YONSEI RESEARCH

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PUBLISHER
Yonsei University
50 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea

EDITING
Office of Research Affairs
University-Industry Foundation
Editor: R&D Strategy Team

DESIGN
Let It Flow
T. +82-2-735-0424

CONTACT
T. +82-2-2123-3898
research@yonsei.ac.kr

INTRODUCING THE VALUABLE ACHIEVEMENTS AND SOCIAL CONTRIBUTIONS OF YONSEI RESEARCHERS

GREETINGS FROM THE PRESIDENT

I am delighted to release the sixth issue of Yonsei Research Magazine, which introduces Yonsei University's outstanding researchers and their achievements to the world.

When it comes to the challenge of changing the paradigm of global collaborative and converged research, Korean universities are no exception to the COVID-19 pandemic that has taken the world by storm and has left universities worldwide in a state of confusion. Yonsei University is responding to this challenge by writing a new chapter in convergence research by new modes of communication and sharing ideas among its constituents while maintaining its research focus. In 2021, we focused on strengthening the capacities of our research teams through the Yonsei signature research cluster program, clustering, and concentrating their research capabilities to develop them as global leaders in their fields.

Yonsei's research community continues to expand. During the pandemic, the Yonsei Frontier Lab expanded its role as a research collaboration hub between Yonsei and the world's researchers, resulting in a significant increase in video conferences and webinars with international institutions. As a result, the percentage of international collaboration in Yonsei University's research projects increased by 40%, the highest among Korean universities.
Further, the consistent support for research capacity development is bearing fruit. Yonsei has taken 450 billion KRW (380 million USD) in R&D projects and owns about 4,500 valid patents registered domestically and/or internationally as of 2020. Yonsei's faculty and research teams have published more than 7,000 high-impact findings in prestigious journals. We have also established the Graduate School of Artificial Intelligence to pioneer cutting-edge research for the future, won the bid to host K-NIBRT on our campus to train the world's best bioprocessing researchers, and are pursuing the goal of becoming the third location outside of the United States, after Germany and Japan, to host an IBM quantum computing data center, all as part of our ongoing effort to enrich Yonsei's research ecosystem.

It gives me immense pleasure to introduce the significant achievements and social contributions of Yonsei researchers through the Yonsei Research Magazine. I hope that the high-impact research achievements highlighted in the magazine will inspire even more researchers worldwide.
Thank you so much.

Seoung Hwan Suh
19th President of Yonsei University

YONSEI HISTORY

Yonsei University was founded in 1885 by visionaries who recognized the value of education that transcends racial and national boundaries.
The pure passion and dedication of Yonsei's founders to nurture future leaders in the service of humanity live on to this day.
Over the past 137 years, approximately 350,000 people have earned a degree at Yonsei University, contributing
to the development of society in the spirit of truth and freedom.

1885. 04
Gwanghyewon, Korea's first modern hospital, is founded as a royal hospital.

1886.03
Chejungwon opens as the first medical school in Korea.

1904 .09
Through a donation from Mr. L. H. Severance, the hospital is reconstructed, and the medical college is finalized.

1917. 04
Chosun Christian College is accredited as Yonhi College, a private institution. Humanities, Mathematics and Physics, Business, Agriculture and Theology are newly accredited.

1957. 01
Yonhi University and Severance Medical College merge to become Yonsei University.

1959. 04
Korean Language Institute is established.

1978. 10
Wonju Campus (College of Health Science) is established.

1985. 05
Yonsei University celebrates its 100th anniversary.

2007. 03
Wonju Campus starts the first residential college in Korea.

2010. 03
International Campus officially opens.

2011. 03
Residential College(RC) education begins at the international campus.

2014. 04
Yonsei Cancer Center is opened.

2017. 09
Institute for Global Engagement & Empowerment (IGEE) is founded.

2019. 04
Yonsei ranks 1st in Times Higher Education (THE) University Impact Rankings 2019 (SDG#9 : Industry, Innovation, and Infrastructure).

2021. 06
Yonsei ranks 79th in QS World University Rankings 2021.

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

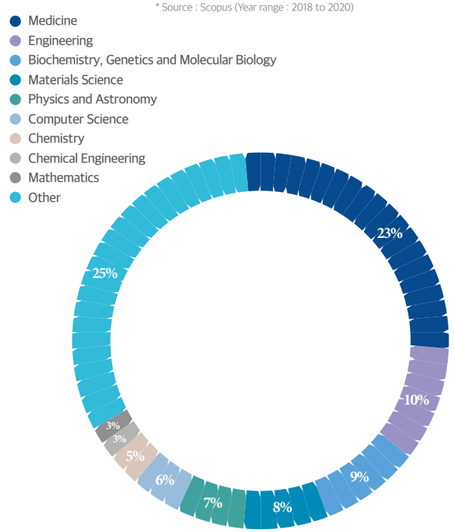
(Unit : Case)

* Source : Scopus (Year range : 2018 to 2020)

Publication by Journal Category(2018-2020)

(Unit : %)

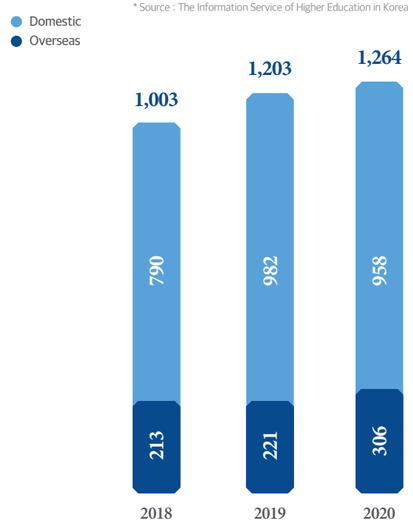
* Source : Scopus (Year range : 2018 to 2020)



Patent Applications

(Unit : Case)

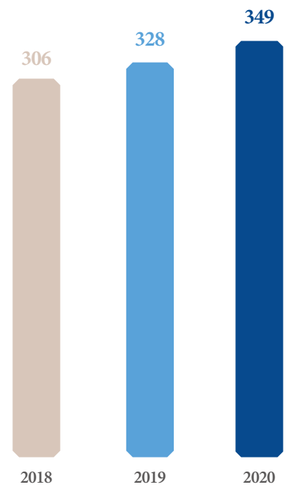
* Source : The Information Service of Higher Education in Korea



Research Funds

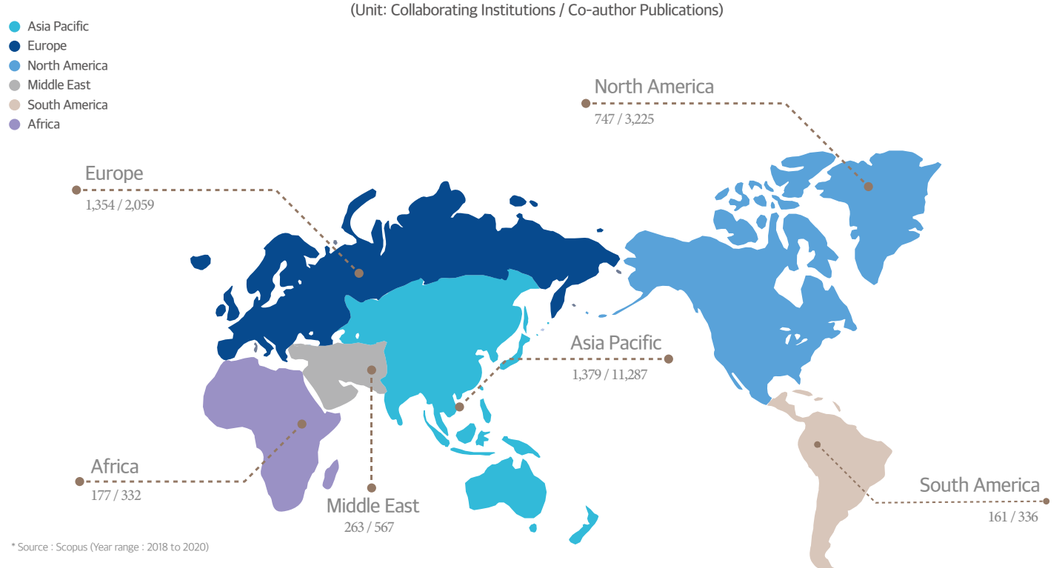
(Unit : million USD)

* Source : The Information Service of Higher Education in Korea



Institutions Collaborating with Yonsei Univ. (2018-2020)

(Unit: Collaborating Institutions / Co-author Publications)

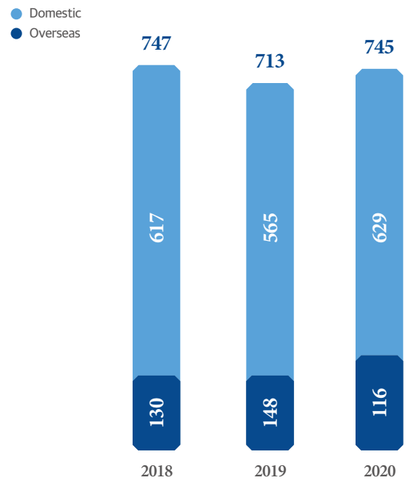


* Source : Scopus (Year range : 2018 to 2020)

Patent Registrations

(Unit : Case)

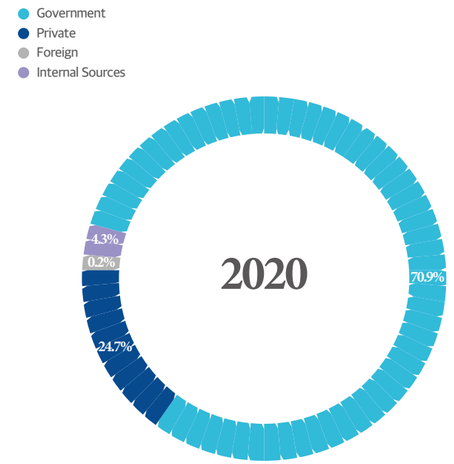
* Source : The Information Service of Higher Education in Korea



Research Funds by Funding Source(2020)

(Unit : %)

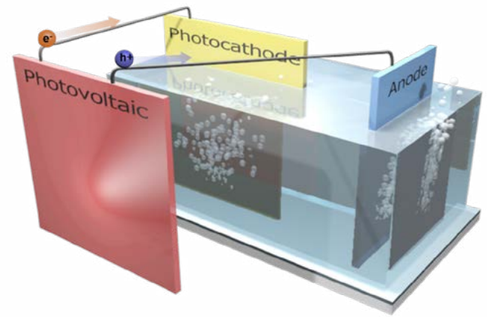
* Source : The Information Service of Higher Education in Korea



YONSEI SIGNATURE RESEARCH CLUSTER PROGRAM

Yonsei University launched **the Yonsei signature research cluster program** in 2021 with the aim of growing into a global research-oriented university. 13 research teams from different disciplines with the potential to reach global standards in research outcomes have been selected to receive a total of 12.5 billion KRW (9.8 million USD) spread over five years, with each team receiving up to 300 million KRW (240 thousand USD) per year.

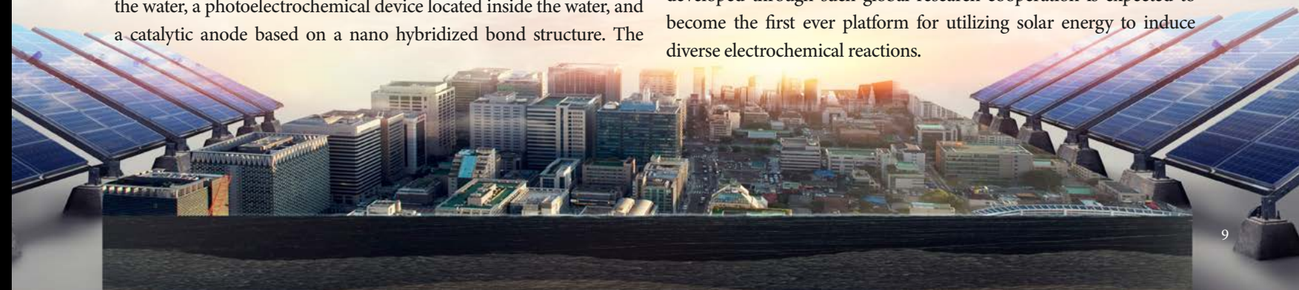
Energy Materials research team led by **Prof. Jooho Moon** (Materials Science and Engineering) “Green Hydrogen Production using a Tandem PV-PEC-Based Solar Station”



The Yonsei signature research cluster team in the field of energy materials is led by Prof. Jooho Moon(Materials Science and Engineering) and comprises of Prof. Cheolmin Park(Materials Science and Engineering), Seong-Ju Hwang(Materials Science and Engineering), Jong Hyeok Park(Chemical and Biomolecular Engineering), Jong Hak Kim(Chemical and Biomolecular Engineering), Hyoung-il Kim(Civil and Environmental Engineering), and Dongho Kim(Chemistry). The team plans to develop a green hydrogen production method through a tandem PV-PEC(photovoltaic-photoelectrochemical) multifunctional solar station that harnesses PV-based water electrolysis technology. Renewable energy such as solar energy has always faced the technical barrier of temporal variability and spatial availability, and PV-based water electrolysis is a technology that can overcome that barrier.

The tandem PV-PEC solar station being developed by Prof. Moon and his team will be built with a photovoltaic device located outside the water, a photoelectrochemical device located inside the water, and a catalytic anode based on a nano hybridized bond structure. The objective is to increase the production of hydrogen and dramatically improve the decomposition of environmental pollutants by harnessing the superior light absorption efficiency and operational stability of PV and PEC cells and enhancing the catalytic activity of the hybrid nanomaterials. Since the PV-PEC water electrolysis method of hydrogen production through the solar station developed by Prof. Moon’s team uses solar energy to split water to get hydrogen, no pollutants are emitted and any environmental pollutants in the water is decomposed in the production process. Thus the project is expected to offer a fundamental solution to reaching carbon neutrality by 2050 and developing sustainable energy.

For the success of the team’s research, Prof. Moon and his team will pursue international collaboration and exchanges with world renown researchers such as Prof. Akihiko Kudo of Tokyo University of Science and Prof. David Tilley of the University of Zurich, as well as invite them as seminar speakers. The multifunctional solar station to be developed through such global research cooperation is expected to become the first ever platform for utilizing solar energy to induce diverse electrochemical reactions.



Artificial Intelligence
Y-AI Group led by **Prof. Kwanghoon Sohn** (Electrical and Electronic Engineering) “Development of a Multiple Signal-Based Universal Social Artificial Intelligence System”

The Yonsei signature research cluster team in the field of Artificial Intelligence is called the Y-AI Group. Headed by Prof. Kwanghoon Sohn (Electrical and Electronic Engineering), the Y-AI Group is comprised of Hong-Goo Kang (Electrical and Electronic Engineering), Sang-Hoon Lee (Electrical and Electronic Engineering), Bum-Sub Ham (Electrical and Electronic Engineering), Seon Joo Kim (Computer Science), Hyung-Chan An (Computer Science), Young-Sok Kim (Artificial Intelligence), and Jin-Young Yeo (Artificial Intelligence).

The Y-AI Group brings together experts in the field of Artificial Intelligence (AI) using video, voice/audio, and natural language signals as well as in the area of high-speed computing processes. Through this research cluster, existing literature on single signal-based AI technology will be integrated to concentrate on further research into multiple signal-based AI technology, with the ultimate goal of developing a multiple signal-based universal social AI system through the effective convergence of software and hardware.

Y-AI is working in close collaboration with 18 universities from ten countries, including the University of Illinois at Urbana-Champaign and the University of Surrey, as well as global enterprises such as Google, Facebook, Microsoft, and Qualcomm. Based on this global network, the group plans to co-organize workshops and international symposiums for active academic exchanges. The first event in launching such efforts was the successful AI International Symposium on October 28, 2021 attended by invited speakers from Facebook and co-organized by Y-AI and the BK Y-BASE education research team in the school of Electrical and Electronic Engineering. Y-AI will continue to pursue international collaborative research in applying state-of-the-art AI technologies to the development of a multiple signal-based universal social AI system that is innovative yet practical, which will spearhead the globalization of Yonsei University’s AI research.

Climate Crisis research team led by **Prof. Hyun Mee Kim** (Atmospheric Sciences) “Climate Science Research to Understand, Diagnose, Predict, and Adapt to Climate Change and Crisis”

The climate crisis arising from climate change is a highly critical and urgent issue faced by the global community. Recent reports by the Intergovernmental Panel on Climate Change (IPCC) show that the earth’s surface temperature rose by approximately 0.99℃ on average from 2001 to 2020 compared to the pre-industrial age from 1850 to 1900. The IPCC predicts that if this trend continues, the 1.5℃-limit of increase from the pre-industrial level temperature, which was recommend by the Paris Agreement (2015), is likely to be reached between 2021 to 2040. To limit the temperature increase within the recommended level of the Paris Agreement, worldwide CO emissions must be reduced by at least 45% by 2030 compared to 2010 levels. Realistically speaking, however, achieving this goal is a huge challenge due to the current global industrial structure.

Prof. Hyun Mee Kim and her research team aim to establish a foundation of climate science that will help us better understand, diagnose, and predict climate change and crisis by broadening the current understanding of this phenomenon and facilitating adaptation to climate change/crisis from the perspective of atmospheric and climate sciences. The team will conduct comprehensive research to connect diverse areas of atmospheric sciences to the study of climate change and crisis. Based on investigations of the various factors that influence the climate and their correlation to climate change and crisis, the team will work to enhance climate modeling so that uncertainties are lessened and accuracy is improved when diagnosing and predicting climate change and crisis. Another objective is to provide climate change and crisis information that is closely connected to everyday life by analyzing the correlations between urban and atmospheric pollution and climate change. To this end, Prof. Kim’s research team has brought on-board experts specializing in almost all areas of atmospheric sciences. By pursuing converged research on climate crisis from diverse perspectives, the team is expected to set an important milestone in addressing the challenge of climate crisis.

Electronic Materials research team led by **Prof. Seongil Im** (Physics) “Multi-Dimensional Nanomaterials for Next-Generation Electronics Device Applications”

The Yonsei signature research cluster team in the field of electronic materials is headed by Prof. Seongil Im(device physics) of the Physics Department and joined by Prof. KwanPyo kim(nanostructure and interface analysis via physics probing), Keun Su Kim(electronic band structure manipulation), Jeong Ho Cho(next-generation materials and device fabrications), and Jong Hyeon Ahn(next-generation devices using ultrathin semiconductors). Prof. Im’s team will be conducting research on “Multi-Dimensional Nanomaterials for Next-Generation Electronics and Devices.” The research objective is to intricately combine low-dimensional (0D, 1D, 2D) nanomaterials that have different functions and structures, and to induce their active interaction so that a new hybrid system for regulating new properties and functionalities can be systematically constructed. For the precise combination of nanomaterials and effective induction of their interactions, a variety of combinations of low-dimensional nanomaterials will be attempted based on a fundamental understanding of nanomaterial combination research such as manipulation of interfacial structures of nanomaterials, elimination of physical/electrical interface defects and the phenomena of self-assembly and epitaxy. Such efforts are expected to lead to the development of systems suitable for next-generation electronic device applications.

Details of the research are as follows:

(1)Investigation of the self-assembly phenomena through a precise probing on the self-assembly structures of various 2D materials, 0D atoms and molecules, and 1D organic materials

(2)Active manipulation and fundamental analysis of electronic structures strongly coupled between 2D materials and assembled interfacial structures

(3)Manipulation of the interface defects formed in the nano hybrid system and in-depth analysis of system-dependent changes in properties

(4)Fabrication and application of flexible and wearable devices based on ultra-thin film 2D semi-conductor materials and their hybrid systems

(5)Fabrication of artificial synapses and development of biomimetic wearable applications utilizing the hybrid systems of 2D organic materials

Medicine & Life Sciences research team led by **Prof. Jihyun F. Kim** (College of Life Science and Biotechnology) and **Sun Ha Jee** (Graduate School of Public Health) “Discovering the Secrets of Oral-Gastrointestinal Microbiome Axes in Health and Gastric and Colorectal Cancers”

The Yonsei signature research cluster team in the field of Medicine and Life Sciences is a multi-disciplinary collaborative research team comprised of Prof. Jihyun F. Kim (principal investigator) and Joon Young Hong from the College of Life Science and Biotechnology, Prof. Sun Ha Jee (co-lead) from the Graduate School of Public Health, Prof. Yong Chan Lee and Tae Il Kim from the College of Medicine, Prof. Na-Young Song from the College of Dentistry, and Prof. Hyo-Eun Kim from Severance Checkup Health Promotion Center.

Gastric and colorectal cancers are two of the most common cancers in Korea, with their incidence in 2020 ranking first and fourth, respectively. Imbalance in intestinal microbiomes and carcinogenic microbes, such as *Helicobacter pylori* and *Fusobacterium* nucleatum, are now considered to be the leading direct or indirect causes of gastrointestinal cancers.
The research objective is to develop a predictive model for gastric and colorectal cancer that integrates clinical, genome, and microbiome data. Based on the results of a large-scale study on cancer prevention in Koreans (KCPS-II) conducted by the Graduate School of Public Health, the research team will analyze the clinical data of healthy individuals and cancer patients visiting the Severance Checkup Health Promotion Center and Yonsei Cancer Center as well as the correlations between genome-wide association studies and oral-gastrointestinal microbiome, which might discover new oncogenic mutations, cancer-causing bacteria, and carcinogenic metabolic pathways. The research will be particularly meaningful as it is the first attempt at an integrated analysis of genetic and oral-gastrointestinal microbiome axis information of cancer patients in Korea.

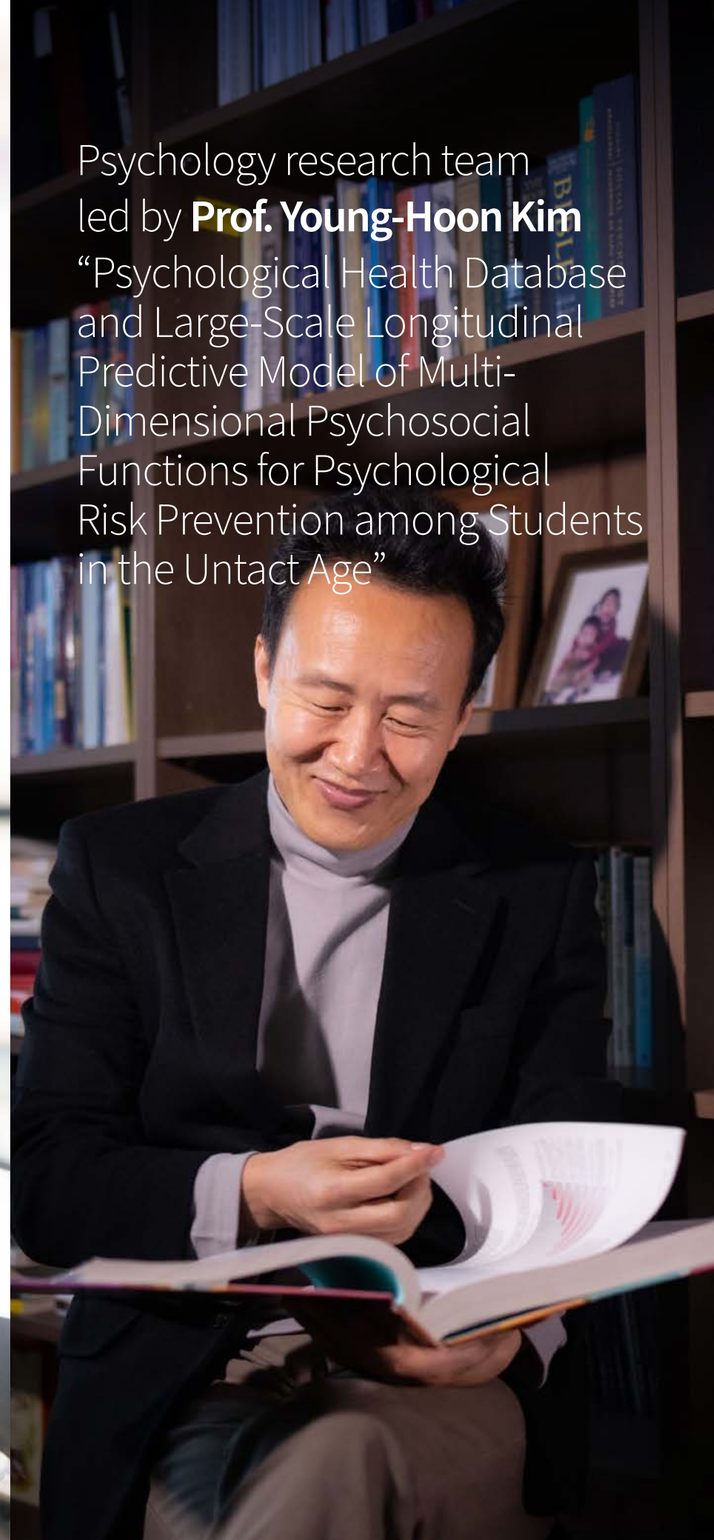
Based on its results, the research will improve the overall understanding of the pathogenesis of gastric and colorectal cancers, which may enable the early diagnosis of cancer as well as individualized treatments to improve the prognosis of patients. By networking with leading local and international microbiome research institutions, the research is also expected to enhance international competitiveness in this field.

Research team led by **Prof. Yoon Jik Cho** (Public Administration) 'Digital Transformation in Public Administration Research – Development and Utilization of Digital Tools for Administrative Innovation in Public and Non-Profit Sectors'

The Yonsei signature research cluster team in the field of public administration explores ways to innovate public administration through digital technology. The team uses gamification for research subjects to enjoy their participation, which helps in collecting relevant data. The team is composed of Prof. Jung Wook Lee, Yoon Jik Cho, Sounman Hong, Sangyub Ryu, and Nara Park from the Department of Public Administration, all of whom are active researchers in various fields, including performance management and organization, human resource management, public finance, e-government, and bureaucracy.

The team developed an interactive digital comic entitled *Coffee of the Day,* by which they are conducting a study on how the personal traits and experiences of people influence their ethical behaviors and strategic decision-making. The results of the subjects' decision-making will be analyzed in connection to their personal disposition and organizational experience that was surveyed in advance. Based on the analysis, the team is expected to provide meaningful implications. Furthermore, data collection through digital gamification not only creates significant academic value but also opens the possibility for industry–academia cooperation in software development.
Following the development of the single-player game, the team successfully concluded their first year of research. Building on its previous developmental experience, the team plans to develop a multi-player decision-making game to investigate more sophisticated and complicated decision-making processes. The research tools developed through this project will provide people working in the public and non-profit sectors with opportunities to indirectly experience several issues likely to arise in their own organizations. The project is expected to not only shed light on elaborating processes involved in decision-making but also support the education and training of administrative staff.

Psychology research team led by **Prof. Young-Hoon Kim** "Psychological Health Database and Large-Scale Longitudinal Predictive Model of Multi-Dimensional Psychosocial Functions for Psychological Risk Prevention among Students in the Untact Age"



Sociocultural psychologist Prof. Young-Hoon Kim has teamed up with stress, trauma and emotion regulation specialist Prof. Soo Hyun Park, anxiety/depression disorder clinical specialist Prof. Ju Yeon Hur, applied brain and cognitive scientist Prof. Sanghoon Han, and psychological counseling specialist Prof. Hyunjung Yang for this research project. Harnessing their diverse specialties within the discipline of psychology, the team has launched a study to measure and track the state of individuals on campus such as their capacity for academic or professional achievement, mental and psychological health and social communal behavior.

The objective of this research is developing integrated functional indicators regarding the multiple dimensions of psychological health. More concretely, the team aims to develop a predictive model and data platform for multi-dimensional psychological health risks to be used in preventive psychological measures for campus life. Through the data on psychological health collected over the recent years, a model for classification/prediction of risk groups in university student cohorts will be developed, and the model used to identify in advance any signs of psychological health issues in individuals and contribute to their speedy recovery. In addition, since the research is taking place under the special circumstances created by the COVID-19 pandemic, the team expects to discover psychological and adaptive characteristics that are specific to the age of untact. It will be an opportunity for detailed studies of how to support the psychological health of individuals in the untact age and which factors make for the best prediction of their psychological health, adaptation and recovery. The research is expected to have much implications regarding individual psychological health in rapidly changing societies.
In order to investigate as many diverse psychological health indicators and predictive factors as possible, Prof. Kim's team is taking into account comparative cultural indicators through collaboration with Columbia University, University of Illinois at Urbana-Champaign, New York State Psychiatric Institute, and Maryland University. Such studies and comparative analyses of psychological health models in a wider social context can play an important role in elaborating large-scale data systems.

School of Business interdisciplinary research team led by **Prof. Boram Do** (School of Business) “Next Normal: Responding to the Changing Human-Digital Relationship and New Business Paradigm”

The School of Business interdisciplinary research team is comprised of Prof. Boram Do, Seung Hyun Kim, Youngsok Bang, KiYoung Lee, Sue Ryung Chang, and Jeonghye Choi. The final goal of the team is to understand the digital transition and business ecosystem changes being accelerated by COVID-19, and to explore ways for businesses to efficiently create and distribute social and economic values in this new business paradigm.

The research revolves around the three main areas of business administration – (1) humans/consumers (2) information systems (3) organization management – and is conducted by three different teams of researchers specializing in each area. Firstly, the ‘digital experience’ team of marketing researchers examines changes in consumer experience and behavior induced by new technologies. Secondly, the ‘big data technology convergence’ team of information system researchers explores and utilizes diverse forms of data that have recently become accessible in order to seek ways to converge such data technology with business systems. Lastly, the ‘smart work’ team of organizational behavior researchers analyzes changes in employee experience and behavior, with the aim of finding new methods for change management and social value creation in the digital era.

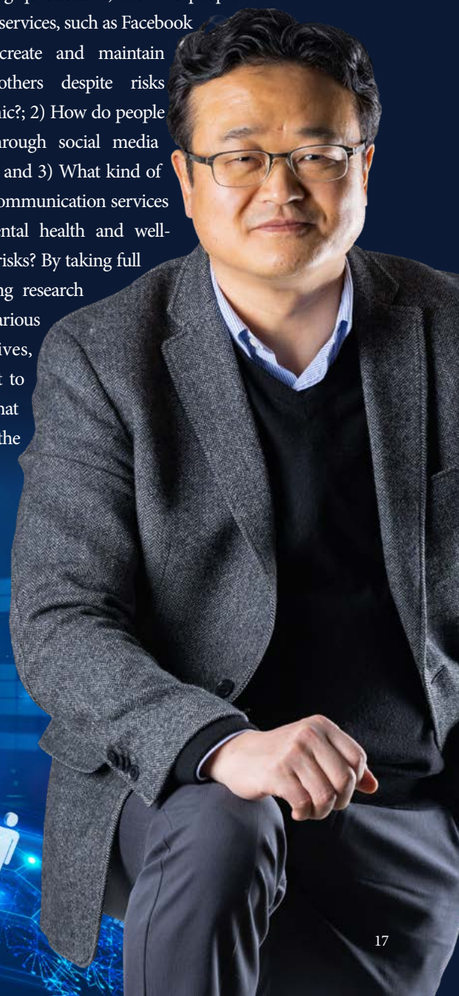
The research is planned to span five years, and its results might garner global interest since the acceleration of digital transformation due to COVID-19 is a worldwide phenomenon. Furthermore, in light of the relatively fast recovery of Korean businesses, the research team is expected to emerge as an academic leader in the global community as it moves towards the Next Normal.

Communication research team led by **Prof. Namkee Park** (Communication) “The Role and Impact of Communication Technology in a Risk Society”

Prof. Namkee Park heads this research team, which brings together his colleagues in the Faculty of Communication that includes Prof.s Yong-Chan Kim, Sang-Yup Lee, Jiyeon So, Jarim Kim, and Hyunjin Song.

Prof. Namkee Park examines the ethical issues that may arise from the interaction between users and agents of artificial intelligence, how such issues develop in a risk society, and how they can be resolved. Prof. Yong-Chan Kim conducts interviews for his research “Risk Society and Local Communication Infrastructure: Examining How Local Independent Bookstores Function as Media.” Prof.s Jiyeon So and Hyunjin Song developed guidelines for scale item reduction based on the Item Response Theory and simulation inference and examine how repeated exposure to news articles on climate change influences message processing. Prof. Sang-Yup Lee conducts research on how media coverage of vaccine side effects and the partisanship of newspapers influence media receivers. Prof. Lee also partners with Prof. Song to conduct a case study on fact-checking by partisan news media based on the theme “Effects of Fact-Checking and Perceived Bias.” Prof. Jarim Kim, using the concept of psychological distance, explores the factors that can facilitate effective GIS-based communication amidst the recent surge in the utilization of the geographically referenced information of GIS.

Together, the team will be conducting studies that investigate the role of communication technology in building and advancing a healthy society in one filled with diverse risks as well as how its members can take advantage of communication technology to overcome and eliminate risks in their society. More specifically, the team will be drawing conclusions to answer the following questions: 1) How do people use social networking services, such as Facebook and Instagram, to create and maintain relationships with others despite risks caused by the pandemic?; 2) How do people perceive strangers through social media in the midst of risks?; and 3) What kind of impact do AI-based communication services have on people’s mental health and well-being in the midst of risks? By taking full advantage of emerging research methodologies from various theoretical perspectives, the researchers expect to determine outcomes that can answer the call of the times.



Research team led by **Prof. Yoosik Youm** (Sociology) "A Multi-Disciplinary and Multi-Dimensional Approach to Korean Adolescent Well-Being: Genetics-Brain-Social Network"

The Yonsei signature research cluster team in the field of Sociology is headed by Prof. Yoosik Youm with his colleagues and co-researchers Prof. Dohoon Lee and Seongsoo Choi. The team will be conducting a convergent study on adolescent well-being in Korea. The research objective is to collect longitudinal data on adolescent genetics-brain-social network with a multi-disciplinary and multi-dimensional approach to build the database of the Korean Study of Adolescent Health (KSAH).

The well-being of adolescents is not determined by a few individual factors but shaped by the complex causal relationships among the biological, psychological, and social aspects of adolescence. Thus, when integrated information is collected in the form of panel data, a cause-and-effect approach that transcends disciplines or dimensions would be possible.

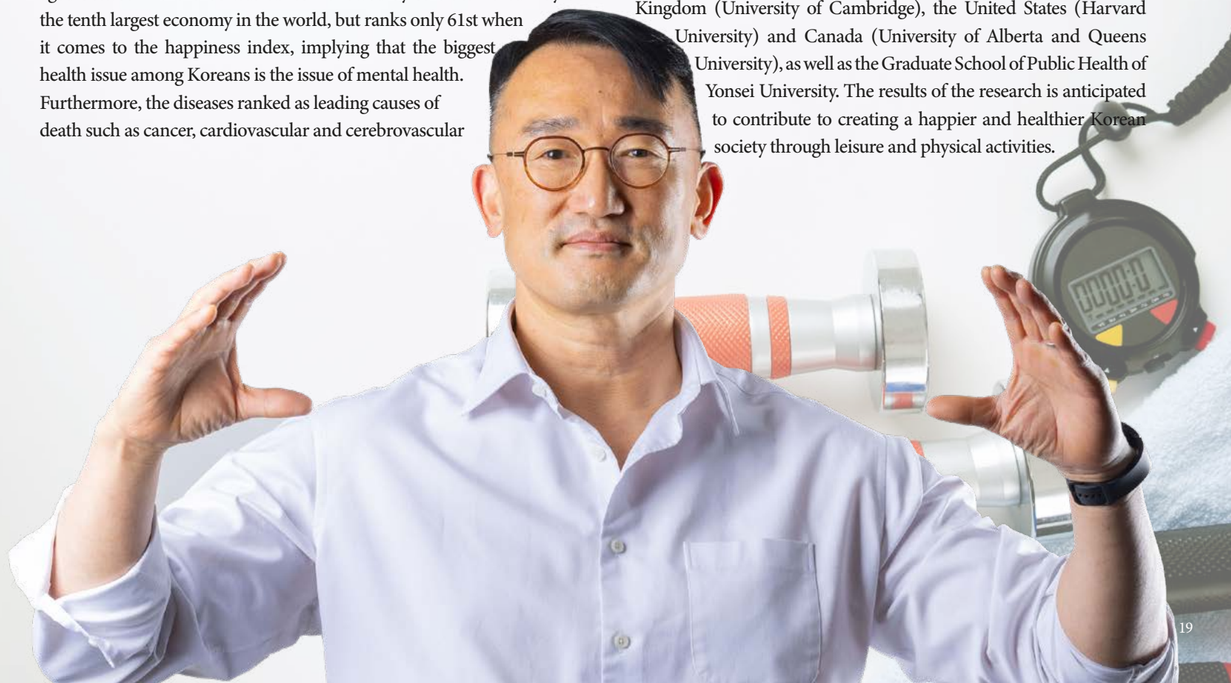
To this end, the research team will be tracking all freshmen admitted into a high school in Seoul for three years, starting from 2022 until they graduate. The team will be collecting genetic data, brain data, and social network data based on saliva, magnetic resonance imaging, and real-name based survey, respectively. Once the KSAH database is built, it will be possible to adopt a multi-disciplinary and multi-dimensional approach that encompasses the genetics-brain-social network aspects of adolescence in studies regarding the well-being of Korean adolescents, whose average scores on the subjective well-being scale has been one of the lowest among OECD countries. The research team plan to publish the findings in world's most cited multi-disciplinary scientific journals, which will not only not only significantly contribute to the existing literature but also provide insights to the mental health issues of Korean adolescents.

Research team led by **Prof. Justin Y. Jeon** "Development and Validation of Generation-Specific Sports and Leisure Programs to Promote Health"

The research team in the field of Sport Industry Studies is composed of Justin Y. Jeon, specialized in Exercise medicine, Prof. Chul Won Lee, specialized in Leisure studies, Prof. Jinmoo Heo, specialized in Senior sports, Prof. Yong Jin Yoon, specialized in sports councelling, Prof. Joon Sung Lee, specialized in Sports management and marketing, Prof. Soren Brage from Cambridge University (Distinguished Prof. In the Department of Sport Industry Studies, Yonsei University) and Prof. Sun Ha Jee from the Graduate School of Public Health, Yonsei University (Adjunct Prof. In the Department of Sport Industry Studies, Yonsei Universtiy).

The team's research objective is to identify the correlations among exercise, physical activity, leisure and health using big data, develop physical activity/exercise/leisure programs tailored to Korean diseases and generations, and validate the effectiveness of such programs. The top five causes of death in Korea are cancer, cardiovascular diseases, pneumonia, cerebrovascular diseases and suicide, but when broken down by age, the top cause of death among teens and those in their twenties and thirties in 2020 was suicide, while the top cause of death among those aged between 40 and 80 was cancer followed by suicide. Korea may be the tenth largest economy in the world, but ranks only 61st when it comes to the happiness index, implying that the biggest health issue among Koreans is the issue of mental health. Furthermore, the diseases ranked as leading causes of death such as cancer, cardiovascular and cerebrovascular diseases, and diseases related to high blood pressure are chronic illnesses that can be prevented through the improvement of lifestyle habits. According to recent global studies, 26.3% of the leading causes of death develop due to lifestyle habits, and 41.2% due to problems with metabolism. In light of the fact that most metabolism issues can also be addressed by promoting physical activity and healthy diets, the implication would be that more than 50% of deaths are either directly or indirectly caused by poor lifestyle habits.

Physical activity and exercise promote public health, effectively treat and prevent obesity, minimize depression, and help raise the happiness index. The reality in Korea, however, is that only 10-15% of Koreans engage in more than 150 minutes of physical activity per week. It is against this backdrop that the research team will be integrating relevant data from Korea, Europe and the United States to investigate the relationship between physical and leisure activities and health by age group and disease, and move on to develop and validate programs to promote physical activity tailored to each Korean age group and disease. The team is engaged in collaborative research with universities in the United Kingdom (University of Cambridge), the United States (Harvard University) and Canada (University of Alberta and Queens University), as well as the Graduate School of Public Health of Yonsei University. The results of the research is anticipated to contribute to creating a happier and healthier Korean society through leisure and physical activities.

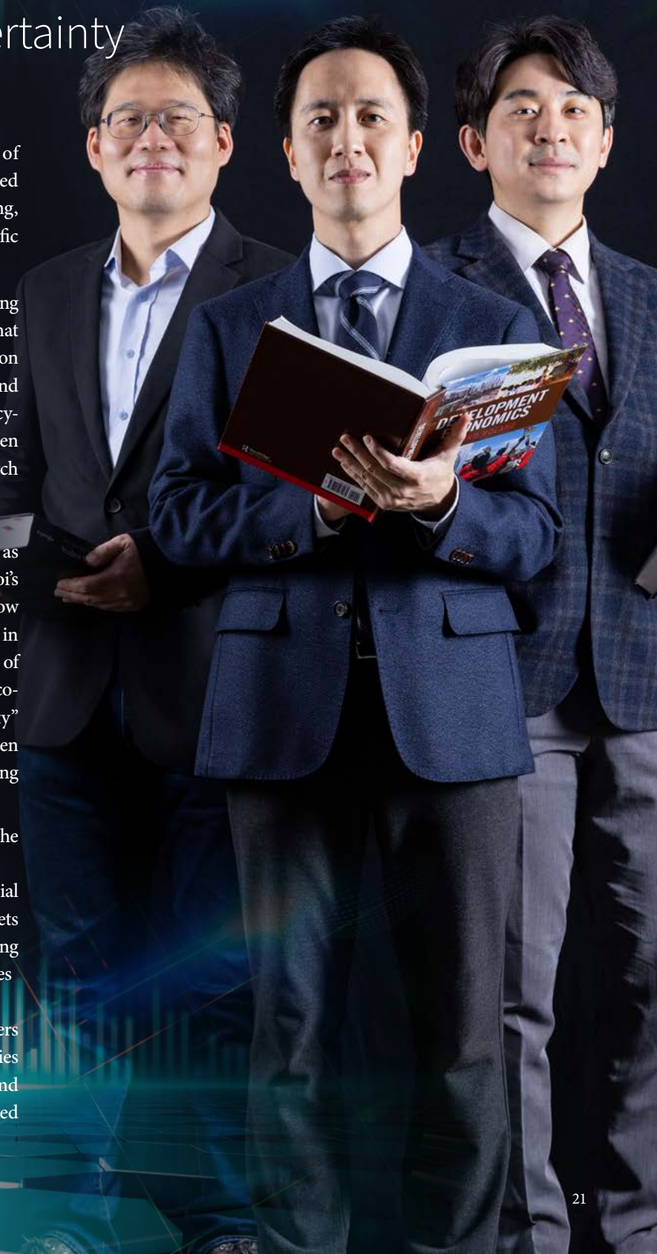


Medicine & Life Sciences
Research team led by **Prof. Seung-Woo Cho** (Biotechnology, College of Life Science and Biotechnology) “Development of Human Organoid-Based Infectious Disease and Microbiome Models as *in vivo* Substitutes”

As the COVID-19 pandemic has shown, the spread of infectious diseases is now perceived to have an immediate impact on the very survival of humankind. Countless deaths occur worldwide due to not only epidemics caused by new viruses but also infectious diseases caused by bacteria and fungi. As the range of infectious microbes that threaten human survival continues to widen, it has become even clearer that humans cannot survive unless we live in symbiosis with what is now called ‘the microbiome.’

Under the leadership of Prof. Seung-Woo Cho(Biotechnology, College of Life Science and Biotechnology), the research team, comprised of Prof. Yong-Sun Bahn, Eunji Cheong(Biotechnology, College of Life Science and Biotechnology), and Hyongbum Kim(Pharmacology, College of Medicine), seeks to develop an organoid-based substitute model that can be used to study the integrated interactions and molecular mechanisms between infectious microbes and microbiomes and their host. Organoids, or miniature organs, can be cultivated to resemble the cell type and tissue structure unique to any given human organ. A variety of microbes can be cultivated in an environment set up to resemble that of a human organ so that the interaction between the microbes and their host can be better recapitulated. In short, humanoids can be used as in vitro models to substitute in vivo studies. In addition, the research team plans to apply gene-editing technology to establish a infectious disease model that has been hitherto impossible. In particular, by applying prime editor technology to the organoid-based infectious disease and microbiome models, the team will be able to investigate which genes are important in developing infections and recovering from disease, thus making significant progress in epidemics research.

Research team led by **Prof. Sangyup Choi** (Economics) Innovative Research to Resolve Social Issues Arising from Increasing Uncertainty



The Yonsei signature research cluster team in the field of economics is headed by Prof. Sangyup Choi and comprised of Prof. Sang-Hyun Kim, Myungkyu Shim, Hee-Seung Yang, Soojin Jo, and Youjin Hahn, who all boast vast experience and prolific research in their respective fields.

In the current age marked by disruptive social changes and increasing uncertainty, there is a growing need for non-normative research that strives to understand various phenomena in the real world based on advanced research methodologies, including machine learning, and experiments using large data, which will ultimately contribute to policy-making. In line with this trend, Prof. Choi and his team aim to strengthen their capacity for innovative research to produce pioneering research outcomes that will contribute to inclusive policy-making.

Breaking away from standardized subdisciplines such as microeconomics, macroeconomics, and econometrics, Prof. Choi’s team pursues collaborative and interdisciplinary research with fellow researchers from diverse fields. As a reflection of current trends in the field of economics, the team encourages outstanding students of Yonsei University to actively participate as research assistants and co-authors, thus nurturing their research capabilities. With “uncertainty” as the keyword and considering the synergies that can be created when combined with existing research, the team has selected the following three core subjects for its research:

(1) The impact of rising economic and political uncertainty across the globe on the macroeconomy and global financial market
(2) The impact of uncertainty brought on by accelerated changes in social structures due to COVID-19 on education, healthcare, and labor markets
(3) The impact of an uncertain future created by new technologies during the 4th Industrial Revolution on labor markets and industrial structures

To facilitate efficient research in the three areas above, all team members will rely on their experiences working as researchers in leading universities and institutes worldwide to continuously pursue active cooperation and collaborative research with renowned scholars. Thus, the team is expected to produce extensive and influential research results.

Yonsei University Has the Most Leading Researchers Selected for State Sponsorship in 2021

Five Yonsei researchers among the 0.3% selected to receive government funding

Prof. Ho Jeong Kwon
Biotechnology

Prof. Keun Su Kim
Physics

Prof. Sunghoon Kim
College of Pharmacy

Prof. Jooho Moon
Materials Scienceand Engineering

Prof. Taehoon Hong
Architecture & Architectural Engineering

In 2021, Yonsei University produced the largest number of researchers to be part of the Sponsorship for Leading Researchers program organized by the Ministry of Science and ICT (MSIT).

Sponsorship for Leading Researchers is a program that the Korean government has been managing consistently since the 1990s. The program selects the top 0.3% of researchers in Korea to provide state funding for their research. The MSIT assessed the international competitiveness of 66 shortlisted candidates, held discussions with them and heard their presentations before deciding on 14 leading researchers in various fields including Natural Science, Life Science, Pharmacology, Medicine, Engineering, and ICT Convergence. Five Yonsei researchers were picked as leading researchers for five research projects in three fields, making Yonsei University the top university in Korea in terms of the number of leading researchers selected for the program. The total funding amounts to 32.4 billion KRW (26.7 million USD).

The research projects selected for Sponsorship for Leading Researchers in 2021 are as follows.

Prof. Ho Jeong Kwon (Biotechnology) – interpretation of the molecular sociological function of organelle communication using small-molecule compounds

Prof. Ho Jeong Kwon's team aims to propose a new paradigm for discovering the molecular sociological network within cells using small-molecule compounds capable of controlling protein structures and functions. The research plan is to ▲ find small-molecule compounds capable of building and regulating the organelle communication expressive screening system; ▲ discover the target protein or adjacent proteome in the small-molecule compound and analyzing its location and function; and ▲ investigate the molecular mechanism of organelle communication disrupted by the small-molecule compound. Prof. Kwon's research is expected to present an innovative paradigm for discovering the mechanism of molecular communication in living cells, contribute to the development of novel therapeutic drugs, and shed light on the mechanism of protein regulation.

Prof. Keun Su Kim (Physics)
– research on band structure control

Prof. Keun Su Kim's team is researching the electronic band structure of 2D quantum materials. By artificially inducing topological phase transition, examining the unique topological quantum state protected by crystal symmetry, and studying quantum many-body interactions and complex particles, the team aims to uncover the mechanism of pseudogaps. By measuring and controlling band structures to study quantum states from the perspective of electronic structures, Prof. Kim will be looking to expand the perceptual framework of Condensed Matter Physics and offer insights into the mechanism of future quantum elements.

Prof. Sunghoon Kim (College of Pharmacy)
– research on amino acid susceptors and signaling

Prof. Sunghoon Kim's research team is working on discovering the existence, mechanism and functional importance of the protein complex that detects the level of amino acids in a cell and regulates protein synthesis, signaling and metabolism. The research plan is to ▲ map amino acid signaling through the multi synthetase complex(MSC); ▲ discover the amino acid detection mechanism of the aminoacyl-tRNA synthetase(ARS) that make up MSC; and ▲ prove the pathophysiological importance of the MSC as an amino acid susceptor. Through this research, Prof. Kim aims to be the first to demonstrate the actual existence of such a systemic function, thus offering important information for maintaining homeostasis in diverse amino acids.

Prof. Jooho Moon (Materials Science and Engineering) – research on spin-green hydrogen

Pro. Jooho Moon's research team aims to break through the current limitation in the efficiency of the solar-to-hydrogen (STH) process through reform and surface treatment of microstructures at the micro and nano levels, and to increase STH efficiency by significantly reducing overvoltage caused by the generation of oxygen in the water splitting process. The research plan is to ▲ develop a spin control system based on chiral perovskite materials with moisture stability; and ▲ materialize and develop a spin-green hydrogen production system based on chiral-induced spin selectivity(CISS). Prof. Moon's research is anticipated to contribute to the development and performance enhancement of next-generation spintronics and enable dramatic improvement in the efficiency of water electrolysis by breaking through the limitations of the current nano-level STH strategy.

Prof. Taehoon Hong (Architecture & Architectural Engineering) – development of NEW LEARN CITY 4.0, a self-learning-based integrated management platform for human-centric smart green cities

Prof. Taehoon Hong's research team is working on building a smart green city model through the monitoring, analysis, evaluation and application of data collected in real time on the built environment and energy performance of a city and the effective management of such data. The research will proceed based on technologies for ▲ monitoring the built environment and energy performance centered around the residents of the city; ▲ performance evaluation; ▲ performance application; and ▲ performance integration. The research will move beyond architectural management to develop technologies for its convergence and integration with ICT and ergonomics, thus proposing a new paradigm for future research.

Development of Next-Gen Obstructive Sleep Apnea Diagnostics Based on Two-Step Advanced AI and Flow Dynamics Characteristics Designated by KFDA as Korea's 11th Innovative Medical Device

Laon Sleep – Medical Image-Assisted Detection and Diagnosis Software with Greater Time and Cost Savings and Increased Accuracy and Convenience

Obstructive sleep apnea is a disorder in which the airway gets blocked during sleep, causing breathing to stop or slow down. It requires active testing and treatment, as obstructive sleep apnea patients are more likely to develop other more severe illnesses such as cardiovascular diseases. Polysomnography(PSG) is currently used to diagnose sleep apnea, but this is a time- and effort-consuming method as it requires the patient to stay asleep for at least six hours with several sensors attached to the body, thus causing great inconvenience. Furthermore, since the test is conducted in an exam room that is different from the patient's usual sleeping environment, inaccuracy of test results is another concern. Thus, despite the suffering caused by snoring and lack of sound sleep, the inconvenience and high cost of existing diagnostics for obstructive sleep apnea have deterred active diagnosis and possibly further treatment.

Collaboration among Mechanical Engineering, Medicine and Dentistry researchers leads to patented innovative technology

Prof. Joon Sang Lee(Mechanical Engineering) has been leading research with Prof. Hyung Ju Cho(College of Medicine) and Yoon Jung Choi/Hwi Dong Jung(College of Dentistry) to develop a new method for diagnosing obstructive sleep apnea that offers more convenience to the patient while enhancing accuracy. Years of collaboration between Prof. Lee's team and Yonsei University Severance Hospital's medical staff since 2018 finally bore fruit with the birth of an innovative technology that converged two methods – autonomous medical image segmentation and prediction of flow behavior in the airway. The technology was recognized for its excellence and originality and patented both domestically and overseas. It was transferred in January 2021 to Laon People Co. Ltd., a tech company specializing in AI, which worked with Prof. Lee's research team in co-developing Laon Sleep, the next-generation diagnostic device for obstructive sleep apnea.

Laon Sleep diagnoses obstructive sleep apnea by automatically extracting data on the shape of the patient's airway from CT images and analyzing the flow changes and biometric data according to the detected airway shape based on AI. Through this technology, the accuracy of obstructive sleep apnea diagnosis will be improved while dramatically reducing the required time and inconvenience to the patient.

Emerging as the next-gen medical software platform leader for sleep disorders In May 2021, the Ministry of Food and Drug Safety designated Laon Sleep, a next-generation obstructive sleep apnea diagnostic device, as Korea's 11th innovative medical device. In designating a new AI device as an innovative medical device, the government considers whether it is expected to dramatically improve safety and application compared to existing devices or treatments through technological advancement, and also how technology-intensive and open to rapid innovation it is. Laon Sleep was designated in recognition of its high technology intensity and potential for real social and economic impact.

Laon Sleep is expected to offer significant benefits to patients in terms of convenience and medical cost savings by simplifying procedures and greatly reducing the time taken for diagnosis of obstructive sleep apnea. In addition, Laon Sleep is poised to emerge as the next-generation medical software platform in the apnea diagnosis and treatment market that is worth more than 1 trillion USD globally, thus becoming the technology that will lead this rapidly growing market.

Biochemistry **Prof. Hyun woo Park**'s Research Team Develops Innovative Technology for the Diagnosis and Treatment of Chronic Leukemia

Discovery of new FLT3-related signaling pathway
From development of new techniques for overcoming drug resistance to international patent application and technology transfer

The research team led by Prof. Hyun Woo Park(Biochemistry) has discovered the new signaling pathway of the oncogene FLT3 in chronic leukemia patients, some 40% of whom acquire post-chemotherapy drug resistance and thus enter a blast crisis that drastically lowers their survival. The team utilized this discovery to successfully develop new techniques for early diagnosis and improved anti-cancer therapy for chronic leukemia.

Discovery of drug resistance signaling factors in chronic leukemia patients in blast crisis

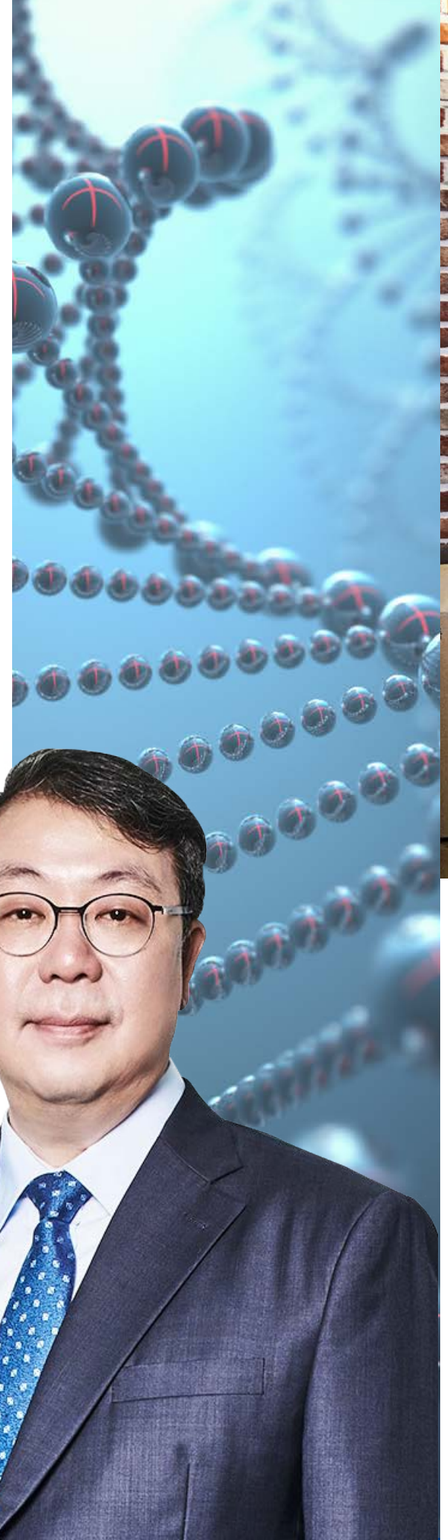
Leukemia patients are largely divided into acute myeloid leukemia (AML) and chronic myeloid leukemia (CML), and undergo targeted therapy specific to their oncogene mutation. CML is a form of blood cancer that develops due to oncogene mutation that triggers the infinite differentiation of leukocytes. Many patients acquired resistance to the first-generation targeted therapeutic drug Imatinib (Gleevec), which propelled the development of second- and third-generation drugs such as Dasatinib and Nilotinib. But patients who acquire resistance to even these drugs will advance to blast crisis (bc-CML) stage with a drastic drop in survival, leading to an urgent need to identify the factors causing resistance to targeted therapeutic drugs. Based on the observation that the prognosis and malignancy of bc-CML are similar to those of AML, Prof. Hyun Woo Park's team made the first-ever discovery of the cause of drug resistance in bc-CML patients – the activation of TAZ-TEAD transcription factors of the AML oncogene FLT3 and Hippo signaling pathway. Studies of samples from CML patients led to the surprising finding that some 40% of bc-CML patients acquired drug resistance through FLT3, which in turn led to the discovery that suppressing FLT3 could help overcome drug resistance and induce hematological cancer cell death.

Hope for developing various diagnosis and treatment techniques to overcome drug resistance

Prof. Park's research has enabled the development of various diagnosis and treatment techniques to overcome drug resistance acquired by bc-CML patients. First of all, the numerous drugs currently being developed or already approved for AML therapy can now be repurposed to pave the way for overcoming FLT3-mediated drug resistance in CML patients. Further steps can be taken to diagnose FLT3 expression in CML patients, which can be used as a drug resistance diagnostic marker for the combined prescription of CML drugs and FLT3 suppressors. In addition, the identification of TAZ-TEAD transcription factors and CD36 receptors as the signaling pathway of FLT3 has opened up the possibilities for overcoming drug resistance through the use of TAZ-TEAD binding inhibitors and CD36 receptor suppressors. Prof. Park's team is currently in the process of optimizing techniques for detecting FLT3, TAZ and CD36 diagnostic markers in samples from CML patients in order to develop techniques for diagnosing drug resistance. The team is also planning clinical tests of BCR-ABL inhibitors and FLT3 suppressors to overcome drug resistance in the treatment of CML patients. Through all these efforts, the team is expected to offer hope to CML patients who are suffering because of the drug resistance they acquired in previous chemotherapy and also create the ripple effect of developing more diagnostic and therapeutic techniques applicable to other incurable diseases.

This research has been led by Ji-Eun Shin, a researcher on Prof. Park's team. The results of this research has been patented in Korea and is awaiting patent approval in the United States and Europe. The team has also succeeded in large-scale technology transfer and is actively pursuing commercialization through translational research.

ICM, Leader in AAV-Based Gene Therapy Drug Development Started by **Prof. Dae-Won Kim** (Biochemistry), Steps Up Clinical Tests to Develop World's First DMOAD



ICM is a biotech venture that develops gene therapy drugs to treat degenerative diseases that are based on the AAV(Adeno-Associated Virus). ICM was started by Prof. Dae-Won Kim(Dept. of Biochemistry, Yonsei University) in September 2012 as a subsidiary of Yonsei University's technological holding company with the goal of developing first-in-class drugs for hard-to-cure degenerative musculoskeletal and sensory disorders.

Prof. Kim made the world's first-ever discovery of the survival mechanism of cartilage cell growth. As the CEO of ICM, he is now leading an international team with a wealth of experience in genetic research to establish the technological platform for AAV gene therapy and develop first-in-class drugs to treat various degenerative disorders.

ICM signs on to transfer AAV gene therapy drug technology to LG Chem in 2020

ICM's core business is the development of AAV gene therapy drugs for the treatment of various degenerative disorders in the musculoskeletal(joints), sensory(visual and auditory senses) and central nervous(brain and spinal cord) systems. Its main product, 'ICM-203,' is used to treat osteoarthritis by promoting cartilage regeneration and suppressing synovial membrane inflammation. Based on its robust efficacy-proving preclinical data, ICM signed a technology transfer agreement (for exclusive rights in Korea and China) with LG Chem in December 2020, a testimony of its technological prowess in the field of AAV gene therapy. The drug is currently undergoing phase 1/2a clinical trials in Australia, and US FDA clinical trials are expected to begin in 2022.

ICM aims to develop first-ever DMOAD

ICM's core pipeline focuses on ICM-203 for osteoarthritis, ICM-302 for retina disorders, and ICM-401 and -402 for auditory disfunctions. Of these, ICM-203 has become the first to reach the preclinical(animal testing) stage, where it proved its efficacy in regenerating damaged cartilage and suppressing joint inflammation, thereby proving its potential as a DMOAD(Disease Modifying Osteoarthritis Drug). DMOAD refers to medication that not only addresses the clinical symptoms of arthritis but at the same time enhances joint functions by slowing down structural degeneration of the joints, thus making for fundamental osteoarthritis therapy. So far, no pharmaceutical has been officially approved by the authorities as a DMOAD yet.

ICM is seeking to expand its business through the development of first-in-class drugs to treat various hard-to-cure degenerative diseases including osteoarthritis. Up till now, it has attracted private investments from large venture capital funds amounting to 52 billion KRW (44 million USD) through four rounds of IR. ICM is expected to continue attracting attention as it gears up for its IPO, an unusual move for the subsidiary of a university technology holding company.

Prof. Hyoung-Il Kim's Joint Research Team Develops Highly Efficient Photoelectrochemical System Utilizing Solar Energy for Durable Hydrogen Peroxide Production

An ideal method for next-generation high value-added production

Hydrogen peroxide is widely utilized in daily life as well as various industrial and environmental processes. However, industrial production of hydrogen peroxide requires the input of toxic organic solvents and huge electrical power, which limits the energy efficiency of hydrogen peroxide processes. Due to the high demand for hydrogen peroxide in the chemical industry, the search for a more eco-friendly and sustainable way to produce hydrogen peroxide is of utmost importance. The photoelectrochemical(PEC) method for producing hydrogen peroxide using solar energy, water and oxygen is a greener alternative to the conventional chemical-intensive method, but it has been assessed as not being efficient enough to be applied to industrial processes. To address this issue, the Korean research team led by Prof. Hyoung-Il Kim of Yonsei University conducted research to come up with a new PEC system for more efficient hydrogen peroxide production and published its results in the journal *Energy & Environmental Science*. The research began in 2018 and is the result of the campus-based development/collaboration efforts of the two leaders of science and technology in Korea – Yonsei University and POSTECH.

A conventional PEC cell is composed of a positively charged anode and a negatively charged cathode. Generally, hydrogen peroxide is generated on only one of these electrodes, that is, the cathode. But Prof. Kim's team aimed at developing a "dual electrode" system that would enhance overall efficiency by simultaneously utilizing both the anode and cathode to generate hydrogen peroxide. Prof. Kim explained that he "wanted to develop a PEC system for producing hydrogen peroxide that utilizes solar photons more efficiently while offering greater durability and selectivity."

The research team developed a bismuth vanadate ($BiVO_4$) photoanode, and discovered that when this photoanode is modified with metal dopants such as molybdenum(Mo) and surface-treated with phosphate, it produces a much more durable PEC reaction to generate hydrogen peroxide. The researchers went on to modify the carbon nanotube cathode using the chemical compound anthraquinone(AQ), and discovered that the presence of AQ makes hydrogen peroxide production by oxygen reduction highly selective. This was how the team succeeded in developing a highly durable and photocurrent-efficient system for hydrogen peroxide production.

Although there have been reports of dual electrode processes for hydrogen peroxide production utilizing $BiVO_4$ photoanodes, Prof. Kim explained that the system that his team developed is "a practical and durable PEC system that utilizes durable and efficient photoanodes and highly selective cathodes for stable hydrogen peroxide production."

The research that led to this "dual electrode PEC system" is being lauded as an ideal and eco-friendly new method for green hydrogen peroxide production that could become the launching pad for further advancement of solar-based PEC systems to bring us closer to a sustainable future.

Prof. Byoung-Chul Cho's Research Team Confirms Efficacy of Amivantamab for Lung Cancer with EGFR Exon 20 Insertion Mutation

40% of patients exhibit tumor shrinkage Anticipated to become new therapy option for patients with lung cancer with EGFR exon 20 insertion mutations

The research team led by Prof. Byoung Chul Cho, College of Medicine, Yonsei University, confirmed the efficacy of Amivantamab, the first targeted therapy drug for lung cancer to be approved in May 2021, in the treatment of lung cancer with epidermal growth factor receptor (EGFR) Exon 20 insertion mutation. The response rate reported by Prof. Cho's team was 40%, and the study results were published in the latest issue of the *Journal of Clinical Oncology(IF 44.544)*.

According to the Health Insurance Review and Assessment Service of Korea, the number of patients diagnosed with lung cancer has been on the rise, with the count as of 2020 recording 100,134. Of these patients, 80 to 85% have non-small-cell lung cancer(NSCLC), and about 50% of these NSCLC patients who are Asian including Korean are found to show EGFR mutation. Exon 20 insertion (Exon20ins) mutation is a mutation in the amino acid sequence that accelerates the growth of cancer cells, and accounts for 12% of all EGFR mutations. So far, EGFR Exon20ins NSCLC has exhibited resistance to conventional targeted therapy drugs such as Iressa, Tarceva and Tagrisso, meaning no other form of treatment except for cytotoxic chemotherapy was available for this type of lung cancer.

Evaluation of Amivantamab's efficacy in EGFR Exon20ins NSCLC patients who were unresponsive to conventional chemotherapy

From 2016 to 2020, Prof. Byoung-Chul Cho's research team studied the efficacy of Amivantamab in 81 EGFR Exon20ins NSCLC patients who had so far not responded to conventional chemotherapy. 40 of the patients (49%) were Asian and the rest non-Asian, and they had undergone platinum-based chemotherapy for three or more progressions including metastasis to the brain.

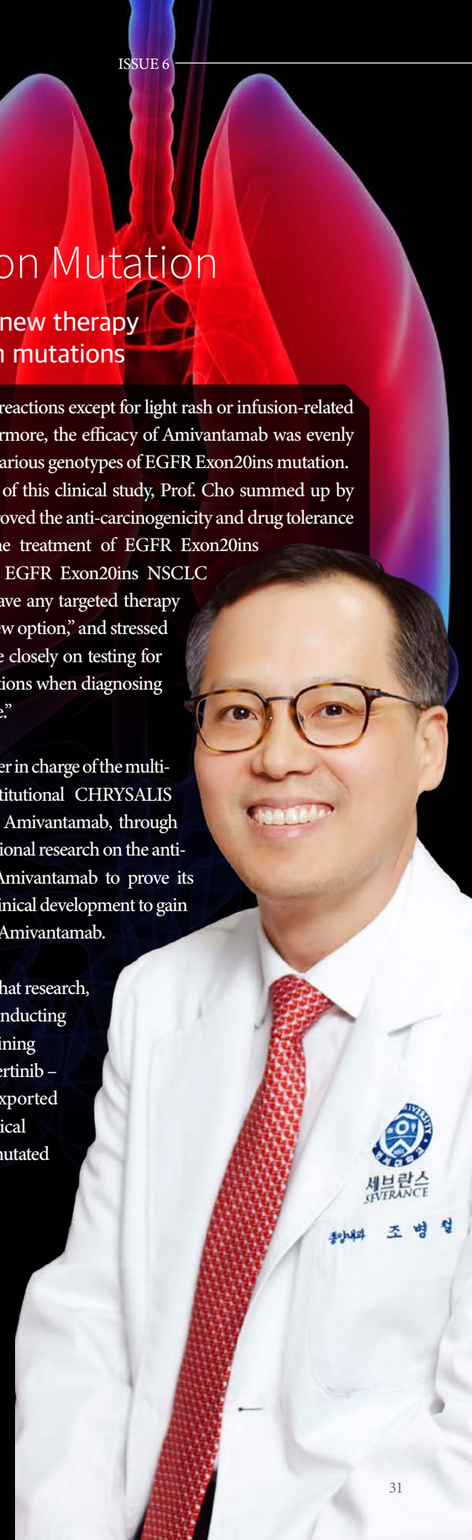
The overall response rate was 40%, meaning Amivantamab helped to eliminate or shrink cancer cells. The reported duration of response was 11.1 months, and the progression-free survival was 8.3 months. EGFR Exon20ins NSCLC is known for its bad prognosis, with progression-free survival lasting only 2~3 months with standard chemotherapy.

Compared to other targeted therapy drugs under development that have side effects such as severe rash or diarrhea, Amivantamab did not cause any high-grade adverse reactions except for light rash or infusion-related hypersensitivity. Furthermore, the efficacy of Amivantamab was evenly distributed among the various genotypes of EGFR Exon20ins mutation.

As the chief supervisor of this clinical study, Prof. Cho summed up by saying that "the study proved the anti-carcinogenicity and drug tolerance of Amivantamab in the treatment of EGFR Exon20ins NSCLC, thus offering EGFR Exon20ins NSCLC patients who did not have any targeted therapy options before with a new option," and stressed "the need to focus more closely on testing for EGFR Exon20ins mutations when diagnosing lung cancer in the future."

Prof. Cho is the researcher in charge of the multi-national and multi-institutional CHRYSALIS phase I clinical trial on Amivantamab, through which he led the translational research on the anti-tumor mechanism of Amivantamab to prove its efficacy and drove the clinical development to gain FDA's final approval for Amivantamab.

Based on the results of that research, Prof. Cho is currently conducting clinical studies on combining Amivantamab with Lazertinib – whose technology was exported by Korean pharmaceutical Yuhan– to treat EGFR-mutated lung cancer.



Prof. Joohyuk Sohn's Research Team Charts New Path for Breast Cancer Patients through Genomics and Liquid Biopsy Research

Prolific clinical and translational research on genomics and liquid biopsy expected to create a new paradigm

The breast cancer research team coordinated by Prof. Joohyuk Sohn, College of Medicine, Yonsei University, (comprised of Prof. Seung-Il Kim, Gun-Min Kim, Hyung-Seok Park, Min-Hwan Kim, Se-Ho Park, Ji-Ye Kim and Seul-Ki Kim, and about 30 researchers from relevant clinical research and lab teams) brings together prof. in the divisions of Medical Oncology and Breast Surgery to conduct clinical and translational research on topics such as the development of novel drugs for breast cancer. In particular, the team has a long-standing interest in genomics and liquid biopsy and has pursued translational research on these topics for some ten years. It is currently in its ninth year of in-depth research on liquid biopsy under Yonsei's R&D project to nurture research-centered hospitals, and has also conducted joint research using liquid biopsy with Green Cross Genome Corporation for three years as part of the inter-ministerial Post-Genome Project led by the Ministry of Trade, Industry and Energy(MOTIE). More recently, it has been engaged in Yonsei Cancer Center's multiomics research project for the past two years.

What sets Prof. Sohn's breast cancer research team apart from other research teams is that it uses the cancer tissue or blood of breast cancer patients collected from clinical trials and cohort studies to conduct its genome research. In other words, unlike conventional genome research, it studies the tissue and blood samples collected from proactive, ongoing clinical research. Since genome studies are carried out concurrently with clinical research, the team can make use of clear genetic data and high quality tissue/blood samples to enhance the quality of genome sequencing, which in turn enables more sharply focused and targeted bioinformatic analysis.

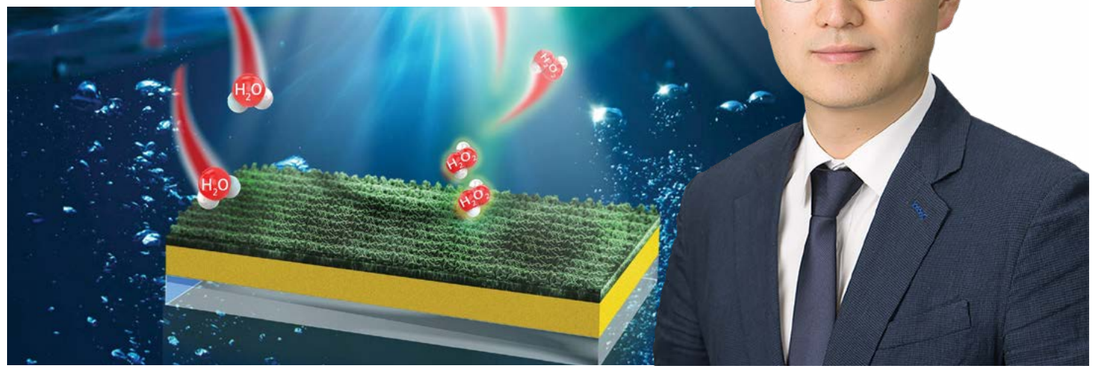
Prof. Sohn's team recently collaborated with Prof. Sang-Woo Kim to conduct research showing that metastatic breast cancer patients who responded to anticancer therapy positively enough for them to be pronounced cured exhibited genome mutation that was relatively simple in terms of tumor mutational burden and copy number alteration. The prof. published their findings in the world-renown journal Communications Biology. This would be a prime example of how a question arising from clinical research was answered by doing genomic analysis of samples taken from the clinical research itself. Prof. Sohn's team is also carrying out genome studies by using the blood samples of almost 700 breast cancer patients – 230 samples from the metastatic breast cancer cohort and 470 samples from the PEARLY Trial (phase 3 trial on early-stage triple-negative breast cancer) in MOTIE's Post-Genome Project. It is conducting and analyzing the whole genome sequencing(WGS) of circulating tumor DNA in order to investigate its role as a prognostic factor and its clinical utility in the detection of molecular clustering, homologous recombination deficiencies and resistant genes. Together with Prof. Min-Hwan Kim, the team is putting together its findings in a thesis for publication.

Gearing up to commercialize new cancer-screening technology

Prof. Sohn's team went on to use its WGS results in a joint research with Dr. Eun-Hae Cho's team at Green Cross Genome Corporation, where AI technology was applied to develop and patent a method to differentiate between cancer patients and non-cancer patients. Based on the patent, Prof. Sohn is gearing up to commercialize this new technology for cancer screening. To this end, he has co-founded a startup named AIMA with Prof. Sang-Woo Kim. Through AIMA, Prof. Sohn will be using AI platform technology to conduct big data analysis of the WGS of the ctDNA collected through cohort studies of all cancer types, which will enable early diagnosis of cancer and ultimately bring us closer to the goal of lowering cancer recurrence and mortality rates.

Prof. Jong Hyeok Park's research team Develops Next-generation Hydrogen Peroxide Artificial Photosynthesis System

Controlled Selectivity over Competitive Reaction through Surface Engineering of a Photoelectrode



The research team led by Prof. Jong Hyeok Park(Chemical Engineering) has developed a system for hydrogen peroxide production utilizing a next-generation artificial photosynthesis system, and has succeeded in highly efficient hydrogen peroxide production with controlled selectivity through various techniques for surface/interface engineering of photoelectrodes.

Increasing demand and interest in hydrogen peroxide as a highly usable and eco-friendly oxidant

Hydrogen peroxide(H_2O_2) has emerged as a next-generation high value added product. The oxidant is also eco-friendly as the only byproduct from its production is oxygen. It is in huge demand thanks to its high usability in diverse sectors including paper, disinfectants, textiles and waste processing. And as it is easier to handle than hydrogen and has an appropriate level of energy density, it is regarded in the energy sector as one of the best forms of chemical energy for manufacturing fuel cells. However, the oxidative product O_2 is thermodynamically dominant in the water oxidation process as the O_2 evolution potential (+1.23 V) is lower than that of H_2O_2 (+1.77 V), and there is also the issue of the highly self-reactive H_2O_2 decomposing into O_2, all of which have posed a challenge in terms of engineering to control selectivity.

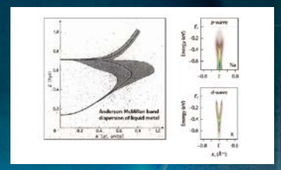
Semi-conductive material (e.g. $BiVO_4$, SnO_2) is deployed in artificial photosynthesis to induce the selection of the evolution of the more valued product(H_2O_2) over the usual water oxidative product(O_2). At the same time, in order to achieve the highest theoretically possible conversion efficiency, further improvements such as hetero junction, doping, and surface/interface and facet engineering are needed. To this end, Prof. Park's research team coated the surface of a $BiVO_4$ photoanode with a SnO_2-x overlayer to create downward quasi-hole Fermi energy at the photoanode/electrolyte interface, thus inducing the selection of the 2-electron H_2O_2 evolution by reduced band bending. This SnO_2–x/$BiVO_4$ photoanode achieves a Faraday efficiency (FE) of over 86%, one of the highest FE records for independent H_2O_2 generation, while also recording a solar-to-H_2O_2 efficiency of 5.6% through the systemization of cathode-based hydrogen production and PEC fuel cell production.

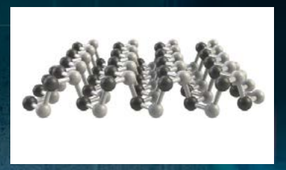
Also, by proving and utilizing the possibility via facet control to coordinate the thermodynamic reactions in water splitting occurring on the facet/electrolyte interface of the $BiVO_4$ photoanode, Prof. Park's research increased the selectivity of H_2O_2 evolution to induce the photoanode to kinetically favor H_2O_2 evolution. When the (010) facets of $BiVO_4$ became dominant, the valence achieved was an appropriate level for H_2O_2 evolution, and the FE recorded 70%.

Prof. Park's research outcomes have the global competitiveness to lead the development of engineering techniques that can be applied to various forms of artificial photosynthesis for photo transformation into high value-added products in the future energy production and conversion sector. The research outcomes were published in the world-renown journal in the energy production and conversion sector, *Journal of the American Chemical Society* (cover article of the May 2020 issue), as well as *ACS Energy Letters* (October 2021 issue).

Young Experimental Physicist **Prof. Keun Su Kim** Solves 60-year-old Puzzle Presented by Nobel Laureates

First-ever successful observation of the electronic structure of liquid metals





Prof. Keun Su Kim is an up-and-coming researcher and member of the faculty of Yonsei University. After gaining admission in 2001 and majoring in Physics, he returned to his alma mater as a prof. in 2017. Since starting his job at Yonsei, he has risen to become one of the most promising and prominent researchers of Physics in Korea and beyond.

First-ever observation of the electronic structure of liquid metals, for which only theoretical models had existed

Scientists were only able to theoretically speculate about the electronic structure of liquid metal, the stuff that the robots in Terminator movies are made of. Although the 1960 Nobel laureates in Physics P. W. Anderson and N. F. Mott did come up with a theoretical model to describe the properties of liquid metal, the unusual property of "backward-bending" band-structure and pseudogap predicted by the theoretical model remained unobserved in experiments for more than half a century. But Prof. Keun Su Kim's research team attracted much attention in the academia by succeeding in actual observation of the unusual band structure of liquid metals for the first time since it was theorized more than 60 years ago.

In the case of crystalline solid matter where the electrons are coherently aligned, it is relatively easy to describe the electronic and photonic properties of the matter. But in the case of matter made of liquids, glass, or amorphous solids where the electrons do not behave coherently, it becomes much more challenging to precisely predict the scientific properties of the matter. Prof. Kim's team adopted a new method to investigate the behavior of electrons in liquid metals. Rather than using the conventional method of directly measuring the electronic properties of liquid metals, the team derived an idea from how alkali metal (sodium, potassium, rubidium and caesium) ions dispersed in a similar manner to that of liquid when doped on a crystalline insulator (black phosphorus), and so adopted the unique approach of doping black phosphorus with alkali metal and observing the electronic structure at the interface of the insulator and dopant. Multiple resonance scattering of the electrons and ions from the atoms of an alkali metal occurs when the alkali-metal dopant interacts with the surface of black phosphorous. So the electrons on the surface of the black phosphorous will behave like those of a liquid metal. The research team utilized cutting-edge techniques such as synchrotron radiation and angle resolved photoelectron spectroscopy(ARPES) to take precise measurements of the black phosphorus electrons, and was able to observe for the first time the unusual band structure of free electrons bending backwards with varying pseudogaps as predicted by the theoretical model of Anderson and Mott in the 1960s.

High temperature superconductivity is one of the oldest unsolved puzzles in Physics, and it occurs when a crystalline insulator is doped by disordered heteroatoms. As mysterious pseudogaps appear in the behavior of electrons in the process, understanding this pseudogap is expected to help solve the mystery of high temperature superconductivity. Thus the mechanism of pseudogaps discovered through Prof. Kim's research could provide important clues in understanding high temperature superconductivity. The research was recognized for its academic value and published in Nature in August 2021.

[Article: Pseudogap in a crystalline insulator doped by disordered metals. Authors: Prof. Keun Su Kim (corresponding author / Yonsei University), Dr. Sae Hee Ryu (first author / Yonsei University), Minjae Huh (first author / Yonsei University), Do Yun Park (first author / Yonsei University)]

Discovery of a new kind of semiconductor based on the concept of "pseudospin"

Prof. Keun Su Kim also discovered a new kind of semiconductor based on the concept of "pseudospin" in 2020. Pseudospin occurs when the atoms constituting matter merge in the shape of a honeycomb, and Prof. Kim's team found that when pressure is applied to this honeycomb system in one direction, pseudospin will align in the same direction. By measuring the pseudospin behavior of phosphorous atoms aligned in a puckered honeycomb structure in black phosphorus, Prof. Kim's team found that bipolar pseudospin polarization was greater than 95%, and named this the "bipolar pseudospin semiconductor." Prof. Kim described this new semiconductor as "a pseudospin analogue of magnetic semiconductors," and explained the significance of this research by forecasting that "just as the discovery of magnetic semiconductors pioneered the field of spintronics, the discovery of pseudospin semiconductors might lead to the birth of a new research field in next-generation semiconductor research called pseudospintronics." The research was recognized for its academic and applicational value and published in the international journal Nature Materials in February 2020.

[Article: Black phosphorus as a bipolar pseudospin semiconductor. Authors: Prof. Keun Su Kim (corresponding author / Yonsei University), Dr. Sung Won Jung (co-first author / Yonsei University & Diamond Light Source), Sae Hee Ryu (co-first author/ Yonsei University & POSTECH)]

Prof. Kim's research was supported by Yonsei University's signature research cluster program and the Ministry of Science and ICT's Fundamental Research Project. The Yonsei signature research cluster program was launched this year to nurture research capabilities in areas that may become Yonsei's signature research.

Focused funding in selected areas where Yonsei researchers have the potential to produce world-class research achievements have led to remarkable results. Yonsei University will continue to focus on discovering and supporting young researchers like Prof. Keun Su Kim.

Yonsei University's Performance Is Introduced in Nature Index's Special Korean Issue

Positioning as a university leading sustainable future

Yonsei University's innovative education and research performance were reported in the special Nature Index 2020 South Korean issue published on May 28, 2020. Yonsei University confirmed its status as a world-class research institution by being listed as Korea's 3rd (147th globally) in Nature Index's educational institution ranking announced recently, following Seoul National University (58th) and KAIST (70th). Concurrently, Yonsei University was listed 47th in THE Global Impact Ranking that assesses a university's social impact, proving that it is taking the lead in advancing a sustainable future through research performance.

Nature Index's special Korean issue introduced Yonsei University's various social participation activities. In particular, international health research that contributes to the universal health coverage of developing countries by utilizing industrial waste, student-led social innovation activities like developing an app that helps the blind shop online, and Global Sustainable Development Forum that acts as a platform for seeking solutions to global challenges were highlighted.

This was the first time since 1993, which was about 30 years ago, that Nature has focused on addressing Korean research performance. This special issue sheds a specific light on the research strategy of Korea that aims to transform from a fast follower to a first mover through intensive investment in basic research and original R&D.
Nature Index is a research competitiveness indicator announced by the natural science academic journal Nature and is presented by considering the ratio of authors per institution and nation for the papers published in 82 prominent international academic journals during the recent year.

Sangnam Institute of Management Achieves the 57th on the FT Global Ranking for Executive Education

Sangnam Institute of Management of the Graduate School of Business was ranked 57th globally in the Financial Times (hereafter "FT") Executive Education Ranking 2020, which is selected by the British FT, as the sole institute in Korea. Not only has Sangnam Institute of Management made the FT ranking for the past five years in a row, but it also accomplished the remarkable feat of stepping up 13 ranks since the last year (70th).
The educational course included in this time's ranking was a commissioned course that was operated by Sangnam Institute of Management of Yonsei University in 2019; major companies that participated are IBK (Industrial Bank of Korea), Shinsegae Group, POSCO, Hyundai Engineering & Construction, LF, GS, BGF, etc. and distinguished Korean companies that lead talent training in the long-term perspective took part.

The evaluation criteria of the FT Ranking include program composition, teaching method, instructor team, trainees' level, new technology and learning effect, educational program follow-up, educational facilities, etc., and also reflect the results of the graduates' survey. Among these, Sangnam Institute of Management was ranked 25th globally in the program follow-up evaluation, which can be interpreted that companies made steady effort to incorporate necessary requirements even after the program had finished, and this resulted in winning favorable evaluation.

Sangnam Institute of Management opened in March 1999 by the fund donation of LG Group's deceased Honorary President, Ja Kyoung Koo, and has greeted its 20th anniversary last year. For the past 20 years, Sangnam Institute of Management has made immense contributions to advancing Korean executive education by fostering talents that reflect the demands of the industry and effectively supplying the changing management techniques through industrial-academic cooperation.

Severance, the first in the world to operate 1,000 SP robotic surgeries Achieves pioneering performance in robotic surgery by applying it to varied illnesses

In June 2021, Severance Hospital became the world's first to perform 1,000 Da Vinci robotic surgeries. Unlike previous robotic surgeries, the Da Vinci SP (Single-Port) robotic surgery enables operation through one hole and therefore is called a single-port surgery.

Severance Hospital conducted Da Vinci SP robotic surgery for the first time in Korea in October 2018 and became the world's first institution to perform 100 robotic surgeries in February 2019. All surgical methods carried out in otolaryngology and thyroid & endocrine surgery were done with the SP robotic surgery for the first time globally, as well as the technologies for obstetrics and gynecology (staging surgery for solenoma, radical abdominal hysterectomy and radical trachelectomy for cervical cancer), hepato-biliary-pancreatic surgery (cholecystectomy), breast surgery and plastic surgery (mastectomy and breast reconstruction), etc. Urology's partial nephrectomy, pelvioplasty, and surgery for children's urogenital system were also performed for the first time in Asia.

Da Vinci SP reduces the incision part with a smaller hole than existing robotic surgeries, minimizing the area of scars for thyroid and breast cancer surgeries commonly performed on female patients. A precise surgery is possible thanks to the polyarticular wrist function that secures wider vision without any blind spots, and the movements of the robot's arms have been improved. Equipment pieces required in the surgery are mounted in one cannula to prevent collision among the pieces, thereby allowing an even more detailed approach.

These advantages lead to a decrease in surgery time and complications. Particularly for otolaryngology, single-port robotic surgery is well utilized and works effectively for a precise incision of the head and neck tumors in the narrow space within the neck.

Robotic Endoscopic Operation Center's Director Byeong So Min revealed, "I think expanding the base for better treatment results by applying robotic surgeries to varied illnesses was the impetus that led to becoming the global mecca of robotic surgeries. We are planning to continuously conduct diverse studies to expand indications for single-port robotic surgeries and develop standard techniques."

The 2nd-Stage Construction Project for the International Campus Signed Targeting the embodiment of a University-Centered "Academy-Research-Industry-Medicine Innovation Cluster"

Yonsei University and Incheon Metropolitan City have entered into an agreement on the 2nd Stage Construction Project for Yonsei University International Campus to create the Songdo Severance Hospital and Yonsei Science Park (YSP). The signing ceremony was held on December 18, 2020, by contactless/online method with the participation of key personnel, including President Seung-Hwan Seo and Incheon Mayor Nam-Chun Park.

Yonsei University will be newly supplied 141,292m^2 as the 2nd-stage campus site in addition to the existing 1st-stage campus site. The gist of the 2nd-stage project is building the Songdo Severance Hospital and creating the Yonsei Science Park (YSP) on 387,777m^2, which is the total of the site to be developed for the 1st stage and the new 2nd-stage site. If the last ten years of the International Campus focused on education and globalization, the coming ten years will be planned to create "a university-centered innovation cluster" with a focus on research and industrial-academic cooperation.

According to the agreement, Incheon City will aid an additional 500 billion won to build and operate the Yonsei Science Park (YSP), and Yonsei University will use this as the basis for building the Songdo Severance Hospital and industrial-academic infrastructure and creating the Science Park by attracting national projects and private investment.
The Yonsei Science Park (YSP) will consist of the six zones of convergence education, convergence research, start-up venture, industrial-academic cooperation, future innovation, and communication innovation. The emphasis is on building the virtuous circle of "education→research→commercialization" through high-tech infrastructure, excellent research manpower, and an optimization operation system. Here, Songdo Severance is planned to be constructed as a research-centered hospital to build an "academy-research-industry-medicine innovation cluster" that lives up to its name. The Songdo Severance Hospital will not only perform the role of a hub institution of the Songdo Bio Health Valley but also function as a regional base hospital for responding to the medical demands of Koreans and foreigners according to the invigoration of the Incheon Free Economic Zone.

"GEEF 2021," the Global Engagement & Empowerment Forum on Sustainable Development Wraps Up in Great Success

Yonsei University is exerting efforts on all levels to strengthen the social responsibility of the university through cultivating "innovative leaders with a spirit of community" under the core values of challenge and excellence, creation and innovation, and coexistence and engagement. Launched in 2017, the Institute for Global Engagement strives to pursue challenging research and knowledge to resolve universal issues that the earth and humanity are facing and sustainable development by the lead of Honorary Director Bank Ki-moon. Every February, it has held GEEF on an international scale to raise global awareness on the importance of sustainable development. Thanks to these endeavors, Yonsei University has ranked as Korea's No. 1 and the world's No. 47 in the 2020 world university influence evaluation of the Times Higher Education (THE), the only global ranking that assesses the efforts of universities for sustainable development goals of the UN.
Honorary Director Ban Ki-moon emphasized the importance of "sustainability based on solidarity with one another" in his closing address. The event came to an end with his message that "cooperation, collaboration, and innovation that surpass borders must lead the progress of sustainable development goals set by the UN and the Paris Agreement on climate change."

GEEF is cohosted by Yonsei University's Institute for Global Engagement, Ban Ki-moon Foundation for a Better Future, and Austria Ban Ki-moon Center for Global Citizens, and this year's event was officially sponsored by POSCO, Fleishman-Hillard Korea, and Hanbul Motors.

The Mirae Campus Student Participation Team Wins Multiple International Design Awards

The "re.do studio" team made up of Jaemoon Choi (4th year), a student in the Division of Design and Art, Mirae Campus, and the students Dongkyu Hwang and Inhwan Kim of Konkuk University won Gold at the IDA (International Design Awards), after being awarded Bronze in August 2020 and Gold in December at the 2020 Spark International Design Award, one of the world-class international design awards.

The Spark International Design Award is a design competition screened by design experts of globally famous companies like IDEO, McLaren, and Sennheiser with the goal of "Promoting better life through better design." It is counted as one of the global-level design contests along with the world's top three design contests, iF, IDEA, and Red Dot, and is held to congratulate the contributions of designers in smart and sustainable multidisciplinary fields and discover new talents.

The "re.do studio" team began with winning Bronze by submitting "Pumper" that allows easy use of bottled water purifier at the Spark International Design Award last August 2020 and then won Gold in the December competition with the design of the "Balance-backpack" that can easily and accurately adjust the backpack straps on both sides with one strap. Afterward, they also won Gold at the IDA in January 2021 with the "Balance-backpack" that won them Gold in the Spark International Design Award, thereby proving their excellent design capacities with the performance of accomplishing three wins at well-known global design awards in a short period of time.

The student Jaemoon Choi revealed, "Children in the growth phase may develop spinal deformity when backpack straps on both sides differ, so to fix this problem, we designed the 'Balance-backpack' that can easily and accurately adjust those."

Yonsei University Signs a Tripartite MOU with the Ireland NIBRT & Korea Health and Industry Development Institute

Yonsei University signed a tripartite MOU for establishing the K-NIBRT (National Institute for Bioprocessing Research & Training) with the Korea Health Industry Development Institute (Director Soonman Kwon) and the Ireland NIBRT (CEO Darrin Morrissey) on March 10, 2021.

The MOU was signed including Yonsei University, which had been selected as the operating subject of the bioprocess educational program in October 2020, as the follow-up measure for the cooperation on fostering bio workforce between the Development Institute and the NIBRT in June 2020.
The three institutions will mutually cooperate as partners for building an advanced Korean-style bioprocess educational system, such as adopting the NIBRT's educational programs, building a K-NIBRT bioprocess workforce training center, and collaborating for education and international exchange in bio-industrial fields.
The K-NIBRT will officially open in 2024 with the goal of constructing a professional workforce training system for the best biomedicine production process in the Asia-Pacific Region by introducing the educational system of the Ireland NIBRT, the world's top biomedicine workforce training institution, to Korea. Prior to the official opening, pilot education reflecting advanced bioprocess trends and Korean companies' demands will commence in Yonsei University's International Campus from July 2021.

Once a full-fledged adoption agreement is signed based on this MOU, K-NIBRT will conduct global cooperation as the global partner of the Ireland NIBRT and a certificate with the same effect as the NIBRT one can be acquired by completing the education of the K-NIBRT. The Ireland NIBRT has started with government-led investment for fostering biomedicine talents and is currently providing field education for trainees of diverse spectrums, from high-school graduates to master's, PH. D students and beyond, in the entire course of pharmaceutical and bioprocesses, including medicine production, good manufacturing practice (GMP), and quality control (QC). President Seung-hwan Seo stated, "We will do our best in building a curriculum that suits the Korean demands and circumstances by promptly adopting the advanced curriculum of the pharmaceutical powerhouse Ireland and tailoring it to Korea's national competency standards (NCS).

Breaks the Record of Papers Selected in the 2021 International Conference on Computer Vision and Pattern Recognition (CVPR)

A total of 20 papers from Yonsei University have been selected in the recent International Conference on Computer Vision and Pattern Recognition (CVPR).

CVPR is the world's top academic conference in the field of artificial intelligence (AI), where major Korean universities have participated every year to prove their excellence in the AI field. Yonsei University has achieved the best performance so far with 20 papers, followed by Seoul National University with 17 papers. Yonsei university's record at this time has been accomplished by the cooperation between outstanding students and prof. in the creative research environment, and particularly, the School of Electrical and Electronic Engineering made a phenomenal record of having 11 papers selected.

Among them, Prof. Kwanghoon Sohn's research team in the School of Electrical and Electronic Engineering had a total of 5 selected papers, achieving the feat of having most papers chosen as a single laboratory in Korea. CVPR is the best international symposium in the field of computer vision ranked as No. 1 throughout SCI journals and conferences in all areas of engineering with a Google Scholar h5-index of 299. It is hosted by the international IEEE and the nonprofit Computer Vision Foundation and is counted as one of the top 3 conferences in the field of computer vision along with the European Conference on Computer Vision (ECCV) and International Conference on Computer Vision (ICCV).

Meanwhile, Yonsei University has lately adopted AI technology as a signature research area, providing utmost research support at a school level. The Yonsei signature research cluster program supports intramural convergence and international joint studies in research fields that can reach a global level, and in the AI field, there is ongoing research on multiple signal-based general social AI technology.

Yonsei University Achieves Its Best Ranking Yet in the QS World University Rankings

Yonsei University has won its best ranking yet by being listed as the 79th on the QS World University Rankings 2022 that was announced by QS (Quacquarelli Symonds), a global university rating agency of the U.K., on June 9, 2021. This is six steps up from the last year's 85th ranking and is an even more significant evaluation in that it was achieved when rankings of a majority of chief Korean universities fell compared to the last year.

Yonsei University showed the tendency of being stagnant in the 100th ranking range up to 2019 but has rapidly risen to the 85th last year and is now indicating a drastic upward trend by entering the top 70 as of this year.
The QS World University Rankings' evaluation indicators consist of the following 6 metrics: academic reputation (40%), graduates' reputation (10%), citations per faculty (20%), faculty/student ratio (20%), international faculty ratio (5%), and international student ratio (5%). Yonsei University has raised the ranking by elevating in all indicators of reputation, research, educational environment, etc., excluding the internationalization indicator that cannot avoid a fall due to the COVID-19 situation.
Yonsei University has continued investment for improving the research indicator through continual research support policy.
Particularly, the researcher all-cycle support policy has been established to discover and support leading researchers and intensify support through the Future-Leading Research Initiative, and the ratio of international joint studies with excellent overseas universities is continuously increased through the Yonsei Frontier Lab to enhance world-class research capacity.
Yonsei University has achieved the best record in primary overseas university rating since its foundation and is planning to continue the uptrend in the future by reinforcing its research competitiveness through discovering and attracting outstanding researchers and supporting promising future fields.

Achieves the Best Ranking of All Time in THE World University Rankings

The only one among major Korean private universities to rise in ranking, leaped 36 steps compared to last year, the best rating since its opening with No. 151

Yonsei University broke its previous records by being listed as No. 151 in the 2022 THE World University Rankings announced by the THE (Times Higher Education), a global university evaluating agency in the U.K. This is 36 steps up from No. 187 in the previous year and is even more meaningful when considering the fact that most of the top universities in Korea had their rankings fall compared to the last year. Especially, Yonsei University was the only one among major private universities that have raised its ranking and was also ranked 4th in Korean ranking, rising three steps compared to the last year.

THE is the most reputable world university rating agency along with QS (Quacquarelli Symonds), and in this year's evaluation, the rankings of 1,662 universities in 99 nations across the world were made announced. The evaluation items of THE are comprised with five areas of educational conditions (30%), research performance (30%), paper citation (30%), internationalization (7.5%), and industrial-academic cooperation (2.5%).

Yonsei University had its scores go up in most indicators, rising by 4.5 points in research performance, by 2.7 points in educational conditions, by 1.7 points in paper citation, etc., and thereby elevated in the overall ranking. While the score fell by a small margin in industrial-academic cooperation, it still maintains a top global level and did not significantly influence the overall ranking. Internationalization obtained the same score as the last year.

In the QS World University Rankings 2022 in June 2021, Yonsei University also recorded the highest ranking (79th) since its opening. It was the only one to go up in ranking amid the general ranking drop of major private universities in Korea. The upward trend will continue from now on as well through strengthening research competitiveness to discover and attract outstanding researchers and support promising future fields, etc.

Cooperation with IBM for Quantum Computing-Based Research & Education

Yonsei University published the plan to establish the IBM Quantum Computing Data Center with IBM on October 25, 2021. Once the center is founded on the Yonsei Science Park, which Yonsei University is currently planning to create on the International Campus, Korea will become the fourth nation in the world to possess an IBM quantum computing data center installed with the IBM Quantum System One Computer after the U.S., Germany, and Japan.

Yonsei University and IBM are planning to cooperate for quantum computing research, including academic studies on quantum computing, software development using quantum computing, and providing quantum computing resources required in the industries.
Moreover, as an IBM quantum hub connecting industries, universities, and institutes in Korea, Yonsei University will work on fostering a quantum computing ecosystem to collaborate with leading organizations interested in quantum computing research, including corporations, universities, research centers, medical institutions, start-ups, and governmental agencies.
This is expected to reinforce Korean education and studies on quantum computing, application development for utilizing quantum computing, and so forth. Ultimately, Korea will obtain a great opportunity to develop and cultivate the national quantum technological capacities of the next generation following its successes in the semiconductor, electronics, and automobile technology industries.

With this, Yonsei University joins the global community of the IBM Quantum Network, consisting of nearly 170 members such as the Fortune 500 Companies, start-ups, academic institutions, research centers, etc. The Network & IBM Quantum Team studies how quantum computing can be utilized across diverse industries and fields, including finance, energy, chemistry, material science, optimization, and machine learning.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