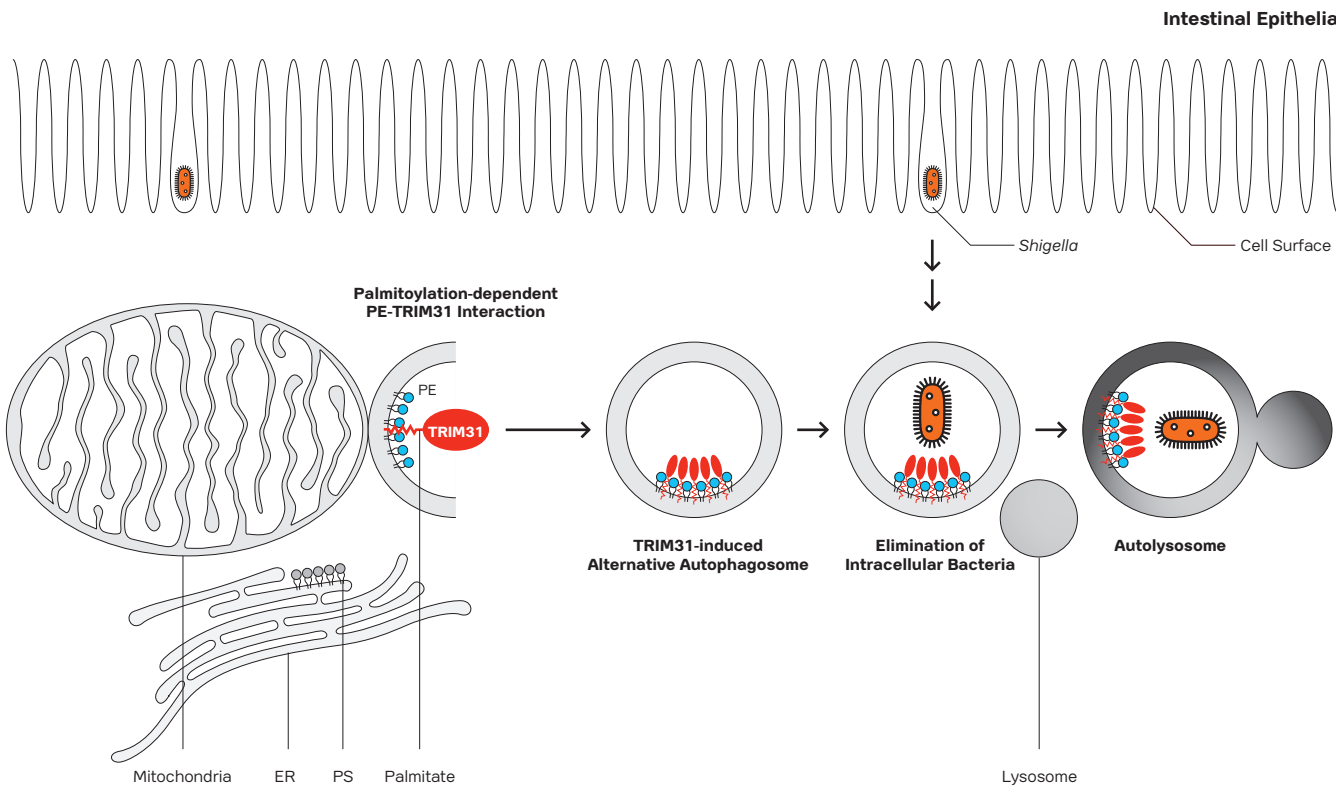
→ A research team, led by Professor Boyoun Park from the Department of Systems Biology, has reported that an intestine-specific protein localized in mitochondria, human TRIM31, is essential for promoting a certain kind of autophagy, or the natural destruction of unnecessary or dysfunctional cellular components. The team discovered that TRIM31 contributes to a broad range of biological events including bacterial infection. The research thus provides important insights into protection against intestinal pathogenic bacterial infection.

Prof. Park's research team includes graduate student Eun A. Ra and Professors Sungwook Lee, Jae Hee Cheon, and Jin Won Cho. The results were published May 24 in the online edition of *Nature Communications* with the title "TRIM31 promotes Atg5/Atg7-independent autophagy in intestinal cells."

It is well known that Atg5 and Atg7 are critical for autophagy. However, Prof. Park's research team found that TRIM31 is able to interact with mitochondria-derived membrane source, phosphatidylethanolamine (PE) in both wild-type and Atg-deficient cells, thereby activating alternative autophagy. Moreover, TRIM31-mediated autophagy pathway can eliminate invasive pathogenic *Shigella* bacteria. These findings suggest that TRIM31-induced non-canonical autophagy in the intestine functions to both limit an overflow of commensal bacteria and eliminate invasive organisms, which promotes heathy gut homeostasis.

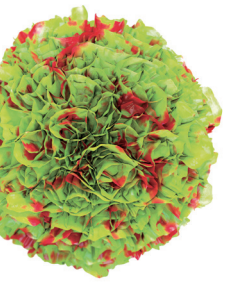
Prof. Park's research team also found that TRIM31 expression significantly decreased in Crohn's disease patients, a type of inflammatory bowel disease (IBD) in which inflammation is localized to the distal small intestine and variable regions in the colon. This proposes that TRIM31 expression is tightly controlled in a tissue-specific manner, which contributes to maintain intestinal homeostasis. The findings of the present study reveal a new alternative autophagy pathway, which could provide additional insight into the potential prognostic and therapeutic implications of TRIM31 in Crohn's disease.

In The Case of Bacterial Infection of The Intestine, New Form of Regulation of Homeostasis and Pathogenic Bacterial Infection



Professor Young Hoon Roh and Professor Paula Hammond (MIT) International Research Team

Develops A Novel RNA Nanotechnology-based Approach for Effective RNA Interference (RNAi) Therapy



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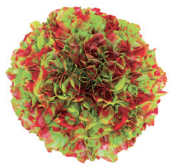
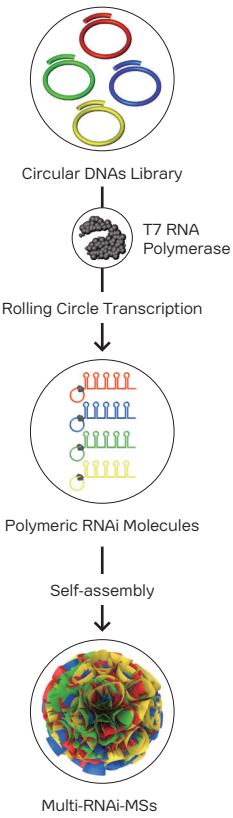


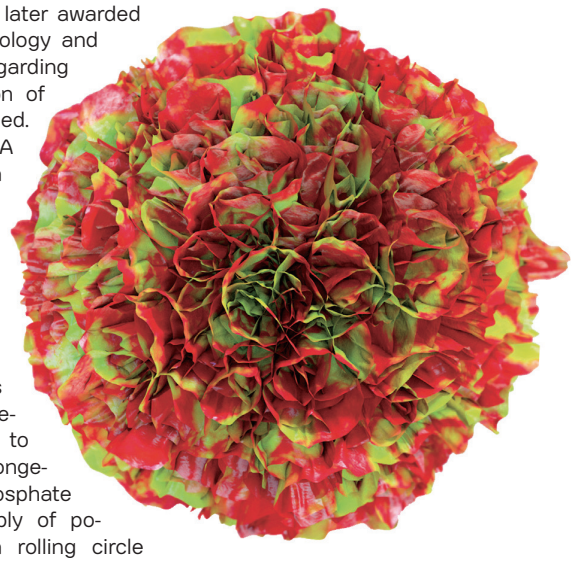
→ An international research team that includes Yonsei Department of Biotechnology Professor Young Hoon Roh and Massachusetts Institute of Technology (MIT) Professor Paula Hammond has developed a novel RNA nanotechnology-based approach for effective RNA interference (RNAi) therapy. Specifically, the team has devised a new microsponge platform for the delivery of multiple polymerized small interfering RNAs. This revolutionary technology has great potential in various RNAi-associated biomedical applications such as cancer treatment, genetic disorders, and viral infections, and is noted for its significant improvement in stability, loading capacity and delivery mechanism. The research was published on March 1st in the renowned *Angewandte Chemie* International Edition, and was selected as a "Hot Paper," highlighted as a "Cover Picture" for the issue.

RNA interference is a biological process that suppresses the expression of a specific protein by binding and inhibiting the protein's mRNA molecules via complementary RNA binding prior to translation. After the publication of Prof. Andrew Zachary Fire and Craig Cameron Mello's research that later awarded them the Nobel Prize in Physiology and Medicine in 2006, research regarding the mechanism and application of RNA interference has flourished. Especially, small interfering RNA (siRNA) is in the limelight as a nucleic acid drug due to its high selectivity and efficacy. However, it is still hampered by its instability, loading capacity and therapeutic efficacy.

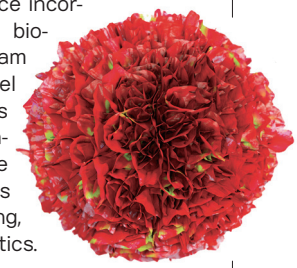
To overcome these barriers, the research team first engineered two circular DNAs which included different RNAi sequences. Then, they were able to synthesize a microsponge (a sponge-like porous magnesium pyrophosphate microstructure) by self-assembly of polymerized RNAi molecules via rolling circle transcription (RCT) of the two circular DNAs. By regulating the ratio of the two circular DNAs, the team was able to precisely control the stoichiometric amount of polymerized RNAi molecules loaded in the microsponge. Moreover, they were able to condense the microsponge with various polymers to change its physicochemical character such as size, shape, and surface charge for efficient delivery. Using this novel microstructure, they could simultaneously inhibit the expression of multiple proteins by variously controlling the ratio of two polymerized RNAi molecules.



Multi-RNAi-MSs Synthesis



Prof. Roh has interested in nucleic acid-based nanostructure ever since he worked as a postdoctoral associate in Massachusetts Institute of Technology. Now, Prof. Roh's research team focuses on nanobioengineering, an integrated science incorporating nanotechnology with bioengineering. Specifically, his team studies the synthesis of novel biomaterials using nucleic acids as both a genetic and generic material. These biomaterials can be used to wide range of applications including medicine, bioengineering, food technology, and even cosmetics.



Development of New Nucleic Acid-based Nanosource

Professor Yong-Sun Bahn's Research Team

Analyzes Systematic Function of Kinases Function to Treat Fungal Meningoencephalitis

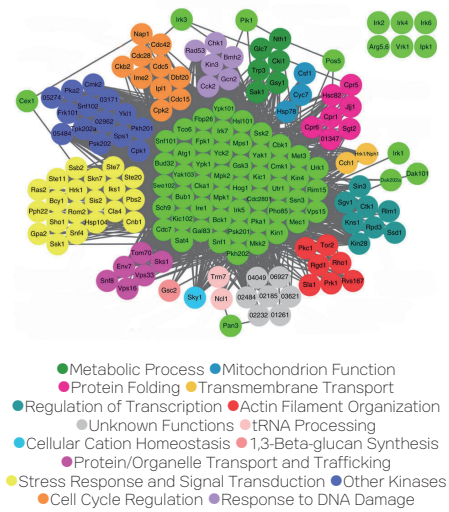
05

→ A research team led by Yonsei Biotechnology Professor Yong-Sun Bahn has analyzed 264 signature-tagged gene-deletion strains for 129 putative kinases, opening the door for the development of more effective antifungal drugs to treat *Cryptococcus neoformans*, the leading cause of death by fungal meningoencephalitis. The results were published online September 28 in *Nature Communications* with the title "Systematic functional analysis of kinases in the fungal pathogen *Cryptococcus neoformans*."

In explaining the purpose and importance of the study, Prof. Bahn said: "This study is the very first to discover a large number of kinases in human fungal pathogens and to identify their functions on a genome-wide scale. Furthermore, our study not only provides insights into the development of drug targets to treat fungal meningoencephalitis, but it also lays the groundwork to develop the next generation of high value-added antifungal drugs."

The team has applied for a domestic patent to secure its original technology from the study and has transferred this technology to a private Korean pharmaceutical company for development of novel antifungal drugs.

Holds Promise for Developing More Effective Antifungal Drugs



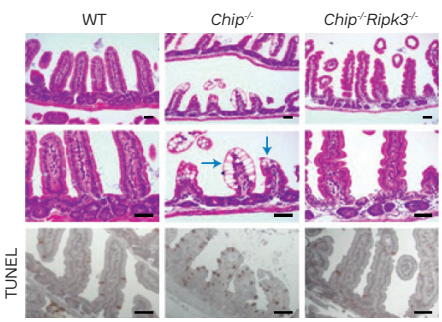
Network-based Functional Relationships among 63 Pathogenicity-related Kinases

New Possibilities for Treatment of Inflammatory Diseases

06

Professor Jaewhan Song and his Research Team

Discover the Regulatory Mechanism of Necroptosis



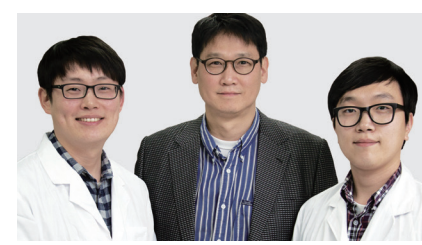
[Figure 1]
CHIP knockout mouse shows intestinal inflammation, and this effect is rescued by RIPK3 knockout.

→ The research team led by Professor Jaewhan Song from the Department of Biochemistry of Yonsei University has discovered a mechanism that regulates necroptosis, a form of cell death known to cause diseases such as sepsis, bowel disease syndromes, and other inflammatory diseases.

Cell death pathways can be classified into caspase-dependent and caspase-independent pathways. Necroptosis is a form of caspase-independent cell death pathway that plays an indispensable role in protection against viral or bacterial infections. Notably, necroptosis results in the release of "damage-associated molecular patterns (DAMP)" from dying cells, which in turn induce and activate innate immune responses by recruiting macrophages and dendritic cells. Over the past few years, many groups have extensively contributed to revealing the mechanisms underlying necroptosis; however, essential regulatory networks yet to be studied are expected to exist. The work of Prof. Song's team published in '*Nature Cell Biology*' in 2016 supports this perspective. The team identified that C-terminus HSC70 interacting protein (CHIP) functions as a negative regulator of necroptosis by ubiquitylation- and lysosome-dependent degradation of Receptor-interacting serine/threonine-protein kinase 3 (RIPK3) protein, which functions as a critical factor in inducing necroptosis. CHIP knockout mouse embryonic fibroblast cells were more susceptible to necroptotic stimuli because of the increased levels of RIPK3 expression. By identifying the site of ubiquitylation on RIPK3, the research team successfully demonstrated that CHIP protein is an essential E3 ligase controlling the activities of the necroptotic protein, RIPK3. In addition to the cellular studies, the physiological function of CHIP regulating necroptosis was further confirmed by using CHIP knockout mice, which exhibited severe intestinal inflammation and died within 10 weeks of birth. These phenotypes were rescued by knockout of RIPK3 in addition to CHIP, indicating that CHIP is a bona fide E3 ligase of RIPK3 (Figure 1).

The research efforts of Prof. Song's team are expected to contribute to developing new therapeutic approaches for cancer, autoimmune diseases, and viral and bacterial infections in the future. (This work was published in *Nature Cell Biology* in March, 2016)

From left, Dr. Eun-Woo Lee, Prof. Jaewhan Song, and Dr. Jinho Seo

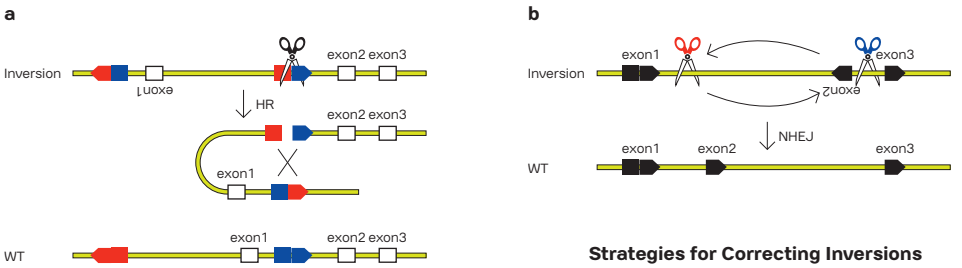


Professor Dong-Wook Kim's Research Team

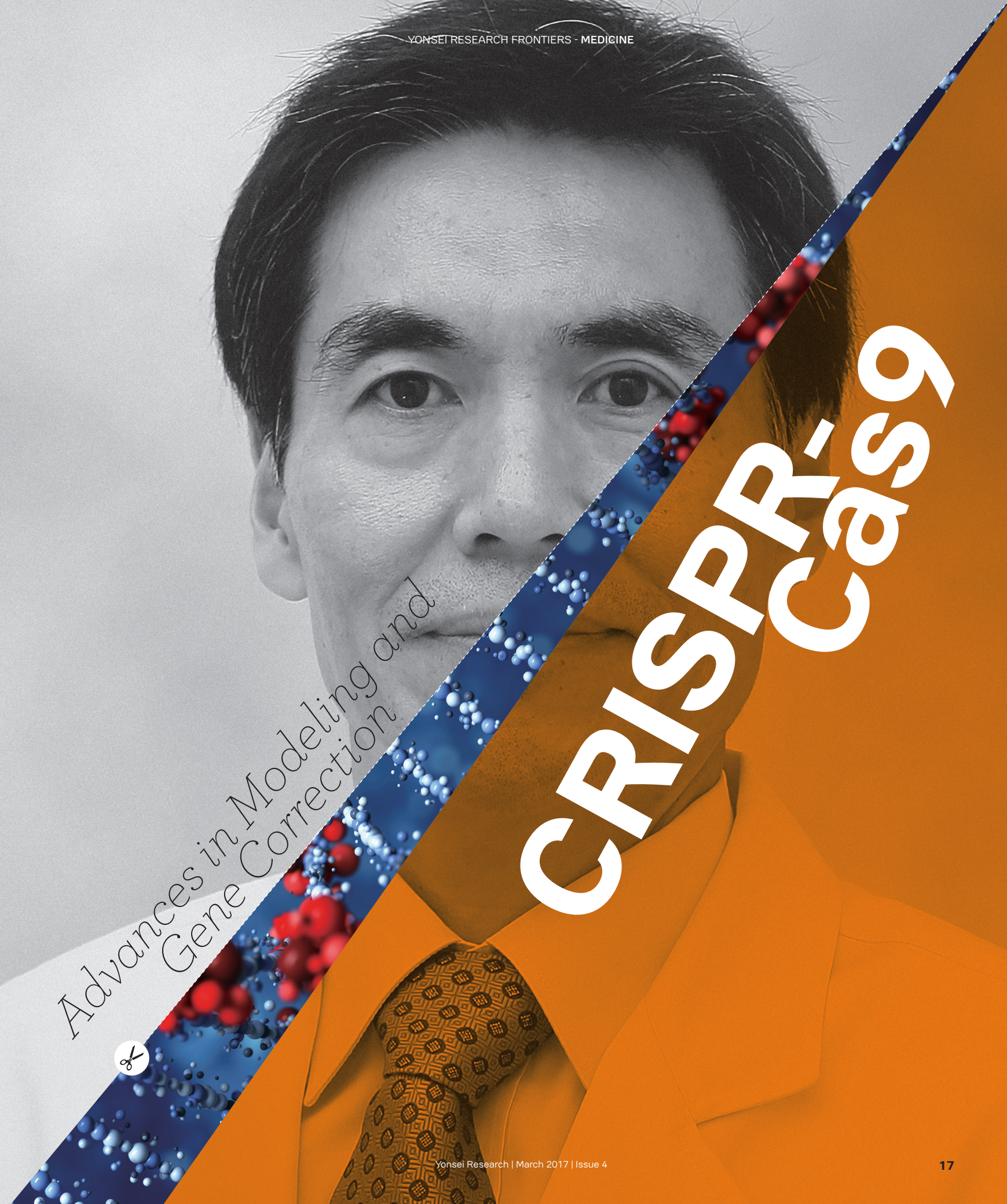
Reviewed Advances in Modeling and Gene Correction of Chromosomal Structural Variations

07

A group of Yonsei researchers headed by Physiology Professor Dong-Wook Kim has published two important review articles on advances in the modeling and gene correction of chromosomal structural variations (SVs). SVs contribute to human evolution and genetic diversity, but they can also cause diseases such as hemophilia. The articles were published in *Nature Protocols*, a sister journal of *Nature*, and *Trends in Biotechnology*, a sister journal of *Cell*. In recent years, the journals *Cell Stem Cell*, *Cell Reports*, and Proceedings of the National Academy of Sciences have reported on Prof. Kim's research into genome editing regarding chromosomal SVs. He has also given keynote addresses at the National Hemophilia Foundation and the Korean Society for Stem Cell Research. One example of SVs is inversion and almost half of severe cases in hemophilia A are caused by chromosomal inversions. In a chromosomal inversion, the order of the base pairs on the chromosome is reversed so the blood coagulation factor VIII (F8) gene doesn't express properly in patients. Prof. Kim has collected the urinary cells from patients to make induced pluripotent stem cells (iPSCs), and then applied CRISPR-Cas9 nucleases to them. The CRISPR-Cas9 reverted the F8 genes in iPSCs. Corrected-iPSCs were induced to differentiate into endothelial cells which expressed the F8 gene. Finally, the endothelial cells with the inversion-corrected genes were transplanted into F8 deficient mice (mice with hemophilia A) and the mice started producing the F8 clotting factor on their own. Of his work, Prof. Kim said: "To the best of our knowledge, this report is the first demonstration that chromosomal inversion can be corrected using programmable nucleases in patient-derived iPSCs."



Strategies for Correcting Inversions



CRISPR-Cas9

Advances in Modeling and Gene Correction

08

On-Site Protein Synthesis in Neural Circuits Explained

From left, Prof. Hosung Jung, Predoctoral Fellow Jane Jung, and Predoctoral Fellow Jiyeon Ohk

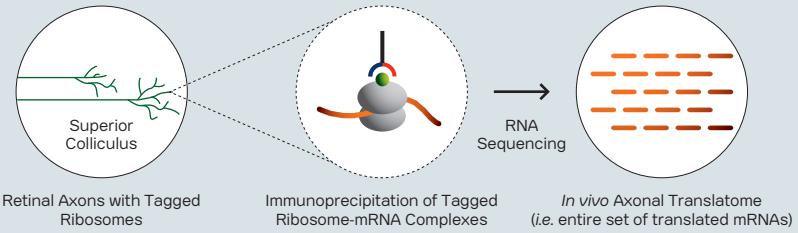
Professor Hosung Jung and his Research Team

Contribute to Research on Neurodevelopmental and Neurodegenerative Diseases

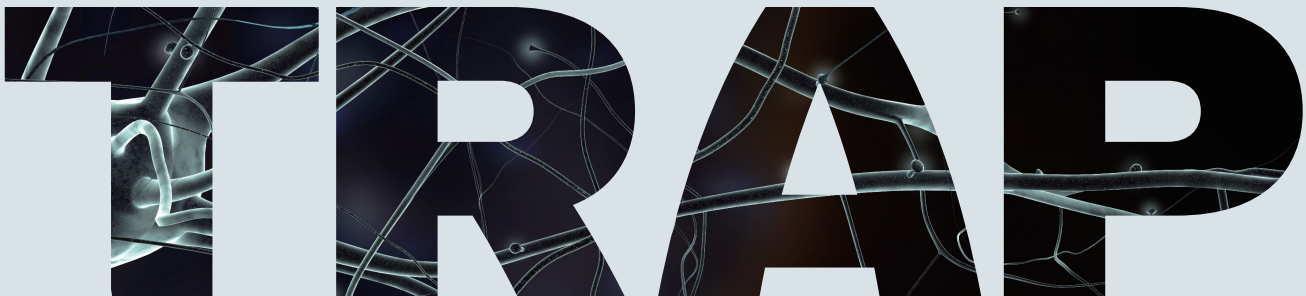
→ College of Medicine Professor Hosung Jung and his team have uncovered potential roles of local mRNA translation in the formation and maintenance of neural circuits. Neurons make long-distance connections via their axons, which need a number of different proteins. The problem is that DNA, the blueprint of protein synthesis, resides in the cell body. How proteins needed at the axon terminal, which is often remote from its cell body, are supplied in a timely manner has remained a puzzle. One idea, which was confirmed in this research, was that the neuron transcribes messenger RNAs (mRNAs) from its DNA in the cell body, transport them in a translationally repressed form to the axon terminal, and synthetize required proteins when and where they are needed by local mRNA translation.

To test this hypothesis, they developed a new technique called 'axon-TRAP (translating ribosome affinity purification)', which allows isolation of mRNAs being translated into proteins at the retinal axon terminal in mouse *in vivo*. Using this technique, they discovered that specific mRNAs are locally translated into proteins necessary for making or pruning connections (*i.e.* synapses) as the visual circuit is built. The unexpected finding was that axonal mRNA translation continues into adulthood, when it is used to make proteins necessary for axon survival. The research could give a fresh insight into the understanding of neurodegenerative diseases, which often result from failure to maintain axonal integrity. According to Prof. Jung: "Although a strong genetic link has been found between the mutations in the RNA-binding proteins (RBPs) and neurodegenerative diseases in human genetics, mechanistic details to explain this link are not well understood. Because RBPs regulate mRNA splicing, transport and translation, this research enables us to view the cause of neurodegenerative diseases from a new perspective: dysfunctional RBPs may prevent local translation of axon survival proteins."

Joining Prof. Jung were two of his graduate students, Jane Jung and Jiyeon Ohk, and Prof. Christine Holt's research team of University of Cambridge. Their findings were published June 30 in *Cell* under the title "Dynamic Axonal Translation in Developing and Mature Visual Circuits."



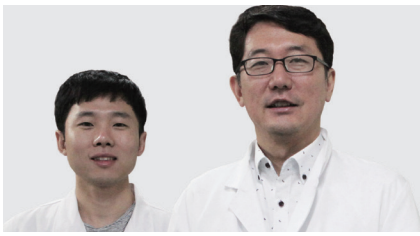
Axon-TRAP



09

Professor Sang-woo Lee's Research Team

Develops Stoichiometric Method to Investigate Intermolecular Weak Binding Interaction of Multiple Particles with DEP Tweezers



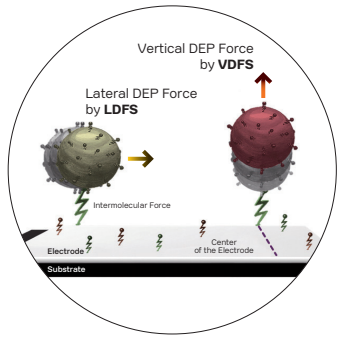
From left, Predoctoral Fellow In-soo Park and Prof. Sang-woo Lee

Possibility to Open New Horizons for Biomolecular Binding Studies

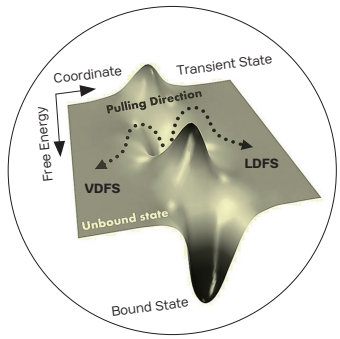
→ A Yonsei research team headed by Biomedical Engineering Professor Sang-woo Lee has developed a novel method to examine intermolecular weak binding interactions of trapped multiple particles with dielectrophoretic (DEP) tweezers. Unlike traditional methods such as Atomic force microscopy and Optical tweezers based force spectroscopy, this method can measure numerous rupture events under the same environment, simultaneously as sequentially applying lateral and vertical forces into the binding interactions.

These advantages that the previous tools do not have can be used to develop a simply, robust and efficient way to investigate intermolecular weak binding interaction. More importantly, the study using this stoichiometric approach should provide deep insight and better understanding more about the dynamics in molecular interactions, specifically in terms of biological phenomena like DNA characteristics analysis, protein combination, and extinction.

The findings of Prof. Lee and his team appeared in *ACS Nano*, a journal published by the American Chemical Society. The title of the article is "Biaxial Dielectrophoresis Force Spectroscopy: A Stoichiometric Approach for Examining Intermolecular Weak Binding Interactions."



A Schematic Model of Bi-directional Monomolecular Characterization Using Dielectrophoretic Technology in Microfluidic Chip



Thermodynamic Properties of Monomolecular Bonds According to Orientation

Schematic Graphic Art Image to Represent Particles as the Probes of Dielectrophoretic Tweezers and Hills as Energy Landscape of Molecular Bond

Biaxial Dielectrophoretic Force Spectroscopy

Enable Personalized Precision Cancer Treatment

→ A research team led by Yonsei University College of Medicine Professor Jae-Ho Cheong has successfully generated human stomach cancer mimetics by grafting tumor fragments into immune-compromised mice. To duplicate the characteristics of tumors from actual patients, team members used the cutting-edge patient-derived xenograft (PDX) model. This tumor translation platform thus allows doctors to personalize cancer treatments by first experimenting on the mice. The results of the research were published March 1 in *Scientific Reports*, a sister journal of *Nature*. The article's title is "Establishment and characterisation of patient-derived xenografts as paraclinical models for gastric cancer."

Despite of widespread utilization of the PDX models in other cancer types, it has only recently been employed to use PDX model in gastric cancer. This was the first time that the model, or "avatar mouse," is reported systematically describing the establishment process and analyzing genomic and histological fidelity compared to patient tumors. According to Prof. Cheong: "In near future, by using the avatar mouse on behalf of real patients with stomach cancer, researchers can first examine the efficacy of a given treatment ahead of clinical application. This will enable doctors to customize cancer treatments based on the results from PDX model of which genomic alterations exactly mimics the patients tumors. This is very helpful."

Prof. Cheong envisioned the future of PDX model. "Now, the strategy is moving from establishing this 1:1 matched avatar model to establishing a PDX library large enough to mirror the heterogeneity and molecular characteristics or subtypes of each cancer. This PDX library will enhance hypothesis-based new potential biological tumor targets can be tested in the PDX models before clinical trial as a proof-of-concept precision medicine trial. We believe that the cataloging of established gastric cancer PDX models using clinically applicable platforms could lead to individualized therapy for gastric cancer."

Professor Jae-Ho Cheong and his Research Team

Generate Human Stomach Cancer Mimetics in Mice

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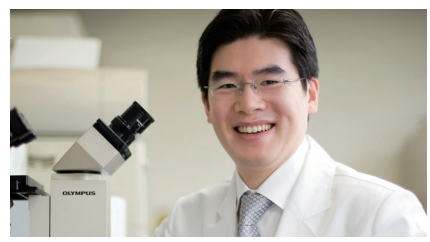
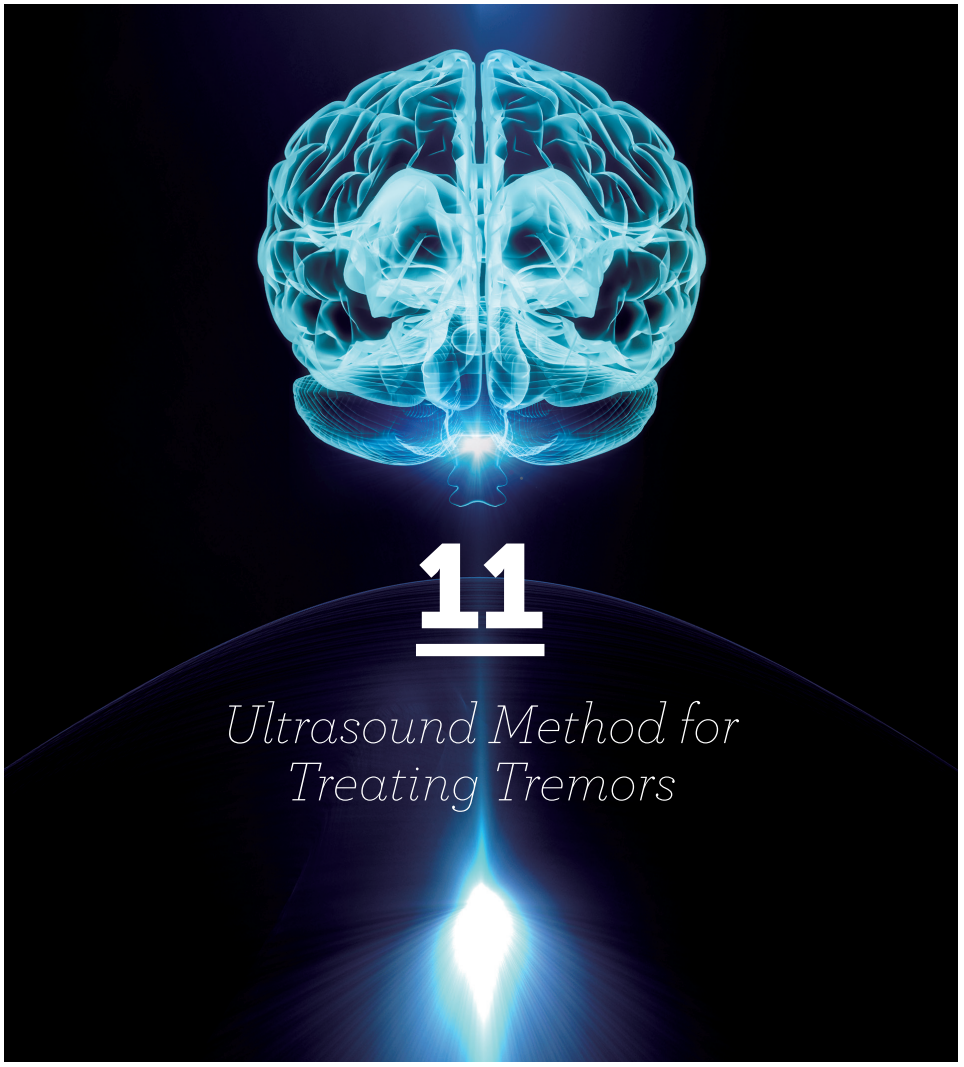


Professor Jin Woo Chang's Research Team

Develops Ultrasound Method for Treating Tremors Proven Effective

→ A Yonsei research team, led by Neurosurgeon Jin Woo Chang, joined with eleven international clinical research centers to run a randomized trial on the effectiveness of focused ultrasound thalamotomy to treat essential tremor, one of the most common movement disorder. What they discovered is that this MRI-guided method significantly reduces hand tremors in patients with essential tremor. The results of the trial were reported August 25 in *The New England Journal of Medicine*, one of the world's most prestigious medical journals.

Speaking of the work with all his collaborators, Prof. Chang said: "We are pleased with the results of the trial, which addressed major issues for patients suffering from essential tremor. It has been difficult for many patients and their families to decide whether to receive treatment for essential tremor, because the main treatment for it often included scalpels and drills. However, with this positive data on the ultrasound procedure, patients can be treated more easily and will be able to return to performing daily tasks with greater ease, while enjoying a better quality of life." He added: "Procedures utilizing similar MRI methods have been studied for the treatment of other disorders, like Parkinson's disease, and neuropathic pain, such as often occurs in depression and OCD."

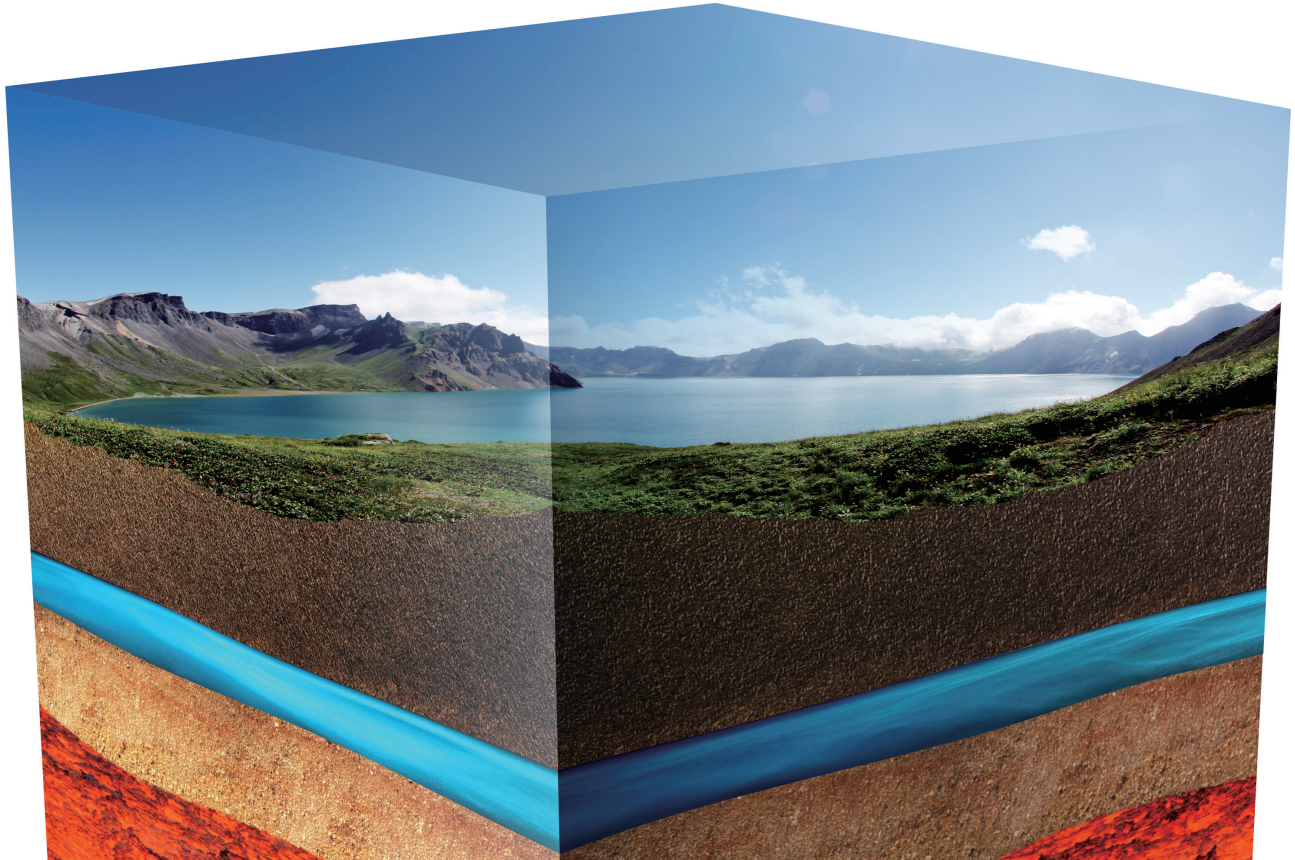


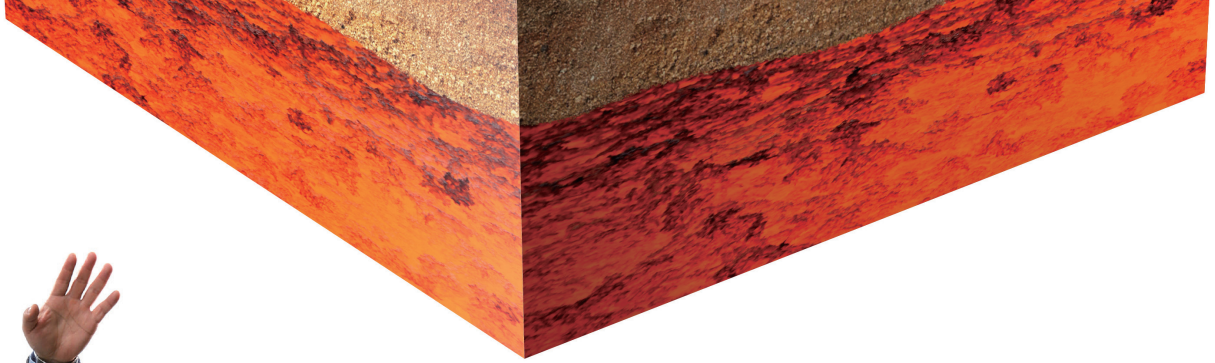
Nuclear Tests Could Trigger Volcanic Eruption

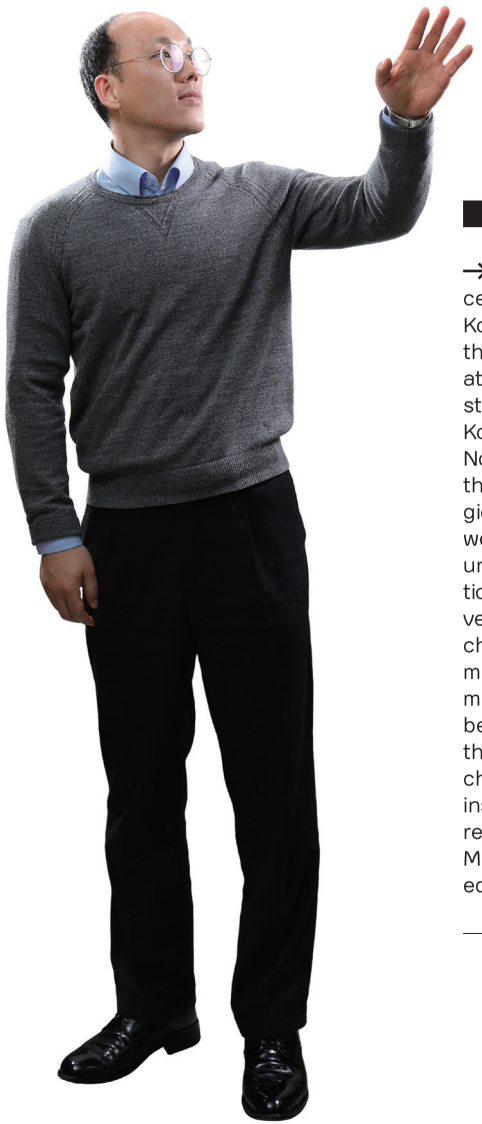
12

Professor Tae-Kyung Hong and his Research Team

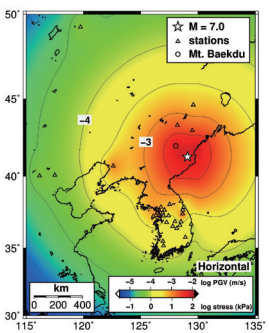
Discover that North Korea's Nuclear Tests Could Trigger Volcanic Eruption in Mt. Baekdu

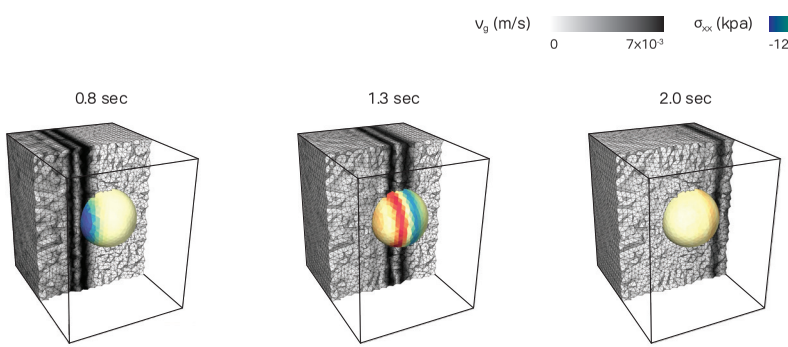




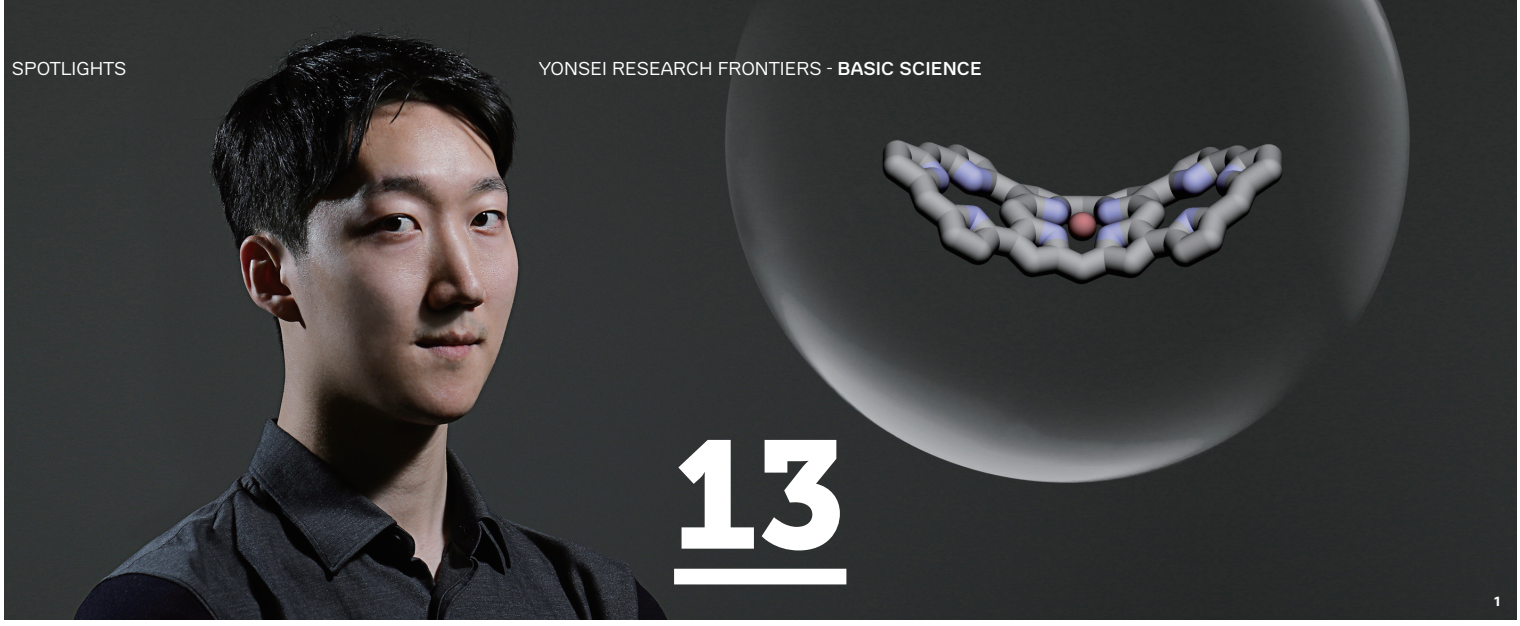


→ Currently, there are fears that North Korea could soon test a hydrogen bomb. Amidst these concerns, Yonsei Earth System Sciences Professor Tae-Kyung Hong and his team are studying how North Korea's nuclear tests could affect seismic activities at Mount Baekdu. This is the first study to show that seismic waves following a nuclear test could possibly cause an earthquake and volcanic eruption at the mountain on the North Korean-Chinese border. Prof. Hong and his team examined the dynamic stress changes of the magma chamber of Mt. Baekdu that can be induced by hypothetical North Korean nuclear explosions. Seismic waveforms for hypothetical underground nuclear explosions at North Korean test site were calculated by using an empirical Green's function approach based on the seismic waveforms of North Korea's first three nuclear tests; such a technique is efficient for regions containing poorly constrained velocity structures. The peak ground motions around the volcano were estimated from empirical strong-motion attenuation curves. A hypothetical M7.0 North Korean underground nuclear explosion may produce peak ground accelerations of 0.1684 m/s^2 in the horizontal direction and 0.0917 m/s^2 in the vertical direction around the volcano, inducing peak dynamic stress change of 67 kPa on the volcano surface and ~120 kPa in the spherical magma chamber. North Korean underground nuclear explosions with magnitudes of 5.0-7.6 may induce overpressure in the magma chamber of several tens to hundreds of kilopascals. Their calculations show that with a magnitude of 7.0, the blast would cause seismic tremors and changes in seismic earth pressure on the surface of Mount Baekdu and inside its magma chamber. This is the first study to show that North Korea's nuclear tests are capable of causing significant volcanic activity at Mount Baekdu. The results were published on February 17 in the online edition of *Scientific Reports*, a sister journal of *Nature*.





Modeling of Pressure Change in Magma Chamber by Nuclear Test Seismic Waves



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1

Professor Dongho Kim and his Research Team

Published Three Articles Featured on Cover of *Angewandte Chemie*

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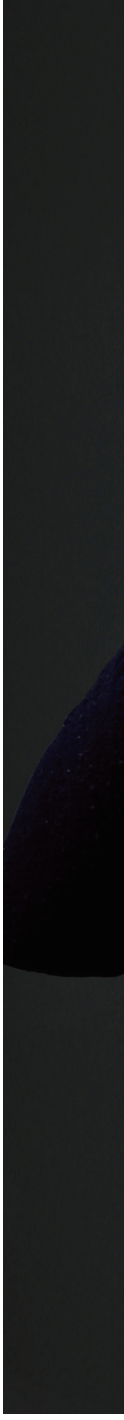
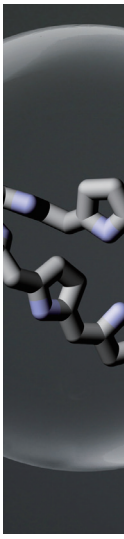
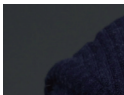
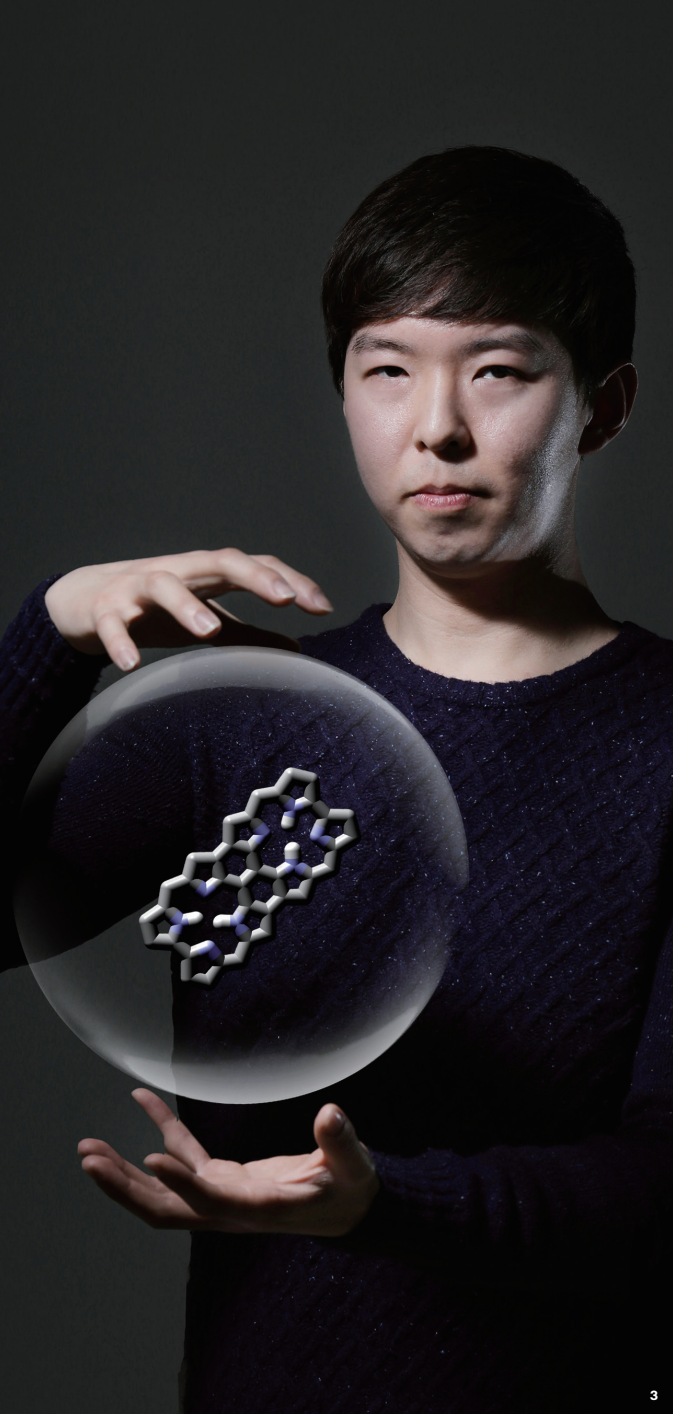
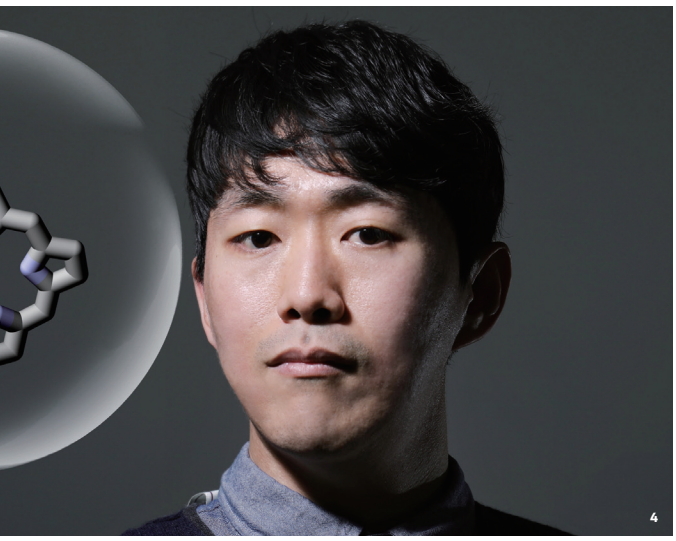
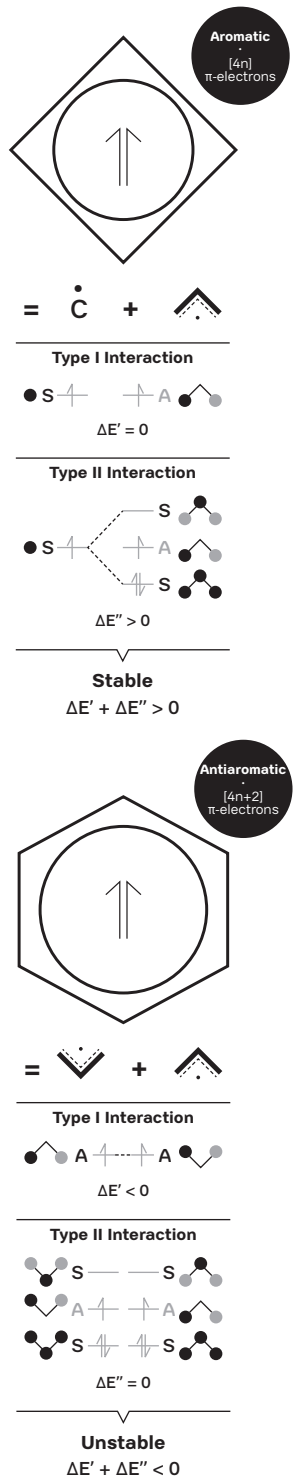












→ Three articles by Professor Dongho Kim and his research team were featured on the covers of the May 23 issue of *Angewandte Chemie* International Edition. The articles detail their research on the reversal of Möbius aromaticity and excited-state dynamics of corrole and porphyrin derivatives. The articles are titled "π-Extended 'Earring' Porphyrins with Multiple Cavities and Near-Infrared Absorption," "Triply Linked Corrole Dimers," and "Aromaticity Reversal in the Lowest Excited Triplet State of Archetypical Möbius Heteroannulenic Systems."

Aromaticity and π-conjugation are the core concepts in chemistry which determine the chemical stability and photophysical properties of a molecule, the smallest unit that determines the properties of substances. Aromaticity of a molecule can change drastically upon external chemical and physical stimuli in conjugation with the changes in the molecular conformations. Prof. Kim and his research team have been studying the fundamental nature of the aromaticity and π-conjugation of various molecular systems and changes upon physicochemical modulations using time- and space-resolved optical spectroscopy.

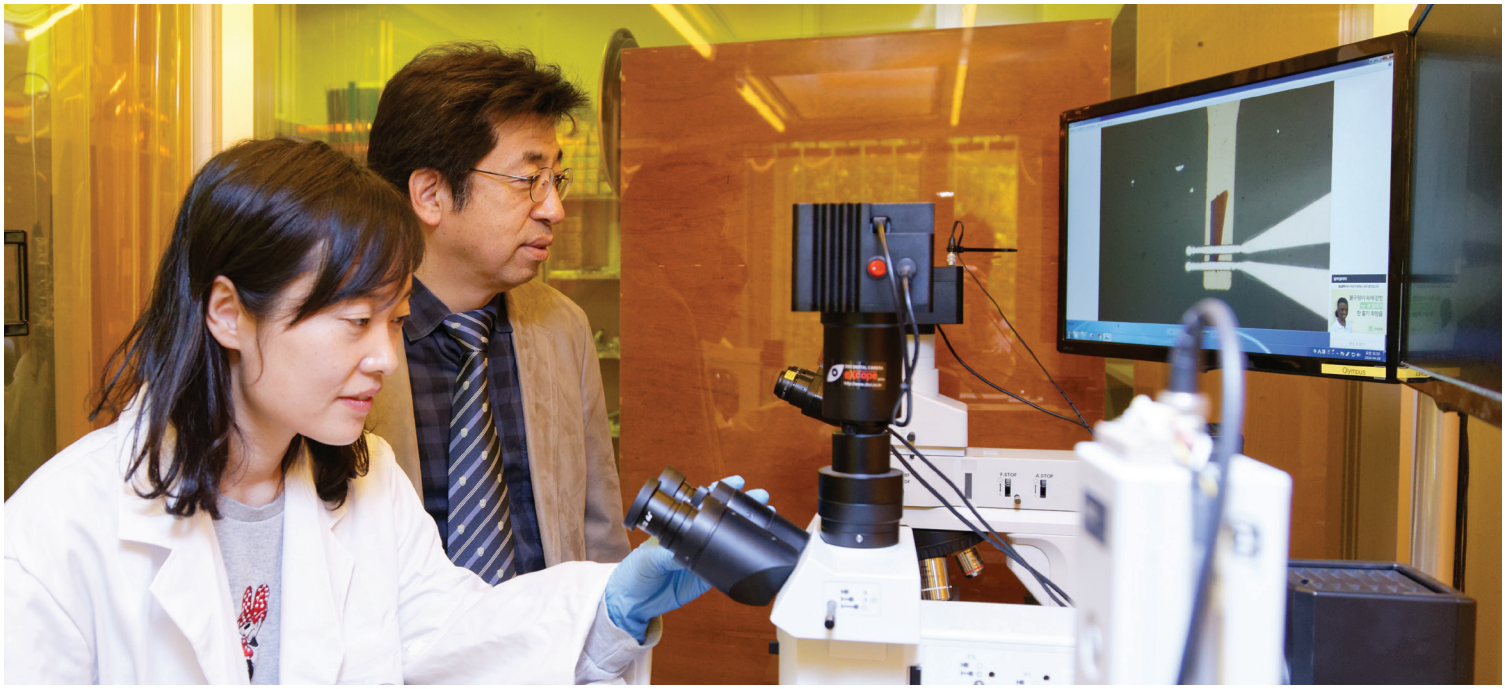
As a part of his research, Prof. Dongho Kim and his research team have studied the reversal of aromaticity of π-conjugated cyclic molecules in the lowest triplet state (T_1). Reversal of Hückel aromaticity in the T_1 state has been proposed theoretically by Baird in 1972 and has recently been experimentally demonstrated by Prof. Dongho Kim and his research team in 2015. In this study, "Aromaticity Reversal in the Lowest Excited Triplet State of Archetypical Möbius Heteroannulenic Systems," the aromaticity reversal in the T_1 state of Möbius aromatic (a distinct counterpart of Hückel aromaticity) metalated expanded porphyrins was demonstrated firstly by time-resolved spectroscopy with an aid of quantum calculations.

In addition, the research team have reported the synthesis of corrole dimers and porphyrin derivatives and analyzed their aromaticity and exciton dynamics in the study of "Triply Linked Corrole Dimers" and "π-Extended 'Earring' Porphyrins with Multiple Cavities and Near-Infrared Absorption". Because these molecules are homologues of porphyrin molecules, which play a critical role in the natural functional proteins such as light harvesting, redox-catalysis and oxygen delivery, the artificial synthesis of these molecules with in-depth characterization provides a great significance for the potential applications as artificial photosynthetic and photocatalytic systems.

These three studies of Prof. Kim and his research team were recognized for excellence and selected as the cover papers of *Angewandte Chemie* International Edition. Going forward, their continuous findings should have a number of important applications, particularly in terms of solar-energy conversion, photodynamic therapy, and next-generation displays.

←

1. Predoctoral Fellow Taeyeon Kim,
2. Prof. Dongho Kim,
3. Predoctoral Fellow Kyu-hyung Park, and
4. Predoctoral Fellow Juwon Oh



From left, Dr. Kyunghee Choi and Prof. Seongil Im

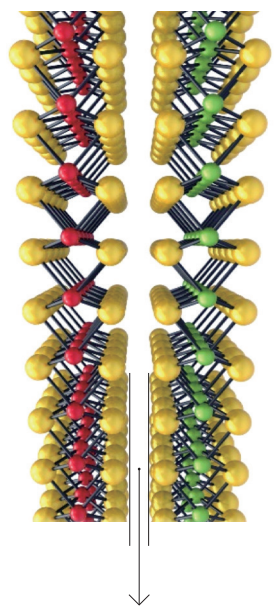
14

Professor Seongil Im and his Research Team

Investigate 'Van der Waals force' for Potential Semiconductor Devices

→ A research team led by Professor Seongil Im from the Institute of Physics and Applied Physics has demonstrated a process for using only 'Van der Waals force' in a functioning semiconductor device. 'Van der Waals force' refers to the residual attractive or repulsive forces between molecules or atomic groups. According to Prof. Im, such Van der Waals force is now used to realize a few atomic layer-thin two dimensional (2D) Nanosheet PN junction diodes, Field Effect Transistors, and even CMOS inverters. Their results were published February 1 and March 16 in *Advanced Materials* (2016, 28, 3216) under the title "Electric and Photovoltaic Behavior of a Few-Layer α-$MoTe_2$ /MoS_2 Dichalcogenide Heterojunction" and *Advanced Functional Materials* (2016, 26, 3146) under the title "Non-Lithographic Fabrication of All-2D α-$MoTe_2$ Dual Gate Transistors."

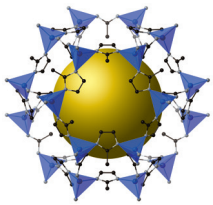
Prof. Im's group continues their Van der Waals processes to fabricate new types of electron devices this year. As a result, 2D blackphorus-1D ZnO nanowire PN junction and junction field effect transistor were reported in *Nano Letters* (2016, 16, 1293) under the title "Black phosphorus–zinc oxide nanomaterial hetero-junction for p–n diode and junction field-effect transistor."



Van der Waals Gap

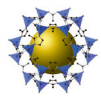
The 2D device applications finally led to successful active mode operation of OLED pixels and results were published November 11 in the online version of *Advanced Functional Materials*, entitled as "Transition Metal Dichalcogenide-Based Transistor Circuits for Gray Scale Organic Light-Emitting Displays" (to be highlighted in Wiley's Advanced Science News).

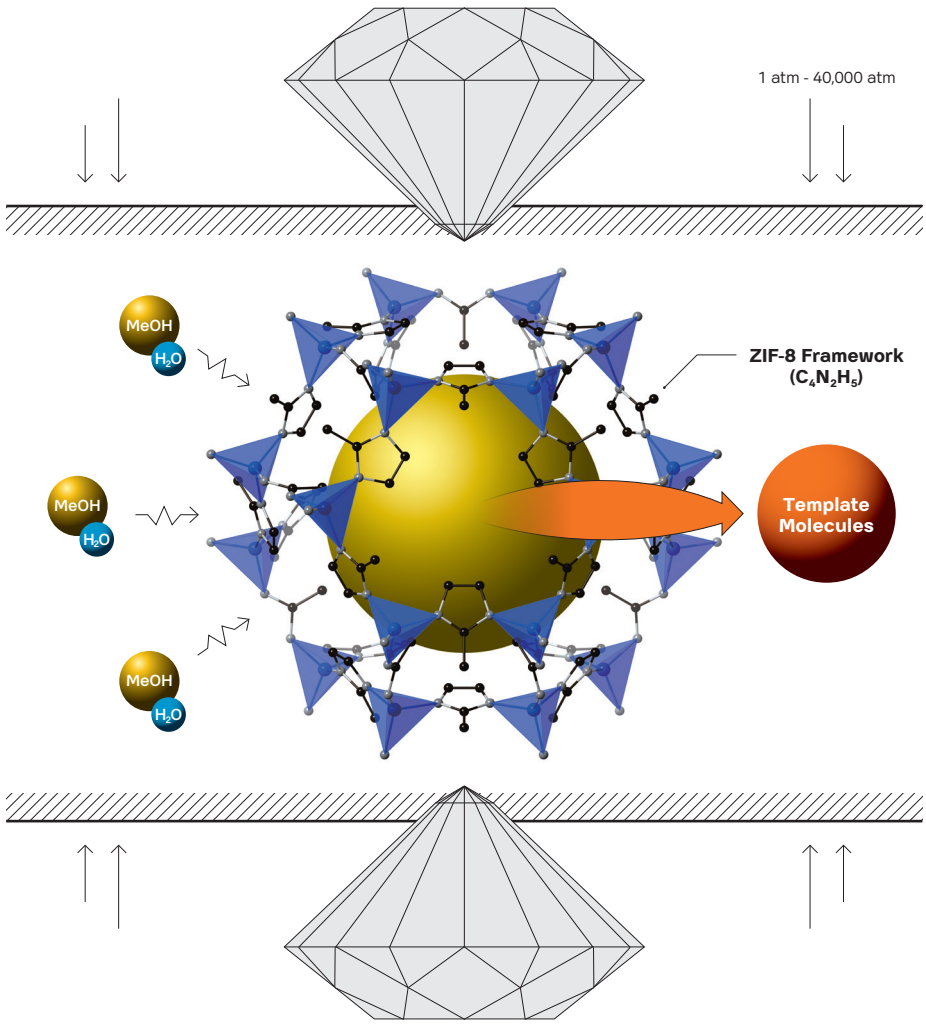
Although Prof. Im's group has tried their best to realize such 2D devices for the last 5 years, it must be regarded that the year 2016 would be the most productive for him in terms of research achievement. Over the last five years, Prof. Im has reported more than 30 journal papers related to 2D devices, and he was thus invited this year by Elsevier, a publisher for review paper. A 20 page-long review paper was written and recently published in *Nano Today* (2016, 11, 626-643) under the title "Two-dimensional van der Waals nanosheet devices for future electronics and photonics". The review summarizes most of world reported 2D devices and their issues, and any future trends of 2D devices were also forecasted in the review.



Pressing Metal Organic Frameworks

- Suggests Novel Applications in Gas Storage, Separation, and Catalysis





Conceptual Drawing of The High-pressure Experiment on ZIF-8 Framework Using A Diamond Anvil Cell

Professor Yongjae Lee's Research Team

Improves the Utilization of New Porous Materials through High-pressure Research

15

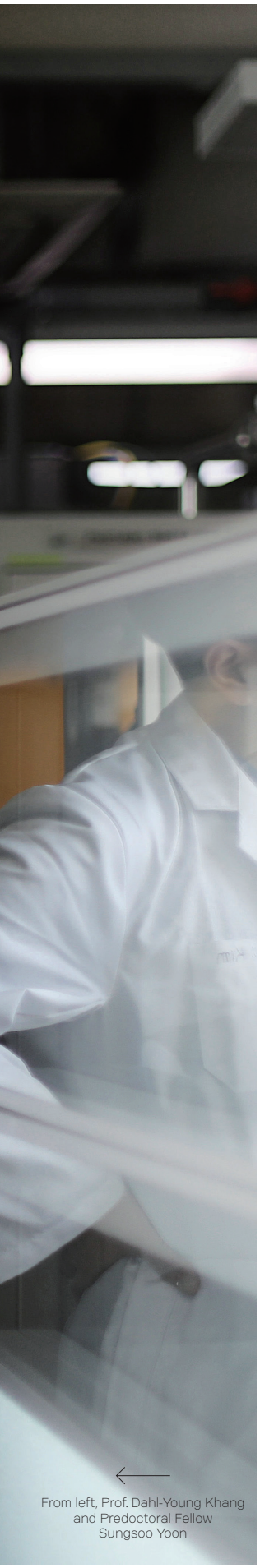
→ A research team that includes Yonsei Professor Yongjae Lee of the Department of Earth System Sciences has published two important papers in American Chemical Society Publications (ACS Publicaitions) on pressure-dependent structural and chemical changes in metal organic frameworks (MOFs). The research was conducted using small pressure device called diamond-anvil cell and synchrotron X-ray power diffraction, and it included the participation of Prof. Sung Hwa Jhung of Kyungpook National University, Prof. Jaheon Kim of Soongsil University, and Prof. Thomas Vogt of the University of South Carolina.

MOFs are a new class of crystalline hybrid materials in which inorganic and organic counterparts form single phase crystalline materials; they have a number of potential industrial applications due to their unique properties such as high surface area, large pore volume, high uniform and permanent porosity, and ease of tuning those structure to introduce additional physical and chemical properties.

Of their work, Prof. Lee stated: "As this research identifies pressure-dependent structural and chemical changes in MOFs, it will contribute to increase the potential applications of MOFs for diverse industrial uses." He added: "I hope this research will be an important stepping-stone towards initiating various pressure-studies utilizing MOFs in the future." The research has been reported to the journals of ACS Publications including "*Chemistry of Materials*" and "*Journal of the American Chemical Society*" in July and September issues in 2016, respectively.

From left, Prof. Yongjae Lee and Dr. Junhyuck Im

Metal Welding at Room Temperature



From left, Prof. Dahl-Young Khang and Predoctoral Fellow Sungsoo Yoon

Professor Dahl-Young Khang and his Research Team

Weld and Sinter Metal Nanostructures by Chemical Means for Flexible, Stretchable Transparent Electrode

16

→ Professor Dahl-Young Khang from the Department of Materials Science and Engineering has developed a new method for room-temperature welding and sintering of metal nanostructures using capillary condensation. Their research results were published May 15 in *Nano Letters* under the title "Room-Temperature Chemical Welding and Sintering of Metallic Nanostructures by Capillary Condensation."

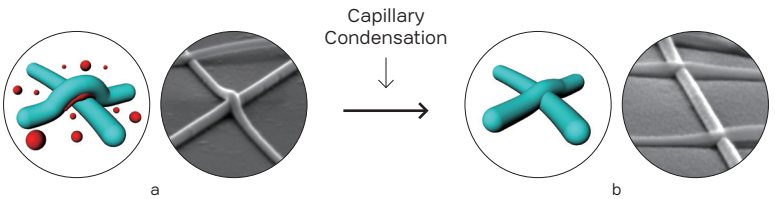
According to Prof. Khang, this new method is particularly noteworthy in that the "chemically welded networks of silver nanowires show much improved performance, in terms of high electrical conductivity, mechanical flexibility, optical transparency, and chemical stability."

Welding and sintering have long been done by applying heat. For nanostructures such as nanowires and nanoparticles, heat is not the proper choice for the welding, especially on fragile substrates, plastics and elastomers as examples. Now the welding and sintering are made possible at room temperature by simple exposure to chemical vapor. The vapor condenses into liquid at/around the junction or small gaps between nanostructures selectively, phenomenon known as 'capillary condensation'.

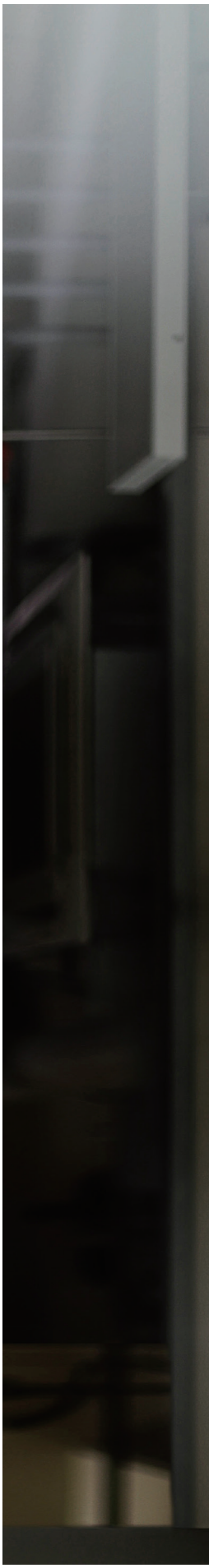
Indium tin oxide (ITO), widely used material for transparent electrode in displays, has high electrical conductivity and optical transparency. Not only the costly material but also mechanical fragility of ITO has led to active search for alternative electrode materials. Metal nanostructures are one of such candidates, especially silver (Ag) nanowires. The connected network of Ag nanowires ensures electrical conductivity and optical transparency at the same time. Those performances of Ag network can be greatly enhanced if one can connect them tightly, even on fragile substrates without applying heat.

As shown above figures, Ag nanowires network can be welded together by exposure to chemical vapor. The initial network structure is connected by simple physical contact (a). Upon exposure to chemical vapor for ~10min, the connection between nanowires turns into tightly bound together (b). This chemically welded Ag nanowires network has high conductivity and optical transparency. When the process is done on transparent plastic (PET) or rubber (PDMS), one can get flexible or stretchable electrodes. The same principle can equally be applied to the sintering of metal nanoparticle aggregates, such as Cu, Fe, Ni, and Co.

High performance electrodes can find widespread applications, such as wearable electronics, soft robotics, sensors, healthcare devices, to name just a few.



Bonding of Silver Nanowires Using Capillary Condensation of Hydrogen Peroxide



Professors Yong-gun Shul and Byungchan Han and their Research Team

Identify New Catalyst for Oxygen-Evolution Reaction

17

→ A Yonsei research team, led by Professors Yong-gun Shul and Byungchan Han from the Department of Chemical and Biomolecular Engineering, has identified a highly functional catalyst-hexagonal perovskite—for the oxygen evolution reaction (OER), a crucial process in the energy conversion process. The research was published online February 24 in the Journal of the *American Chemical Society* under the title "A New Family of Perovskite Catalysts for Oxygen-Evolution Reaction in Alkaline Media: $BaNiO_3$ and $BaNi_{0.83}O_{2.5}$."

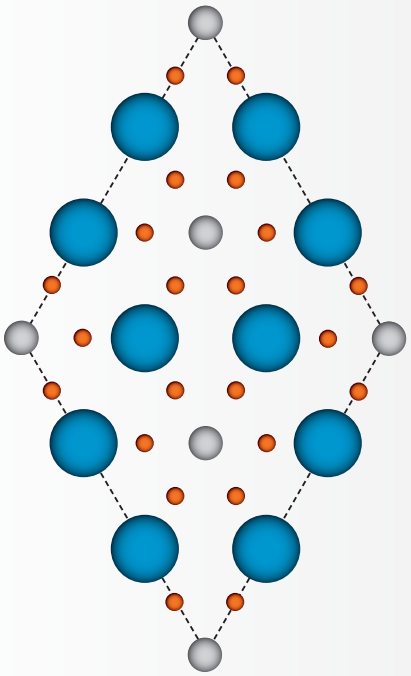
According to Professors Shul and Han, the findings are significant in terms of establishing a sustainable energy society. Hexagonal perovskite, they said, has strong potential to become a "cost-effective and highly active catalyst for energy conversion and storage devices, such as metal-air batteries and electrochemical water-splitting systems."

The researchers detected a dramatic enhancement on the catalytic activity of $BaNiO_3$ during the early stage of oxygen evolution reaction. They attempted to unveil underlying mechanism on the extraordinary result by developing an atomistic level theory and verifying it with experimental observation. Their systematic cooperation successfully led to capturing a key descriptor for the result: phase transformation of the hexagonal perovskite due to Ni defect.

This study was reviewed by peers as innovative due to the creation of new ways of tuning catalytic activity toward oxygen evolution reaction beyond the state-of-the-art IrO_2 and opening up high-throughput screening of new candidates for any desired functionality via tight collaboration of first principles computational prediction and experimental validation.

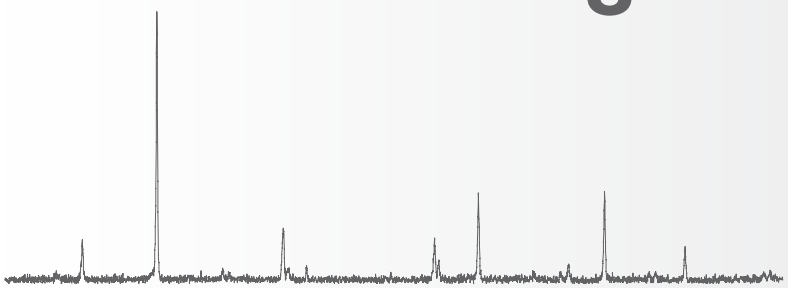
From left, Prof. Yong-gun Shul and Prof. Byungchan Han

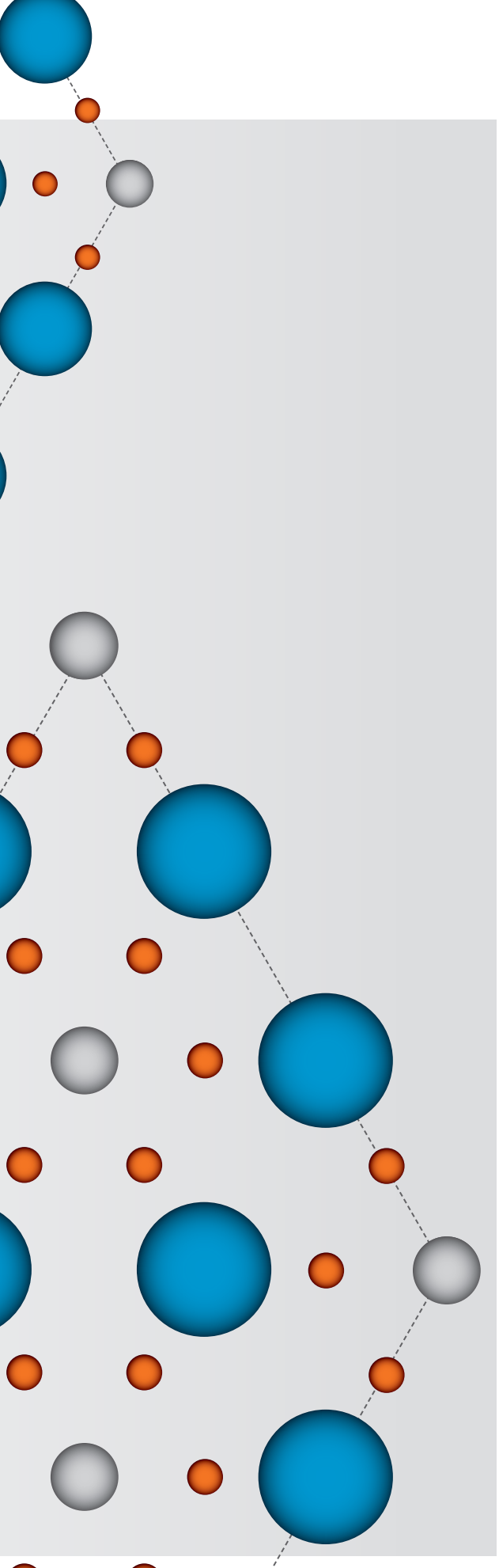
Important Implications for a Sustainable Energy Society



Ni-Ni (5.718 Å) Ni-O (1.897 Å) Ba-Ni (3.518 Å)

$BaNiO_3$





→ *Microsoft Research* has named Yonsei computer scientist, Professor Seungwon Hwang, as one of its Outstanding Collaborators. Marking its twenty-fifth anniversary, *Microsoft Research* selected thirty-two influential researchers from around the globe. Of the three researchers chosen from Asia, Prof. Hwang is the only one from Korea.

Since 2003, Prof. Hwang has collaborated with *Microsoft Research* in the U.S. and China; in particular, she worked with four different teams on big data projects, which resulted in international academic publications with 12 Microsoft researchers. In all, Prof. Hwang has authored over fifty articles in international journals and conferences from these joint projects.

Prof. Hwang's collaborative work with the *Microsoft Research* has also included training and mentoring students at Yonsei. Because of her work, her graduate students have participated in internships at *Microsoft Research* in the U.S. and China, and several of these students have won *Microsoft Research* Asia Fellowships.

Currently, Prof. Hwang has also worked to implement research collaboration in the undergraduate curriculum. To this end, she has developed a curriculum on developing cloud and Operating System (OS), distributing the contents worldwide through open source software.

18

Microsoft

Professor Seungwon Hwang

Selected for 'Outstanding Collaborator Award' from *Microsoft Research*

Yonsei Center for Research Facilities

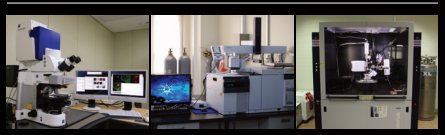
In the era of globalization, the requirements of the facilities for preoccupy the advantageous position in academic research areas are more and more increased. In other words, the facilities and analysis equipment should be provided to achieve a high level of researches. In order to jump up to be a world-class educational · research institution beyond the nation's premier facilities, Yonsei Center for Research Facilities (YCRF) has supported the activation of research and the improvement of facilities in the innovation process of university.

YCRF which retain 50 kinds of the facilities and analysis equipment worth more than 10 billion won is an institution for bio, inorganic, organic, and surface analysis. Experts in the center can provide advanced material analysis for enhancement of research support and cooperation between industry and school.

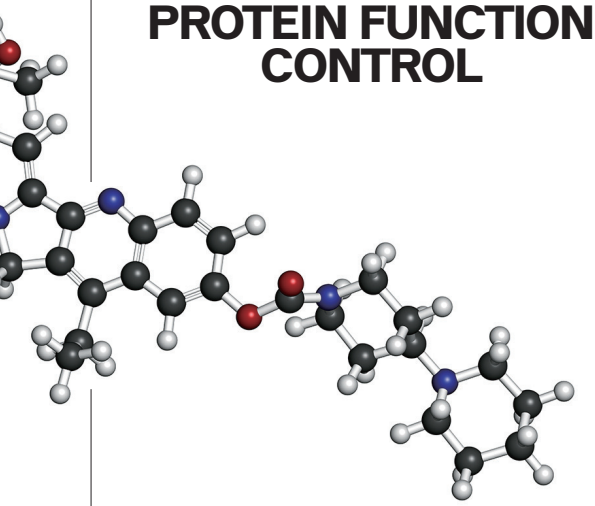
YCRF expects that the designation as Korea Laboratory Accreditation Scheme (KOLAS) by Korea Agency for Technology and Standards will significantly expand analytical capabilities to become a leading center of the world. In this respect, the facilities in YCRF are retained consistently for the purpose of construction of the research infra that offers the most advanced scientific technology research. Moreover, YCRF also have been hold workshops for specific/whole equipments and run the tour through the center.

Based on these total active supports, YCRF possesses capability for the high level of analytical techniques and education especially on the most advanced scientific technology research.

http://ycrf.yonsei.ac.kr



TRANSLATIONAL RESEARCH CENTER FOR PROTEIN FUNCTION CONTROL



→ Translational Research Center for Protein function control (TRCP, Director: Kang Yell Choi) aims to develop protein function controlling bio-materials (PFCMs) which can be developed as drugs for treatment of diseases and improvement of human being's quality of life via translational research. The goals of TRCP center are as follows: 1) to develop mechanism-based protein function-controlling matters which can be used for treatment of diseases and improvement of human being's quality; 2) to establish a system for translational research for rapid and efficient application of basic research to industry; 3) to cultivate well-trained and high quality researchers for translational research related with development of PFCMs.

Since TRCP was opened on September 1, 2009, the research center has consisted of expert members specializing in various fields of biochemistry, cell biology, medicinal chemistry, structural biology, and pharmacology etc., and performed translation research involving development of protein function controlling bio-materials, characterization of functional mechanisms of the protein controlling matters, and output of high quality bio-materials and small molecules that can be practically used in bio-industry by optimization. TRCP has conducted establishment of infra-structural/systems required for the translational research, which is an important content of TRCP, allowing/enabling a more efficient transfer of basic research findings into industrial applications. Based on the establishment of infra-structural/systems, TRCP has evaluated potential industrialization of bio-materials, which are patented or on the way of development, such as anti-cancer, anti-osteoporosis or drugs for skin diseases and hair formation. Consequently, TRCP has produced substantial technology transfer achievements for protein function controlling bio-materials and small molecules to pharmaceutical companies. For the recent 5 years, TRCP members

University (Yonsei)

Basic Research

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Translational Research

Mechanism-based Drug Development

Established High-throughput Screening (HTS) Systems

Translational Research/ Collaborative Work with Industry

↓

Industry

Industrial Application

↓

VISION

Improvement of Human Being's Quality of Life

TRCP

Total Article Publications

(SCI, etc. 2010-2016)
Unit: Case

240

237 — SCI

3 — etc.

Total Patent

(2010-2016)
Unit: Case

223

Applications

159

Registrations

64

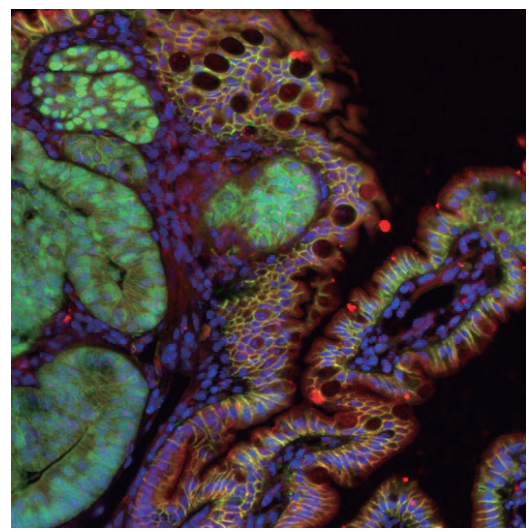
have published more than 200 papers including 40 papers ranked in the top 10% JCR score such as Nat. Chem. Biol., J. Exp Med, JNCI-J. Natl Can Inst., J. Am. Chem. Soc., EMBO Mol. Med, PNAS, Adv. Funct. Met., Adv. Mat., Can. Res., Cell Death and Diff., and Sci. Sig. Etc. TRCP also retains more than 150 patents including pending applications, and transferred 5 items to industry for commercialization.

TRCP actively shares its study and research results by hosting regular academic/industry joint seminars and participating in both national and international conferences. For instance, TRCP and RIKEN (Institute of Physical and Chemical Research, Japan), and collaboration with various outstanding national and international institutes including Nottingham Treat University Cancer Center (England), Stanford University (USA), and Lund University (Sweden) etc.

Through outstanding achievement in basic science and translational researches, TRCP received several outstanding research and development awards by the government; TRCP center was chosen for 'TOP100 National Research and Development Excellence Award' in 2013 and 2014, and 'TOP50 Basic Research Excellence Award' in 2014 funded by the National Research Foundation of Korea (NRF). Moreover, TRCP was selected many follow-up research project awards funded by the government in 2015.

TRCP center is expected to accomplish the objectives; achievement of national competitiveness of economy and national brand image through technology (PFCMs) transfer to the domestic and global pharmaceutical companies; development of TRCP as a Hub-organization for academy-industry collaborations for production of high quality PFCMs which can be used for treatment of patients and improvement of quality of our life; achievement of high national brand image in science by publication of papers in the leading journals for the scientific results acquired through the research and development; education of well-trained and high quality researchers who have overall experiences for the translation research involving the development of drugs/PFCMs.

MORE
http://www.trcp.kr



Recovering Human Dign Eradicating Global Poverty

ity,

INSTITUTE FOR POVERTY ALLEVIATION AND INTERNATIONAL DEVELOPMENT

What We Do

• Academic research, pertinent information exchange, and establishment of cooperative relationships with institutes that work on poverty and international development from around the world

• Development and operation of educational programs and development projects

• Promotion of cultivating and exchanging human resources

VISION

A Regional and Global Leader in Poverty Related Research and Programs Designed to Recover Human Dignity and Eradicate Poverty

MISSION

To Alleviate Global Poverty and Promote Sustainable International Development

→ The Institute for Poverty Alleviation and International Development (IPAID) was established on March 23, 2010 as a university-wide research institution, but its foundational roots are based on the restructured expansion of the Institute of Regional Studies and Development (IRSD), which has been in operation since 1990. The goal of IPAID is to alleviate poverty and promote sustainable international development, particularly in developing and less developed countries, through various domestic and international collaborations and comprehensive research on regional and global poverty reduction around the world.

Approximately 1.7 billion people globally live in absolute poverty meaning they lack the ability to afford basic human necessities such as clean water, safe shelter, food, and clothing.

Definitions of the poverty line may vary considerably among nations, but the common international poverty line is $1.25 per day at 2005 purchasing-power parity.

All United Nations member states and many international organizations have agreed to achieve the Millennium Development Goals (MDGs) and the MDGs include: reducing extreme poverty, reducing child mortality rates, fighting disease epidemics such as AIDS, and developing a global partnership for development. However, progress has been uneven and slow in realizing these objectives, and much more work remains to be done to fully achieve the MDGs before the end of the decade.

Although poverty alleviation is a huge and complex matter, IPAID plans to meet these challenges through the following major activities: (1) research on domestic, regional, and global poverty; (2) domestic and international conferences and meetings for poverty alleviation and sustainable international development; (3) publication of journals on poverty and development in English and Korean; (4) publication of a book series on poverty in English and Korean; (5) circulation of the newsletters; (6) exchanges and collaborations of domestic and international organizations on poverty; (7) building domestic, regional, and global networks; (8) the development and operation of the human resource development programs; (9) the development and operation of the poverty reduction programs; and (10) other related matters.

We are eager to cooperate with domestic, regional, and global partners and look forward to working with you. Many thanks.

IPAID

MORE
http://ipaid.yonsei.ac.kr

IMA

Imagination
+
Technology
+
Future

VISION

Imagine
the Future with
Technology

↓

THE NEO-RENAISSANCE

INSTITUTE OF MEDIA ARTS

→ Founded on May 1, 1998, the Institute of Media Arts (IMA) has become a prominent research hub for Korean film and media in the global era. As the flux of global culture moves further beyond the national, regional, and ethnical boundaries than ever, the IMA has brought together various fields of study from the last decade to explore new possibilities in Humanities, which faces a crisis in the present world of rapidly evolving media. The IMA has taken initiative actions in today's global spirit of "integration of knowledge." Underneath numerous projects during approximately two decades lies the IMA arduous efforts to analyze the cultural aspects of the 21st-centry post-digital era through cross-disciplinary studies in the fields of literature, history, philosophy, aesthetics, media, engineering, design, and science.

Since 2014, the IMA is witnessing a new phase of critical renovation along with the international research project, "Post-Hallyu Korean Cinema." With multiple years' funding from the Yonsei's Research Affairs, the IMA launched its sub-unit, called Center for Korean Visual Culture (KOVIC), and organized an international research team. The project team consists of 13 scholars and 1 research assistant, coming from Yonsei University as well as 7 prominent overseas research universities in Canada, USA, and UK. The purpose of the project is to create the new paradigm for Korean cinema as a global media by establishing an international research consortium with promising scholars over the world, who have dedicated to the studies of Korean culture, film and media, and visual communication. Until now, the KOVIC has served as a central hub for prominent researchers and facilitated intensive collaborations.

Especially, for last two years, the IMA's activities have been very successful and have gone global. It hosted multiple international workshops and conferences at Yonsei University as well as at various research institutes in the world, including Princeton University, Southern California University, and McGill University so on. The IMA has also pursued for dynamic interaction with regional and local agencies of cultural production. For instance, it was last year that the IMA developed a close partnership with the Seoul International Women's Film Festival and agreed on the MOU in order to enhance create a new cultural platform that invites critical dialogues and discussion between scholars, artists, students, and local residents. In 2017, the IMA will continue to broaden its international and domestic networking for the new paradigm of globalizing Korea media and enhance the production of knowledge and leadership.

MORE
http://yonseiima.cafe24.com/en

YONSEI INSTITUTE FOR NORTH KOREAN STUDIES

MISSION

Responding to Academic and Policy Needs Arising from the rapidly Changing Internal and External Conditions for Unification Centered on the Korean Peninsula

→ The Yonsei Institute for North Korean Studies (YINKS) was founded in 1995 as a university research institute, striving to respond to academic and policy needs arising from the fast-changing internal and external conditions for Korean unification.

YINKS has striven to gather resources from various fields including politics, diplomacy, military security, economics, sociology, cultural studies and healthcare, while expanding the scope and depth of research related to Korean unification. In addition to the Interdisciplinary Graduate Program in Korean Unification Studies, YINKS hosts a number of international academic conferences every year and provides forums for Korean and foreign scholars to discuss current issues in relation to the unification of Korea from various perspectives. For instance, YINKS and HSF (Hanns Seidel Foundation Korea) signed a bilateral MOU for collaborative projects aimed at promotion of Korean unification, and a panel of experts on DPRK discussed the situation of the Korean Peninsula after the 7th Congress of the Workers' Party of Korea in political and economic terms on May 30.

In August, in partnership with Mongolia Institute for Strategic Studies, 2016 Korea-Mongolia Strategic Dialogue was held to promote cooperation between Korea and Mongolia for peace and prosperity in Northeast Asia and within the Korea Peninsula. This strategic dialogue introduced a strategic approach aimed at inducing cooperative behavior from neighboring countries, and explored a more diversified approach to the problems within the Korean peninsula. The third Korea-Mongolia Strategic Dialogue is scheduled to be held in 2017.

From September to December, YINKS organized 2016 Korea Global Forum jointly with KANKS (Korean Association for North Korean Studies) and the Ministry of Unification. The forum was held in a series at different location such as in China, Germany, the US, and Seoul. Through these forums, government officials and international scholars presented comprehensive views on peace and unification of the Korean Peninsula and sought solutions for international cooperation to build peace on the Korean Peninsula.

In October, the Korea-China Future Vision Forum was held to discuss the future projections of Korea-China relationships. As one of the few remaining Korea-China conferences under the current condition of strained relation between the two countries, the Korea-China Future Vision Forum will be held again as a 1.5-track conference.

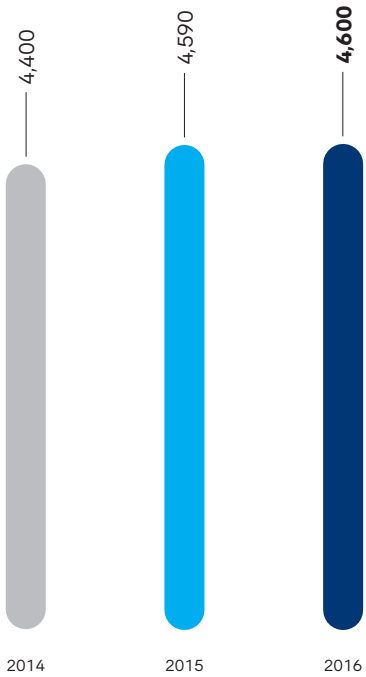
In addition to seminars and forums, the inaugural lecture of the "William J. Perry Lecture Series", which is an annual collaboration of YINKS and PCI (Pacific Century Institute), took place on November 14. YINKS invited Dr. William J. Perry, the 19th US Secretary of Defense, to present his autobiography "At the Nuclear Brink" at Yonsei University. Dr. Perry's lecture provided a great opportunity to look into the solution to the North Korean nuclear problem at this difficult time of a strained inter-Korea relations, owing to his thoughts and experiences on the idea of peace on Northeast Asia. To improve the quality of research on North Korea and to expand academic exchange, YINKS also aims to enhance the publication of nationally and internationally recognized journals: *North Korean Review* (NKR) and *Journal of Territorial and Maritime Studies* (JTMS) which are both English journals, and *Unification Studies*. YINKS has also been publishing various academic journals to provide continuous and multi-faceted research activities to complement the various conference organized in collaboration with other reputable institutes and government organizations. *The North Korean Review* is the only English journal that focuses on North Korea and will be enlisted on SSCI in 2017; *the Journal of Territorial and Maritime Studies*, one of the few journals dealing with marine territorial issues, is receiving academic writings from more than 10 countries; *Unification Studies* has been published for nearly two decades after its initial publication in 1997. *Unification Studies* is a KCI-registered academic journal and is published biannually.

In the midst of a rapidly changing international society, the active role played by YINKS will contribute to promotion of a peaceful unification in the Korean peninsula. In the following year 2017, YINKS is expecting some progress and a more variety of programs, thereby, widening and deepening the discourse of peaceful unification. As in 2016, the Korea-Mongolia Strategic Dialogue and the Korea-China Future Vision Forum will continue. In collaboration with Friedrich-Ebert-Stiftung (FES), YINKS will be holding an international academic conference. With a number of upcoming events, YINKS expects 2017 to become another successful year of academic and policy discussion, which facilitates peace in the Korean Peninsula.

MORE
http://www.yinks.or.kr

Article Publications (SCI, SSCI, A&HCI, etc.)

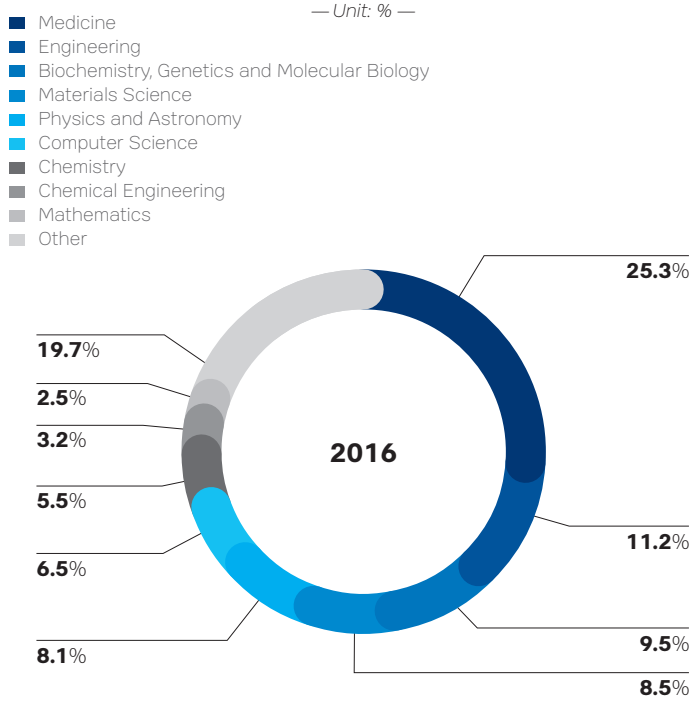
— Unit: Case —



* Source: Scopus (Year range: 2014 to 2016)

Publications by Journal Category (2014-2016)

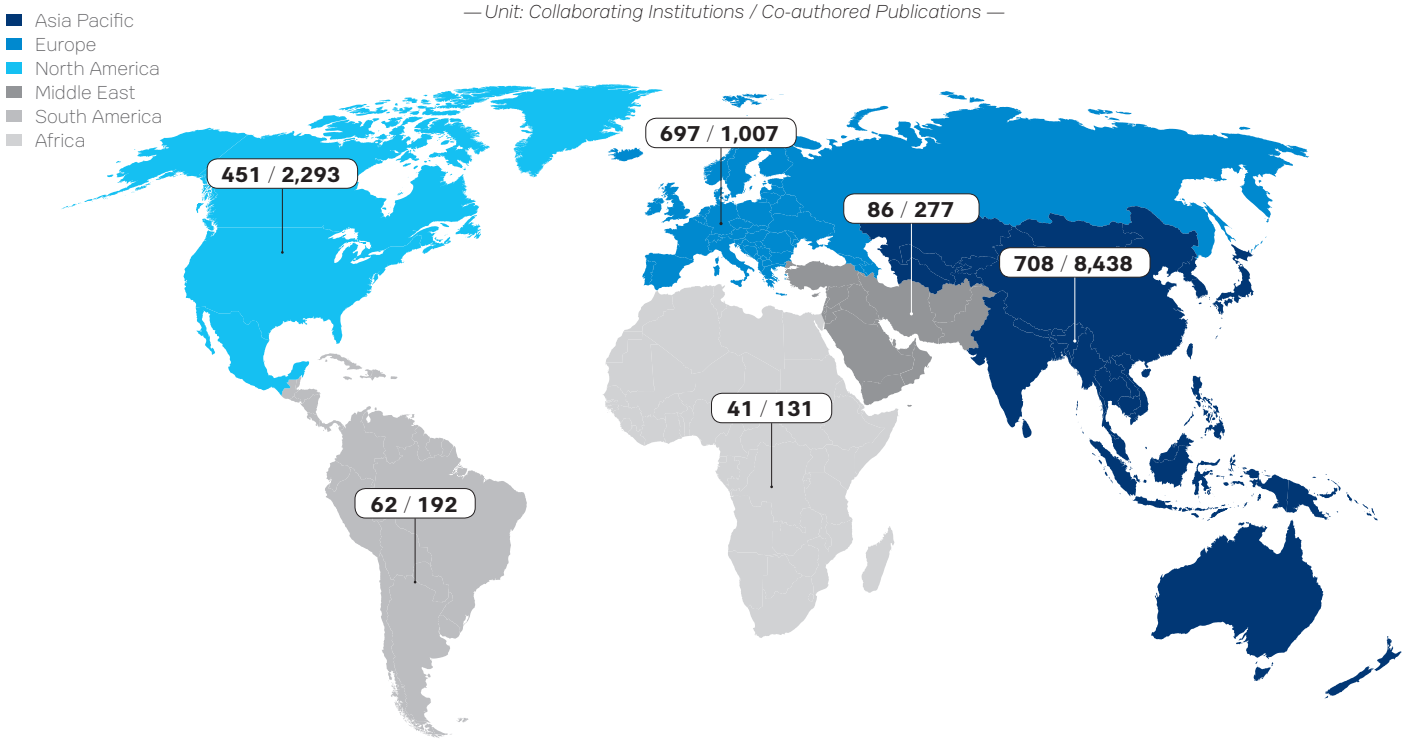
— Unit: % —



* Source: Scopus (Year range: 2014 to 2016)

Institutions Collaborating with Yonsei University

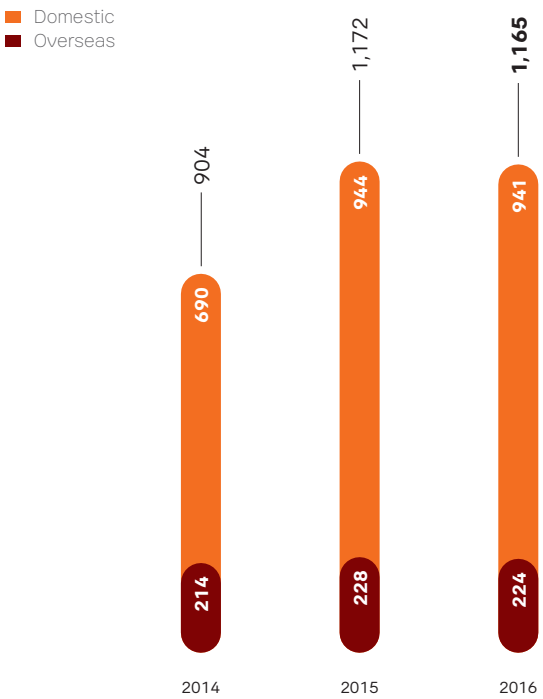
— Unit: Collaborating Institutions / Co-authored Publications —



* Source: Scopus (Year range: 2014 to 2016)

Patent Applications

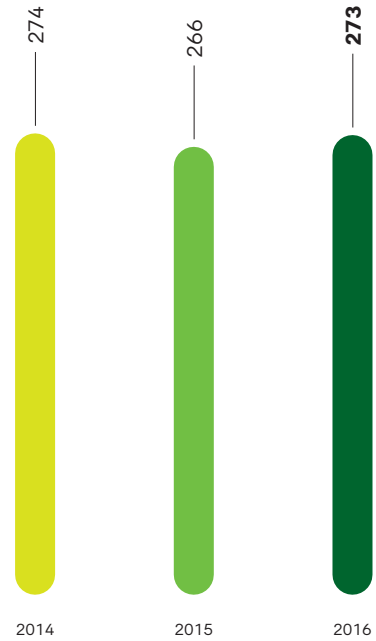
— Unit: Case —



* Source: The Information Service of Higher Education in Korea

Expenditures

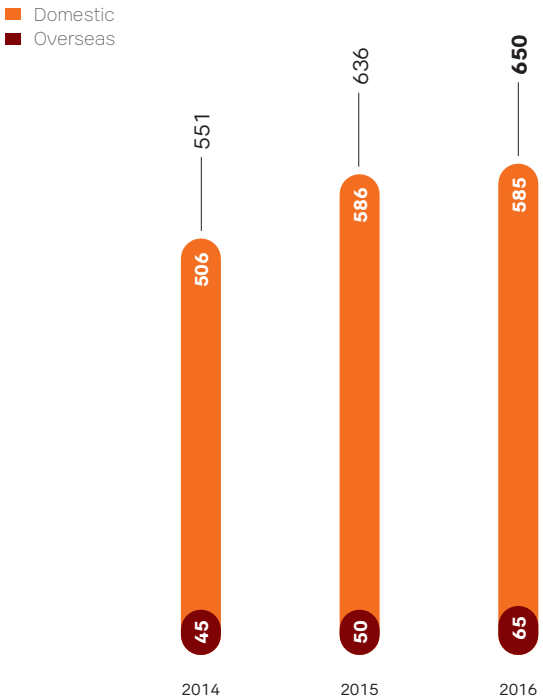
— Unit: million USD —



* Source: The Information Service of Higher Education in Korea

Patent Registrations

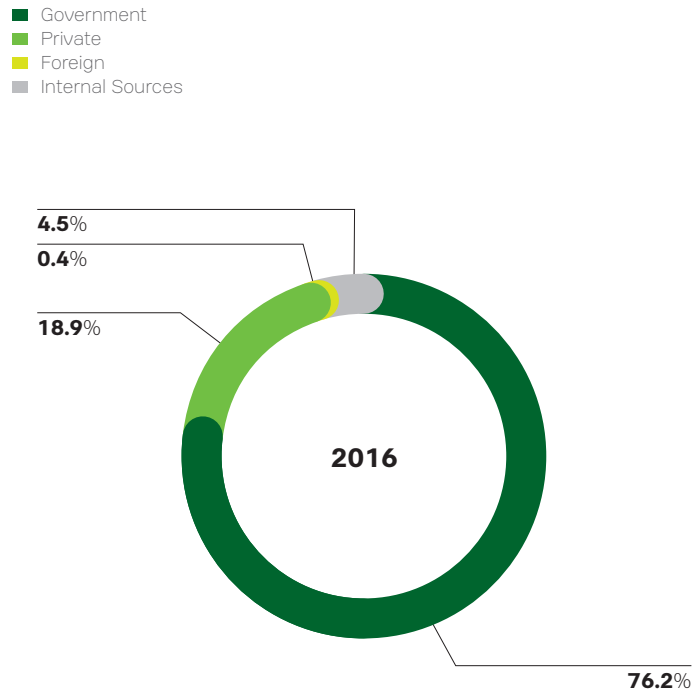
— Unit: Case —



* Source: The Information Service of Higher Education in Korea

Expenditures by Funding Source

— Unit: % —



* Source: The Information Service of Higher Education in Korea

Your Dream of Starting A Venture

YES Foundation will give wings to your dream so that it will fly high.

Yonsei Enterprise Support Foundation (YES Foundation) was started as Yonsei Business Incubation (BI) Center, which was established in March of 1998. The basic functionality of Incubation Center was to support the successful establishment of startups based on creative thinking, innovative ideas, and superior technology. In March of 2011, Yonsei University was selected as the Leading University in Entrepreneurship. As one of the follow-ups Yonsei BI center was promoted to the Yonsei Enterprise Support Foundation. YES Foundation is given a mission of developing the programs with three emphasis on education, consulting, and investment. Our foundation supports upcoming entrepreneurs who utilize superior technology or who demonstrate original ideas by providing them with not only space and equipment to start up their businesses, but also working-level support regarding business management so they can grow into top-tier companies.