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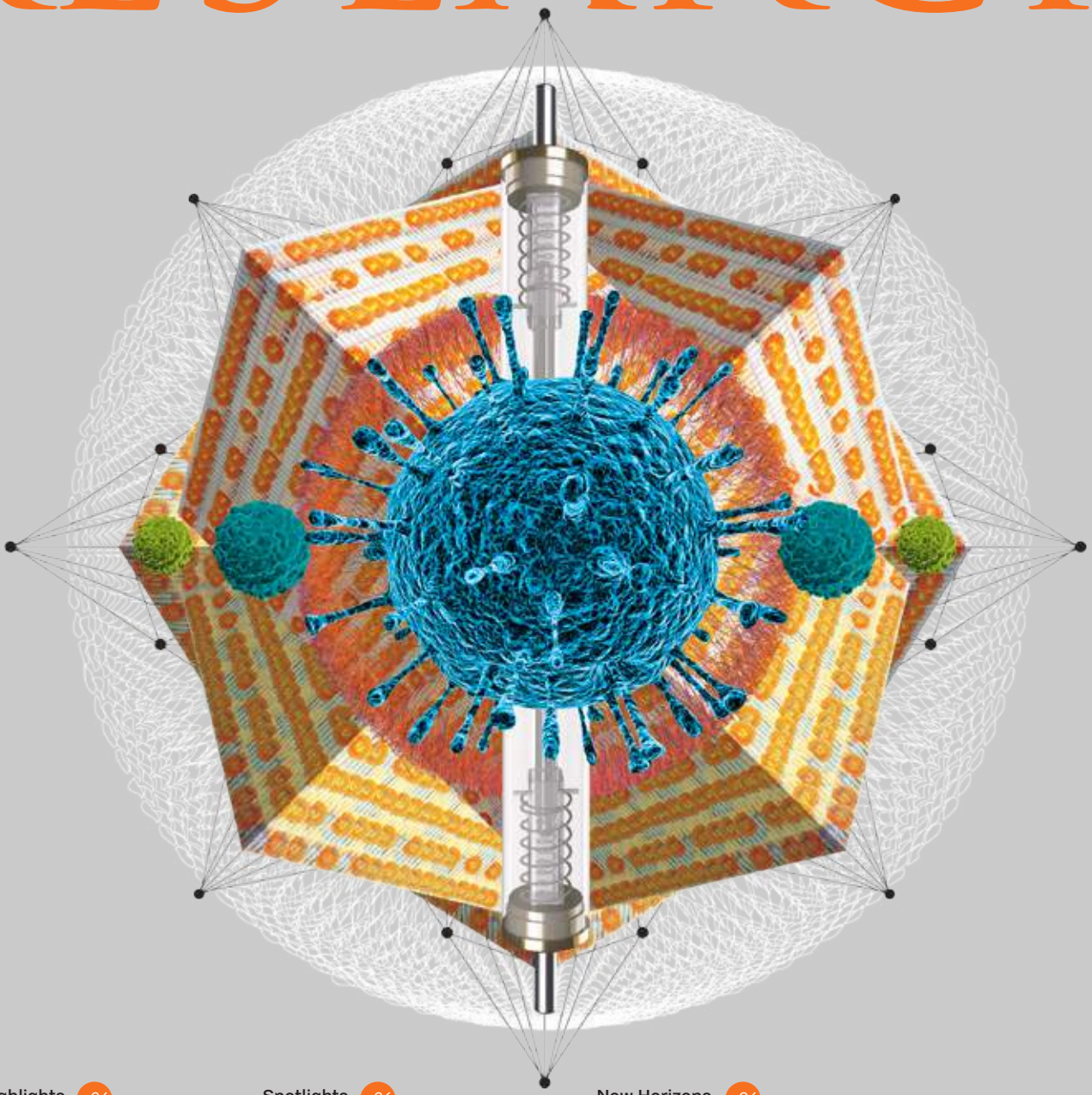

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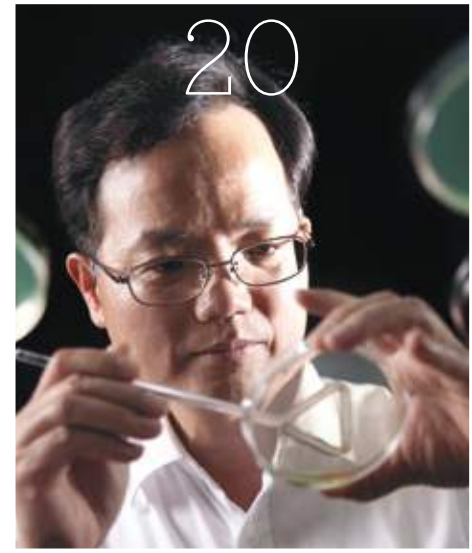
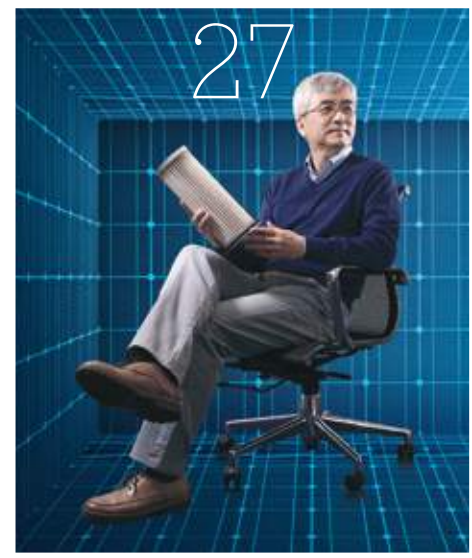




Greetings

I am very pleased to share with you the spirit of innovation and challenge that drives the future-initiative research taking place at Yonsei University. Yonsei's pursuit of the Third Founding continues in 2015 as we celebrate the 130th anniversary of our foundation.

For more than one century, Yonsei University has engaged in research leading to scientific advances, technological innovation, economic development and enhancement of the quality of life. The scope of research at Yonsei University is broad and diverse, including the fields of medicine, biochemistry, human health, engineering, materials science, physics, and neuroscience, not to mention the areas of the humanities and social sciences.

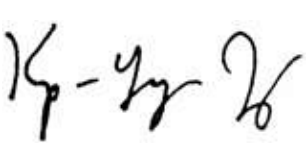
Our faculty, staff, and students are eager to take part in solving the grand challenges that we, mankind, are facing in modern days: water shortages, food security, energy, national security, and health. To solve these grand challenges, Yonsei University has been undertaking future-leading research projects and international cooperative research. These ventures are the largest to date, investing 21 million dollars over the course of five years. In addition, Yonsei provides a vast network to support scholarly collaborations leading to innovative interdisciplinary research.

To further strengthen our research excellence, while establishing leadership in the area of research, Yonsei University facilitates inter-campus and interdisciplinary research. We, at Yonsei, continue to foster interdisciplinary areas such as medicine and biology, combining life sciences, health studies and biomedical engineering, as well as offering support for environmental engineering, modern Korean studies, poverty alleviation and international development.

Based on these policies, Yonsei University is making outstanding research accomplishments. Yonsei's research funds amount to $266 million, and annually achieves roughly 4,400 publications in renowned domestic and international academic journals and 1,170 patents.

Moving forward, Yonsei will expand and develop advanced research areas by identifying and supporting innovative research that contributes to the sustainable future of humanity.

I am enormously proud of the research taking place at Yonsei University. This publication exhibits a mere sampling of the remarkable things happening on Yonsei campus. I invite you to learn more about Yonsei's continuing journey of innovation and challenge through the Yonsei Research Magazine.



Jeong Kap-Young, Ph.D.
President
Yonsei University

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YONSEI'S 130TH ANNIVERSARY CEREMONY

On May 9, Yonsei's official 130th Anniversary Ceremony was held in Baekyang Concert Hall. The ceremony was attended by more than 800 people, and it included a luncheon and reunion event. In his address, Yonsei President Jeong Kap-Young reflected on the vision of the "Third Founding" and the next 100 years of the university, emphasizing that the spirit of Yonsei's founders remains very much alive today. "Yonsei," he said, "should do its utmost to focus on the individual student and raise each one as a future global leader. The expansion of the university and the ongoing infrastructure projects are contributing to this aim." President Jeong reiterated that Yonsei's goal of producing outstanding graduates capable of effecting positive change both locally and globally is being achieved through efforts to increase the university's research and educational capacity.

Yonsei MOOCs

In 2014, for the first time in domestic universities, Yonsei University joined Coursera and FutureLearn at once which are world's largest global MOOC platforms. Through these affiliations, Yonsei has placed itself at the forefront of online higher education in Korea. In 2015, Yonsei Open and Smart Education TF Center opens MOOCs. Through Yonsei MOOCs, user can take 27 courses of 10 universities including Yonsei university for free of charge. (http://www.kmooc.kr) The general public—especially high school students, parents, and Yonsei alumni—will be able to benefit from a number of new and exciting educational opportunities. Yonsei officials see the university's commitment to offering high-standard MOOCs as demonstrating the values of service leadership integral to its "Third Founding."

YONSEI GLOBAL SUMMIT 2015

Liberal Arts for the Asian Century
—
University Leaders from around the World Participate

On October 27, university representatives from throughout the globe gathered in Baekyangnuri Grand Ballroom for the 2015 Yonsei Global Summit. In his opening remarks, Yonsei President Jeong Kap-Young spoke of the important function of higher education in Asia's future: "The university will increasingly play a key role in Asia's sustainable development, and universities should find a way to emphasize the importance of liberal arts in the process." The Yonsei Global Summit was held in conjunction with the university's 130th anniversary and the conclusion of the Baekyang-ro Renovation Project. The summit was intended to share Yonsei's vision for the future with leaders from a number of prestigious global universities, while also promoting cooperation and development in Asian higher education.

President Jeong Kap-Young Speaks at

THE Summit

Discusses International Joint Research and Challenges Confronting Asian Universities

On October 1 and 2, Yonsei President Jeong Kap-Young participated in the 2015 Times Higher Education World Academic Summit in Melbourne, Australia. Sponsored by Times Higher Education and the University of Melbourne, the summit aimed to share knowledge and experience of global higher education, while enhancing networks between universities, industry, and government. There were approximately 300 participants, including leaders from a number of prestigious universities and a handful of Nobel Prize winners. President Jeong spoke on the topic of international joint research, introducing several projects Yonsei researchers have undertaken with counterparts from other universities. He also highlighted Yonsei's efforts to establish joint research funding with Seoul National University and found an international research organization.

17th YONSEI NOBEL FORUM

On May 28, the Seventeenth Yonsei Nobel Forum was held in Severance Hospital's Eunmyung Hall. The theme was "Founding the System of Intracellular Trafficking," and it was supported by the College of Medicine, College of Dentistry, and College of Life Science and Biotechnology. More than 500 professors, researchers, students, and other guests were in attendance.

Yonsei Ranked 98th in 2015 Center for World University Rankings

98

Yonsei has been ranked 98th in the 2015 Center for World University Rankings (CWUR). According to CWUR, Harvard is the world's top university, followed by Stanford, MIT, Cambridge, and Oxford. In Korea, only Seoul National University (24th) and Yonsei were included among the top 100 universities. In last year's CWUR, Yonsei was ranked 107th. In 2014, Yonsei was also ranked among the world's top 100 universities by Times Higher Education (THE).

Yonsei Ranked 36th Most Innovative University in the World by Reuters

7
36

Ranked 7th in Asia, 4th in Korea

Yonsei has been ranked 36th in Reuters' 2015 list of the world's most innovative universities and ranked 7th in Asia, 4th in Korea. Topping the rankings are Stanford, MIT, and Harvard. Of the top 100 universities, half are located in the United States. Japan (9) placed the second most, followed by Korea (8), and France (8). Each institution appearing in the Reuters ranking was evaluated according to several indicators, including scholarly publications and the number of patents registered.

2015 Future-leading Research Initiative

In 2014, 65 projects selected and in 2015, 52 projects added. Yonsei supports 4.2 billion won in total funding.

Research Leaders Program

Challenging Research Program

Problem-solving Convergence Research Program

University-Industry Collaborative Research Program

International Collaborative Research Program

Global Specialization Project

Free Assignment Support Project

Yonsei Technology Holdings Receive Management Awards from Maeil Business Newspaper

Yonsei Technology Holdings was awarded 2015 Best Management prizes by the Maeil Business Newspaper. The award is designed to encourage public institutions and enterprises to find creative solutions for addressing global economic crises. The function of Yonsei Technology Holdings (YTH) is to create profits from intellectual properties resulting from research and development undertaken by Yonsei personnel. YTH also facilitates technology transfers between the university and private companies; in cases where Yonsei researchers have difficulty in transferring their technology, YTH will establish a subsidiary company to assist them. The prize for Win-Win Growth Management was awarded to YTH for the substantial profits it has generated the past several years. In particular, YTH achieved a turnover of 9.4 billion won last year by selling shares in one of its subsidiaries, Raphas, which is commercializing a biodegradable microneedle technology created by Yonsei researchers.

Establishment of Yonsei-Institute for Basic Science

Creation of Center for Nanomedicine Up to 10 Billion Won Pledged for Long-Term Basic Science Research

On April 30, Yonsei signed an MOU with the Institute for Basic Science (IBS) to establish the Yonsei-IBS. The founding mission of IBS is to promote excellence in Korean basic science research; to this end, over the next ten years, IBS has pledged to provide up to 10 billion won in funding and grants for basic science research at Yonsei. The total amount of funding is contingent upon the research achievements made through Yonsei-IBS. The Yonsei-IBS administration will report directly to Yonsei's president, which will help to ensure long-term development and innovation. Yonsei-IBS's first major project is the establishment of the Center for Nanomedicine, which will conduct integrated research in science and medicine. It is expected that the new Yonsei-IBS Building, containing about 3,300m² of office and research space, will be completed next year.

01

Identification of NCOA6 Gene Mutation in Human Dilated Cardiomyopathy

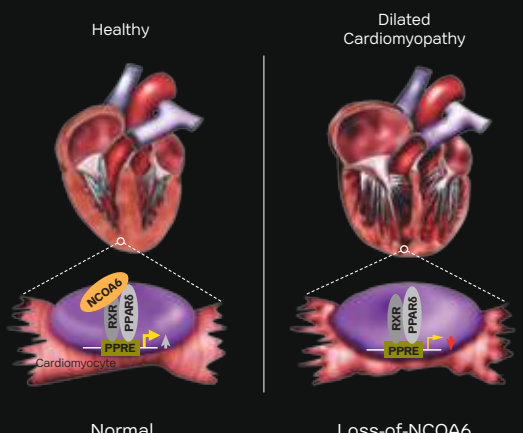
From the top,
Prof. Lee Han-Woong,
Prof. Kang Seok-Min, and
Predoctoral fellow Roh Jae-il

Professor Lee Han-Woong and Kang Seok-Min's Research Team

Discover NCOA6, a Novel Gene for Dilated Cardiomyopathy

→ Dilated cardiomyopathy (DCM), characterized by cardiac enlargement and systolic dysfunction, is the most common form of cardiomyopathy, accounting for up to 30–40% of all heart failure cases. Clinical investigations have shown that approximately 40% of idiopathic DCM patients exhibit the patterns of autosomal-dominant inheritance, implying that genes play an important role in DCM pathogenesis. Recently, correlation between genetic mutations and DCM has been reported, while only few candidates are identified. Depletion of one of nuclear hormone receptor, PPARδ, leads to DCM in mice, however its relevance to human DCM is still unknown. Using two independent mouse models of NCOA6, a PPARδ coactivator, Prof. Lee and Kang's lab revealed that cardiac-specific knockout (cKO) of *Ncoa6* causes DCM in mice, accompanying impaired PPARδ activity in the mouse heart. Ultra-structural examination of the mouse heart showed disarray and functional impairment of mitochondria in the *Ncoa6* cKO mouse. Importantly, by screening of entire NCOA6 coding sequences of the genome, Prof Lee and Kang's lab identified three patient-specific non-synonymous substitutions (G703E, M766L, and T1176A) in 10 out of 50 idiopathic DCM patients. Additional examinations with those mutant forms showed remarkable reduction of PPARδ activity, compared with wild-type NCOA6. These works suggest that malfunction of NCOA6 causes DCM with the relevance to human DCM.

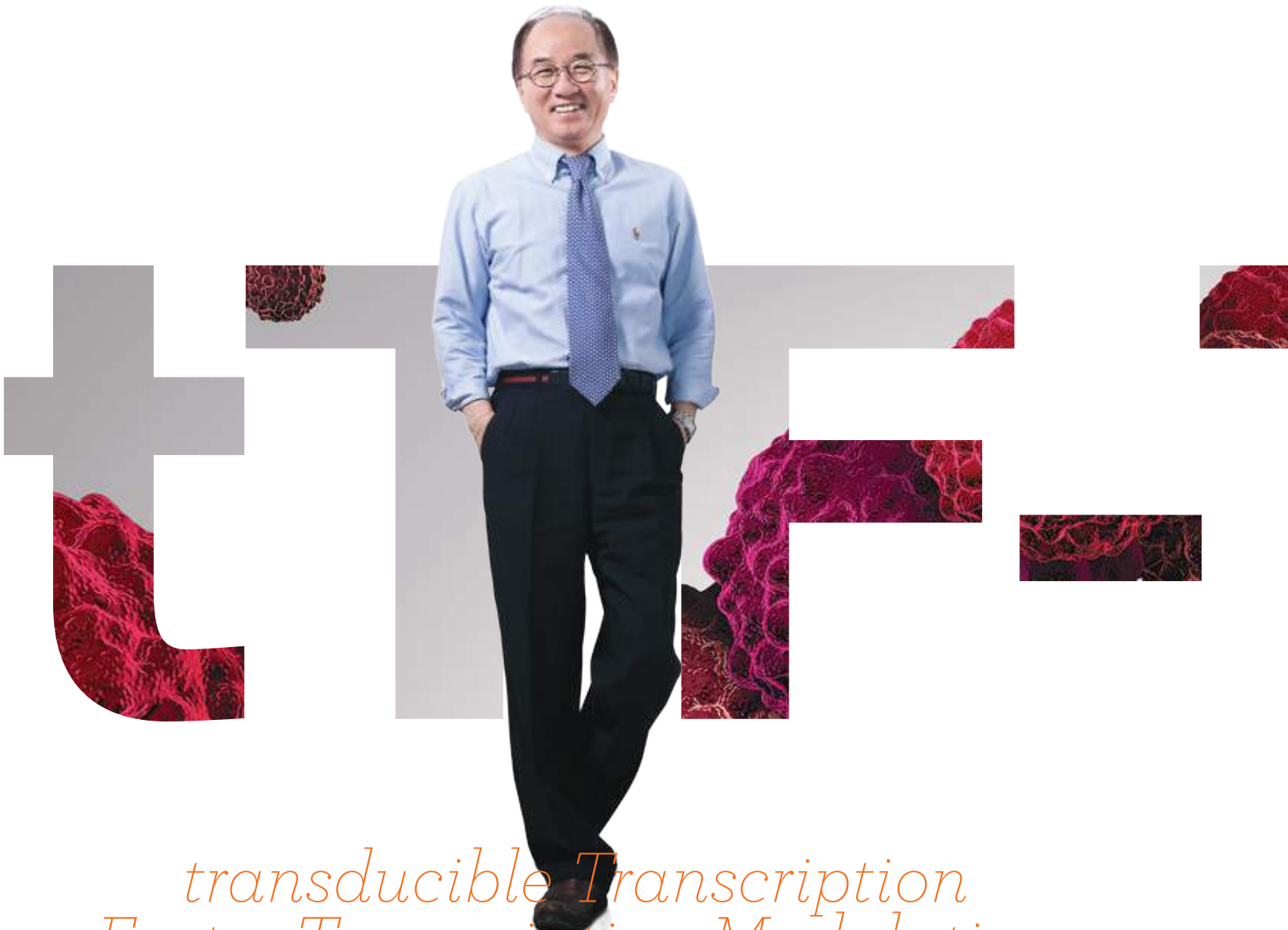
A recent study in mice revealed that NCOA6 promotes ubiquitination-mediated degradation of ERα, while *Ncoa6* deficiency causes ERα accumulation in uterine stromal cells during the pre-implantation period. Consistent with these findings, they observed that the expression of ERα and its target genes were significantly increased in *Ncoa6* cKO mice prior to DCM development. Interestingly, it is common for ERα expression to increase in end-stage DCM patients. Based on these lines of evidence, they hypothesized that the expression and/or function of NCOA6 may be suppressed prior to the onset of DCM, possibly accelerating the progression of the disease. Taken together, Prof. Lee and Kang's findings will manifest stepping forward to screening and diagnosis of human idiopathic DCM. (This work was published in *Cell Reports* in August, 2014)



02

Professor Lee Sang-Kyou's Research Team

Develops Novel Therapeutic Strategy for Treatment of Autoimmune Diseases



transducible Transcription Factor-Transcription Modulation Domain (tTF-TMD)

→ A research team led by Yonsei Biotechnology Prof. Lee Sang-Kyou has developed a novel therapeutic strategy for treating autoimmune diseases like multiple sclerosis and rheumatoid arthritis.

Human body is constantly contacted and influenced by pathogens or danger. When pathogenic infection or dangerous conditions become persistent, inflammatory cells create a microenvironment for the differentiation of naïve T cells (T_0 cells) into T_H1, T_H2, T_H17 or T_{reg} cells. The active T_H cell subsets, after the subsidence of causative pathogens or danger stimuli, attack and destroy the cells and organs of its own body resulting in different types of inflammatory and autoimmune disease in each T cell subset-specific manner. The main driving force for the differentiation from T_H0 into T_H1, T_H2, T_H17 or T_{reg} cells is the activity of specific master transcription factors; T-bet for T_H1, GATA3 for T_H2, RORγt for T_H17 cells, or Foxp3 for T_{reg} cells. Development of cell type-specific therapeutic agents to inhibit differentiation of T_H1, T_H2, T_H17 or Treg cells can reveal promises of alleviating T_H cell-specific autoimmunity.

To modulate autoimmunity associated with each T_H subset, for example T_H17, the intranuclear delivery of the therapeutic protein containing TMD (Transcription Modulation Domain) of T_H17-specific transcription factor (RORγt) would compete with endogenous RORγt for binding to cognate sequences, or displace bound RORγt, leading to the blockage of RORγt-mediated transcription. Our research team designed a novel therapeutics, tRORγt-TMD, to deliver RORγt-TMD efficiently into the nucleus of the cells that regulates T_H17-mediated autoimmune diseases. The squelching activity of tRORγt-TMD on differentiation potential and functions of T_H17 cells, and onset or maintenance of autoimmunity/inflammation associated T_H17 were investigated.

The results were published December 30 in the proceedings of the National Academy of Sciences of the United States of America (PNAS) with the title "RORγt-specific transcriptional interactomic inhibition suppresses autoimmunity associated with T_H17 cells (First author: Dr. Park Tae-Yoon, Corresponding author: Prof. Sang-Kyou Lee)." We demonstrated that interactomic modulation of RORγt functions with tRORγt-TMD can be a therapeutic reagent with the natural specificity for the treatment of inflammatory diseases associated with T_H17 (Multiple Sclerosis and Rheumatoid Arthritis). This novel strategy can be easily applicable to development of a novel therapeutics for the treatment of various diseases, where a specific transcription factor has a key role in pathogenesis.

MS (Multiple Sclerosis)

RA (Rheumatoid Arthritis)

← From left, Prof. Lee Sang-Kyou, Dean of College of Life Science and Biotechnology, and Researcher Dr. Park Tae-Yoon

Professor Jung Hyungil's Research Team

Developed Various Novel Medical Applications for Microneedle which Shows Potential to Replace Hypodermic Injection and a Safer Drug Delivery in Near Future

03

→ Prof. Jung Hyungil's research team are investigating on various dissolving microneedle patch technologies by which delivery of pharmaceuticals and cosmetics has become possible. Dissolving microneedle patches contain micron scale dissolvable needles that are capable of delivering encapsulated compounds into the skin without causing any pain [IMAGE 2]. Therefore, dissolving microneedles are expected to replace the current hypodermic injections in near future. Beside cosmetics and beauty dissolving microneedle patches that are already in the market, Prof. Jung's research team have developed insulin microneedle patches that are capable of delivering the required dosage of insulin to mouse and are currently improving this system for clinical trial tests. Prof. Jung's research team are continuously working on developing limitations of microneedle based delivery system and that makes them as one of the fastest growing dissolving microneedle research groups in the world with various novel researches in this field. Prof. Jung's research team has also developed a patch-less dissolving microneedle shooting system which is capable of inserting microneedles into skin in less than 1 second, without causing any pain [IMAGE 1]. This system could overcome the main limitations of dissolving microneedle patches such as low delivery efficiency and long waiting time.

Additionally, Prof. Jung Hyungil and his research team have been awarded a 2015 New Industry Creative Production Research Project grant by the Ministry of Science, ICT and Future Planning and the Research Results and Practicality Advancement Institute. The grant has been given to support their project to develop a "Development of minimal pain multi-micro lancets for one-touch-smart diagnostic sensor."

Prof. Jung and his fellow researchers will receive a total of 2.06 billion won over two years for research and development. Competition for the grant was very strong; out of a total of 159 research proposals, only seven projects were ultimately chosen to receive funding. The selection committee awarded the grants based upon a project's potential to create new and innovative technology that will be able to benefit the public within two years.

The final product of the team's project will be called the "One Touch Smart Blood Test Diagnosis System." The device will integrate "micro-lancet" technology with a "smart diagnosis sensor" in order to painlessly extract blood samples and quickly diagnose metabolic disorders from them. With the device, blood samples will no longer need to be transported to a laboratory, as the diagnosis sensor will provide almost instantaneous results, meaning that it can easily be used in the field. The risk of infections or other side effects that comes from drawing blood will also be greatly reduced. The team hopes to commercialize the finished device two years from now.

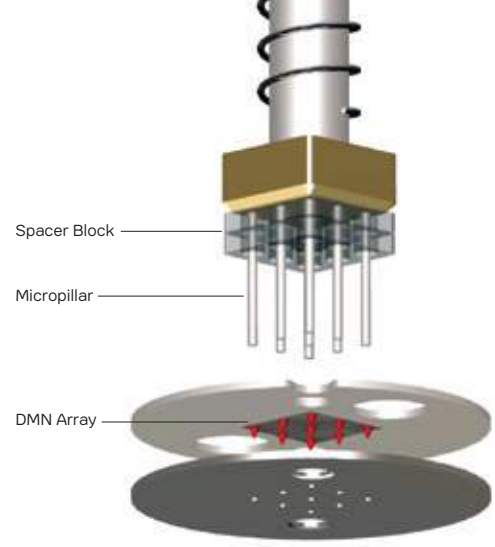


IMAGE 1

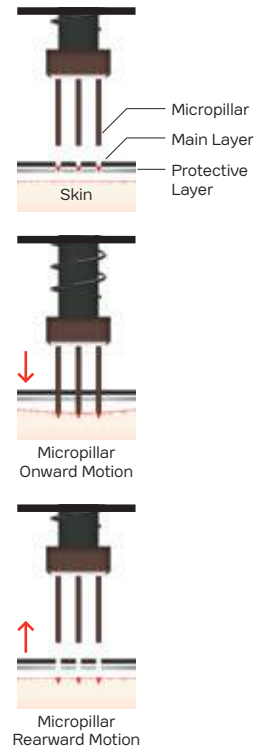
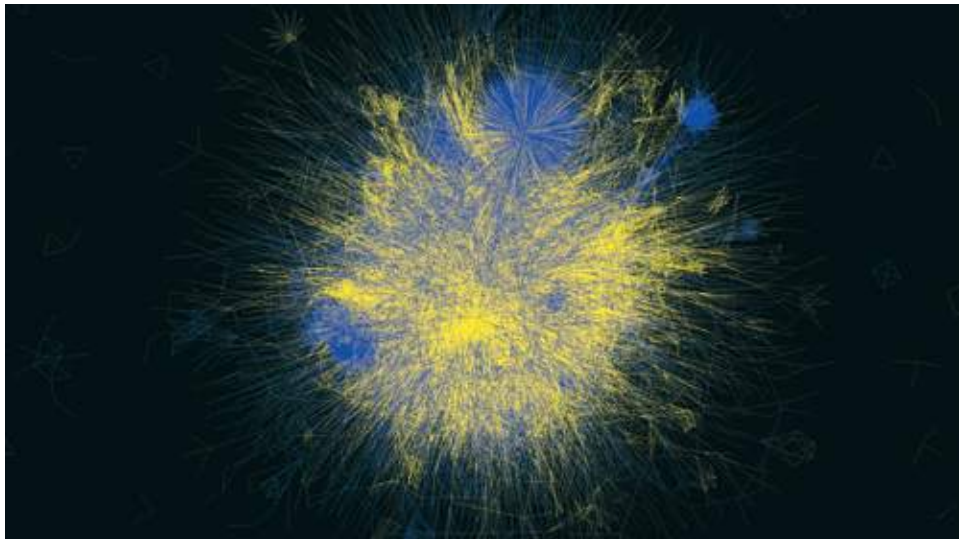


IMAGE 2



Big Data Analysis could Improve Plants for Humanity

→ Yonsei Biotechnology Prof. Lee Insuk and his research team have recently published two articles on crop genetics using network biology approaches.

The first article, "Network-assisted crop systems genetics: network inference and integrative analysis," was published April 1 of 2014 in *Current Opinion in Plant Biology*, a prestigious review journal dedicated to major recent advances in the field. For this issue of the journal, Prof. Lee served as guest editor along with Dr. Todd Mockler from the Danforth Plant Research Center in the United States. Together, they edited sixteen review articles related to the issue's theme, which was "Data-driven approaches to genotype-to-phenotype studies in crops." These articles, which include Prof. Lee's, cover recent advances related to the crop genome project, plant system genomics using next generation sequencing, functional genomics, and bio-information system technology.

The second article, "RiceNet v2: an improved network prioritization server for rice genes," was published March 26 in the online version of *Nucleic Acids Research*, a peer-reviewed journal published by Oxford University Press. Here, Prof. Lee and his coauthors present their updated genome-scale functional network server called RiceNet v2 (www.inetbio.org/ricenet). Rice is the one of four major food crops of the world, and the most food staple in Asian country, including Korea. RiceNet is the largest and accurate network of almost 26,000 rice genes. The network was developed by mining big biological data available from the Internet such as DNA sequence, microarray, and protein-protein interactions. Hence, RiceNet successfully demonstrated the power of data-driven biology which will bring a new paradigm in many fields of life science.

RiceNet server which is located in Yonsei University Sinchon campus provides research service of predicting new functions of rice genes for scientists all over the world through the Internet. His research team also developed human gene networks and pathogenic microbial gene networks for disease research. These gene network systems are also under public service from web servers located in the Yonsei campus. He believes these research servers will be recognized as significant contributions in various field of life science in near future.

04

Professor Lee Insuk's Research Team

Accelerates the Study of Food and Energy Crops Using Data-driven Biology

Professor Kim Tack-Joong and his Research Team

Challenge Commercialization as Anti-muscle Atrophy Technology

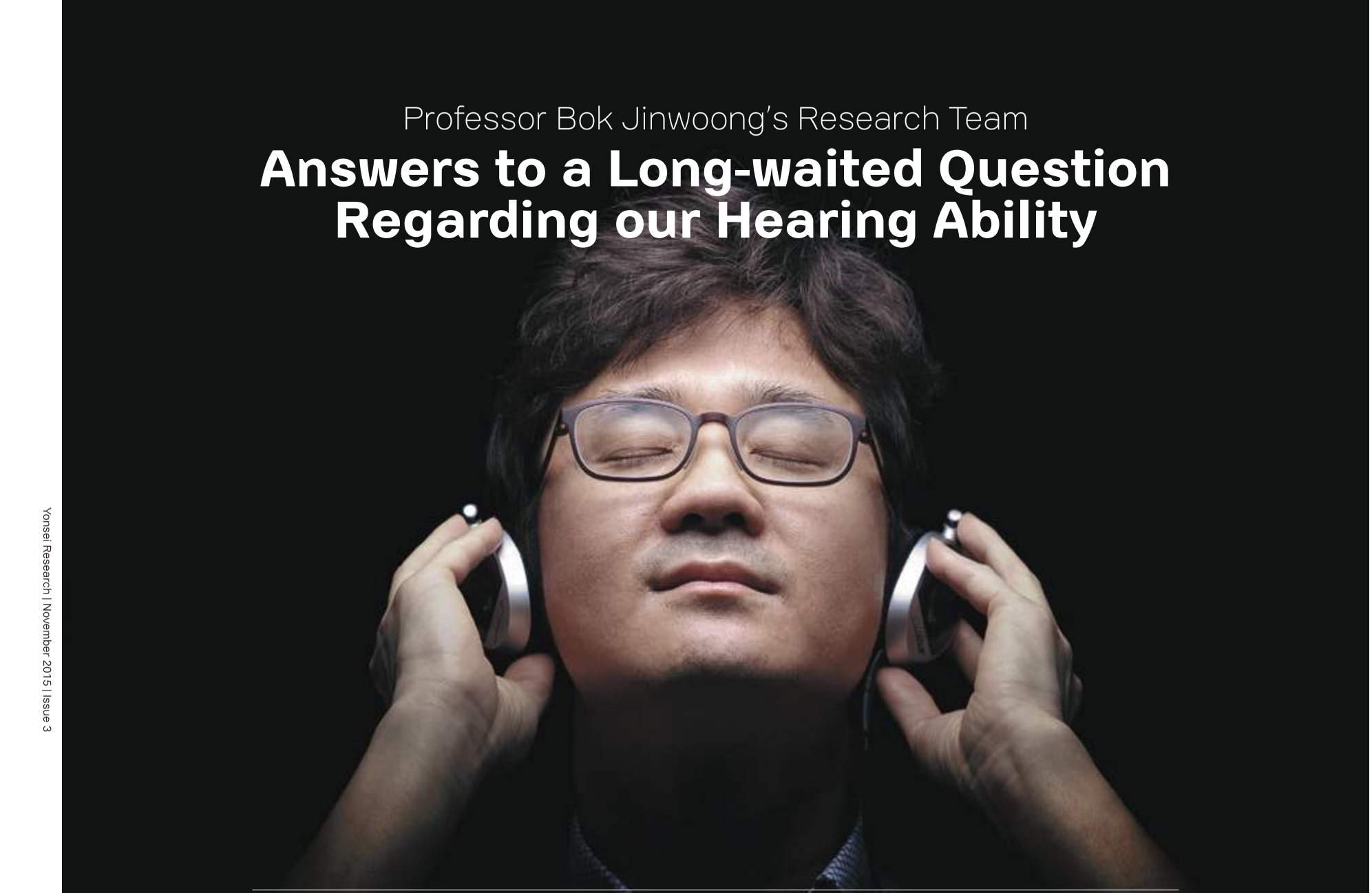
05

→ Prof. Kim Tack-Joong (Division of Biological Sciences and Technology) transferred patents of anti-muscle atrophy technology with YD Global Life Science Company. This contract highlights a novel technology developed by Prof. Kim Tack-Joong and his research team that prevent muscle atrophy and improve symptoms of patients. Through this transferred patent, hundreds of millions (KW: won) of royalty income is expected from licensing fees for the technology and also running royalties from net sales. The technology is particularly relevant for astronauts who must spend extended periods in the International Space Station and during space exploration missions. In these low gravity space environments, heat shock proteins are turned on in the body that can result in rapidly proceeding muscle atrophy. To combat this, Prof. Kim Tack-Joong's research team developed agents that ameliorate muscle atrophy using evening primrose and chicory extract technology. A spin-off of this is that proper commercialization of this product would allow consumers on the ground to utilize the same product that is used in space. Recently, the proposal for commercialization was selected. This is a practical technology that can improve muscle function or prevent muscle atrophy using these extracts. The hope is that this space technology may also be used as a treatment in rehabilitation medicine to combat muscular atrophy problems and disease in patients with these disabilities. However, this technology may even have more general uses. For instance, it can be used as a treatment for the prevention of muscle damage from various exercises such as marathons, soccer and climbing, and musculoskeletal disease for the elderly.

06 | The Ability of the Cochlea to Discriminate Different Sound Frequencies is Established by Hedgehog Signaling

Professor Bok Jinwoong's Research Team

Answers to a Long-waited Question Regarding our Hearing Ability



→ Sound frequency discrimination is crucial for daily activities such as verbal communication and social interactions throughout animal kingdom. This process begins at the auditory peripheral organ, the cochlea, which resides within the inner ear. In 1961, Prof. Georg von Békésy was awarded the Nobel Prize in Physiology or Medicine for one of his findings that high-frequency sounds were perceived near the base of the cochlea and lower frequencies toward the apex. Since then, many graded anatomical and physiological features that facilitate frequency discrimination within the cochlea have been identified. However, the underlying molecular mechanism (s) for establishing this cochlea's special organization, known as the tonotopy (from Greek, tono- = frequency and topos = place), remained largely elusive.

In a recent study published in *PNAS*, Prof. Bok Jinwoong's research team proposed that Sonic hedgehog (Shh), which is one of the key signaling molecules important for animal development and homeostasis, mediates specification of regional identity along the developing cochlea, and this regional identity prefigures the tonotopic organization of the mature cochlea. Prof. Bok's research team also revealed that while the early role of Shh in specifying the regional cochlear identity is conserved in mammals and birds, downstream effectors that play roles in executing the Shh function in the tonotopic organization are diverged between the two species. Prof. Bok noted that this finding answers to a long-waited question of how the cochlea acquires its capability to discriminate different sound frequencies.

07

Investigational Anticancer Drug May Benefit Subgroup of Patients with Head and Neck Cancer

Professor Cho Byoung Chul, Kim Hye Ryun and their Colleagues

Show that Dacomitinib, a Pan-HER Inhibitor, is Active in Patients with Recurrent and/or Metastatic Squamous Cell Carcinoma of Head and Neck

→ Patients with recurrent or metastatic squamous cell carcinoma of the head and neck (SCCHN), the most common form of head and neck cancer, may benefit from treatment with the investigational drug dacomitinib if their cancer has no defects in a cell signaling pathway called the PI3K pathway and no signs of excessive inflammation, according to results of a phase II clinical trial.

"Patients with recurrent and/or metastatic SCCHN have a very poor prognosis. There are few approved therapies for these patients and their median survival is six to nine months," said Cho Byoung Chul, MD, PhD, an associate professor at Yonsei Cancer Center in Seoul, the Republic of Korea. "Our data show that dacomitinib has promising antitumor activity in heavily treated recurrent and/or metastatic SCCHN in patients without PI3K pathway alteration or overexpression of proinflammatory cytokines."

"Our findings obviously need confirming in phase III clinical trials comparing the efficacy of dacomitinib with other palliative chemotherapy," added Dr. Cho. "By using our biomarker data to select those patients who are most likely to benefit from the drug—those without PI3K pathway alteration or overexpression of proinflammatory cytokines—the trial will be more likely to succeed."

Dacomitinib blocks the activity of a protein called epidermal growth factor receptor (EGFR). According to Dr. Cho, the rational for their clinical trial is that most SCCHN have elevated levels of EGFR, which makes it a potential therapeutic target.

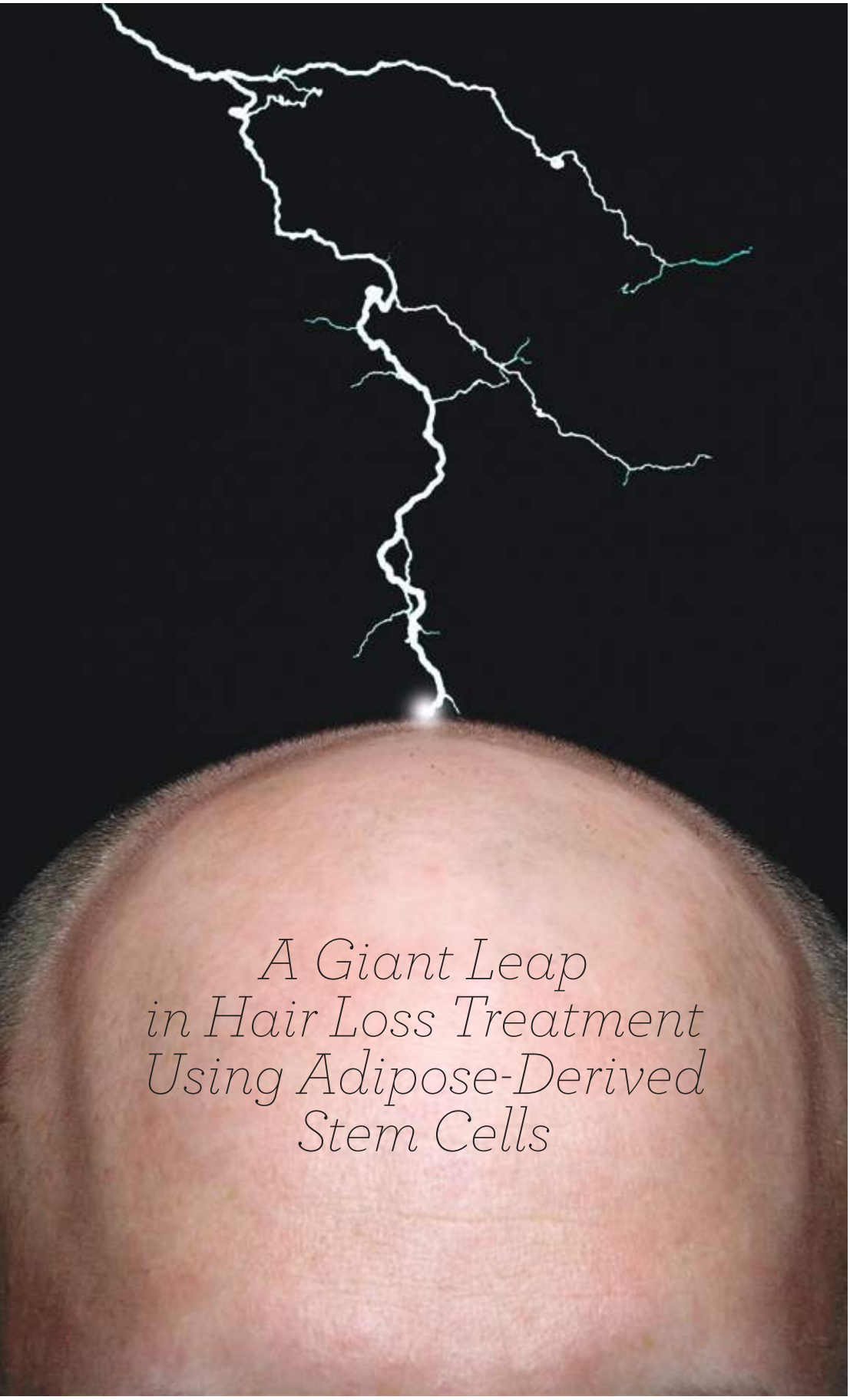
Dr. Cho and colleagues enrolled 48 patients with recurrent and/or metastatic SCCHN in their phase II clinical trial. All patients received oral dacomitinib once a day. Response Evaluation Criteria In Solid Tumors (RECIST) guidelines, version 1.1, were used to assess patients' responses.

Ten patients had a partial response and 31 patients had stable disease. This meant that the overall response rate (ORR), which was the primary endpoint of the study, was 21 percent. In addition, after a median follow-up of 8.4 months, the average time to disease progression was 3.9 months and the average overall survival time was 8.2 months.

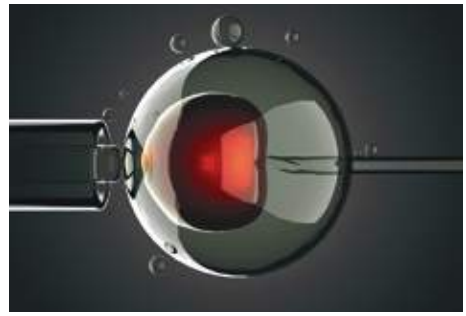
The researchers performed genetic analyses of tumor samples obtained from the patients and identified a number of markers associated with response. Patients with tumors containing mutations in two genes important for the PI3K pathway, PI3K and PTEN, had their disease progress more than twice as quickly as patients with tumors without PI3K and PTEN mutations: Average progression-free survival was 2.5 months and 5.4 months, respectively. For two of the patients with tumors lacking mutations in PI3K and PTEN, the time to disease progression was much longer than the average, 13.1 and 18.9 months.

The researchers also found differences in average progression-free survival between patients with tumors with high and low levels of genes linked to inflammation, including IL6, IL8, PTGS2, and PLA2G2A: Average progression-free survival was 1.9 months and 6.8 months, respectively.

"If our results are confirmed in phase III clinical trials, dacomitinib could provide a new targeted treatment option for a disease for which new therapies are desperately needed," said Dr. Cho. "We are conducting further biomarker analysis to better define patients most likely to respond."



A Giant Leap in Hair Loss Treatment Using Adipose-Derived Stem Cells



→ Prof. Sung Jong-hyuk and his research team, from college of pharmacy, has discovered a promising way to treating hair loss by using adipose-derived stem cells. This would be far reaching consequence both in the stem cell research and in hair regeneration. His research team found that preconditioning of adipose-derived stem cells using PDGF-D enhanced the hair growth more than three times compared with control group. This research was published in the 'Stem Cells' entitled 'Functional regulation of adipose-derived stem cells by PDGF-D'. Recently, his research team also developed a new isolation method of adipose-derived stem cells to enhance the hair regenerative potential. Collectively, these works may lead to new ways of radical cure in female pattern alopecia, and replace hair transplantation to stem cell therapy in the future.

The team is concentrating their energies on the research and make a promise to contribute to nation and Yonsei university. By this chance, Prof. Sung has established a company, Stemore Co. Ltd, with Yonsei Technology Holdings. He will expand his research and start clinical trial in a few years. Stemore Co. Ltd. has research network including Yonsei Institute of Pharmaceutical Science, and will develop new drug for hair loss treatment.

08

Professor Sung Jong-hyuk and his Research Team

Find a Clue to Solve Hair Loss Using Adipose-derived Stem Cells

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HOSTED ICEM 2019

Scene of hosting the International Conference of Emergency Medicine decisions

Professor
Lee, Kang Hyun

Show the Outstanding Leadership in Emergency Medicine

→ Prof. Lee Kang Hyun of Yonsei University, Wonju College of Medicine (Chairman of Board of Directors, Korean Society of Emergency Medicine, and Asian Representative of Board Member of International Federation of Emergency Medicine, IFEM) has succeeded in host the 18th ICEM (International Conference of Emergency Medicine) 2019 in Seoul after participating in IFEM board of directors meeting at Chicago on October 2014. The 2019 ICEM is expected to hold about 4,000 emergency physicians participating from more than 50 countries which will be the one of world's biggest conference. In this year on the 43th national health day (April 7) of Korea, Prof. Lee was awarded with Okjoe-Keonjenog Medal (Honor) which is the national medal of republic Korea.

Prof. Lee has been playing a large role in establishing South Korea's HEMS (helicopter emergency medical services system) by adopting Doctor Helicopter. Also he has played an important role when typhoon Haiyan disaster in Tacloban, Philippine and Sewol Ferry capsized incident happened. He has been acknowledged for his contributions in these disasters and his dedications have been honored and awarded.

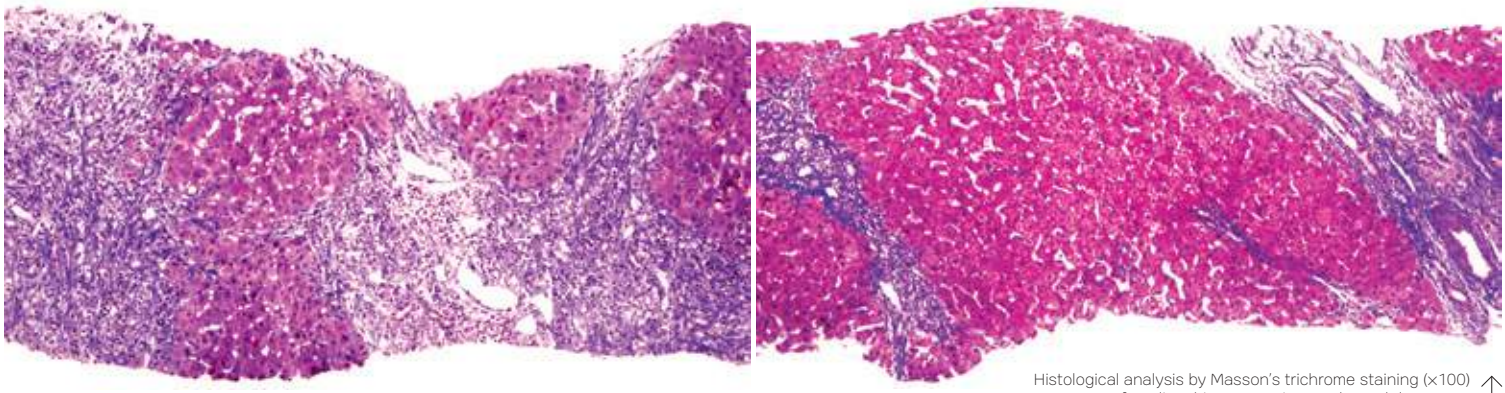
Especially for his contribution of improving the injury prevention and emergency medical services system has decreased the death rate of trauma patients, which has been nation's big problems.

Prof. Lee is working on diverse researches in biomechanics of motor vehicle accidents and EMS system for injury prevention.

IFEM

The International Federation for Emergency Medicine is an international association composed of national emergency medicine organisations that are members of the IFEM as defined by these bylaws. IFEM represents a co-ordinating consortium of these organisations.

Adult Stem Cells for Treatment of Hepatic Fibrosis



Histological analysis by Masson's trichrome staining (×100) from liver biopsy specimens showed decreases in a thickness of fibrosis band as blue from pre- (Left) to post-therapy of stem cell (Right).

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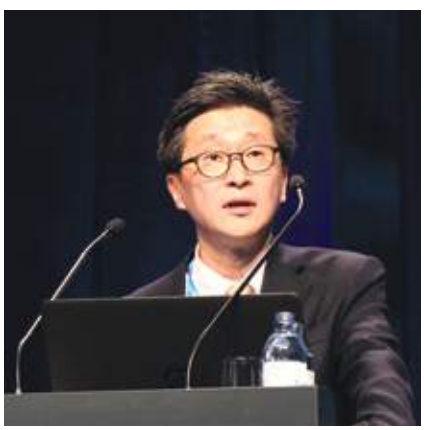
Professor Baik Soon Koo and his Research Team

Find the Potential Use of Mesenchymal Stem Cells in Hepatic Fibrosis



→ Cirrhosis, the end stage of progressive hepatic fibrosis, is characterized by distortion of the hepatic architecture and the formation of regenerative nodules, angiogenesis, and shunt formation, leading to loss of liver function and the development of hepatocellular carcinoma. The main causes of cirrhosis are chronic alcohol abuse, and hepatitis B and C viruses. Alcoholic cirrhosis (AC), one of the major medical complications of alcohol abuse, is a major cause of chronic liver disease worldwide. Currently, the most effective therapy for cirrhosis is a liver transplant. However, this procedure has several limitations, such as lack of donors, surgical complications, immunological rejection, and high medical cost. Consequently, alternative approaches that circumvent the use of the whole organ, such transplantation of cells of various origins, have recently been accepted. For example, stem-cell transplantation has been suggested as an effective alternate therapy for hepatic disease. Among the stem cells, mesenchymal stem cells (MSCs) in particular have practical advantages in regenerative medicine due to their high capability for self-renewal and differentiation without ethical or tumorigenic problems. In our experimental models, BM-MSCs are capable of differentiating into hepatocytes and exhibit antifibrotic effects. However, there have been no reports regarding the effect of autologous BM-MSC therapy on humans with AC. Hence, we performed a pilot study to determine the safety and antifibrosis effect of MSCs on alcohol-related hepatic fibrosis in humans. After autologous BM-MSCs injection, histological improvements were observed in 6 out of 11 patients (54.5%). Moreover, the liver function tests were improved in ten patients (90.9%), and the expressions of fibrosis markers were significantly decreased. More importantly, no significant complications or side effects were observed during this study. These results indicate that BM-MSC therapy has a potential as an antifibrotic treatment in cirrhosis and a bridging therapy for a liver transplantation in advanced cirrhosis with hepatic insufficiency. The obtained results support the approval of this class of agents as a therapy for hepatic fibrosis. Therefore, we have been conducting multicenter large-scaled randomized clinical trial to investigate thoroughly the antifibrotic effect of BM-MSCs on AC as a phase II clinical study in 11 tertiary hospitals since 2013 September. According to the results, BM-MSC therapy may provide a new strategy for antifibrosis therapy of AC.

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Professor Koh Sang Baek's Research Team

Successfully Hosted the Gangwon-do Wide Area Anti-Smoking Center

→ The research team headed by Prof. Koh Sang Baek of Yonsei University Wonju College of Medicine hosted the Wide Area Anti-Smoking Center in Gangwon-do. This project was a part of the national smoking cessation support program and funding support of 2.4 billion KRW for three years by the Ministry of Health and Welfare. Accordingly, the center established a separate office near the main entrance of Wonju Severance Christian Hospital, to provide outreach non-smoking services for smokers within Gangwon-do. This service is comprised of providing professional smoking cessation counseling, along with material support in the form of supplements for smoking cessation. Moreover, the service also includes 1-night, 2-days smoking cessation camp and 4-nights, 5-days intensive smoking cessation camp with professional smoking cessation therapy; both for smokers who wish to quit smoking. It was determined that hosting of the center at this time will provide an excellent opportunity for Yonsei University to not only make a contribution on national public health policy, but also in establishing an academic foundation for tabacco control related studies.

Professor Kim Hee-Joung

Wins the 2015 National Top 100 Excellent Progress in Research

→ Prof. Kim Hee-Joung (Radiological Science & Radiation Convergence engineering) successfully developed a semiconductor-based Spectral-CT and multi-imaging system for low-dose and high-image quality. This newly developed system is based on photon counting, which provides the information of not only the number of photons detected but also the energy for each photon. By using the energy discrimination capability of the photon counting system, image quality, including signal-to-noise ratio (SNR) and contrast can be significantly improved. Additionally, by using this system, multi-energy images can be acquired the acquisition of both low- and high- energy with just one exposure. As these characteristics applied to the material-decomposition technique, we expect not only the low-dose high quality image but also quantitative imaging. Based on this research, the article "Quantitative material decomposition using spectral computed tomography with an energy-resolved photon-counting detector" was published in Physics in Medicine and Biology on August 28, 2014.

Moreover, this project was selected as the 2015 national TOP 100 excellent progress among all national researches and developments funded by government since 2010. By carrying out this large-scale project, this system is expected to improve the image quality and reduce the absorbed dose significantly. Also, it can enhance the accuracy of material decomposition, the quantitation of multi-energy X-ray images, and thereby introduces new applications in imaging areas.

Prof. Kim said that "This research focused on the development of photon counting Spectral-CT techniques, which plays a leading role in development of multi-energy counting fusion imaging system. This project will strengthen the international competitive power in medical/industrial fields using photon counting X-ray, CT, multi-imaging, and contribute to professional manpower cultivation."

12

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

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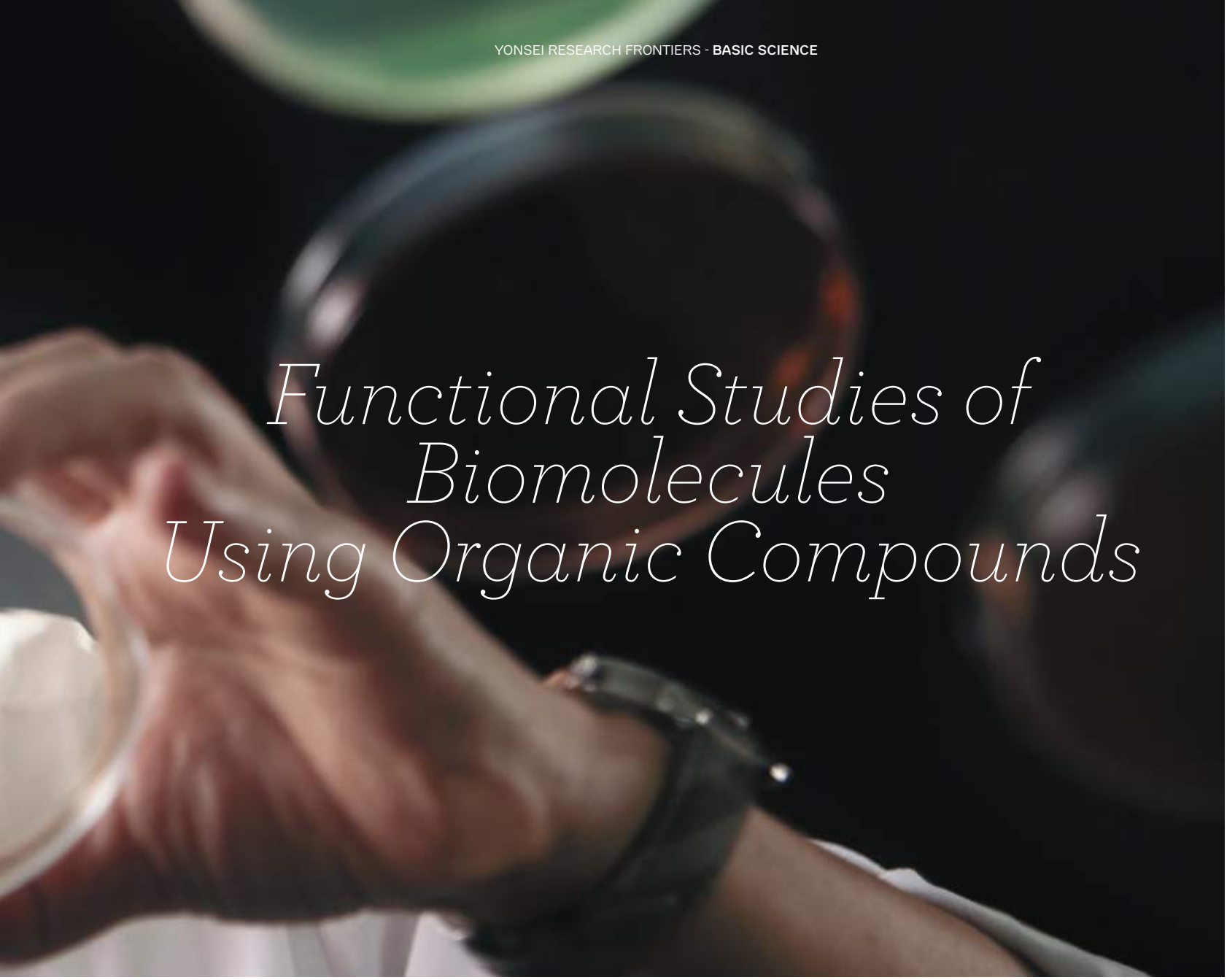
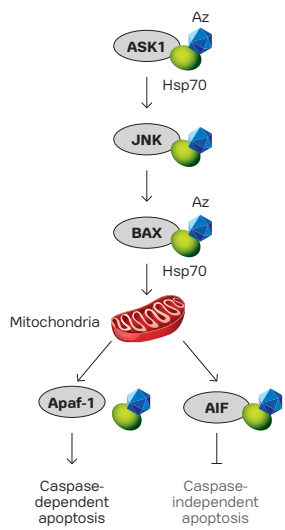
Professor Shin Injae's Research Team

Develops Bioactive Molecules That Regulate Biological Processes



Functional Studies of Biomolecules Using Organic Compounds

→ Prof. Shin has been devoted to the functional studies of proteins and carbohydrates with synthetic organic compounds since 1998 after joining Yonsei University. His research has focused on the following research fields: 1) synthesis of various organic compounds including small molecules, carbohydrates and peptides, 2) the discovery of novel bioactive molecules that regulate functions of proteins in cells, 3) development of microarrays that can be applied to rapid analysis of biomolecule-associated recognition events, and 4) exploitation of disease targeting drug delivery systems. As a result of this effort, his research group has reported the first high-density carbohydrate microarrays (*Angew Chem Int Ed and Nat Protoc*). This microarray has received considerable attention as one of core technologies in functional glycomics. In addition, his group has identified the first small molecule which induces neurogenesis of human muscle cells (*J Am Chem Soc and Nat Protoc*). As part of the research on neurogenesis inducing small molecules, Prof. Shin has opened the new research area termed 'small molecule-based cellular alchemy'. Furthermore, his research group has discovered a novel inhibitor of Hsp70 and Hsc70 which can be used in cancer treatment (*Angew Chem Int Ed*, 2008). In collaboration with Prof. Wan Namkung (Yonsei pharmacy), Prof. Jonathan L. Sessler (the University of Texas at Austin) and Prof. Philip A. Gale (University of Southampton), Prof. Shin's team recently developed synthetic ion transporters that induce apoptosis, the natural process of programmed cell death. This work has published in *Nat Chem* under the title "Synthetic ion transporters can induce apoptosis by facilitating chloride anion transport into cells." As a continuing work, the same research team has exploited more active squaramide-based ion transporters which promote cell death by inducing apoptosis and disrupting autophagy. His final research goal is to develop small molecule-based drug candidates to treat various diseases.



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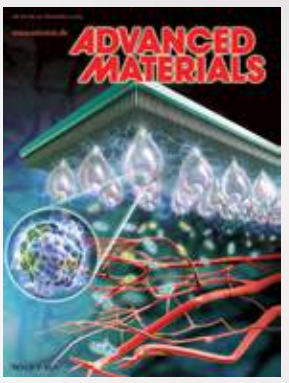
Spheroids Have Great Potential for Cell Regeneration Therapies and Treating Vascular Diseases

Professors Lee Tae-yoon and Cho Seung-woo's Research Team

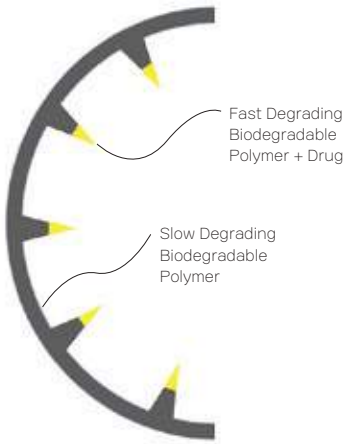
Develops Platform for Mass-Producing 3D Stem Cell Spheroids

→ A Yonsei research team led by Professors Lee Tae-yoon and Cho Seung-woo has developed a new platform for mass-producing three-dimensional (3D) stem cell spheroids. This new technology is expected to have a number of medical applications, particularly in treating vascular diseases and cell regeneration therapies. The 3D stem cell spheroids, which are composed of clusters of more than 1000 single cells, have the potential to promote angiogenesis, the process by which new blood vessels are formed from preexisting vessels. The method created by Professors Lee and Cho for producing functional, high-quality 3D cell spheroids uses super-hydrophobic surfaces, an advance which increases cell-to-cell communication and the efficacy of blood vessel regeneration.

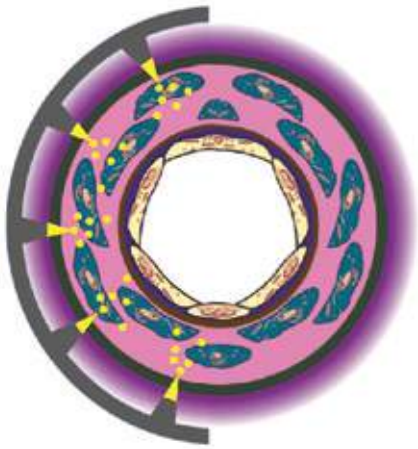
The results of the research were published November 5 as the cover article of Advanced Materials with the title "Switchable Water-Adhesive, Superhydrophobic Palladium-Layered Silicon Nanowires Potentiate the Angiogenic Efficacy of Human Stem Cell Spheroids." According to Professors Lee and Cho, their research "proposes a new method to mass produce 3D cell spheroids, which have great potential for cell therapy and tissue engineering due to their therapeutic and regenerative capacity." They added: "This method may be applied to other kinds of cells and could be utilized in a variety of ways by the biotechnology industry."



←
From left, Prof. Cho Seung-woo and Prof. Lee Tae-yoon

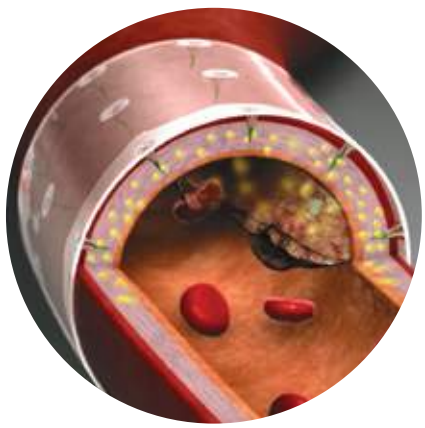


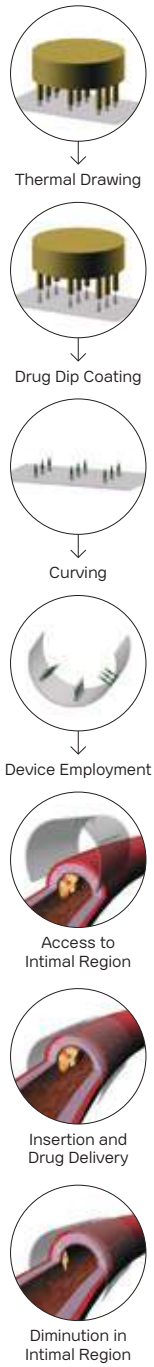
Microneedle Cuff



Microneedle Cuff + Blood Vessels

Microneedles Significantly Enhance Drug Delivery to Vascular Tissue Layers





From left,
Prof. Ryu WonHyoung,
Prof. Youn Young-Nam, and
Predoctoral fellow
Lee Kang Ju

Professors Ryu WonHyoung and Youn Young-Nam's Research Team

Develop Microneedle Cuff Devices for Treating Vascular Diseases

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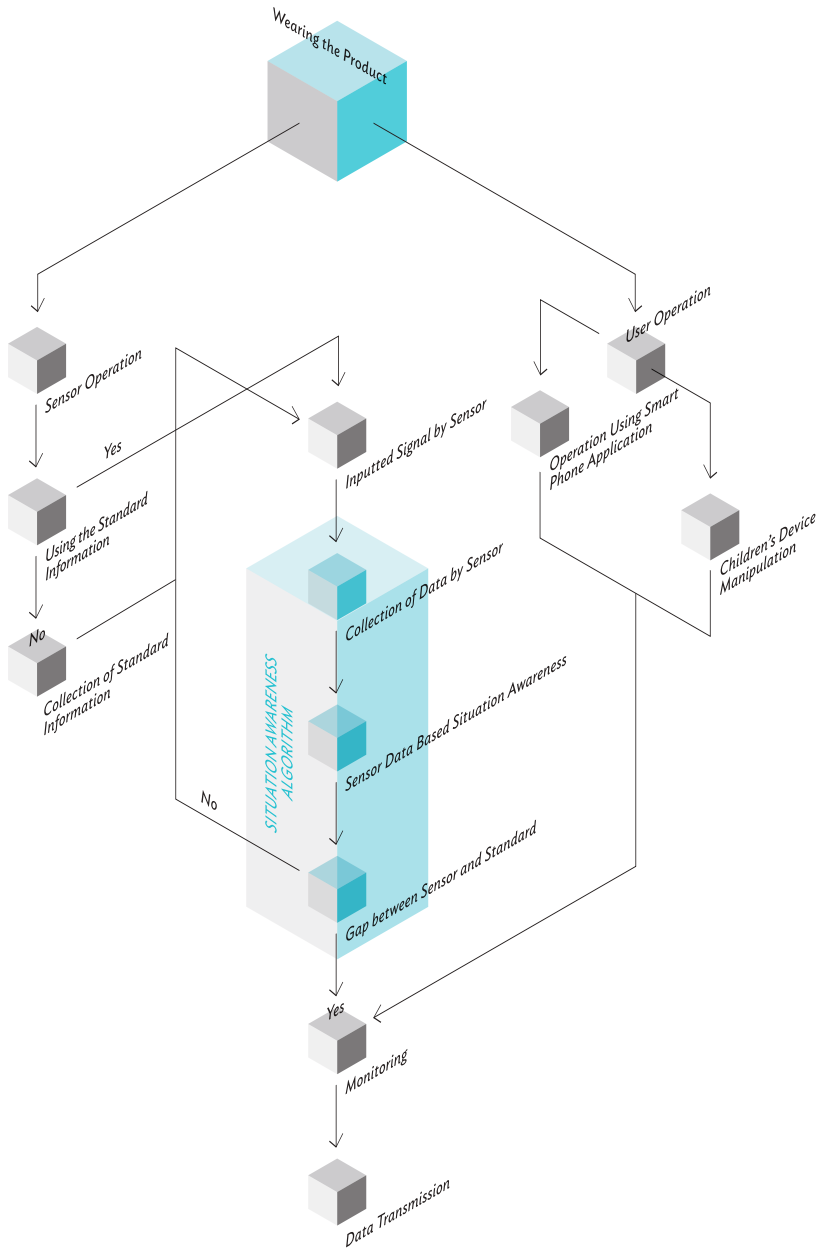
→ A Yonsei research team, led by Prof. Ryu WonHyoung from the School of Mechanical Engineering and Prof. Youn Young-Nam of the College of Medicine, has developed a biodegradable microneedle cuff. Their microneedle cuff, which allows for highly-efficient drug delivery to the tunica media (the middle layer of an artery or vein), is a significant advance over existing vascular drug delivery devices—such as drug eluting stents or balloons—which are used to treat vascular diseases like restenosis (the narrowing of a blood vessel). Since the microneedle cuff is made from biodegradable material, it is absorbed slowly in a body within a few months without need for additional surgery for its removal.

It was the first attempt to use microneedles to deliver therapeutic compounds to vascular tissue layers for enhancement of drug treatment to prevent unwanted restenosis or re-occlusion after bypass grafting surgery. The device showed significantly higher delivery efficiency as well as efficacy in multiple animal studies. The microneedle cuffs can be conveniently applied to the surgical grafting sites and deliver drug at a controlled rate for a few weeks to months.

The results of the research were published July 12, 2014 in the online version of the Journal of Controlled Release under the title "Perivascular biodegradable microneedle cuff for reduction of neointima formation after vascular injury" (the article was published in print form on October 28, 2014).

According to Prof. Ryu: "our new microneedle drug delivery provides a platform for using drugs more effectively and efficiently." He added: "the microneedle device will be further developed in various forms to treat vascular diseases more effectively than ever." Prof. Youn said, "This device will also have a preventive function for the progression of vascular disease and graft stenosis after bypass surgery. In the era of aging society, it could be an innovative treatment for the patients who suffer from atherosclerotic disease". The research team currently continues to improve the microneedle devices that can be employable for diverse surgical situations. The project was supported and funded by the Ministry of Science, ICT and Future Planning and the Ministry of Health and Welfare.

Enhancement of Parent-Child Relationship though Wearable Life-logging Technology



Professor Ji Yong Gu and his Research Team

Develop a New Wearable Device that Records Children's Daily Life

16

→ The research team led by Prof. Ji Yong Gu (Information and Industrial Engineering) is working in the development of "Wearable Life-logging Device" that focuses on enhancing parent-child interaction. Prof. Ji's research team has been at the forefront of Human-Computer Interaction (HCI) in wide range of fields, including: smart home, wearable device, and autonomous vehicle. Through their interdisciplinary research, they are seeking to address fundamental issues about Parent-Child interaction by the development of this new device.

The wearable life-logging device is a daily life product that combines the recently spotlighted technology of IoT and Life-logging, meant to record children's lives in their points of view. The main focuses of this research in technological perspective are the development of sensors that are able to detect the environmental change triggered by children's behavioral change, as well as friendly and familiar looking skin designs that could attract the kids' interest.

The research team said "According to previous studies, repetitive exposure to previous events can enhance significantly on memory recall". Subsequently, the wearable life-logging device can be helpful in improving child's memory and learning ability, and at the same time strengthening the bondage between parents and their child. Thus, this device is expected to have a significant positive effect on children's security issues.

According to Prof. Ji Yong Gu, the research team is currently filing a patent and going a field test when the prototype gets ready. After the field test, the research team will commercialize the product with a private company.

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Prompt and synergistic antibacterial activity of silver nanoparticle-decorated silica hybrid particles on air filteration

Development of Air Filtration System for Clean and Safe Indoor Air Quality (IAQ)

Professor Hwang Jungho and
his Research Group

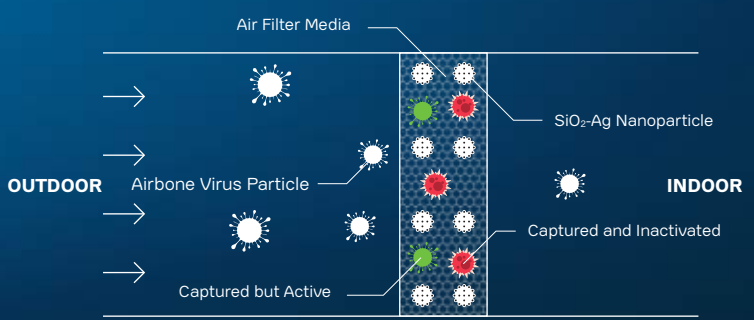
Develop Antimicrobial Particles and Their Application to Air Filtration Systems

→ A research group led by Prof. Hwang Jungho in the Mechanical Engineering department has developed in aerosolizing three different kinds of nanoparticles (NPs) that exhibit strong antimicrobial (antiviral + antibacterial) activities upon contact and applied these NPs to air filtration systems. Because of these NPs' capabilities to inhibit the growth of harmful and pathogenic microorganisms including bacteria, viruses, and fungi, these NPs are expected to have a number of future green environment applications. In particular, air filters can be coated with these NPs to prevent harmful airborne microorganisms from entering into indoors.

First, carbon nanotubes (CNTs) which had the mean diameter of 50 nm and length of 2 μm were aerosolized using an atomizer, delivered to a glass fiber air filter medium by forced convection, and coated on the medium owing to electrical attraction between charged particles and the medium having the opposite charge. During the process, electro-aerodynamic deposition (EAD) technique was used (patented). Second, silver NPs (smaller than 20 nm) were fabricated by spark discharge generation (SDG) system, delivered to a glass fiber air filter medium by forced air flow, and deposited on the medium mainly by Brownian diffusion. Third, silver composited NPs with silica (SiO_2-Ag, 400 nm), of which synthesis technique was developed by Dr. Woo Kyoungja in the Korea Institute of Science and Technology (KIST), were aerosolized using an atomizer, flowed to a glass fiber air filter medium, and deposited on the medium by inertial impaction.

Culture assays, fluorescence microscopy, and electron microscopes have been used to investigate the inactivation efficacies of these NPs to test microorganisms (*E. coli, S. epidermidis*, MS2 bacteriophage virus, etc.) captured to a filter after aerosolization from their stock solutions. As he explained it, the particles function like teeth and bite away at the microorganisms.

In 2014, some of the results appeared as a cover article in Journal of Materials Chemistry B with the title "Prompt and synergistic antibacterial activity of silver nanoparticle-decorated silica hybrid particles on air filtration" and also appeared as an article in Journal of Hazardous Materials with the title "Fabrication of an anti-viral air filter with SiO_2-Ag nanoparticles and performance evaluation in a continuous airflow condition." Prof. Hwang states that his research group constitutes a crucial advance in terms of understanding antimicrobial qualities of Ag and CNT based NPs. It can be expected that in a near future these particles will be commercially applied to air purifiers and air conditioners and eventually prevent severe air infection diseases.



Air Filteration System

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Pioneering the Key Technologies in LCD and OLED Displays

Professor Kim Hyun Jae

Won the 12th Merck Award from International Meeting of Information Display 2015

→ Prof. Kim Hyun Jae won the 12th Merck award from International Meeting of Information Display 2015 (IMID 2015) held in Daegu, Korea on August 20.

Merck, one of the leading companies in OLED, medicine, fine chemicals, and display materials, had selected Prof. Kim for the 12th Merck award winner for his achievements in developing low temperature polycrystalline silicon (LTPS) and oxide thin film transistor (TFT) technologies for flat panel display applications.

The Merck award started in 2004 to commemorate Merck's 100th anniversary of liquid crystal research, and it is given to researchers with significant research achievements in display area. Annually, committees from the Korean Information Display Society (KIDS) select the winner by considering originality and importance of his/her research.

Prof. Kim had received his PhD degree from Columbia University and his research theme was LTPS which is a key technology for crystallization of amorphous silicon films and it enables production of high quality polycrystalline silicon films at low temperatures. After his initial researches on LTPS, many follow-up researches had been conducted, and eventually LTPS was adapted for mass production of backplanes for high resolution displays such as Samsung's Galaxy series and Apple's iPhones. During his PhD years, he had published four papers related to LTPS, and their total citations exceeded 1100 times, setting a milestone in development of LTPS technology. After receiving his PhD degree from Columbia University, he proceeded as a leading engineer in research and development of LTPS TFT during his Samsung Electronics career, and with this achievement he contributed to the initial commercialization of mobile LCD and OLED display products.

After he moved to Yonsei University to become a professor, he has contributed to the development of future display technology by developing a synthesis of In-Ga-Zn-O solution and fabricating solution-processed In-Ga-Zn-O TFT for the first time in the world. Based on these fundamental researches, he has reported numerous research achievements; about 140 international SCI journals, 170 conference papers, 88 domestic patent applications, 50 domestic registered patents, 26 international patent applications, and 10 international registered patents. Furthermore, he has been serving as the head of Yonsei-Samsung display research center in order to construct a strong foundation for vigorous joint research between academy and industry. In recognition of his contribution in both industry and academy, Merck has given him the 12th Merck award.

→ Prof. Sanghoon Lee and his laboratory (Multidimensional Insight Lab, MDI Lab) have published several major journal papers including IEEE JSTSP (Journal of Selected Topic in Signal Processing) and TIP (Transactions on Image Processing). In those papers, they have presented world-wide top-quality evaluation models needed to quantify visual discomfort and perceptual quality based on the human visual system when entertaining 3D visual contents. As an acknowledgement of the contribution, they achieved a Yonsei academic distinguish award in the field of applied science at the 130th the anniversary of Yonsei University's founding. Besides, prof. Lee has chaired the IEEE P3333.1 standard working group while constructing international networking in the area of image signal processing. In this group, he has been leading to setting up new international standardization on quality of experience and visual discomfort measurement on 3D contents. This working group has been established after the PAR (Project Authorization Request) and has been approved by IEEE standardization organization in 2011. Currently, 77 members from 18 countries including England, France and China have been actively participating in this working group. Moreover, in order to keep pace with the industry trend, this working group are working on establishing new standard for the measurement of visual presence when watching UHD (Ultra high Definition) contents. In particular, the first standardization document submitted by the working group has been approved by the IEEE standard organization after a technical review from the IEEE review committee in March, 2015. The standard document will be published in this year and maintained for 10 years the issue date. MDI Lab. is making a sincere effort to target the research direction to leading the recent technology trend in the IT field. Currently, they are researching on the topics of 3D image analysis, quality of experience and 3D avatar generation, and virtual reality authentication.

Professor Lee Sanghoon

Honored by Yonsei Academic Awards in Electric Electronic Engineering Field

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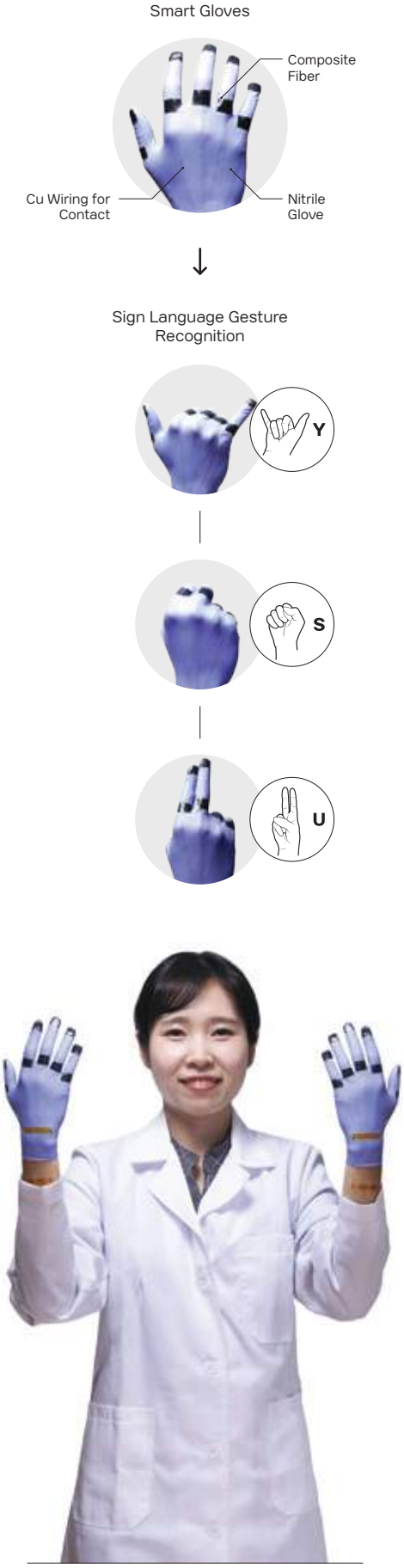


Professor Lee Tae-yoon, Professor Kim DaeEun, and their Research Team

Develop Stretchable Fiber for Use in "Smart Gloves" and Other Wearable Electronic Devices

20

Sensors Embedded in Smart Gloves Capable of Discerning Sign Language

→ A joint research team, led by Yonsei College of Electrical and Electronic Engineering Professors Lee Tae-yoon and Kim DaeEun, has developed a highly-stretchable, conductive fiber capable of detecting sign language when embedded in "smart gloves." This composite fiber, which is made of silver nanowires and nanoparticles in a stretchable polymer, has the potential to be used in a number of wearable and foldable electronic devices to perceive human motions. The stretchable fiber constitutes a significant advance over existing technologies, and because it can be fabricated using a simple wet spinning method, production costs should be relatively low.

The results of the team's research were featured as the cover article in the June 3 issue of Advanced Functional Materials, a top international journal in the field of materials research. The title of the article is "Stretchable Electronics: Ag Nanowire Reinforced Highly Stretchable Conductive Fibers for Wearable Electronics." According to Prof. Lee and Prof. Kim: "We expect this exciting research to contribute greatly to developments not only in wearable 'smart fabrics,' but also in the fields of health care, skin care, and robotics."

← Predoctoral fellow Lee Seulah

Make or Buy

21

Professor Yoon Dae-Hee

Received Yonsei Research Award in Yonsei 130th Anniversary Ceremony

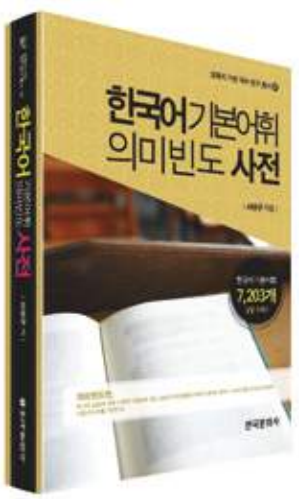
→ Prof. Yoon Dae-Hee (Associate Professor of Accounting, School of Business) received Yonsei Research Award in Yonsei 130th Anniversary Ceremony. His research focuses on the role of accounting information and compensation in balancing conflicts of interest in organizations. The current research topics include strategic delegation based on compensation structure and the effect of corporate disclosure on market competition and supply chain efficiency.

Recently, his research ("Revisiting the Make-or-Buy Decision: Conveying Information by Outsourcing to Rivals" with Anil Arya and Brian Mittendorf) has been featured at the Accounting Review, which is one of the top academic journals in business. The published research paper examines how a firm's outsourcing strategy affects the information transfer between firms. The textbook make-or-buy decision is typically described as choosing the cheaper of the two sourcing options. However, research in accounting has consistently demonstrated that strategic and informational considerations often complicate such seemingly straightforward criteria. In a similar vein, the paper shows that when a firm becomes privy to accounting information pertaining to its profitability, its sourcing choice has powerful informational reverberations. This is because input procurement from an outsider serves to convey both profitability information and strategic positioning. *Conveying profitability information* refers to the fact that the size of the input order provides the supplier a credible signal of the firm's internal accounting information and, thus, its relative ability to compete in the marketplace. *Conveying strategic positioning* refers to the fact that the upfront placement of the input order also informs the supplier about the firm's chosen strategic choices in the marketplace. The research demonstrates that both sources of information conveyance together can point to a firm preferring to buy inputs from a retail rival even when it can make them internally at a lower cost. This penchant for outsourcing to a rival is more pronounced the more accurate the firm's accounting system.

His future research goal is to investigate the role of accounting information in incentive contracting, supply chain management, and market competition.

22

Professor Seo Sang-Kyu's Research Team Publishes the *Dictionary of the Usage Frequency of Basic Korean Vocabulary*

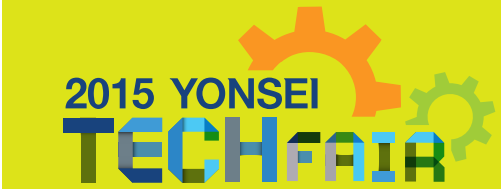


→ Although some words have only one meaning, in most cases, words can have multiple meanings. Polysemy is more prominent in words that are frequently used in everyday life (high usage frequencies). The various meanings of a word can be defined in a dictionary, which allows us to understand them. However, it is difficult to know which meaning is more important or more common. Therefore, when students are learning the meaning of words, it is helpful for teachers to decide on basic educational vocabulary. Basic vocabulary consists of words that naturally have high usage frequencies. These words tend to be polysemic, with a relatively wide scope of meaning. Users need to consider which meaning is most important, or should be learned first, among the multiple meanings of each word in the basic educational vocabulary. Based on an investigation of frequencies in a large-scale corpus, the *Dictionary of the Usage Frequency of Basic Korean Vocabulary* suggests "words that are used with high frequencies and that appear in diverse language resources" and presents quantitative information on the senses of the words to provide an objective evaluation of their degree of importance.

Prof. Seo Sang-Kyu's research team examined the 300 words with the highest frequencies in modern Korean (1998) as indicated by the Yonsei Corpus (approximately 40,000,000) in terms of how many homograph entries and senses were defined for them in the *Yonsei Korean Dictionary* (1998). The results showed that individual words had an average of approximately 1.7 homograph entries of the same part of speech (approximately 3.5 when including different parts of speech) and an average of 7.2 senses. Moreover, an analysis of the entries in the *Dictionary of the Usage Frequency of Basic Korean Vocabulary* (2014) revealed 7,203 homograph entries for the total of 5,162 words, resulting in an average of 1.4 homograph entries per word.

Prof. Seo Sang-Kyu's research team initially obtained three sub-lists with independent characteristics to establish a "basic Korean vocabulary" for the *Dictionary of the Usage Frequency of Basic Korean Vocabulary*. Corpus material (A), a Korean language textbook (B), and a basic vocabulary list of expert or basic vocabulary in learner's dictionaries (C) have different characteristics because they use different objective selection methodologies. The basic vocabulary words from the three sub-lists (approximately 2,000 words) were combined (in other words, A∪B∪C) to formulate the "total basic vocabulary." The words that appeared on all three sub-lists (in other words, A∩B∩C) are referred to as "critically important vocabulary." This vocabulary list is based on the three sub-lists but is further distinguished by introducing quantitative information and utilization concepts related to each item.

Information Extracted from the Corpora is Applicable to Linguistic Education and Research



2015 Yonsei Tech-Fair Held

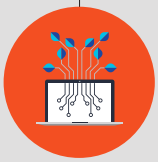
On November 13, the first Yonsei Tech-Fair was held at Baekyangro Grand Ballroom, Yonsei University, to promote research for commercialization and university-industry cooperation.

As a host of the Fair, Yonsei University Technology Holdings exhibited more than 33 prototypes and 68 posters of R&D achievements of Yonsei University. Some items were visualized as a video clip using 3D rendering. There were also several speeches about technology demand, success story and inviting investment by speakers from university and industries.

To celebrate this event, over 300 people participated from companies, other universities, consulting organizations and government, etc. Jeong Kap-Young, president of Yonsei University, also celebrated the Fair and said, "There will be more chance to collaborate between Yonsei University and industries after this Fair and Yonsei University will try to become a leader in technology commercialization of university of Korea."

http://www.ysuholdings.com

→Barun* ICT Research Center is aiming at analyzing and resolving social problems



Digital Divide Research

We conduct an analysis of social phenomena caused by digital divide and suggest alternative ways to resolve. The needs for creative solutions have increased as ICT environments change around the world. We use a diverse methodological toolkit, and develop cutting-edge models to make people understand ICT in the righteous way.

that arise with the spread of ICT, including digital divide, ICT addiction and privacy infringement.

* Barun [*baleun*] is Korean word for righteous or correct.

Barun ICT Research Center

Excessive Consumption of Digital Technologies/ Devices

The rapid development of smart technologies has brought side effects including digital addiction and overusing them. We put out utmost effort on finding countermeasures of digital addiction by formulating theories. It is expected to be used to shape an anticipative policy and good practice on the reinvention and use of ICT.

Barun ICT Research Center investigates the social phenomena driven by digital divide to seek effective measures to bridge the gap; identify psychological causes and problems involved with excessive use of digital technology and devices; and conduct researches to find better ways to protect user privacy and build trust in the IoT environment.

Since Barun ICT Research Center was opened on April 30, 2015, Barun ICT Research Center actively share its study and research results by hosting a regular academic seminar and participating in national and international conferences. For instance, Barun ICT Research Center and NIA (National Information Society Agency) signed the bilateral MOU for cooperating educational and research activities, and a panel of IT experts discussed "What Barun ICT is" on May 29. In July, Lee Suk-Jun, 1st vice-minister of Science, ICT, and Future Planning (MSIP) was invited to present "the Role of ICT in Creative Economy and Preparing the Future" at the Barun ICT research seminar. This Center also invited Oh Hyelim, assistant professor at National University of Singapore, to talk about her research, "Free versus for a Fee: the Impact of Paywell on the Pattern and Effectiveness of Word-of-mouth via Social Media," on July 27. On September 4, Barun ICT Research Center held 2015 ISACA Korea Conference jointly with Information System Audit and Control Association (ISACA) Korea and Graduate School of Information at Yonsei University. In this conference, ICT experts and researchers presented and shared their perspectives and research findings about IoT (Internet of Things) and Cybersecurity. At a conference co-hosted with Korean Information Science Education Federation (KISEF), Jeannette M. Wing, the vice-president of Microsoft Research, presented "Computational Thinking," and this was a great showcase for the future IT education and computer programming.

Barun ICT Research Center is expected to shape into a world-renowned research center by the year 2020 with exceptional strength in mobile communication technologies and will carry out a wide spectrum of mobile-related studies; actively take part in the development of IT solutions and programs; and make efforts to build a healthy ICT culture by participating in the policy-making process. Going forward, Barun ICT Research Center plans to diversify research areas by joining forces with not only the ICT-related organizations in Korea but also prestigious international ICT research centers including Berkman Center for Internet & Society (Harvard University), Oxford Internet Institute (Oxford University) and Center for Research in Electronic Commerce (The University of Texas at Austin).

Information Security and Privacy

Security and privacy are essential for the digital world to continue to serve as a platform for innovation, new sources of economic growth, and social development. We aim to seek solutions out to reinforce protection of private life in an IoT environment, which would establish credibility among ICT users.


World-class Research and
Scientific Innovation
Interdisciplinary Science
Premier Education & Training
Synergistic Teamwork
World's Best Landmark Institute

Y-IBS

Nanoscience and Medicine Convergence to Understand the Utmost Complexity of Biological Systems

BEYOND 1ST CLASS PRIDE

Professor
Cheon Jinwoo
is the Founding Director of Yonsei-Institute for Basic Science (Y-IBS)

→ Prof. Cheon Jinwoo has successfully led the founding of an IBS center at Yonsei University, paving the groundwork for world-class research. IBS is Korea's first dedicated basic science research institute. The institute specializes in long-term projects to achieve the highest quality of research that will generate new high-technology based opportunities for Korea. IBS is headquartered in Daejeon and has branches at several top universities in Korea. It was benchmarked against the Max Planck Institutes, Germany's leading research organization that has a proud history of over 100 years and more than 30 Nobel laureates.

IBS signed a memorandum of understanding with Yonsei University regarding the opening of the research center in December, 2015. Accordingly, Yonsei University established Yonsei-IBS (Y-IBS) institute to deliver innovative basic research in the themes of nanoscience and medicine. The Y-IBS institute or 'Yonsei-IBS Hall', will be housed in the 4,300 square meter on Sinchon Campus and is due to be built by late 2016. It receives annual research funding of approximately 10 million US dollars.

The goal of the Y-IBS institute is to establish a foundation for future-oriented convergence science and to create new science with themes of nanomaterials and biological systems. Nanoscience can provide useful concepts that allows for a fundamental understanding of biological systems such as cellular mechanics, neuronal networks, and signaling cascades. The Y-IBS institute aims to introduce new possibilities to the scientific communities by developing nanomaterials capable of monitoring and understanding biological phenomena with ultimate precision and accuracy. To this end, the institute comprises three research groups specialized in nanomaterials design, nano-bio interfacing, and nano-imaging and nanomedicine. Cooperation among the three teams is expected to lead to innovative, high-performance nanomaterials and nanosystems that can help identify the fundamental principles behind biological phenomena at the single cell level. Some of the long term outcomes will include innovative concepts and tools for ultra-sensitive, high-accuracy, and high-efficiency diagnosis and treatments of diseases. On the basis of interdisciplinary research across chemistry, physics, bioengineering, medicine, the Y-IBS institute will create scientific fields with new paradigms.

→ **Prof. Cheon Jinwoo** received Bachelor's and Master's degrees in Chemistry from Yonsei University in Korea, and a Ph.D. degree from the University of Illinois at Urbana-Champaign in the United States. After working as an assistant and associate professor at KAIST, he is now the Horace G. Underwood Professor at Yonsei University and the IBS director of Center for Nanomedicine. In 2014, he was named the world's most influential scientific minds by Thomson Reuters, with more than one hundred papers published in prestigious journals. The originality and far-reaching implications of his scientific work have been recognized globally. Prof. Cheon was chosen as a Fellow of the American Chemical Society (ACS) and Royal Society of Chemistry (RSC) in recognition of his contribution to the development of nanochemistry and nanomedicine. In addition, he has been Senior Editor for Accounts of Chemical Research (ACR), a leading chemistry journal, since 2009. He has also served as an Editorial Advisory Board Member for Nano Letters (ACS), J. Materials Chemistry (RSC), and Materials Horizons (RSC). He was recently awarded Ho-Am Prize for Science (2015). Other awards and honors include POSCO TJ Park Prize (2012), Inchon Prize (2010), Creative Research Grand Prize (2010), Song-gok Science Award (2007), and Presidential Young Scientist Award (2002).

Song-Dang Institute for Cancer Research, Yonsei Cancer Center and WIN Consortium

Discuss Development of New Drugs for Specialized and Targeted Cancer Treatment

→ On May 15, Dr. Vladimir Lazar, chief operating officer of the WIN (Worldwide Innovative Networking in cancer medicine) Consortium, visited the Song-Dang Institute for Cancer Research to discuss the development of specialized and targeted cancer treatment drugs based on genetics. Headquartered in Paris, the non-profit WIN Consortium was created in 2010 with the leadership of France's Gustave Roussy Institute, where Dr. Lazar is head of the Integrated Biology Platform, and the University of Texas MD Anderson Cancer Center.

According to its website, the WIN Consortium "represents a global collaboration of cancer centers, life science and biotech organizations, pharmaceutical and technology companies, health plans, and patient advocacy groups. These stakeholders have come together from all parts of the world to address the challenge of increasing the efficacy of cancer diagnostics and therapeutics by understanding the genetics and biology of each individual's tumor and accounting for genetic differences across diverse populations—from North and South America, Europe, Asia, and the Middle East." The Yonsei Cancer Center joined the consortium in 2014.

Currently, one the WIN Consortium's projects involves developing new treatment drugs for squamous cell lung cancer. During his visit, Dr. Lazar discussed practical issues related to these clinical trials with professors of Lung Cancer Team at Yonsei Cancer Center. They also discussed current research on many other types of cancers, the development of more efficacious drug evaluation systems, and the transfer of medical technologies. Later, Dr. Lazar was given a tour of several of the specialized clinics that make up the Yonsei Cancer Center.

On the same day, Prof. Rolf A. Stahel, director of the European Society for Medical Oncology, visited Song-Dang Institute for Cancer Research. While there, Prof. Stahel gave a special lecture on "Recent Immunity Treatment in Lung Cancer." He also discussed potential joint clinical research projects with professors of Medical Oncology Department focused on developing new cancer drugs. The two parties plan to continue these discussions at future conferences, in particular the ESMO-Asia Oncology Conference, which will be held in December.

IGS

Institute for Global Sustainability

→ The Institute for Global Sustainability (IGS, Director: Jeong Kap-Young, Deputy Executive Director: Jung Tae Yong) has just recently held its inception on October 22, 2015 at Songdo International Campus in Incheon, Republic of Korea. Although still in its infancy, IGS has already garnered the attention of scholars, academia and policy-makers within the realm of sustainability in Korea and around the world. The recent inauguration invited distinguished guests, from the former Prime Minister Han Seung-soo to our very own Jeong Kap-Young, the president of Yonsei University and the director of IGS, and other distinguished scholars and academia in global sustainability.

Even before the official inauguration, seminars and workshops were regularly held on a monthly basis, inviting key speakers and experts on sustainability from all around the world, such as Japan and Germany. This creation of a vast array of network with experts and policy-makers from different parts of the world provided IGS with the opportunities for knowledge sharing and identifying the global needs for sustainability.

One of the notable and recent seminars held and sponsored by IGS was by none other than the distinguished Dr. Alexander Fisher who is a senior advisor to the German Environmental Ministry, and former Managing Director of the German Institute for Economic Research in Berlin (DIW). One of his significant contributions with the seminar was his enlightening lecture on "Energiewende", or Germany's unique transition into sustainable energy which aspires to promote carbon neutrality.

Our institute is divided into three different centers: the center for international development cooperation; center for water and disaster management; and center for capacity building and education. Research fellows from the centers meet regularly to discuss, deliberate, consult and update on the many ongoing researches from climate change knowledge sharing program to future workshops and collaborations.

Another aim of this institute is to provide a setting and environment for collaboration among and between like-minded institutes and organizations. As such, a special guest speaker, Dr. Yoon Jong-soo, the director of United Nations Office of Sustainable Development (UNOSD) was invited on August 8 to give a lecture on Agenda 2030 – UN's new Sustainable Development Goals – titled "Challenges and Response to Global Sustainability." Our next special lecture was held on November 11, titled "A Global Forecast for the Next Forty Years: Implications for Young Leaders", co-hosted by WWF-Korea and Warm Heart Center inviting Jorgen Randers, Professor of Climate Strategy at the Norwegian Business School and the former deputy director general of WWF International. It was touted as a highly significant seminar that garners interest from students, scholars and fellow professors alike. The aim of this seminar was not just dissemination of information, but also to foster and nurture next generation leaders on sustainability and growth.

With special lectures, collaboration, networking and dissemination of information, IGS aspires to become one of the leading research institutes in the world, and to export Korea's unique case of development and sustainability.

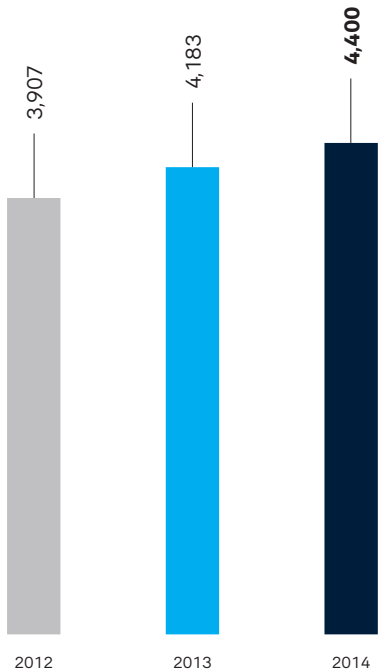
1
The plaque-cutting ceremony of Institute for Global Sustainability by President of Yonsei and the Director of IGS, Jeong Kap-Young and former Prime Minister, Han Seung-soo on October 22, 2015.

2
Dr. Alexander Fisher's lecture on Germany Energy Transition, "Energewende" on September 24, 2015

3
International Seminar on Sustainability on October 22, 2015 at Songdo International Campus

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

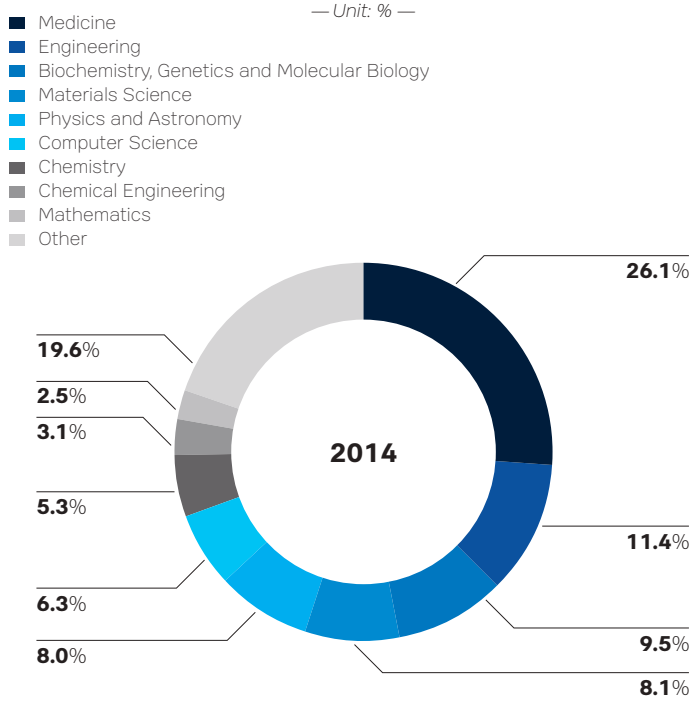
— Unit: Case —



* Source: Scopus (Year range: 2012 to 2014)

Publications by Journal Category (2012-2014)

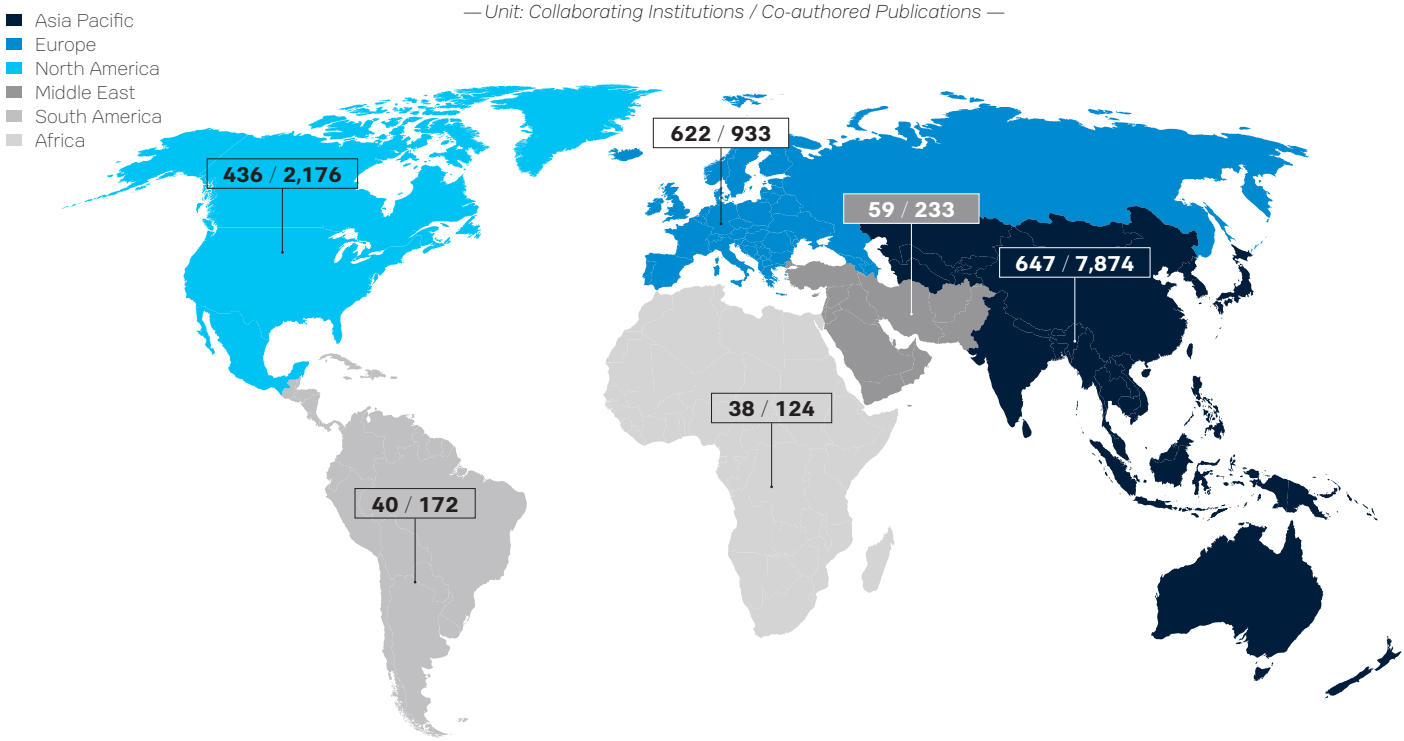
— Unit: % —



* Source: Scopus (Year range: 2012 to 2014)

Institutions Collaborating with Yonsei University

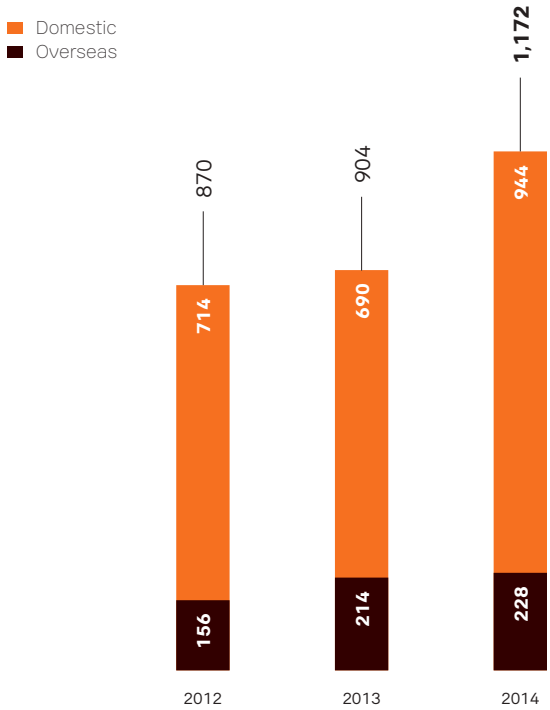
— Unit: Collaborating Institutions / Co-authored Publications —



* Source: Scopus (Year range: 2012 to 2014)

Patent Applications

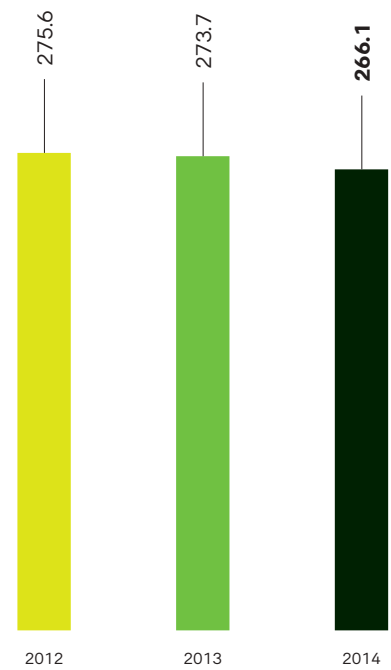
— Unit: Case —



* Source: The Information Service of Higher Education in Korea

Expenditures

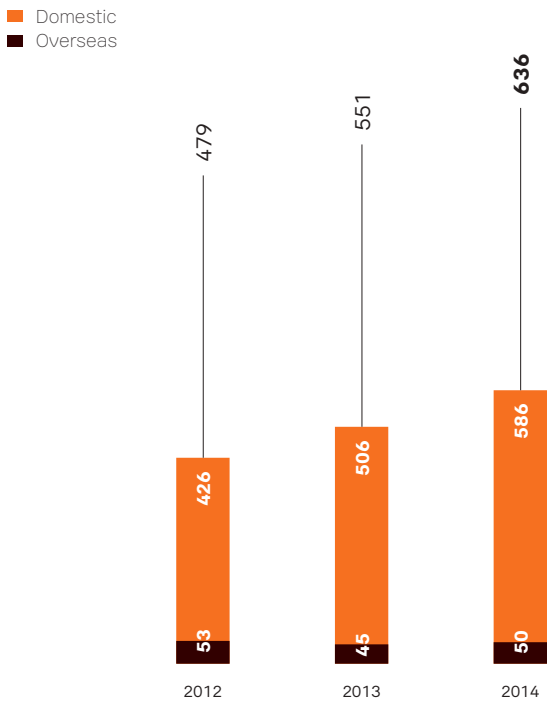
— Unit: million USD —



* Source: The Information Service of Higher Education in Korea

Patent Registrations

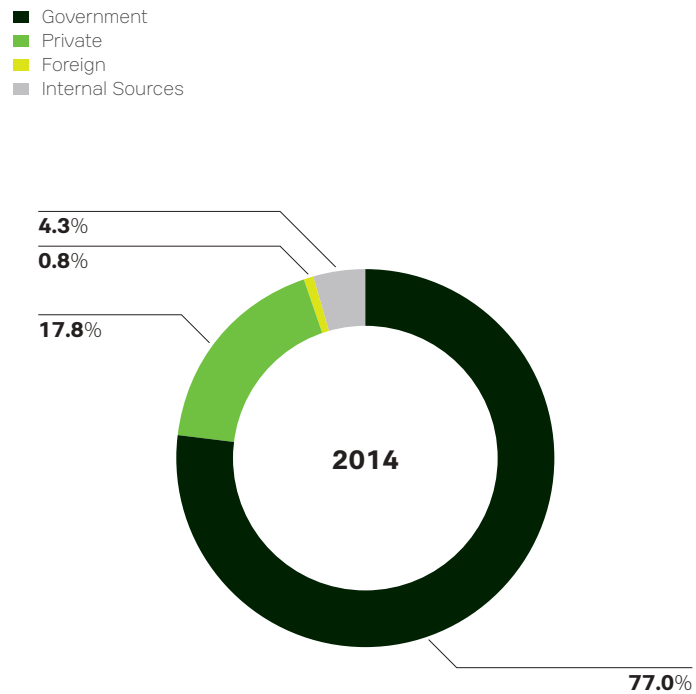
— Unit: Case —



* Source: The Information Service of Higher Education in Korea

Expenditures by Funding Source

— Unit: % —



* Source: The Information Service of Higher Education in Korea

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Best Value Creator
for Early Ideas in the World

Yonsei University
Technology Holdings

Yonsei University Technology Holdings was established in May 2011 to commercialize excellent research results of Yonsei University. After that, through a combination of entrepreneurship and technology licensing services, the Holdings was launched as the first professional and specialized company in technology commercialization of university in Korea. The Holdings is currently managing 12 subsidiaries in 2015 and conducts entire technology commercialization services from technology development to business with various programs. Based on this, the Holdings will achieve two vision of suggestion a success model by creating sound revenue models and contribution to social progress by commercializing our technology.

YONSEI, where we make *history*

YONSEI UNIVERSITY