INCHEON NATIONAL UNIVERSITY RESEARCH HIGHLIGHTS VOL. 1 2024. 04.

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INCHEON NATIONAL UNIVERSITY

RESEARCH HIGHLIGHTS

INCHEON NATIONAL UNIVERSITY RESEARCH HIGHLIGHTS

10 Years After the Incorporation of National University–A History of Development and Innovation and a **New Challenge** for the Future

Jong-Tae Park, President of Incheon National University, a National University Corporation

I am delighted to share our university's amazing research outcome in <Research Highlights> through this special occasion to introduce Incheon National University.

After it was incorporated in 2013, Incheon National University has achieved much growth and development over the past 10 years through constant innovation and efforts. In the research, the international level of paper publication performance and citation index have been steadily increasing, achieving quantitative and qualitative growth in the corresponding area. Based on these achievements, our university's national ranking rose to 21st in the overall ranking in the 2023 JoongAng Ilbo University Evaluation, and the number of international academic journal papers per professor ranked second among national and public universities and eighth in educational conditions in the country.

Our university has been pursuing large-scale projects to grow as a research university. In 2022, we established a collective research system centered on excellent research institutes and created a challenging environment for large-scale national research projects. In 2023, we launched the INU SURE LAB project, a sustainable personnel management program for research lab building. Moreover, by establishing a medical school, we are striving to strengthen local public healthcare and contribute to resolving the shortage of essential medical personnel.

In an era of university crisis where the value of universities is threatened due to a decline in the school-age population and youth employment difficulties, we will overcome the crisis through excellent research outcomes. <Research Highlights> narrates the stories of researchers who have produced outstanding research results in various fields. We aim to create world-class research outcomes through collaboration with domestic and foreign institutions, universities, and researchers. We look forward to much interest and support from those who value Incheon National University. Thank you.

Incheon National University
Targets Virtuous Cycle of Knowledge

Interview with **Han, Minsub**, Dean of Research

Q. What's the purpose of becoming a research university?

A. Incheon National University has dynamically changed after it was founded in 1979. Since being incorporated in 2013, the research capabilities of full-time faculty have significantly improved. Incheon National University's operating goal is to establish a lab-centric national university system centering on practical studies. A university's competitiveness begins with its research capabilities because the key role of universities is to create new knowledge, thereby generating a virtuous cycle of knowledge. A research university is one where professors and students participate in lifelong learning. Research universities are ranked among the top universities worldwide. Hence, Incheon National University aims to be one of the top 100 universities in the world and the top 10 in Korea. We intend to achieve university development by leaping as a research university.

Q. What is the process of becoming a research university?

A. First, a research-centered collective research system must be established. Universities' academic organization has a very well-structured hierarchical management system based on its long history. On the other hand, university research organizations do not have a strictly established communication system among researchers, affiliated institutions, and management organizations. Thus, the first necessary step toward becoming a research university is to restructure the research activity organization. Incheon National University introduced a lab-centric collective research system in 2022. A new system needs a focal point, a foundation, and a subject. Incheon National University's collective research system is centered on 10 excellent laboratories, the foundation is an annual collective research support project worth KRW 2 billion, and the subject comprises about 60 full-time faculty members, 10 postdoctoral researchers, and 200 student research groups. Moreover, we established the Collective Research Innovation Planning Group as a superstructure of the collective research system. The new research system is known as the Incheon University model, attracting attention among universities and research institutions.

Second, there must be a sustainable research personnel management program. Securing skilled research personnel for each degree program in the research lab, which is the basic unit of research activities, is essential for research development. We must secure research personnel at each level by motivating our students to advance to higher degree programs and continue as postdoctoral researchers. We must also strengthen our research competitiveness through the transfusion of high-quality domestic and foreign research personnel. Through this, we can create a stable research personnel supply structure and establish a virtuous cycle structure at the research lab level, creating an environment where researchers can focus on research with peace of mind. Incheon National University has set an ambitious plan to supply research personnel by investing an annual budget of KRW 2.5 billion, including research funds, labor costs, scholarships, and lodging expenses, in the research lab in 2023. The project name is INU SURE LAB(SURE: SUstainable human REsource Management Program for Research LAB). Through this project, we will increase the number of research labs with master's and doctoral students at each level from the current level of 44 to 100 in the future.

Q. What is the development direction of research universities?

A. Fundamentally, the characteristic of university education is that professors and students participate in an endless exploration.
Humboldt, a German educator, proposed the ideology that lower-level education is limited to imparting definitive and complete knowledge, while higher-level education is based on the joint pursuit of knowledge by professors and students. Research universities are close to the original functions of these universities. Students receive training and develop their capabilities through research, and professors utilize students to produce outstanding research results. This can be the genuine combination of education and research. Based on this philosophy, we aim to set challenging research topics, form a collective research team, and seek ways to support innovative research methods and autonomous research performance. Incheon National University's research university's future development direction is to establish a performance-oriented research system that generates a virtuous cycle of social value creation and creates a high value-added research industry-academia cooperation brand.

1 The Leading Strategy for Incheon National University's Convergence Research

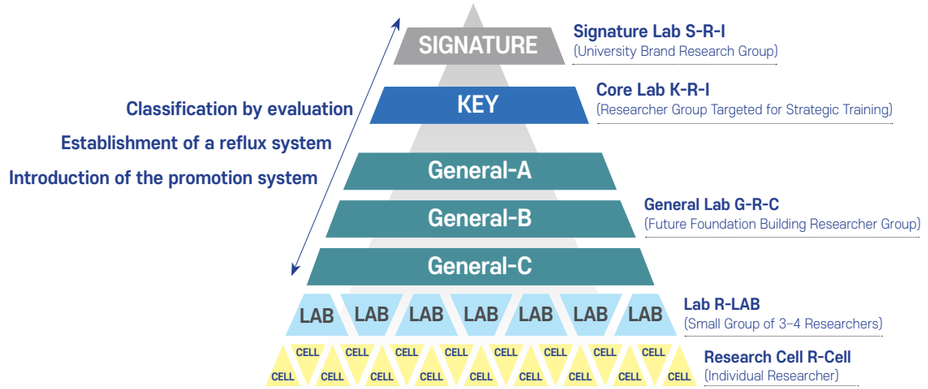
Lab's Collective Research System

Incheon National University is transitioning from researchers' traditional research methods to establishing a collective research system focused on research labs. We introduced a training system that continuously develops and produces young researchers, and we have been providing full-cycle support for knowledge creation led by universities.
First, we moved away from the traditional approach of quantitative growth in research and focused on "qualitative growth in research."
Second, we went beyond the individual-centric research method with high departmental divisions and introduced a collective research system that restored the original function of the research labs.
Third, we are striving to create a research brand for the university by fostering a signature research lab that represents Incheon National University.

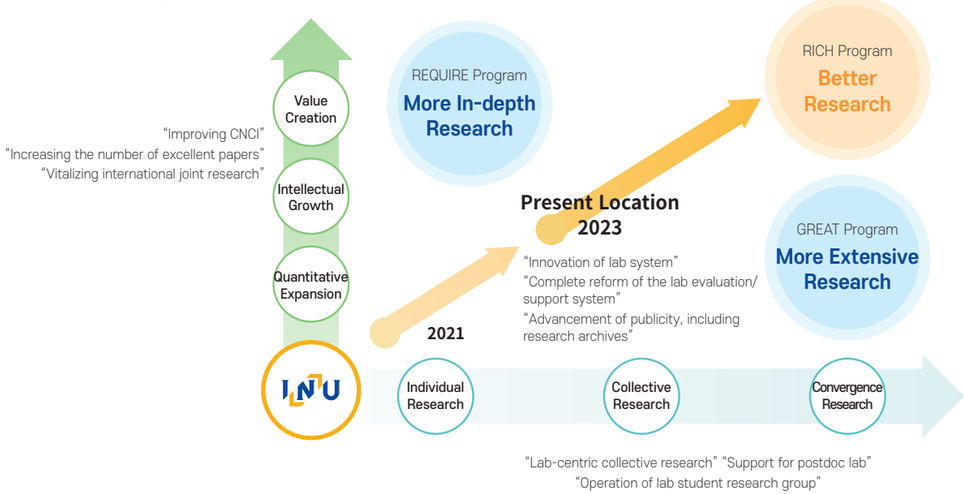
3 Research Support Systems and 6 Strategies

3 Systems	6 Strategies	Major Projects and Systems
Qualitative growth of research achievement(REQUIRE) **REQUIRE** Research Quality IncREasing **Program**	Strategies for expanding excellent papers	Multi-acknowledgement system by JCR ranking
		General multiyear project system for the top JCR 10%
	International joint research strategy	International joint multiyear project system for the top JCR 25%
		Support project for postdoctoral researchers' overseas training
Activation of collective research (GREAT) **GREAT** Group REsearch AcTivation **Program**	Collective research support strategy	Support project for collective research attraction
		Collective research support project for excellent labs
		Lab personnel support project
		Support project for lab student group
	Convergence research development strategy	Lab consortium system
		Collective Research Innovation Planning Project
		Collective research symposium project
Establishment of university brand (RICH) **RICH** Research Institute-Centered Heightening INU Brand **Program**	Lab innovation strategy	Lab evaluation and rating system
		Signature lab cultivation
	Reputation improvement strategy	InCites(Research achievement analysis)
		Research archive project
		Research Highlights project

Collective Research Ladder System(Group Research Ladder System)



INU's "Strategic Direction of Research Activation"



Incheon National University planned to transform into a research university incrementally. With the creation of a lab cluster(before 2021) ⇒ improvement of the lab evaluation system(2022) ⇒ structuring of support projects by lab evaluation grade(2022) ⇒ implementation of the SURE LAB program(2023), we adjusted the research policy to promote collaboration between researchers within the university and create synergy.

Developing Strategies for a Step-by-Step Collective Research System

2021

A research-centric university focused on creating a collective research ecosystem

- Focused Research University(FRU)
- Research cluster establishment project
- Building a foundation for university brand development

- Establishment of a research university conversion plan
- Research cluster creation project
- Support for the establishment of a research institute development plan
- Support project for winning collective tasks
- Support project for excellent research personnel
- Support project for colleges' research promotion

2022

Lab-centric collective research system

- Complete reorganization and implementation of the lab evaluation system
- Concentrated support for winning collective research projects
- Launch of the Collective Research Innovation Planning Team
- Structuring the support projects by lab rating

- Introduction of lab rating system
- Support project for collective research by excellent labs
- Launch of the Collective Research Innovation Planning Group
- Lab personnel support project
- Support project for the lab's student research group
- Fostering a signature lab

Future Vision(2023-)

Sustainable research support system

- SURE LAB Program
  - A virtuous cycle structure for fostering research personnel
  - Cultivation of undergraduate students and postdoctoral researchers
  - Introduction of excellent domestic and international PhD graduates and doctoral students into the research lab
- Expansion of research space and research planning support

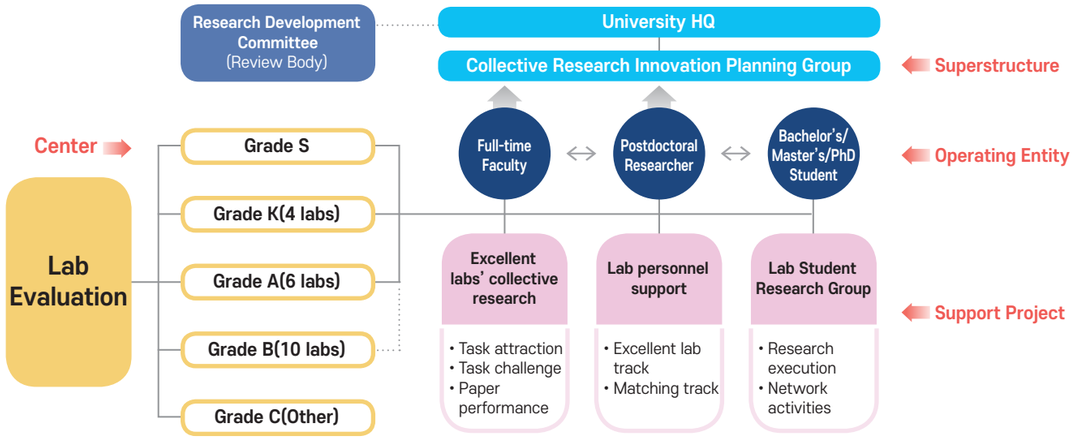
- Introduction of the INU SURE LAB program
- LAB-Building Project
- Lab employment support for postdoctoral researchers
- Invitation for overseas researchers' visit
- INU Research Highlights
- Establishment of an overseas platform

Incheon National University implemented the "Support Project for Winning Collective Projects" to catalyze changes attracting the government's collective projects and large-scale projects. After the lab evaluation in 2022, the research labs were classified into grades K, A, B, and C, and support projects for each lab grade were promoted. We introduced a lab consortium system to strengthen cooperation between research labs, and R&D planning capabilities, such as establishing long-term research policies and planning future research tasks. To produce a signature research lab, four lab consortiums were selected as the highest level(KEY level), and six A-grade labs were chosen as the next highest level. Moreover, by focusing on these research institutes, we efficiently attracted external large-scale projects and revitalized collective research. The Collective Research Innovation Planning Group was established to lead collective research within the school and promote future research planning, analysis, and sharing of research information internally and externally, as the construction of a research network. We formed a group-type research-focused faculty member system and a collective research team of about 60 full-time faculty members, which has been supporting postdoctoral researchers. Lastly, we introduced a student research group at the lab, where about 200 students have been working on research activities.

2022 Lab Evaluation Results		Department of Humanities, Social Sciences, Arts and Physical Education	Department of Natural Engineering
Key Lab	Grade K	• Institute for Chinese and Overseas Chinese Culture Consortium (Organizer) Institute for Chinese and Overseas Chinese Culture (Cooperator) Institute of China Studies	• Urban Sciences University Lab Consortium (Organizer) Incheon Disaster Prevention Institute, (Cooperator 1) Institute of Urban Sciences, (Cooperator 2) IoT & Big Data Research Center
			• Basic Sciences Lab Consortium (Organizer) Institute of Basic Sciences, (Cooperator 1) Institute of Green Bioplastics, (Cooperator 2) Institute of Yellow Sea Studies, (Cooperator 3) Intelligent Sensor Convergence Research Center
			• Convergence Research Center for Insect Vectors Consortium (Organizer) Convergence Research Center for Insect Vectors, (Cooperator 1) Institute of New Drug Development, (Cooperator 2) Institute of Biological Resources and Environment, (Cooperator 3) Institute of Biomaterial and Process Development
General Lab	Grade A	• Institute of Social Science • Incheon Studies Institute	• Institute of Engineering Technology • Energy Excellence and Smart City Lab • Multidisciplinary Core Institute for Future Energies • Innovation Center for Chemical Engineering
	Grades B and C	Applicable to those other than grades K and A	

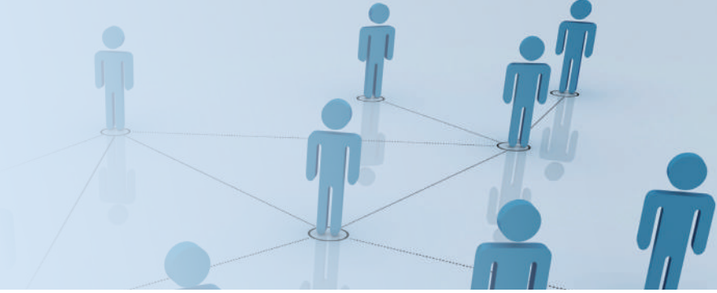
Lab-centric Collective Research-based System Diagram

Establish the foundation for conducting large-scale research and society-contributing research by transitioning from an individual researcher-oriented system to a collective research system centered on university labs



2 Sustainable Platform

SURE LAB



Incheon National University has set a strategic goal to develop into a world-class research university by establishing a performance-centric research system that creates a virtuous cycle of social value. In September 2023, the "SURE LAB" project, a sustainable personnel management program for research labs, was launched as part of an effort to continuously secure excellent research personnel to create an environment immersed in research.

SURE LAB stands for "**SU**stainable Human **RE**source Management Program for Research **LAB**" The project reflects Incheon National University's goal to train graduate students and doctoral-level researchers as the next generation of researchers.

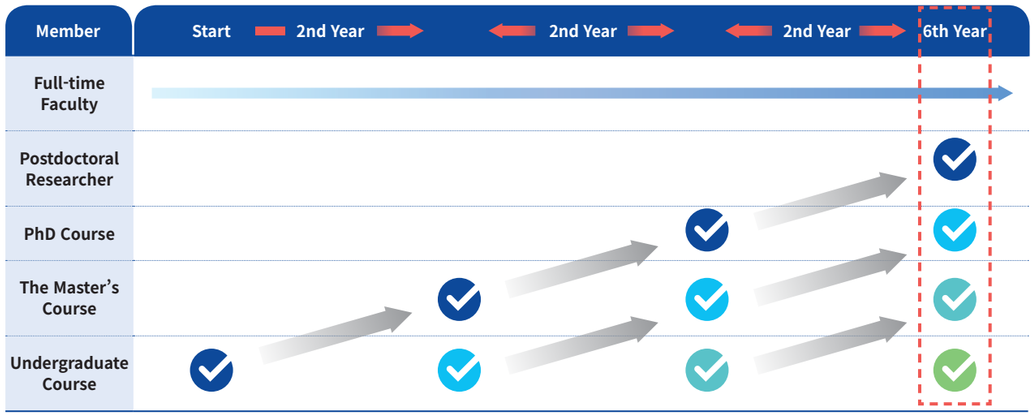
Since the success of LAB depends on increasing the availability of skilled research personnel for each degree program, there is a close correlation between securing research personnel and the research performance of full-time faculty.

Incheon National University's research performance is currently developing into quantitative stabilization and qualitative growth. However, factors such as a decrease in the school-age population and the advancement of students to higher degree programs at universities in Seoul deteriorate the research environment of universities and threaten the foundation for fostering the next academic generation.

"SURE LAB" is a program that motivates our school's excellent undergraduate and graduate students to advance to higher degree programs at our school and pursue postdoctoral research. It also aims to introduce high-quality domestic and foreign researchers to revitalize the research level and create 100 LABs. Incheon National University has been strengthening its research competitiveness by providing necessary support services, such as international collaborative research and career development opportunities, as well as providing operating support funds for graduate students to continue stable research and entrance scholarships to outstanding graduate students.

INU SURE Program(Sustainable Research Personnel Training Program)

SURE: SUstainable human REsource



Equipped with individual research capabilities and a group research system, Incheon National University has been focusing on securing research sustainability by providing support for research personnel. INU established nine specific projects to shorten the time required to train doctoral level personnel, which takes approximately six to eight years from a bachelor's degree.

Expected Outcomes

Personnel Training (As of 2024)	LAB Activation	Research Performance Creation	University Brand Promotion
More than 278 beneficiaries per year ※ 254 graduate students of our school	Expansion of LAB with full-time master's and doctoral graduate students ※ (2022) 44 → (2027) 100	Continuous increase of top-ranked papers' performance (More than 200 papers within the top 10% of JCR, more than 60 papers with IF 10 or higher)	✓ Full-scale promotion of conversion to a research university ✓ An attractive destination for potential researchers

❶ Generating research outcomes through training research personnel and activating LAB
❷ Promoting the university brand as a research university
❸ Fostering the university's outstanding talents into the academic successor generation and research personnel

Specific Projects

Type	Specific Projects	Content	Personnel in Charge	Scope of Support
LAB personnel input	① LAB and building support project	Operating fund for graduate students	Lab	Master's degree/PhD
	② Scholarship for excellent graduate students	Admission scholarship for students with excellent grades	Graduate school	Master's degree/PhD
	③ LAB employment support project for postdoctoral researchers	Labor cost + settlement fee	Lab	PhD
Research visit to Incheon National University	④ Support project for foreign researchers' research visit	Research funding + settlement fee + accommodation	Lab	PhD(master's degree or higher)
	⑤ Support project for foreign university(graduate) students' research visit	Living expenses + airfare + accommodation	Lab	Bachelor's degree / master's degree /PhD
Overseas training for academic successors	⑥ Support project for postdoctoral researchers' overseas training	Labor costs + severance pay	Lab	PhD
	⑦ Funding project for PhD students' short-term overseas training	Airfare + living expenses	Graduate school	PhD
Platform building	⑧ Overseas platform-building project	Establishment of a domestic and foreign researchers pool	Lab	

Hu, Jong Wan, Director of Incheon Disaster Prevention Research Center,
Professor, Department of Urban & Environmental Engineering

Convergence of Three Elements: Safety, Social Environment, and Cutting-Edge Technology

Urban Sciences University Lab Consortium

Organizer: Incheon Disaster Prevention Institute(Professor Hu, Jong Wan)
Cooperator 1: Institute of Urban Sciences(Director Park Jihoon, Professor, Department of Urban Architecture)
Cooperator 2: IoT and Big Data Research Center(Director Kim Hoon, Professor, Department of Electric Engineering)

Research on Solutions to Social Infrastructure and Incheon's Urban Problems

Incheon National University's Urban Sciences Lab Consortium is a research consortium comprised of three on-campus research labs: the Incheon Disaster Prevention Research Center, the Institute of Urban Sciences, and the IoT & Big Data Research Center. It aims to converge the three elements of safety, social environment, and advanced technology in line with Koreans' needs.

At present, when rapid changes in the social environment and technological development take place, the demands for social infrastructure are also becoming more diverse; hence, the exchanges between institutes are essential to prepare technological and social measures and establish future-oriented social infrastructures.

This research consortium conducts research in different fields and strives to establish a research support system in link with the university HQ and industry-academia cooperation group to achieve one goal while serving as a consortium of on-campus research bases. Moreover, it focuses on building the infrastructure needed for research by attracting many R&D research projects and working to improve the welfare of students conducting research and the research environment.

Professor Hu, Jong Wan of the Department of Urban and Environmental Engineering, the director of the lab, and the director of the Incheon Disaster Prevention Research Center have been conducting disaster prevention research to prevent large-scale damage to various social infrastructures caused by disasters. Professor Park Jihoon of the Department of Urban Architecture, head of the Institute of Urban Sciences, studies urban science and conducts research to solve common problems in the Incheon urban area, and Professor Kim Hoon of the Department of Electronic Engineering, head of the IoT & Big Data Research Center, studies AI convergence technology to solve social problems based on his research expertise in IoT and big data, which are core elements.

To promote exchange between labs, affiliated research students give presentations on ongoing tasks or academic work and exchange feedback on research methods for each project. Based on constant research exchange, feedback, and support from professors, the consortium has been successfully carrying out the university's four major missions: "Training creative talent", "securing global research capabilities", "generating shared value", and "improving the operating system".

Currently, the Urban Sciences University Lab Consortium has been winning and operating R&D projects supported by various government agencies, such as the National Research Foundation of Korea, the Ministry of Trade, Industry, and Energy, the Ministry of Land, Infrastructure and Transport, the Ministry of Environment, and the Ministry of SMEs and Startups. Through this, it has been improving the research capabilities and experience of students, researchers, and professors, and effectively generating research outcomes, such as SCI-level papers and patents yearly to achieve goals according to tasks.

▲Website

Kim, Tae-Hyun, Director of the Institute of Basic Sciences, Professor, Department of Chemistry

At the Forefront of Blue Carbon Biomass-Based Source Material Development

Basic Sciences Lab Consortium

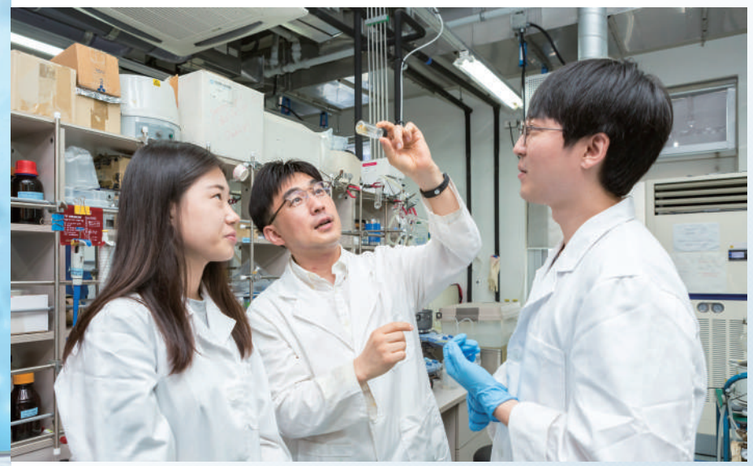
Organizer: Institute of Basic Sciences (Professor Kim, Tae-Hyun)
Cooperator 1: Institute of Green Bioplastics (Director Dong-Ku Kang, Professor, Department of Chemistry)
Cooperator 2: Institute of Yellow Sea Studies (Director Jae-Sung Rhee, Professor, Department of Oceanography)
Cooperator 3: Intelligent Sensor Convergence Research Center (Director Choi Soobong, Professor, Department of Physics)

Sustainable Conservation and Response to Climate Change

The Institute of Basic Sciences led by Professor Kim, Tae-Hyun of the Department of Chemistry, chosen as a "Key University Research Institute in the Science and Engineering Field" by the National Research Foundation of Korea under the Ministry of Education in June 2017, has been working with the Department of Chemistry and the Department of Oceanography faculties for seven years to "develop blue carbon biomass-based source materials and building a platform for recycle marine resources." In line with climate change response research, the consortium has continuously conducted basic scientific research on securing and applying blue carbon recycling source technology since 2016, established a domestic and international multidisciplinary convergence network, and conducted joint research and technology transfer, marking it a leader group in domestic blue carbon-related research.

The consortium has published 174 SCI-level papers, and 51% of which were published in academic journals within the top 20% of JCR. Its patents include 84 domestic applications, 50 domestic registrations, nine international applications, and one international registration, resulting in a contract worth KRW 430 million through technology transfer and winning and currently conducting six joint research projects with industry-academia-research cooperation organizations.

Moreover, it explores the fundamental properties of blue carbon, which is an unexplored field, secures biomass containing it and conducts research on the development of source technology for environment-energy-wellness materials through recycling. It also established a blue carbon recycling platform at its lab to pursue sustainable conservation of the marine ecosystem and respond to climate change. The consortium's goal is to develop itself into a research base in the region by establishing domestic and international multidisciplinary convergence networks and joint research and training high-level researchers related to the development of functional materials and climate change response.



▲Website

The Basic Sciences Lab Consortium, comprised of the Institute of Basic Sciences, the Institute of Green Bioplastics, the Institute of Yellow Sea Studies, and the Intelligent Sensor Convergence Research Center, has been conducting joint research to become a carbon-neutral-based research center.

The consortium will grow into a signature research institute representing Incheon National University and a world-class carbon-neutral research institute by seeking linkages with and activating joint research with ▲the Institute of Green Bioplastics, which creates a white bio cluster and strives to train white bio-industry professionals, ▲the Institute of Yellow Sea Studies, which is building the only domestic and international marine environment research platform for the Yellow Sea, and ▲the Intelligent Sensor Convergence Research Center, which develops an education program to accumulate basic technologies and foster experts for convergence technology as a specialization project of Incheon National University, and by becoming a carbon-neutral base research institute by attracting new collective tasks.

Kwon Hyungwook, Director of the Convergence Research Center for Insect Vectors(CRCIV), Professor, Department of Life Sciences

Advancement of International Level Quarantine and Protection of Public Health

Convergence Research Center for Insect Vectors (CRCIV) Consortium

Organizer: Convergence Research Center for Insect Vectors (CRCIV) (Professor Kwon Hyungwook)
Cooperator 1: Institute of New Drug Development(Director Lee Misoo, Professor, Department of Life Sciences)
Cooperator 2: Institute of Biological Resources and Environment (Director Bae Yangseop, Professor, Department of Life Sciences)
Cooperator 3: Institute of Biomaterial and Process Development (Director Lee Wonjong, Professor, Department of Life Sciences)

Leading the Way in Solving Overall Vector Insects Problems

Approximately 400,000 bee colonies died this year due to climate change. The number of bees responsible for 70% of food production, such as vegetables and fruits by pollinating, is decreasing every year. As the possibility of vector-borne diseases increases and is introduced due to climate change and human and material movement increases, the importance of research on disease-carrying insects focusing on basic and convergence studies is also emphasized.

The Convergence Research Center for Insect Vectors (CRCIV) was established in 2017 to (1) secure source technology based on research on vector insect resources, such as mosquitoes and bees; (2) establish an international joint research collaboration network for the convergence bio-industry; and (3) establish research and education infrastructure for vector insect resources.

Director Kwon Hyungwook, professor of the Department of Life Sciences, conducts research by creating models focusing on insect resources, such as bees, mosquitoes, and fruit flies. He understands the behavioral control mechanisms of the insect brain and nervous system and the information-processing mechanisms of physical and chemical sensory reception. He further investigates the development of behavior control substances and the insect genome and microbiome. He established the Korean Society for Pestology and Disinfection in 2022 to prevent and disinfect insects and pathogens related to infectious diseases and hygiene. He has also been serving as the first president of the society.

▲Website

The research center was chosen as a key university lab by the Ministry of Education in 2020. It solves problems related to insect vectors and fosters research personnel by establishing a multidisciplinary convergence research infrastructure with excellent researchers in fields such as embedded systems engineering, information and communication engineering, and electronic engineering. One of its major studies is to monitor scientific quarantine methods for bees and mosquitoes using AI technology.

Together with excellent researchers, it has achieved many outcomes, such as (1) the completion of the world's first full-length genome analysis of native bees, (2) the development of a biosensor based on bee chemical receptors (3) the acquisition of the world's first research outcome on mosquito blood-sucking mechanism (4) the establishment of automatic mosquito classification and monitoring system through convergence research, and (5) the establishment of Korea's first domestic mosquito microbiome database, which has been contributing to vector research, infrastructure construction, international cooperation, and training of professional personnel.

The Convergence Research Center for Insect Vectors(CRCIV) Consortium carries out research on public health and the prevention and treatment of infectious diseases based on the resource development of vectors that transmit infectious diseases and diseases in cooperation with the Institute of New Drug Development, the Institute of Biological Resources and Environment Research, and the Institute of Biomaterial Processing of the College of Life Science Technology.

As news of an increase in the incidence of infectious disease-carrying insects, such as bedbugs and malaria in Korea, the essence of specialized and advanced education and research programs has also increased. As a research infrastructure with a long-term plan is necessary, the consortium will lead in advancing and standardizing the quarantine system.

Chang Jung-A, Director of the Institute for Chinese and Overseas Chinese Culture, Professor, Department of Chinese Language and Cultural Studies

Leading the Academic World with Critical and Reflective Research on China and the Greater Chinese Region

Institute for Chinese and Overseas Chinese Culture Consortium

Organizer: Institute for Chinese and Overseas Chinese Culture (Professor Chang Jung-A)
Cooperator: Institute of China Studies (Director Cho, Hyungjin, Professor, Academy of Chinese Studies)

Contributing to Society through International Networks and Close Cooperation with Local Communities

▲Website

The Institute for Chinese and Overseas Chinese Culture Consortium conducts critical and reflective research on China and the greater Chinese region. It formed an international base for academic networking by establishing Korea's largest China and pan-Chinese specialized data center and has been contributing to the local community by integrating academics and practice and presenting a successful model for disseminating the humanities socially.

Accurate understanding and critical reflection on China and the greater Chinese region are needed more than ever to overcome intercultural conflicts and misunderstandings prevalent worldwide. The consortium's researchers have conducted in-depth studies by expanding the scope to mainland China, Hong Kong, Taiwan, Southeast Asia, and around the world. They have also been contributing to society by fostering the next generation of scholars, conducting social dissemination of humanities through citizen lectures and webzines, and working closely with the industry-academic community and local community.

The civic lectures run online and offline by the consortium, which has established itself as a humanities hub in the Incheon area in response to the local community's needs, have been receiving a warm response, with over 200 participants from all over the world. Its "Youth International Affairs Summer School" developed for middle and high school students in the Incheon area were also received well. Moreover, it has proposed an exemplary model that contributes to the local community by disseminating humanities studies socially by combining academics and practice by collaborating to revitalize Incheon's culture and Chinatown based on academic achievements.

The Institute for Chinese and Overseas Chinese Culture, headed by Professor Chang Jung-A of the Department of Chinese Language and Cultural Studies, has been chosen for the "Humanities Korea Project" and "Humanities Korea Plus Project," a world-class humanities institute development project supported by the Ministry of Education and the National Research Foundation of Korea. It has been active as a key research base for studies on China, the greater Chinese region, and Chinese people around the world. The [Chinese Practices] webzine, published for 13 years, has received excellent reviews from approximately 2,600 readers, including researchers, entrepreneurs, journalists, students, and the general public.

The Academy of Chinese Studies researchers have been leading the academic world with consistent research achievements, including the publication of about 70 translated books and about 170 academic papers, where several of which were selected as excellent books by the National Academy of Sciences of Korea and the Sejong Book Selection and Purchase Support Project and were published in internationally renowned journals. The research team constantly produces unrivaled achievements, including the world's first published [Encyclopedia of Overseas Chinese on the Korean Peninsula] but also focuses on nurturing the next academic generation by holding seminars and conferences for new scholars.

Its other notable activities include its active academic cooperation by establishing international networks with China, Vietnam, Japan, Singapore, and the US. The academy is expected to become a base for the consortium to create and lead a private cooperation body for East Asian humanities exchange in Korea in the future.

Energy Excellence and Smart City Lab Director Jun, Kyungkoo,

Professor, Department of Embedded Systems Engineering

The Energy Excellence and Smart City Lab was founded to contribute to universities and the local community through research activities related to energy and smart cities. Specializing in the city data ICC field, it is leading the establishment and advancement of a shared collaboration cluster between geography, industry, and academia. This will eventually lead to regional and national strategic and specialized industrial development, talent training, technology development and commercialization, start-ups, sharing, and collaboration.
Director and Professor Jun, Kyungkoo, Professors Jeon Gwanggil and Kim Hyunbeom of the Department of Embedded Systems Engineering, and Professors Jeon Hyuntae and Lee Byeongjoo of the Department of Information and Communication Engineering head the lab's operations. With the research topic for 2023 to 2026, "Mobility Hub," the lab has been researching digital twin core technologies and efficient control of urban underground spaces and continuously takes on research-oriented external projects.
Incheon National University's energy excellence innovation examples include ▲the "Green Canvas Project" which improves members' work capability and quality of rest by providing nature-friendly rest areas, and ▲the ESCO(Energy Service COmpay, energy saving) project, which allows energy users to improve energy-saving facilities without technical or economic burden.

Multidisciplinary Core Institute for Future Energies (MCIFE) Director Joondong KIM,

Professor, Department of Electrical Engineering

Multidisciplinary Core Institute for Future Energies (MCIFE) is exploring transparent energy technology, which generates electrical energy from sunlight, using transparent solar cells that can be applied to glass windows and displays. Since research is underway to ensure that this technology can be used in buildings, cars, and mobile phone covers, transparent energy technology is expected to be used effectively in various areas in the future. Its transparent feature makes it suitable for installation on glass windows, where energy can be obtained. If mobile devices or other electronic devices needed by people are made transparent, convenience, practicality, and usability will be further expanded. The institute aims to help improve people's quality of life by enhancing several features of solar cells, which are currently attracting attention in the green energy sector. On-site power generation technology, which allows energy production and demand to be met on-site, is a clear example. Transparent solar cells, which have further improved in terms of capacity, can be used in various fields, including the exterior surface of structures, by applying various colors. The institute seeks to become a leading global research group by conducting original and ground-breaking research about energy.

Innovation Center for Chemical Engineering Director Yeong Don Park,

Professor, Department of Energy and Chemical Engineering

With the vision of "Realizing carbon neutrality by 2050 through the dissemination of sustainable energy technology," the Institute of Chemical Innovation aims to cultivate high-quality human resources with specialized skills for the entire life cycle of the new energy industry. It conducts multidisciplinary convergence research, ranging from porous material design to device manufacturing or analysis. The institute organized a convergence research group with a molecular design team majoring in inorganic chemistry, organic chemistry, computational chemistry, and materials engineering, and a device application group majoring in electrochemistry, energy engineering, interface engineering, and analytical chemistry, in which the experts from various fields are striving to achieve. The average SCI paper performance per full-time faculty member is 40, including seven papers in the top 3% of JCR over the past five years. Moreover, the average number of patents per full-time faculty member at the institute is 15, including two US patents over the past five years.

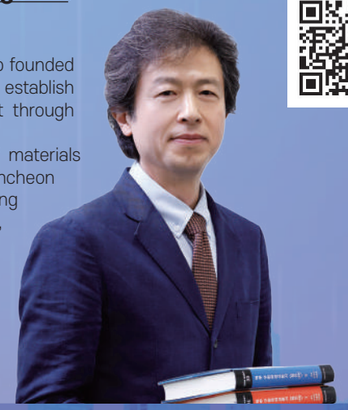
Institute of Social Sciences Director Leem, Junghoon,

Professor, Department of Creative Human Resource Development

The Institute of Social Sciences was founded to actively respond to the 21st-century convergence society and conduct interdisciplinary integration and convergence research on various disciplines in social sciences. There are five sub-research labs, including the Regional Society Research Lab and the Media Information Education Center, and researchers have been improving their capabilities through regular seminars that cover the latest trends related to social change and social issues and special lectures on the latest research methodologies in the social sciences. It shares research outcomes with social sciences researchers across the country by publishing the journal [Journal of Social Science], which was chosen as a registered journal by the National Research Foundation of Korea. In the future, the institute will strive to develop into an outstanding institute with global competitiveness by exploring alternatives and discovering policies to solve various issues facing Korean society in relation to the core research topic of humans and society.

Incheon Studies Institute Director Kwack Dongwha,

Professor, Department of Architecture and Urban Design



Incheon Studies Institute is the Incheon National University affiliated lab founded in February 2002 to identify the realistic dynamics of Incheon society, establish regional identity, and present a future vision for urban development through systematic research on Incheon's history, culture, and society.
It has published over 100 books through research and discovery of materials related to Incheon and has been striving to establish the identity of Incheon and its regional studies by publishing academic journals twice and holding more than three academic conferences annually. Its academic journal, [The Journal of Incheon Studies], was listed for the National Research Foundation of Korea's academic journal evaluation, which is a rare occasion, highlighting the status of the institute and the university.
The institute has been strengthening its network through academic exchanges with various regional studies research institutes in Korea and abroad, offering various academic services for national and local governments.

Introducing large-scale projects
that Incheon National University has been working on.

1 Innopolis
2 White Bio
3 LINC3.0
4 BK21
5 Semiconductor Personnel Training

1 Innopolis

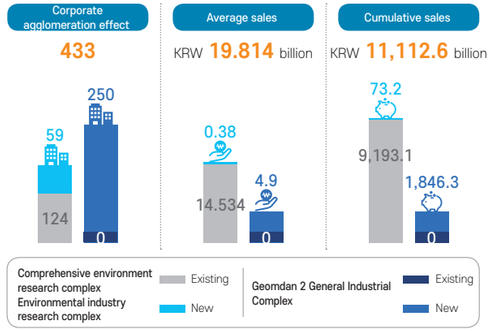
INCHEON INNOVATION CLUSTER

In June 2022, Incheon National University was designated as an Innopolis Cluster by the Ministry of Science and ICT as a technology core institution. With the goal of “establishing a base for ICT convergence environmental pollution treatment and management technology commercialization,” we achieved 83% of research institute companies(20 achievements out of 24 goals), 88% of technology transfer and investment(63 achievements out of 72 goals), 77% of technology startups(27 achievements out of 35 goals), and 216% of investment contracts(KRW 10.8 billion out of the target KRW 5 billion) compared to the initial target in just two years after designation.
As a core technology institution, Incheon National University strives to activate R&BD of special zone companies by developing cooperation plans according to Incheon’s technology needs and applying environmental technologies owned by the university and public research institutions in the environmental fields with the Incheon Innopolis Cluster. Incheon Innovation Cluster is the only environmental special zone in Korea that has selected the “information and communication technology(ICT) convergence environmental pollution treatment and management” as its specialized field. It is equipped with various key technologies in △Measurement and treatment of environmental pollution monitoring △Waste recycling and alternative material development △AI-based environmental managament. Incheon National University has been providing diverse support to develop special zones, such as technology supply, joint research, and environmental technology experts training by connecting the university’s environmental field capabilities with the Institute of Environmental Convergence Technology and the Institute of Bioplastics. Through the Incheon Special Zone Council, we discover needs, such as difficult technologies and technology verification, and utilize the INU environmental technology information system to promote technology-demand matching and transfer. With three promotion strategies of ▲establishing a foundation for environmental industry research and technology commercialization, ▲developing an innovation ecosystem through the convergence of ICT environmental technology, and ▲maximizing performance generation by strengthening the collaboration system, the special zone project is expected to improve local environmental issues, enhance local science and technology capabilities, establish a foundation, and generate sustainable development and growth.

Expected Outcomes

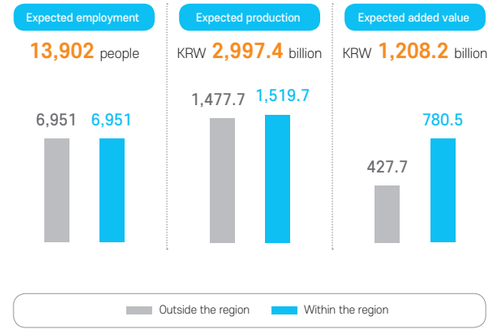
Ripple Effect of Companies Moving into the Special Innopolis Zone (’22~’26)

- **309** new companies expected to move in
- Cumulative sales within the special zone are expected to increase by KRW **1,919.5** billion



Economic revitalization effect (’22~’26)

- Employment generation effect within and outside the region: **13,902** people
- Estimated production/value-added effect of KRW **4,205.6** billion



2 White Bio

Bioplastics Center

Plastic is the most commonly used material developed by humankind, utilized in almost all fields, including aviation, space, automobiles, electronics, medicine, and household goods. Consequently, a large amount of carbon dioxide is emitted during the production and disposal of products using petroleum, So it is considered a major cause of rapid climate change. Thus, plastic alternative material technology and industry are growing rapidly, and there are demands for bioplastics which are from biological resorcues and has a potential for biodegradable.

The Bioplastics Research Center (BRC) was founded by Incheon National University and it has been supported by the Korean Ministry of Trade, Industry, and Energy since 2021. Our goal is to support the Korean industry, which is related to sustainable plastic materials, and also to accelerate industry-university cooperation. Thirty-three professors from Incheon National University, including the director of the center, Professor Dong-Ku Kang of the Department of Chemistry, are involved in the BRC, and it is operating with a team leader and two administrative researchers.

It has been making various efforts, such as exploring and developing advanced technologies in the field of sustainable materials and energies which are the core carbon-neutral technologies. They are also focusing technology transfer, commercialization, holding international academic conferences, training research personnel, and supporting startup companies. BRC has been increasing its capabilities in the whitebio field by securing a total R&D grants of over 20 billion Korean won (KRW) from the Korean government, including 'Plastic Substitute Materials, Components and Equipment Industry Support Center', 'Man power program for supproting Master and Ph.D. student in the field of Whitebio', and 'Technology Development Project for Carbon Reduction Petroleum Substitution Chemical Process'.

Since July 2023, the center has been working with CJ Cheilledang and LG Chem to lay the foundation for fostering core industrial technologies for developing biodegradable and bioplastic materials, parts, equipment, and new industries related to the circular economy and ease regulations that hinder the development of new industries through demonstration projects after becoming the center of the establishment of the 'White Bio Circular Economy Technology Research Association', a research body approved by the Ministry of Science and ICT.

In the future, the BRC will do its best to support the Korean industry and research society, which are related to sustainable plastics.

3 LINC3.0

Incheon National University's LINC3.0(Leading industry-academia-research cooperation university development project), comprising 27 departments, is operated to serve as a hub for a new industry-academia cooperation shared ecosystem centered on the hyper-connected digital industry-academia cooperation platform(INdigo). The six divisions-▲Digital Industry-Academia Innovation Team, ▲Industry-Academia Cooperation Operation Team, ▲Technology Commercialization Team, ▲Corporate Collaboration Team, ▲Industry-Academia Cooperation Education Team, and ▲Shared Collaboration Team-promote various projects, such as establishing a foundation for training future talent, generating corporate value, and creating an industry-academia-research sharing and collaboration system.

Core Strategies of LINC3.0

System	Personnel Training	Technology Development and Commercialization	Sharing and Collaboration	Sustainability
Establishment of a digital industry-academia cooperation governance system	Innovative talent training and full-cycle management through industry-academia collaboration	Industry-academic cooperation brand creation and value based on commercialization research generation	Establishment and operation of a digital industry-academic cooperation sharing and collaboration platform	From people-centered to system (data)-centered industry-academia cooperation

Major Projects by Division

Digital Industry-Academia Innovation Team	• Establishment and operation of a digital industry-academic cooperation platform • Management of university industry-academic cooperation resource information linkage	
Industry-Academia Cooperation Operation Team	• Operation of various business group committees and management of participating departments • Management and execution of project costs and response funds	• Response and management of relevant organizations, such as the National Research Foundation of Korea
Technology Commercialization Team	• Technology transfer and discovery of companies in demand for technology • Planning and support for joint industry-academia technology development tasks	• Creation and management of intellectual property rights, technology marketing, etc.
Corporate Collaboration Team	• Family company management and support • Operation of various corporate support projects, such as difficult technology consulting • Promotion of local government-linked and collaborating projects	• Establishment of industry-academia cooperation network by ICC field(bio convergence/city data/marine environment/culture)
Industry-Academia Cooperation Education Team	• Planning and operation of industry-academia-linked education programs in the personnel training field • Capstone design operation and support	• Operation of industry-academia-linked educational environment improvement project for participating departments
Shared Collaboration Team	• Planning and operation of employee training courses reflecting corporate demand • Support for the operation of common equipment and common equipment resources	• Business planning and operation related to the expansion of business results • Activities linked to other university and business group projects

4 BK21

BK(Brain Korea)21 Project A creative talent training program launched by the government in 1999 to improve the educational conditions and strengthen the research capabilities of domestic graduate schools

Two education research teams at Incheon National University were selected for the fourth phase of the BK21 project(2020–2027) and have been working on the project.

AI and Digital Platform-Based Cross-border International Logistics/Distribution Leader Training Business Team

Song Sanghwa, Education Research Team Leader, Professor, Graduate School of Logistics

Vision and Goals

- The vision of the team is to grow into a world-class leading education and research institution in digital innovation in the field of global SCM by leveraging the convergence of economics, trade, logistics, and artificial intelligence/digital technology.
- The goals for realizing the vision consist of core objectives in the field of education and research, and securing international capabilities to strengthen the leading role in education/research.

Education/Research Directions

Education Directions

- (Objective) Equip cross-border e-commerce digital convergence experts with global competencies
- (Curriculum) In addition to existing courses on SCM, logistics management, logistics systems, and international logistics, supplement theoretical courses on data analysis and artificial intelligence, and operate new courses on digital and smart technologies.
- (Extracurriculum Programs) Strengthen professional education by conducting industry-university collaboration projects, supporting internships, holding industry-university seminars, and operating external advisory groups.

Research Directions

- (Objectives) To become a global innovation center for cross-bordere-commerce innovation by leveraging artificial intelligence and digital technology.
- (Programs) The team encourages participating students to publish papers in international journals and provides opportunies for international research collaborations with top-tier research institutions and schools.

Global Blue Carbon Education Team for Future Generations

Kim Jang Kyun, Education Research Team Leader, Professor, Department of Marine Science

Vision and Goals

- Establishment of the world's only blue carbon convergence research and personnel training platform

Direction of Research International-ization

- Establishing the "Global Blue Carbon Network"
- Securing leadership in blue carbon research around the world
- Developing joint education/research projects between Korea and China

Excellence of the Education Research Team

- The four participating professors have published 150 SCI-level papers over the past five years, conducting very active research by publishing an average of more than seven papers per year per person.
- Learned the latest research trends and improved internationalization capabilities through seminars with domestic and foreign experts from maritime research institutes and industries
- Signed an MOU for the exchange of research personnel with research institutes and industries in the maritime field and carried out actual domestic and international exchanges
- Held special lectures directly run by CEOs or working-level staff of blue carbon-related companies
- Implemented a joint degree system for graduate students with Ghent University, Belgium
- Completed the agreement on the exchange student system with the Graduate School of Fisheries and Environmental Sciences, Nagasaki University, Japan

5 Semiconductor Personnel Training

Industry-Driven On-Site Semiconductor Engineer Training Project/
I-Nanofab & INU Research Facility Center (Director Sung Hun Jin)

This project, operated by Incheon National University's I-Nanofab Center and Institute of Research Facilities, aims to improve job duties for incumbents who work on semiconductor infrastructure and link the recruitment of outstanding personnel to secure mid- to long-term technological competitiveness in the domestic semiconductor equipment, materials, and components industry.
The university is experienced in providing process equipment training through excellent research personnel affiliated with the I-Nano fab center.
It planned several undergraduate, graduate, and unemployed personnel training programs and established an IPP-based employment-linked course. It has also been preparing process training for employees and has experienced conducting process and equipment training through outstanding research personnel from the I-Nanofab Center. Moreover, it is planning various education-linked projects through the Institute of Research Facilities' continuous process services and has been operating them based on the contents below.

- Providing the field-ready personnel training program customized to the needs of materials, parts, and equipment companies
- Establishing a feedback system through surveys and supplementing educational programs through self-diagnosis of personal capabilities
- Doubling job competency through self-directed and metacognitive training to improve the employment retention rate of current employees

Training Details

Introduction	Semiconductor materials, parts, and equipment companies' thin film devices and analysis technology(for prospective employees) Data-based semiconductor defect analysis theory and practical training(for current employees)
Basic	Memory device process and device analysis(for prospective employees) Thin film devices and analysis technology for engineers(for current employees)
Intensive	Understanding charge trap flash(CTF) devices and defect analysis techniques(for the unemployed) ALD, ASD expert course, and thin film analysis technology(intensive training linked to corporate practitioners, such as large corporations and SMEs)

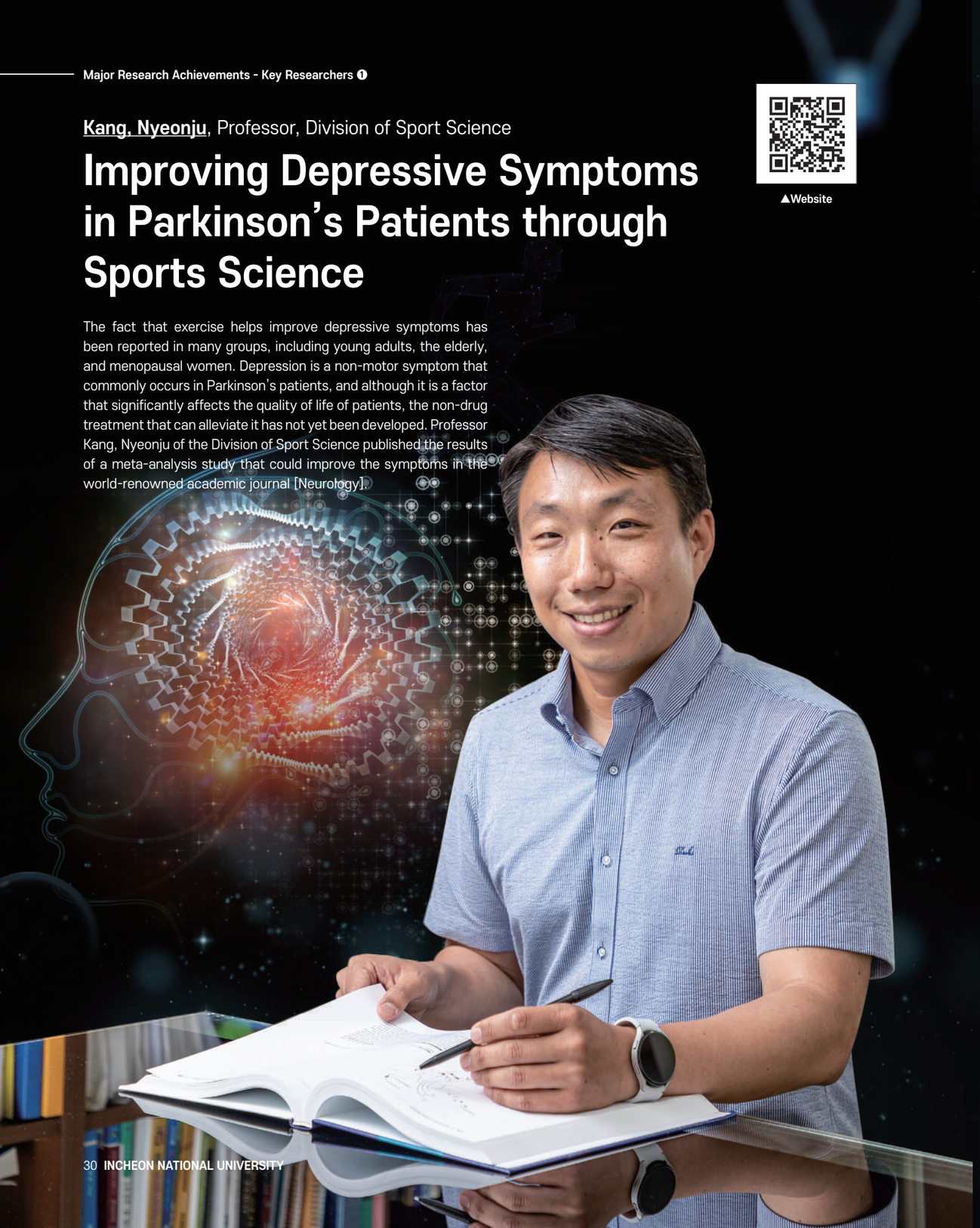
The first year's achievements in 2022 include ✔ 81 current trainees which produced 78 trainees; ✔ 74 prospective employed trainees which resulted in 57 trainees; and ✔ developed four curricula, four educational materials, and operated one employment support program.
The project will continue to train outstanding personnel in materials, parts, and equipment to bridge the gap between supply and demand of industrial technical personnel and strengthen the capabilities of SMEs to expand the industrial ecosystem. The outstanding curriculum and industry-academia cooperation system developed in this project will be shared between universities and industry to ensure that results are produced and industry-academia cooperation continues even after the project's completion.

Kang, Nyeonju, Professor, Division of Sport Science

Improving Depressive Symptoms in Parkinson's Patients through Sports Science

▲Website

The fact that exercise helps improve depressive symptoms has been reported in many groups, including young adults, the elderly, and menopausal women. Depression is a non-motor symptom that commonly occurs in Parkinson's patients, and although it is a factor that significantly affects the quality of life of patients, the non-drug treatment that can alleviate it has not yet been developed. Professor Kang, Nyeonju of the Division of Sport Science published the results of a meta-analysis study that could improve the symptoms in the world-renowned academic journal [Neurology].



Compound exercises have shown significant improvement

There have been many research attempts to prove the antidepressant effect in Parkinson's patients, but there has been a lack of scientific evidence on the type of exercise and intensity, which are more effective in reducing depressive symptoms.

Professor Kang, Nyeonju of the Neuromechanical Rehabilitation Research Laboratory, the Division of Sport Science, conducted a systematic literature review and extensive meta-analysis of individual precedent studies with Professor Kim Ryul's team at Inha University Hospital to overcome this problem. The results were published in the January 2023 issue of the global neurology journal [Neurology] under the title, "Effects of Exercise on Depressive Symptoms in Patients With Parkinson Disease: A Meta-analysis."

Nineteen randomized clinical trial studies were included in the meta-analysis, and the total number of Parkinson's patients reached 1,302. The result of the meta-analysis showed that the antidepressant effect was not statistically significant when only cardiovascular exercise, such as running, was performed, but a form of combined exercise that included cardiovascular exercise and other types of exercise, such as strength training, revealed a statistically significant improvement in depression.

In terms of exercise intensity, it was confirmed that medium-intensity and high-intensity exercise indicated a positive effect on improving depression. Overall, it suggests that the type of exercise may be a crucial factor to consider rather than the difference in exercise intensity when providing an exercise program to reduce depression for Parkinson's patients.

This information can be applied to patients and other cases due to aging or neurological problems. "Motor and cognitive skills are linked, so when one declines, the other declines as well. There is no cure for Parkinson's disease, and as complete recovery is difficult, many patients suffer from depression, which leads to lower activity levels. A non-invasive and drug-free method to improve the situation is exercise. Among them, it was confirmed that compound exercises were the most effective."

It is possible to go beyond the statistical estimation of experimental studies, produce results on a larger scale and with higher reliability, and even go as far as creating exercise protocols in clinical practice in the long term through meta-analysis.

Based on the research outcome, Professor Kang is conducting a clinical study with Professor Kim's team and Professors Byeon Byeongho and Park Giwon's team at Incheon National University to apply various types of exercise programs to effectively improve motor and non-motor symptoms, including depressive symptoms, in Parkinson's patients.

He has recently conducted other research and was chosen as one of the "High Impact Journal Papers"(impact factor of 10 or more) by the Biological Research Information Center (BRIC). Emphasizing that "exercise is the best treatment and prevention method," he plans to continuously study and work to create a social mood by informing people that they can improve and overcome any motor disturbance through exercise so that they do not despair.

Jeon Gwanggil, Professor, Department of Embedded Systems Engineering

Crowd Analysis Solution for Smart City System

When the movement of a large crowd occurs or in other situations, crowd analysis or location determination may be necessary. Crowd analysis and location identification research, mainly conducted independently, can now be carried out practically in the smart city system.
It can be achieved through the integrated framework Scale-Context Perceptive Network(SCPNet) proposed by Professor Jeon Gwanggil of the Department of Embedded Systems Engineering at the College of Information Technology.

▲Online published paper

A new solution for dense crowd control and management

Professor Jeon Gwanggil's paper "Scale-Context Perceptive Network for Crowd Counting and Localization in Smart City System" was published online in 2023 in IEEE Internet of Things Journal, a world-renowned academic journal in information and communications. As of 2022, this academic journal ranks third worldwide in telecommunications according to the journal citation report, and its journal impact factor(IF) reached 10.238.
Research on analyzing the movement and location of large crowds can be applied to various real-world situations. For example, this technology is used at large events or concerts to help conduct events safely. Organizers can deploy security personnel where needed and respond quickly to emergencies by analyzing crowd density and movement paths in real time. This technology also has a vital part in urban transportation planning by contributing to optimizing the transportation system and reducing traffic congestion by analyzing public transportation usage patterns and pedestrian flows. Moreover, crowd analysis technology is used in different situations, such as setting safe evacuation routes for crowds when responding to disasters and managing the safety of large-scale protests or rallies. The paper proposes a method to analyze and predict the number and location of people in a crowd, which is practical and essential in smart city systems.
Crowd localization is a fundamental subtask of crowd analysis where the goal is to provide the "location" of each instance. "Location" refers to the center point of the head, and assigning a bounding box annotation to each head in a crowded scene is not only expensive but also difficult to analyze. Thus, there was a problem that crowd prediction performance was limited when situations such as crowd movement occurred. This is why crowd datasets only provide point-level annotations.
On the other hand, this research outcome can be applied to automated public monitoring such as traffic control. This crowd-counting system simultaneously recognizes objects of arbitrary size in various situations, including crowded or cluttered scenes.
Through research, Professor Jeon developed a deep learning-based algorithm that can directly calculate the number of people in photos and proved its performance through extensive experiments. Crowd counting and location identification can increase crowd control efficiency for crowd safety.
The research also proposed a comprehensive framework called SCPNet that can perform crowd analysis and location identification simultaneously. The SCPNet comprises two modules—a scale perceptive(SP) module that provides multi-scale functions and a context perceptive(CP) module that provides channel and spatial level information.
Professor Jeon is working on tasks related to AI-based image signals and computer vision and plans to continue research on developing deep learning models. This will be the starting point for building a high-quality multimedia environment.

Chang Hanteut, Professor, Department of Mechanical Engineering

Targeting the Future Market with Innovation in Next-generation Robot Technology

Professor Chang Hanteut of the Department of Mechanical Engineering founded Faraday Dynamics Co., Ltd. and is conducting R&D focusing on high-performance servo motors, which is the core of robotics. He is attracting the industry's attention for his project on increasing the safety of high-torque-density servomotors for human-robot interaction.

Securing unrivaled high-performance servo motor technology

The robot market has been showing rapid growth worldwide. By 2025, the service, logistics, and manufacturing sectors alone are expected to reach $177 billion. Thus, it is important to preemptively secure technology to dominate the market. Professor Chang Hanteut, who has been devoted to robotics R&D, founded Faraday Dynamics Co., Ltd. in 2020. Since then, he has continued to research source technologies that enable robots and humans to physically interact in our daily lives.

"Existing technologies have difficulties enabling robots to 'safely' interact with humans. This is because commercial motors have a low torque density, which refers to the output torque relative to weight, which makes the robot heavy and makes it impossible to implement flexible joints due to friction in the reducer. For the development of wearable robots or walking robots, it needs an actuator with a torque density similar to that of human muscles."

Existing motors use high-friction, high-rigidity reducers to offset weak strength, which inevitably results in rigid robot joints. Rigid robot joints can easily cause human injury and robot damage. Moreover, a torque sensor is applied to suppress impact from high rigidity, but as cost and weight increase, economic costs also increase.

Professor Chang succeeded in developing a high-torque density motor that dramatically improved the problems faced by existing motors. He realized high torque with a lightweight while miniaturizing the robot based on "high-density magnetic field-based stator and rotor design and manufacturing technology." It achieved a torque density approximately 15 times higher than that of Maxon, which ranks first in market share and realized more uniform and smooth rotation. He developed the motor, reducer, and controller in-house. While the servo motor market is centered around developed countries, such as Japan, Germany, the US, and Switzerland, the success of local production with higher quality is even more meaningful. There are many strengths in terms of production as well. Since he has his production facilities and overseas production, he can simultaneously reduce costs and control quality.

His research approach is also noteworthy. This is a case where he developed a technology to prove a hypothesis as a scholar, and he started with an essential question and proceeded to find an answer. Faraday Dynamics Co., Ltd. has participated in various government-supported projects and has completed or is currently working on Incheon Special Innopolis Zone technology transfer commercialization tasks and nano and material technology development project tasks. In early 2024, the company plans to carry out a project to develop a wearable robot high-density torque motor with the Korea Institute of Industrial Technology and the Korea Institute of Materials Science.

His company has a bright future as all Faraday Dynamics products can respond to all fields that require lighter motors and higher output. Professor Chang expressed his determination to challenge the global market with his unrivaled technological capabilities. "In the future, we want to grow into a global high-end servo motor company. While the robot market is growing rapidly, the mass-produced motor market is already a red ocean. We want to compete with the highest performance products 'filled with craftsmanship' and 'only we can make!'"

Han-Bo-Ram Lee, Professor, Department of Materials Science and Engineering
Associate Editor, Chemistry of Materials - ACS Publications

▲Website

Core Semiconductor Technology That the World Is Paying Attention To

Atomic layer deposition is considered the top manufacturing technology in the semiconductor industry. Professor Han-Bo-Ram Lee of the Department of Materials Science and Engineering has been leading the way with international status in this field. Technology transfer based on this will lead to faster development and greater results.

Expected effects of ALD-based technology transfer

From his doctoral studies to the present, Professor Han-Bo-Ram Lee has been conducting research on deposition technology for semiconductor processes for a long time. Atomic Layer Deposition(ALD) in particular has been attracting attention as an indispensable technology in the semiconductor process because it can apply thin films thinly and evenly even on complex three-dimensional structures with many fine irregularities and has a low degree of contamination.

Professor Lee has been responsible for one axis of the development of the semiconductor industry through joint research or technical advisory roles with domestic and foreign semiconductor-related companies, such as Samsung Electronics, SK Hynix, Merck, and Lam Research. In December 2022, the results of a study conducted with the research team of Samsung Advanced Institute of Technology at Samsung Electronics were published in Nature Communications.

Since 2018, he has been serving as an associate editor for the American Chemical Society's [Chemistry of Materials], and his appointment as an associate editor, who is responsible for the first review of over 200 papers submitted to the journal each year, is based on his academic performance and social reputation, which shows that he is recognized in many ways.

In 2025, the International ALD Conference hosted by the American Vacuum Society will be held in Korea. As the president, Professor Lee has been working hard to prepare from various angles for successful operations. In addition to attending overseas conferences, he also gave lectures as a guest at places such as Lawrence Livermore National Laboratory in the US.

His technology transfer achievements are also remarkable—thanks to his long-term research on deposition technology. In December 2023, he transferred the coating and processing technology of electron microscope equipment, jointly developed with the Ajou University research team using ALD technology, to a related company. It is "a core technology for pre-processing equipment for the use of electron microscopes," and semiconductor or nanotechnology will further develop in the future.

In addition, he was chosen for the 2023 Technology Commercialization Support Project(Type 1) conducted by the Incheon National University Industry-Academic Cooperation Foundation to accelerate technology commercialization, the Ministry of Science and ICT's 2023 Research Equipment Industry Promotion Project, and the Local Industry-linked University Open-Lab Development Support Project. And with this background, he has been fostering master's and doctoral students. Indeed, he can significantly help establish the equipment and infrastructure needed by the industry in the future and create new fields and markets. He also plans to continue ALD and ASD research while expanding computing power convergence research.

In the lab, 12 researchers of various nationalities are working on about 10 tasks. There are photobooth shots taken with students on the professor's office door, and a glimpse of their lively appearances can be seen on the social media(@hbrleelab) that introduces the lab. Professor Lee says, "My goal is to create a lab where the members are happy in the long term beyond producing good research outcomes." The trajectory that Professor Lee has charted as a trusted professor and scientist will serve as good fertilizer for the academic world and for fostering future generations.

University Evaluation Performance

- 2023 WURI(The World's Universities with Real Impact Ranking): 18th in the world, 2nd in Korea
- 21st in Korea in 2023 JoongAng Ilbo's Comprehensive University Evaluation Rankings, 2nd among national and public universities in number of international journal papers per professor

Incheon National University, a University That Grows Qualitatively

- Since incorporating into a national university in 2013, Incheon National University has been expanding its research capabilities by securing young and excellent faculty. Incheon National University, which has been promoting "research university" as a core task, has emphasized qualitative growth and is showing remarkable results. The following is the analysis of the qualitative growth of Incheon National University's research outcomes, and the results of international research cooperation:

❶ **Analysis target** SCI-level Incheon National University papers published from January 1, 2018, to December 31, 2022
- Papers registered in the Web of Science InCites dataset(as of January 10, 2024)

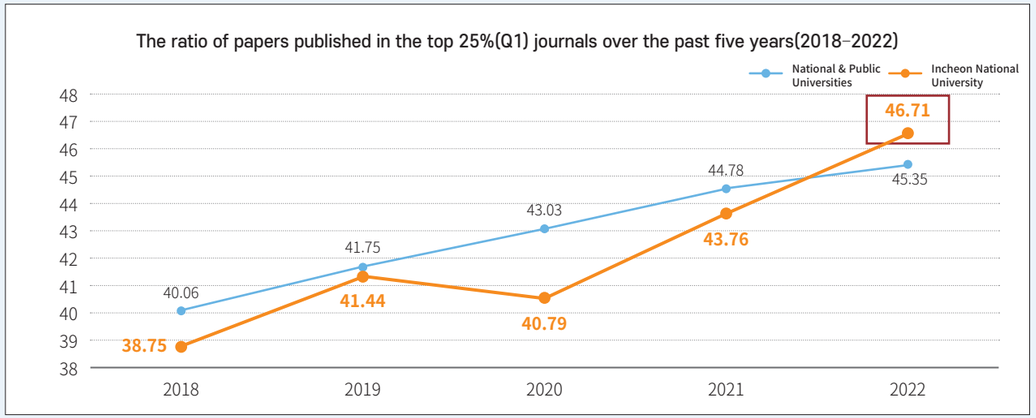
❷ **Analysis tools** InCites research performance analysis program based on the Web of Science citation index database

(1) Ratio of papers published in the top 25% of journals

At Incheon National University, the ratio of papers published in the top 25% of journals by research field(Q1) has been increasing. The top 25% of journals(Q1) refer to those included in the top 25% of journal impact index fields. The more papers published in Q1 journals, the better the university/institution's paper performance can be.

*JIF Journal: A journal included in a Web of Science-based database that compares and analyzes performance based on citation criteria. It is given an impact factor every year based on the number of publications cited in the two years immediately preceding the base year.

The ratio of Incheon National University papers published in journals within the top 25% was lower than the national/public university average(40.06%) in 2018(Incheon National University 38.75%), but its research performance grew rapidly as it exceeded not only 41% in 2019 but also the national/public university average in 2022(Incheon National University 46.71%, national and public universities average 45.35%).

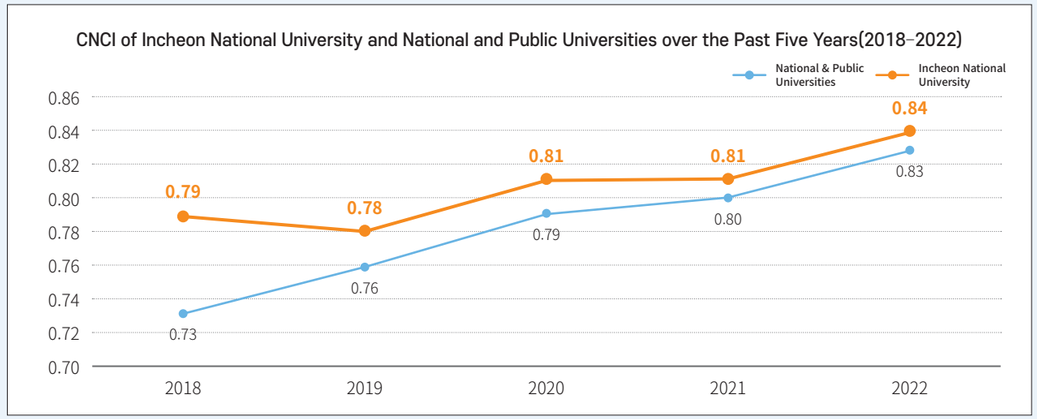


National and Public Universities: National and public universities subject to information disclosure as of 2023(28 universities, excluding junior colleges, teachers' colleges, and national university corporations)

(2) Paper citation impact(Category Normalized Citation Impact, CNCI)

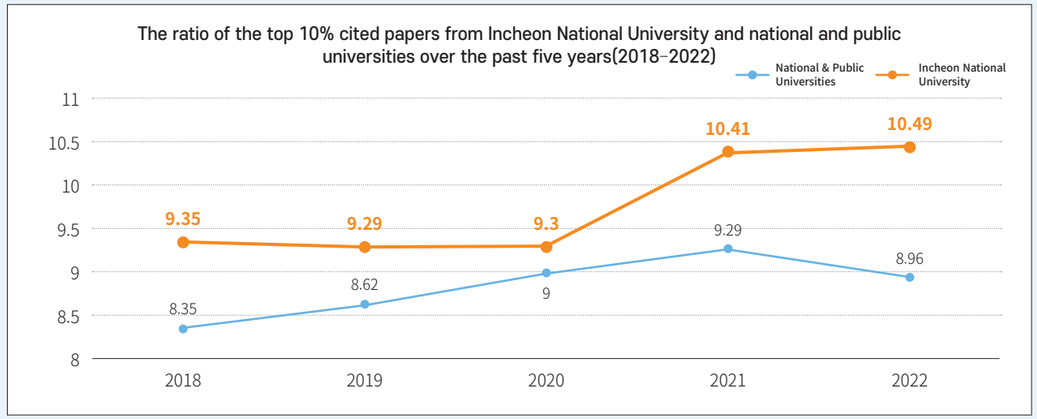
Category Normalized Citation Impacts, an indicator that evaluates the quality of papers by indexing the normalized citation influence or citation influence by field, compares each paper with the population corresponding to the same (a) research field, (b) publication year, and (c) document type to determine relative citations. This value represents performance based on the average (1.0).

Looking at the citation impact of papers by Incheon National University researchers as the main author or corresponding author published over the past five years(2018-2022), the normalized citation impact of papers written by Incheon National University researchers as the main author or corresponding author is higher than the average of the 28 national and public universities compared. Moreover, its influence is gradually growing.



(3) Ratio of top 10% cited papers

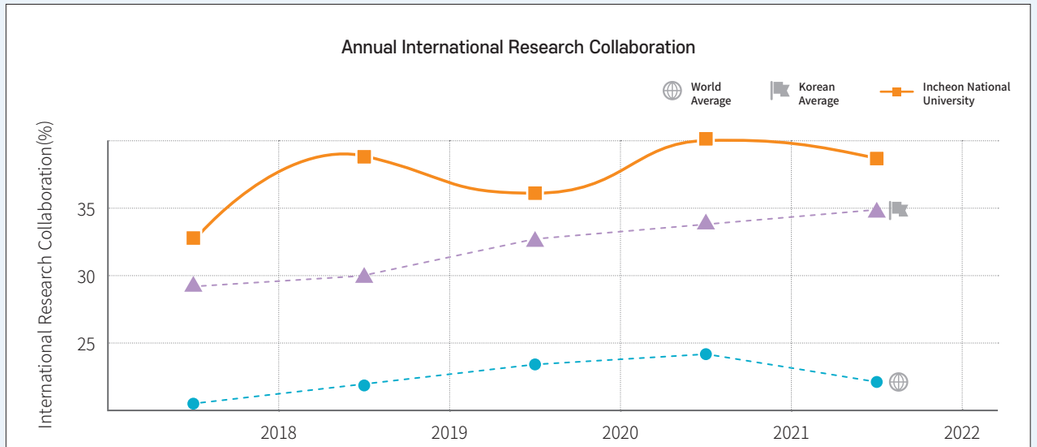
The qualitative performance can be identified by the ratio of papers in the top 10% of citations, considering the research field, publication year, and document type. The comparison of the ratio of papers cited in the top 10% by Web of Science research field of papers published over the past five years by Incheon National University and public universities shows that Incheon National University's research is steadily growing.

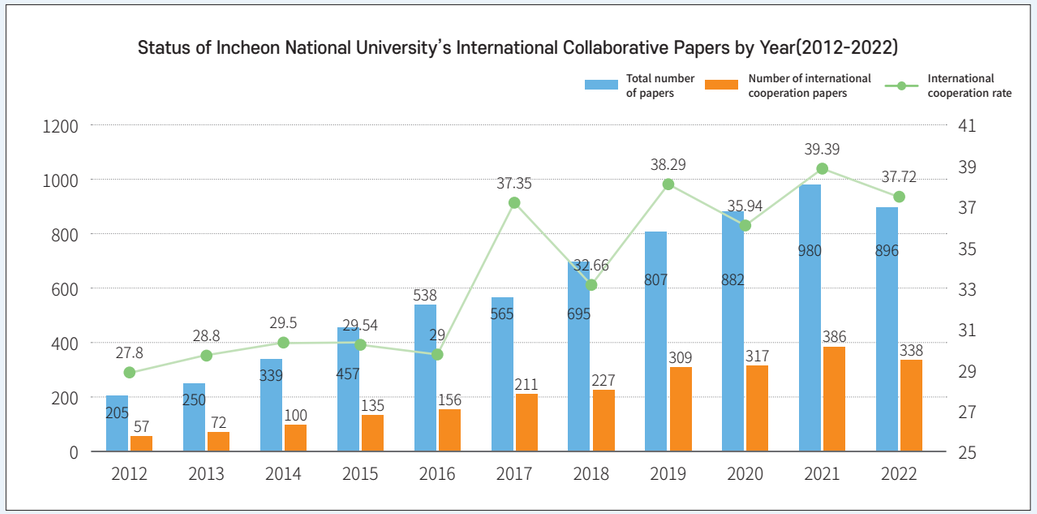


A University with Active Global Research Collaboration

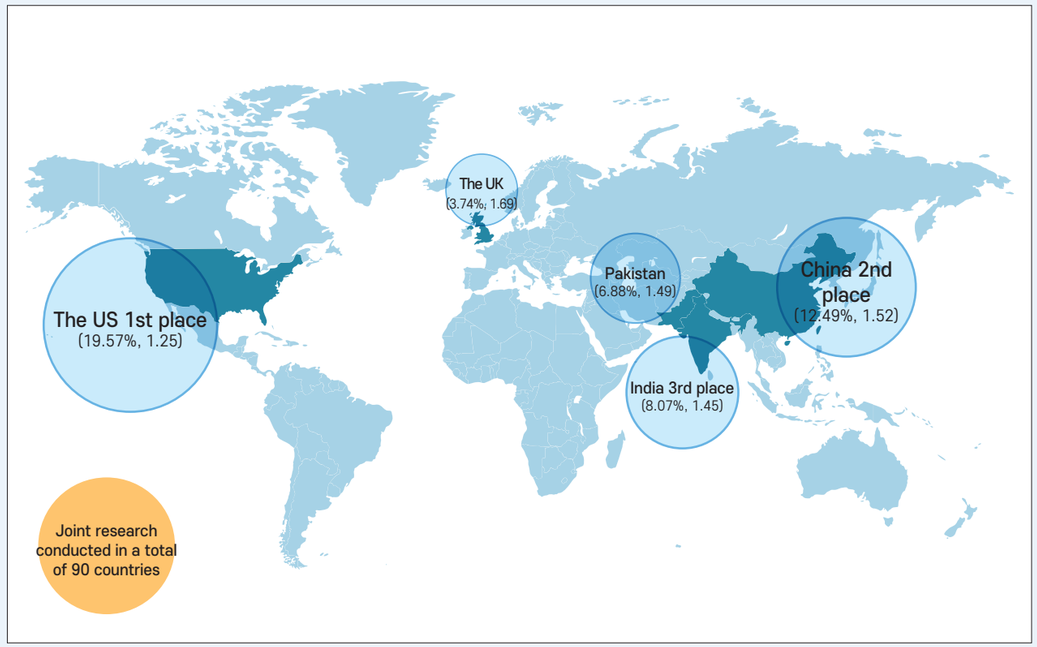
International joint research has increased citation impact and improved the awareness of researchers, universities, and institutions by expanding research networks. Incheon National University's international research collaboration is much higher than the world average and the Korean average; thus. it can be expected that the recognition of researchers and university research will increase through international research collaboration.

The international joint research rate, which was only 28.8% in 2013, reached 32.72% in 2022, generated research outcomes through active collaboration with global research institutes.





Countries Collaborated on Joint Research with Incheon National University (Top 5 Countries in Number of Papers)(2018-2022)



Over the past five years(2018–2022), 37.22% of Incheon National University's paper achievements were generated through international cooperation. The countries that have conducted the most joint research with Incheon National University are the US, China, India, Pakistan, and the UK, and the citation impact of papers with those countries is also high. Incheon National University is increasing the recognition and citation impact of researchers and the university by expanding its international research network.

Countries Collaborated on Joint Research with Incheon National University (Top 8 Countries in Number of Papers)(2018-2022)

Country	The US	China	India	Pakistan	The UK	Italy	Vietnam	Canada
Number of Collaborative Papers	492	314	203	173	94	92	87	79
Paper Ratio(%)	19.57	12.49	8.07	6.88	3.74	3.66	3.46	3.14
Citation Impact(CNCI)	1.25	1.52	1.45	1.49	1.69	1.94	1.01	2.69

The Status of the Research Support Projects for School Year 2024

(※ See the business announcement for business details)

Type	Project	Details
I. Professor Research Support Project	01. Create a research project	
	A new professor's research project	Support for one research project per new faculty member
	General professor research project	Support for one research project per general full-time faculty member
	02. Academic activity expense support project	
	Expenses for participating in international academic conferences(airfare)	Airfare support(once a year) for faculty who attend credible international academic conferences and exhibitions(performances) as a presenter
	Publishing papers in academic journals	Differential support by journal category for papers published in excellent international and domestic academic journals
	Exhibitions and performances	Incentives for the achievements of domestic and international exhibitions and performance activities by faculty members in the field of arts and physical education
	Book publication	Encouragement of publication of technical books by full-time faculty members • Limited to academic books, translations, and editing
	Holding an academic conference	Partial expenses support for holding academic events(once a year within budget)
	Foreign language proofreading costs	Partial support of foreign language paper editing costs for excellent academic research papers(Limited to meeting separate qualification requirements)
	SCI-level cover paper	Expense support for journal cover papers within 25% of JCR (Limited to meeting separate qualification requirements)
	03. Establishment of a research environment for new faculty members	Support for research funds and equipment purchases for new faculty members
II. Research Personnel Support Project(INU SURE LAB Project)	01. Lab-building support project	Operating fee support for graduate students for lab establishment
	02. Scholarship support project for outstanding graduate students	Scholarship support to excellent graduate students upon admission
	03. Postdoctoral researcher lab employment support project	Labor cost support for hiring domestic and foreign doctors in labs
	04. Overseas researcher visit research support project	Visit research support for faculty and researchers affiliated with overseas universities
	05. Support project for overseas undergraduate(graduate) students' visit research	Invitation to undergraduate(graduate) students belonging to overseas universities
	06. Overseas training support project for postdoctoral researchers	One-year overseas training for those who have received a doctorate from our university
	07. Support project for doctoral students' short-term overseas training expenses	Up to two months of overseas training for doctoral students
III. Collective Research Activation Project	01. Collective research project for outstanding labs	Support collective research tasks according to the lab evaluation grade
	02. Research personnel support projects for labs	Labor cost support for postdoctoral researchers at outstanding labs
	03. Support project for a student research group at the lab	Scholarship support for participating student researchers and research activity expenses support for advisors
	04. Collective Research Innovation Planning Group project	The direction of the group research system and member communication
	05. Collective task winning support project	Support project to win external research projects (Future Strategic Planning Team)
IV. Research University Brand Establishment Project	01. Research archive project	Improvement of the awareness of universities and researchers by selecting excellent and latest papers and promoting them to each research channel and public channel
	02. WOSAC research reputation improvement project	Marketing to promote research outcomes targeting overseas SCI-level scholars closely related to the university's core research fields
	03. Overseas platform project (INU SURE LAB)	Establishment of the database for overseas researchers related to the university, joint research, and promotion of the university's research outcomes

INU Overseas Platform Project

Basic Plan(Draft)

The aim is to improve research performance, enhance domestic and international research reputation, and become a research-oriented university by establishing a database of overseas researchers, forming a close research collaborative relationship with Incheon National University and related research institutes, and establishing a continuous and organic research human network.

1. Overview

Promotional background and basis

- [Incheon National University's four-year(2021-2024) Operation Performance Goals]
- Performance goal II-5. Advancement of convergence-based research support system for qualitative growth
  - 5-1. Strengthening of the research support system
  - 5-3. Expansion of global academic and research exchange activities
- Performance goal IV-11. Establishment of a brand as a national university base
  - 11-1. Strengthening of promotional activities to improve the university's reputation
- [External University Evaluation Index]
  - Research reputation, etc.
- Basic plan for INU SURE LAB(draft)

Business purpose

- Secure personal information of excellent overseas researchers, build and manage this in an internal database, and use it for collaboration on various research and academic activities and for research promotion.

Project period

- December 2023 - ongoing(twice a year)
- Manage with the consent to provide and use personal information once every five years.

DB construction target

- Joint overseas researcher conducting joint research with Incheon National University
- Research year invitee, researcher at the institution where a full-time faculty member conducts the research year
- Overseas advisor for new faculty members
- Foreign graduates and foreign visiting researchers of the Incheon National University Graduate School
- Personnel in charge of overseas graduate schools and research institutes
- Faculty members from overseas universities that have signed an MOU with Incheon National University
- Other Incheon National University and related overseas researchers

2. Promotion Details

DB form

- Prepare with the Google Forms(https://forms.gle/UFBrdRVhfZnaaUEv7)
- Information included in DB: DB construction date, name, gender, research field, research website (research outcome), position, major, affiliation, highest education level, residence(country), email, Incheon National University personnel, consent to personal information, usage(promotion) details, etc.

▲ Google Form

Usage

1) For university work(open data, information consent data)
   - Securing recommendations from overseas researchers when conducting overseas training support projects such as postdocs and PhDs
   - For recruiting co-researchers
   - Requesting attendance when conducting offline events (e.g., research outcome PR or outcome exchange meetings with Incheon National University)
   - For conducting research cooperation with Incheon National University

2) For HQ work(all data)
   - For the research reputation survey with Incheon National University(in-house survey)
   - For the email PR of the Incheon National University research outcomes(in linkage with the research planning and management department's research promotion project(research highlights, research reputation improvement project, and INU research archive)
   - Securing a base for recruiting foreign graduate students

◆◆◆ Advanced Program for Securing Research Personnel ◆◆◆

Overseas Platform

Securing excellent research personnel by activating support for training at overseas institutions for Incheon National University's faculty, students, researchers, etc., and systematizing the attraction of overseas research personnel

Establishment of a pool of domestic and foreign research personnel and universities → **Establishment of a global research personnel support platform** → **Enhancement of the ability to secure global research personnel**

- MOU-signed universities
- Alma mater of full-time faculty member
- Join research institutes and researchers
- Research year training university or invited overseas professors, etc.

Collaborative research matching
- Registration and search of researchers wishing to conduct joint research

Recommendation of research institutions and researchers
- Registration of recommended research institutions and researchers

Personal information consent
- Consent when establishing a research pool DB

Registration of overseas personnel history
- Registration of personal information of overseas researchers wishing to conduct research
- Increased hiring convenience through background check

- Postdoctoral overseas training
- Accompanying research year faculty member for one's doctoral course
- Attracting overseas postdocs
- Domestic training for overseas graduate students

Invitation Letter

Incheon National University is currently conducting the “OVERSEAS PLATFORM” project to establish a personal network with exceptional overseas researchers to enhance its domestic and international research reputations and foster collaborative research activities.

This project involves the integration and construction of a database for overseas researchers, such as yourself, who are related to us. This database will be used to promote our university’s research achievements, recruit collaborative researchers, enlist foreign graduate students, and recommend overseas researchers.

If you wish to participate in this project, please click on the Google Forms link below, provide your consent for the use and collection of personal information, and fill out your personal details. It should take approximately three minutes of your time.

▲ [Google Forms Link: https://forms.gle/o1AjjCQJyxVtRWjj8]

We look forward to your valuable contributions that will support the advancement of our university. Please do not hesitate to contact us anytime should you have any questions or require additional information. We hold you and your profound knowledge in high regard and look forward to fostering productive collaboration between you and our university.

We appreciate your response to this e-mail. Thank you for your comments.

Incheon National University Development Fund

Main Business

- Scholarship projects and student welfare projects for the Incheon National University students
- Support for research activities, academic exchanges, and expansion of educational facilities

Sponsorship Area

General fund(purpose not designated)

- After donations are accumulated, their use is delegated to Incheon National University.

Designated fund(use and purpose designated)

- You can designate the use of the donation(college, graduate school, other departments) and the purpose of the fund(scholarship, facility expansion).

Scholarship

- **Development Fund Scholarship:** Given per semester (twice a year)
- **Overseas Training Scholarship:** Recipient chosen during the first semester every year(once a year)

Sponsoring Method

STEP 1. Write a contract.

- The contract can be downloaded from the website or filled out using the QR code.

Incheon National University Development Fund website

STEP 2. Deposit to the Incheon National University Development Fund account.

Shinhan | 100-029-277330

Benefits

Donation	KRW 1 Million or More	KRW 10 Million or More	KRW 100 Million or More	KRW 200 Million or More	KRW 500 Million or More
Donor name displayed on LED monitor	●				
Year-end thank you card	●	●	●	●	●
Deposit ceremony and certificate of appreciation presented		●	●	●	●
Copperplate		●	●	●	●
Appreciation plaque			●	●	●
Classroom named after the donor				●	●
Bust sculpture					●

*Benefit details may change, so please check the website for details.