

INCHEON NATIONAL UNIVERSITY

COLLEGE OF LIFE SCIENCES & BIOENGINEERING

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**FULFILLING EDUCATION
AND RESEARCH THAT
BRING HAPPINESS TO
BOTH HUMANS AND
NATURE AT**

**INCHEON NATIONAL
UNIVERSITY**
COLLEGE OF
LIFE SCIENCES &
BIOENGINEERING

INU
INCHEON
NATIONAL UNIVERSITY



Incheon National University established its College of Life Sciences & Bioengineering in March 2012 by integrating the existing College of Natural Science's Division of Life Science and the College of Engineering's Department of Nanoengineering according to the plan of empowering the country's competitive edge due to the demand of the times in the bioindustry society of the 21st century.

Based on life science and bioengineering, the College of Life Sciences & Bioengineering strives to foster talented individuals instilled with creativity, future-oriented thinking, and well-rounded character who are committed to progressing Korea's bioindustry.

The college will also contribute immensely to Incheon National University as it transforms into a national university by taking on the challenge of global research and development to become a part of the country's growth engine.

Incheon National University's College of Life Sciences & Bioengineering will turn you into a leader of the advanced bioindustry.

Life science and bioengineering are academic areas related to the actual problem-solving of issues that humans face, dealing with fundamental studies including the structure and functions of organisms and the principles of vital phenomena, as well as applied fields such as biopharmaceuticals, medical devices, biosensors, and bioenergy.

With the experience of being selected as a specialization focus college by Incheon National University, the College of Life Sciences & Bioengineering is equipped with cutting-edge classrooms, labs, and various advanced experiment instruments. The college also expands its education and research foundations through vibrant industry-university collaboration and is committed to constantly focusing on establishing itself as an outstanding educational institute, leading the growth of the country's bio-related fields by securing excellent faculty members.

The Songdo International Business District, where Incheon National University is located, has formed an advanced bioindustry cluster with a mass number of bioindustry-related companies, research centers, and educational institutes. This feature offers the best opportunity to develop into a global bioindustry complex, enabling immense potential for our graduates.

We hope that our young students with hearts that cherish the value of life will realize their bright dreams for the future at Incheon National University's College of Life Sciences & Bioengineering.

Dean of Incheon National University College of Life Sciences & Bioengineering

Vision

The college that fulfills education and research by bringing happiness to both humankind and nature

Educational Goal

Under the vision, “the college that fulfills education and research by bringing happiness to both humankind and nature,” the College of Life Sciences & Bioengineering strives to foster talented individuals that take initiative, create value, and tailor themselves to the bioindustry, dedicating themselves to the empowerment of the country’s competitive edge based on the convergence between areas such as medical, nano, and information technologies, as well as train them based on the college’s fundamental area of biology.

Who We Look For

Communication-oriented students who lead the creative innovation of life science technology

History

1980~2008

- Oct. 1980** Established new College of Natural Science's Department of Biology at the Jemulpo Campus (40 students)
- Nov. 1984** Founded the Graduate School's biology masters program
- Oct. 1987** Increased number of students in the College of Natural Science's Department of Biology (50 students)
- Nov. 1987** Founded the Graduate School's biology doctorate program



2009~2010

- Aug. 2009** Department of Biology relocated to Songdo Campus
- Mar. 2010** Established new College of Engineering's Department of Nanoengineering (30 students)
- Mar. 2010** Expanded and reformed the Department of Biology into Division of Life Sciences (30 students for Major of Life Sciences, 30 for Major of Bioengineering, and 20 for Major of Basic Medical Science)



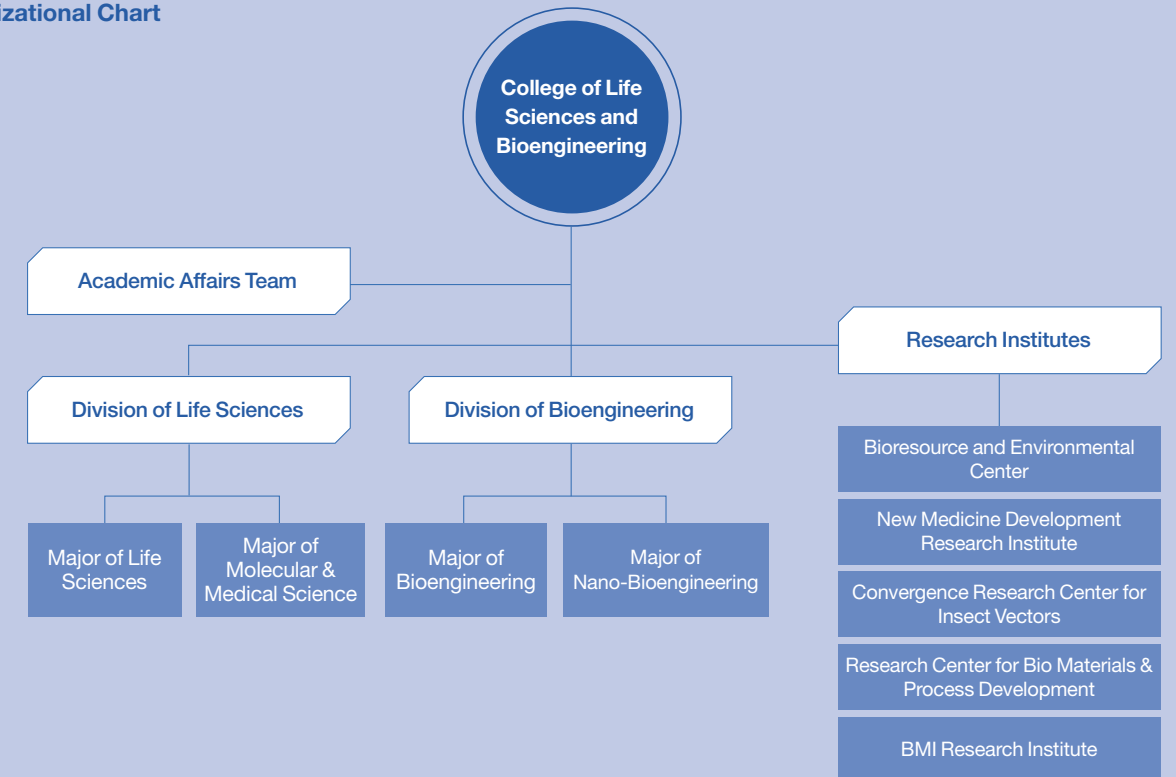
2011~2015

- Mar. 2012** Approval for establishment of College of Life Sciences & Bioengineering (125 students)
 - Division of Life Sciences (enrollment: 60)
Major of Life Sciences: 30,
Major of Molecular & Medical Science: 30
 - Division of Bioengineering (Enrollment: 65)
Major of Bioengineering: 35,
Major of Nano-Biology: 30
- Mar. 2012** Bae Cheol-hun, 1st Dean of College of Life Sciences & Bioengineering
- Jul. 2012** Lim Kyung-hwan, 2nd Dean of College of Life Sciences & Bioengineering
- Jul. 2014** Bae Yang-seop, 3rd Dean of College of Life Sciences & Bioengineering
- Aug. 2015** Transferred to Building 29 of Division of Bioengineering
- Dec. 2015** Adjusted enrollment number of majors
 - Division of Life Sciences (enrollment: 57)
Major of Life Sciences: 28,
Major of Molecular & Medical Science: 29
 - Division of Bioengineering (Enrollment: 61)
Major of Bioengineering: 35,
Major of Nano-Biology: 28

2016~2024

- Jul. 2016** Ahn Sun-gil, 4th Dean of College of Life Sciences & Bioengineering
- Sep. 2016** Established master's and doctoral courses for the Division of Bioengineering and Nano-Bioengineering at the Graduate School
- May 2017** Establishment of the Center for Innovative Human Resource Development of the Local Industry-Tailored Personnel Fostering Project
- May 2021** Kim Gil-won, 5th Dean of College of Life Sciences & Bioengineering
- Jul. 2023** Michael Lee, 6th Dean of College of Life Sciences & Bioengineering
- Mar. 2024** Changed admission system from college-based to major-based
- Mar. 2024** Changed the name of 'Major of Nano-Biology' to 'Major of Nano-Bioengineering'
- Jul. 2024** Transferred Major of Life Sciences to R&D Complex Building

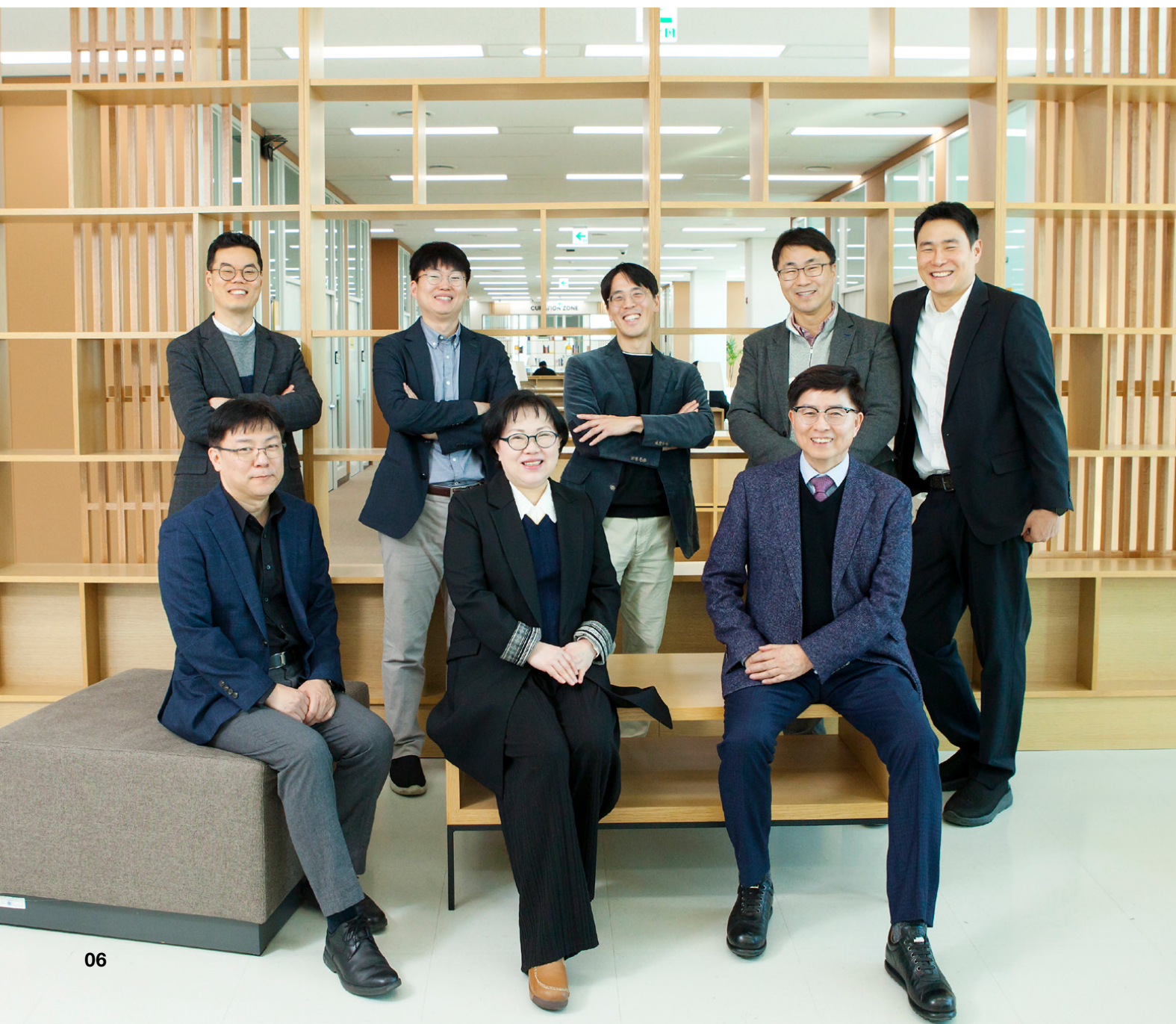
Organizational Chart



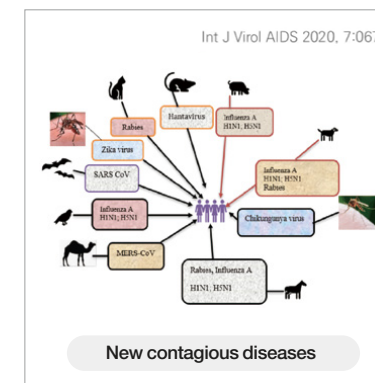
Major of Life Sciences

The Leader in Integrative Idiobiology!

- Students take various courses to understand how the diverse levels of vital phenomena interact, how they form temporal and spatial patterns, and how they create dynamic and stable characteristics.
- The feature of the major's curriculum is the emphasis on understanding various vital phenomena from an integrative organismic biology aspect, the paradigm of 21st-century biology.



Major of Life Sciences 01



Infections Disease Vectors

Detailed Research Areas

A. Training experts of early disease vector detection

- Training experts on classification, movements, and ecological characteristics of disease vectors
- Training personnel on preventive measures for wild animals (large animals) that are hosts
- Training experts on migration of host animals and predicting the spread of infectious diseases as well as personnel for preventive measures

B. Training research and development personnel for infectious disease diagnostic technology

- Training personnel who research the detection of pathogenic microorganisms, such as germs and virus

C. Training personnel who research infectious disease pathogenesis

- Training basic research personnel who study the interaction between infectious microorganisms and host cells and pathogenicity and immunopathology of infectious disease animal models

D. Training personnel in research and development for infectious disease prevention, treatment, and vaccines

Major of Life Sciences 02

Ecological Information Modeling

Detailed Research Areas

A. Identification of animal classification, behavior, and ecology

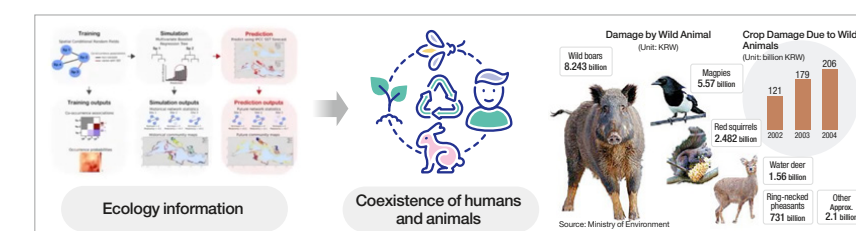
- Development of animal classification technology and detailed investigation of habitat statuses
- Development of social behavior and evolution mechanisms
- Identification of habitats and ecology

B. Ecology Information Analysis and Modeling

- Identification of behavior and movement patterns
- Density estimation and population movement modeling

C. Development of Wild Animal Management Measures

- Development of monitoring techniques, including infra-red ray camera drones and uncrewed sensor cameras
- Seeking autonomous wild animal disease monitoring and vaccine processing measures
- Development of population preservation and management technologies



Major of Life Sciences 03



A. Research on vaccine development and functional substances via the establishment of indoor culturing methods for plant resources

B. Creation of a natural ecosystem observation center and observational studies on behavior

C. Creation and operation of the Smart Bee House project and development of smart beekeeping system

Faculty

- Key Experience
- Research Field and Details



Professor Lee, Jong Koo

Doctor of Science from Indiana state university (ecology)

- Postdoctoral researcher at Ben-Gurion Univ. of the Negev (Israel)
- Researcher of Chungnam Institute
- Influence on wild animals due to human activities and habitats
- Identification of relationship between environmental factors and animal habitats
- Ecology information modeling



Professor Kim, Byung-seok

Doctor of Pharmacy from Seoul National University (Immunology)

- Postdoctoral researcher at MD Anderson Cancer Center
- Researcher of Seoul National University General Pharmacy Research Institute
- Developed cancer cellular immunotherapy agent
- Developed targeted therapy agent on Th17 cell for autoimmune disease



Professor Kim, Gil-won

Doctor of Science from the Department of Life Sciences at Nancy-Université in France (Animal Behavioral Ecology)

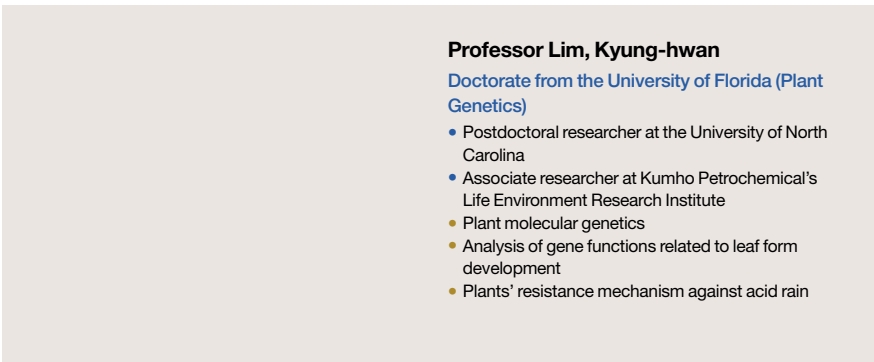
- Postdoctoral researcher at the University of Wisconsin, US
- Assistant Professor at Seoul National University Department of Biological Sciences (contract)
- Mechanisms of social behavior and adaptive values
- Animals' reproductive ecology and predation ecology and strategies
- Animals' communication mechanisms
- Adaptive strategies of animals' nurturing behavior



Professor Kang, Ki-yoon

Doctor of Science from Chonnam National University (Plant Biology)

- Postdoctoral researcher at Michigan State University
- Researcher at Seoul National University Plant Dielectric Breeding Research Institute
- Development and cultivating genome-edited plants
- Research on environment stress-resistant mechanisms
- Research on plant aging and flowering mechanisms



Professor Lim, Kyung-hwan

Doctorate from the University of Florida (Plant Genetics)

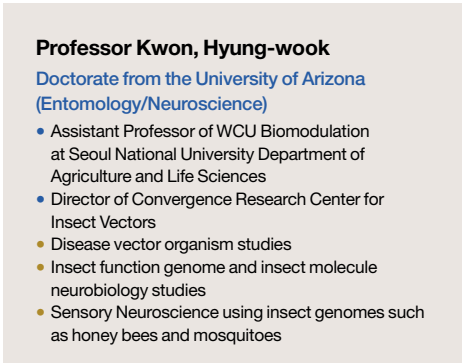
- Postdoctoral researcher at the University of North Carolina
- Associate researcher at Kumho Petrochemical's Life Environment Research Institute
- Plant molecular genetics
- Analysis of gene functions related to leaf form development
- Plants' resistance mechanism against acid rain



Professor Bae, Yang-seop

Doctorate from the Osaka Prefecture University (Entomology)

- President of Insect Diversity Research Society
- Director of the Incheon Green Environment Support Center
- Animal lineage classification and insect ecology studies
- Research on preservation and restorative ecology
- Research on lineage classification regarding insects



Professor Kwon, Hyung-wook

Doctorate from the University of Arizona (Entomology/Neuroscience)

- Assistant Professor of WCU Biomodulation at Seoul National University Department of Agriculture and Life Sciences
- Director of Convergence Research Center for Insect Vectors
- Disease vector organism studies
- Insect function genome and insect molecule neurobiology studies
- Sensory Neuroscience using insect genomes such as honey bees and mosquitoes



Professor Kim, Jae-kwang

Doctor of Engineering from Osaka University (Biotechnology)

- Research official at the Rural Development Administration
- Board member at the Korea Metabolomics Society
- Research on metabolomics study platform expansion
- Research on functional organism material exploration
- Research on quality evaluation of genetic resources from plants



Professor Choi, Jae-hyuk

Doctor of Agriculture from Seoul National University (Agricultural Biotechnology)

- Postdoctoral researcher at the University of British Columbia
- Lead Researcher at Korea Atomic Energy Research Institute
- Research on genome analysis of eukaryotic microorganisms
- Research on biological activity based on microorganism materials
- Research on non-degradable material degradation based on microorganisms

Major of Molecular & Medical Science

Studying the Secrets of Life, Aging, Sickness, and Death from Medical and Micro-Level Perspectives

Aims to foster talent with creative convergence capabilities demanded by an aging society and the post-COVID age, as well as train personnel who can respond flexibly to the fluctuations in industry workforce demand



Carries out education focused on research, bio-research expert training, global network education and research systems



Training commercialization research personnel for development of new medicines in the field of diseases



Training global biology talent based on biology expertise and practical research abilities

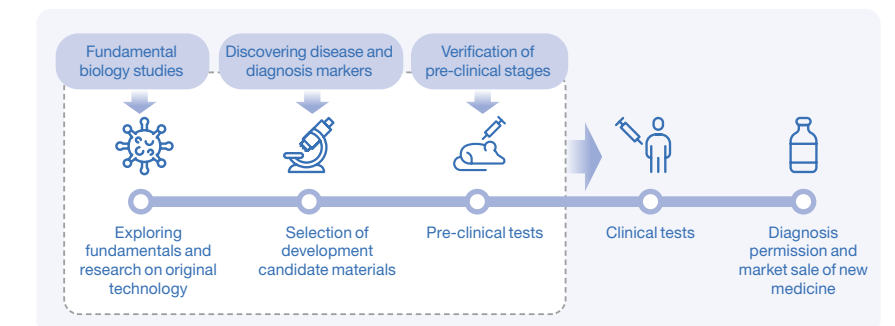


Major of Molecular & Medical Science

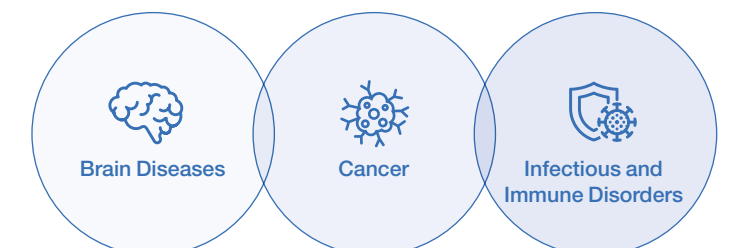


Aims

- Fundamental biological studies on infectious diseases and various disorders to prepare for an aging society and post-COVID age and curricula for research related to non-clinical stages are desperately needed for the healthy future of humanity
- The major aims to discover outstanding talent in innovative new medicine research and development and biology areas through the enhancement of learning capabilities by operating curricula that can respond actively to changes in future industries



3 Key Research Areas



- Provides opportunities to comprehensively learn basic life sciences and their practical and applied areas
- Deduces candidate materials during new medicine development and trains biology experts specialized in pre-clinical stages
- Aims to foster talent with creative convergence capabilities demanded by the post-COVID age and operate curricula that train personnel who can respond flexibly to the fluctuations in industry workforce demand
- Commercialization research to develop innovative new medicine in the areas of brain disorders, cancer, and infectious diseases

Faculty

- Key Experience
- Research Field and Details



Professor Michael Lee
Doctor of Science from the Korea Advanced Institute of Science and Technology (KAIST) (Molecular Pharmacology & Toxicology)

- Post-doctoral Fellow at the United States Department of Health and Human Services' National Cancer Institute (NCI/NIH)
- Senior Researcher at Korea Research Institute of Chemical Technology's Safety Evaluation Research Institute
- Investigated signal delivery mechanism within cells during tumor cells' deaths due to anticancer drugs
- Research on autophagy's role according to cancer development stages

Professor Hara Kang
Doctorate from the University of Utah (Neurobiology and Anatomy)

- Postdoctoral researcher at the University of California San Francisco
- Postdoctoral researcher at the Tufts Medical Center
- Research on mechanisms of gene expression and disease related disruptions
- Discovery of RNA-based diagnostic markers
- Research on intercellular communication through exosomes





Professor Yeh, Jung-yong
D.V.M., Ph.D. from Konkuk University College of Veterinary Medicine (Virology)

- Veterinary Researcher at the Hazardous Material Department of the National Institute of Agricultural Sciences, run by the Rural Development Administration
- Veterinary Researcher at the Foreign Infectious Disease Department of the National Veterinary Research & Quarantine Service
- Visiting Researcher at the Central Veterinary Research Institute of Wageningen University in the Netherlands
- Visiting Researcher at the National Veterinary Services Laboratories of the United States Department of Agriculture
- Visiting Researcher at the Prion Disease Research Institute in Japan
- Research on anti-virus RNA interference using siRNA
- Research on autophagy metabolism of infectious virus cells
- Research on viral infection epidemiology



Professor Kim, Jae-geun
Doctorate from Ulsan University (Neuroscience)

- Postdoctoral researcher at the Yale University School of Medicine
- Research Professor at Ulsan University College of Medicine
- Research on appetite and obesity control through the control of the brain's hypothalamus
- Research on control of degenerative brain disease due to bioactive secretory protein
- Development of optimized recombination protein refinement technology for disease control research



Professor Lee, Mi-su
Technische Universität München, Dr.rer.nat. (Life Science)

- Postdoctoral researcher at Helmholtz Zentrum München
- Research Assistant Professor at Yonsei University College of Medicine
- Guest Professor at Yonsei University College of Engineering
- Director of Incheon National University New Medicine Development Research Institute
- Research on cancer metabolism
- Research on anticancer drug tolerance
- Research on new medicine development in pre-clinical stages

Professor Park, Joon-tae
Doctorate from Johns Hopkins University School of Medicine (Protein Engineering)

- Postdoctoral researcher at Johns Hopkins University School of Medicine
- Senior Researcher at Samsung Electronics' Advanced Institute of Technology
- Principal Researcher at Samsung BIOEPIS
- Established vector platform for the next-generation expression vector
- Research on reverse aging mechanism
- Research on anti-cancer effect using mushroom mycelia





Professor Han, Mi-Ryung
Doctorate from Vanderbilt University School of Medicine (Epidemiology)

- Research Professor at the Catholic University of Korea School of Medicine
- Research Professor at the Korea University Medical Center
- Multi-omics approaches for disease prevention and diagnosis
- Interpretation of tumor heterogeneity via radiogenomic analysis
- Algorithm development for disease detection
- Integrated analysis of genomes and epigenomes



Professor Bong, Ji-hong
Doctorate from Yonsei University (Biosensors)

- Postdoctoral researcher at Universität Münster
- Nano particles for medical purposes using colon bacillus surface expression technology
- Biosensors using antibody engineering
- Ultrahigh speed immunoassay technology using special peptides

Major of Bioengineering

The Core of Cutting-Edge Bioindustry

The Major of Bioengineering aims to foster human resources with the expertise and creativity required for the development of advanced biomaterials and technologies, including biopharmaceuticals. The Major of Bioengineering operates a diverse and in-depth education and research system centered on the development of biomaterials and processes that are the core of the bioindustry, and the cultivation of global leaders who will lead the advanced bioindustry. As a result of these efforts, the Major of Bioengineering is playing a leading role as a core bio major at Incheon National University, located at the heart of the advanced bioindustry, based on the major's key strategies of advancing into cutting-edge fields, globalization, fostering excellent human resources, and industry-academia cooperation.

Key Research Areas



Biopharmaceuticals
We pursue a healthy future by overcoming incurable diseases and infectious diseases through the development of next-generation biopharmaceuticals. To achieve this goal, we develop advanced biopharmaceutical development and production technologies, including cell and gene therapies, biofusion therapies, and microbiome therapies using biomaterials such as proteins, nucleic acids, and cells.



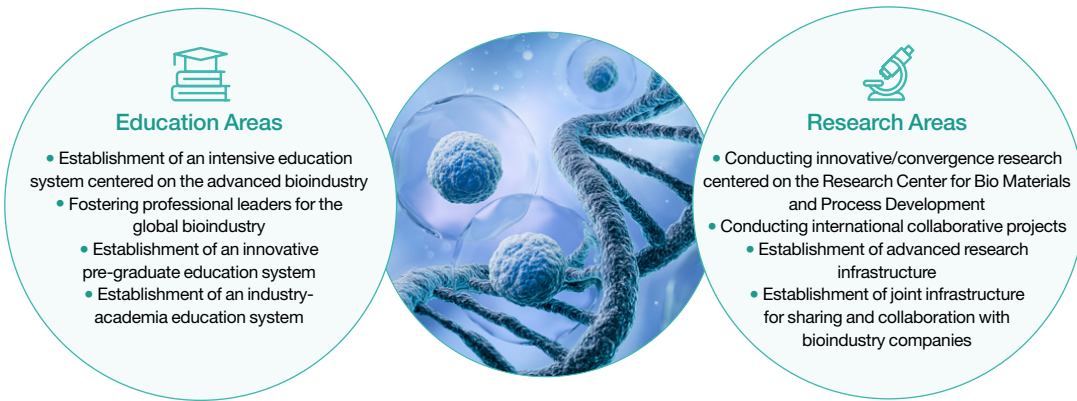
Medical Devices/Diagnosis
We develop advanced medical devices/advanced biopharmaceuticals using functional materials, such as tissue regeneration using functional biomaterials, smart drug delivery, and bioartificial organ models. We also develop advanced biosensors/imaging technologies to build next-generation diagnostic/monitoring technologies, such as early diagnosis of diseases, detection of infectious diseases, and real-time monitoring of biological functions and specific factors.



Biofood/Chemicals
We develop functional dietary and pharmaceutical materials and foods produced by applying traditional fermentation technology and the latest bioengineering technologies. We also aim to contribute to the realization of a sustainable society by producing chemical products from renewable resources through biological processes, and as a strategy, we develop advanced technologies, such as genome editing and synthetic biology for the development of microorganisms and enzymes.

Education and Research Vision

An educational and research institution that cultivates key talents with expertise and creativity in the advanced bioindustry to become globally competitive in the development of innovative biomaterials and technologies



Major-Specialized Programs

Area	Programs and Details
Curricular Specialization	Enhanced Graduation Certification Requirements: Completion of a laboratory-linked project to write and present a graduation thesis Storytelling Bioengineering Laboratory Course: Reorganization and expansion of the Storytelling Bioengineering Laboratory course Bioengineering Seminar: Implementation of bioengineering seminar classes to develop working professionals
Extra-curriculum Specialization	Bioprocessing Entrustment Program: Expanding existing bioprocessing programs and establishing new advanced biotechnology specialization programs Startup Idea Contest: Encouraging students to propose innovative ideas and realize them Nano-Degree: Linked to university Nano-Degree, focusing on biomaterials and processes Student Analyst Support: Supporting the publication of articles and news in the field of advanced biotechnology
Educational Environment	Basic Bioengineering Laboratory: Establishment of classroom and laboratory infrastructure customized for advanced biotechnology Advanced Bio-specific Research Facilities: Establish and expand specialization-related culture rooms and shared equipment rooms
Industry Demand	Convergence Course and Convergence Capstone Design: Operate convergence courses to foster creative and innovative talents Customized Education System for Industrial Needs: Planning and researching projects related to industrial companies through agreements with industrial companies and encouraging students to create their own project Industry-supported Scholarships: Encouraging students to participate in corporate R&D projects and managing projects



Faculty

- Key Experience
- Research Field and Details



Professor Won Jong Rhee
Doctor of Engineering from Seoul National University (Biochemical Engineering)

- Senior Researcher at LG Life Sciences
- Postdoctoral researcher at Georgia Institute of Technology, USA
- Development of next-generation biologics
- Liquid biopsy diagnosis and biosensor development
- Plant nanoparticle-based pharmaceutical and cosmetic material development
- Smart biomaterial production process development

Professor Myung-Ji Seo
Doctor of Engineering from Yonsei University (Microbial Biotechnology)

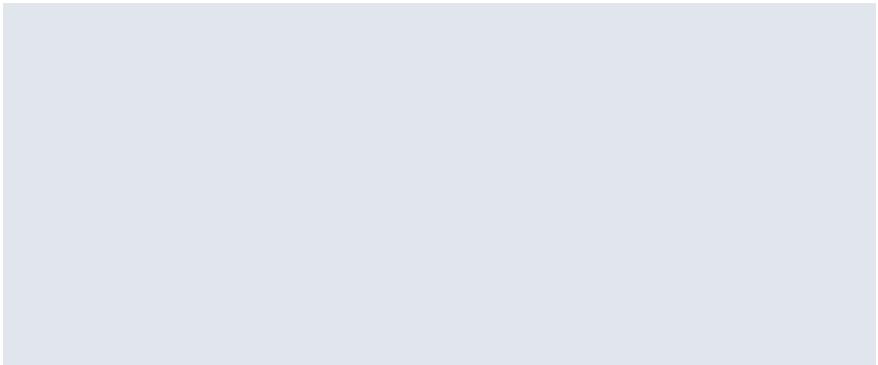
- Senior Researcher at Korea Food Research Institute
- Postdoctoral researcher at Brown University
- Discovery and characterization of novel and useful microbial resources
- Genome mining for core biosynthetic enzymes of natural products
- Development of microbial materials by biological chemistry and metabolic engineering
- Industrialization of functional biomaterials by bioprocessing optimization





Professor Kyung Min Park
Doctor of Engineering from Ajou University (Biomaterials)

- Postdoctoral researcher at Johns Hopkins University
- Development of advanced biomaterials
- Tissue engineering and regenerative medicine
- Engineered tissue models
- Smart drug delivery





Professor Byeong Hee Hwang
Doctor of Engineering from POSTECH (Molecular Bioengineering)

- Postdoctoral researcher at University of California, Santa Barbara
- Visiting scholar at Rice University
- Development of gene editing tools based on CRISPR technology
- Development of new biopharmaceutics
- Biomolecular engineering for biomedical applications
- Cosmetic and biotechnological applications of biomolecules

Professor Eunjung Kim
Doctor of Engineering from Yonsei University (Nanomedicine)

- Postdoctoral researcher at Imperial College London
- Development of nucleic acid-based multifunctional inorganic/organic nanobiomaterials
- Development of biosensing and imaging technologies for ultra-precise diagnostics
- Development of in vitro multiplex diagnostic technologies for next-generation disease prediction and diagnosis
- Development of targeted therapy and drug/vaccine delivery technologies





Professor Sungho Jang
Doctor of Engineering from Pohang University of Science and Technology (Biochemical Engineering)

- Postdoctoral researcher at Boston University
- Synthetic biology and evolutionary bioengineering
- Development of engineered microorganisms for environmentally-friendly production of chemicals
- Development of engineered live biotherapeutic products (eLBP)
- Development of RNA-based therapeutics



Professor Kisuk Yang
Doctor of Engineering from Yonsei University (Stem Cells and Tissue Engineering)

- Postdoctoral researcher at Harvard Medical School
- Postdoctoral researcher at Broad Institute (MIT and Harvard)
- Development of stem cell therapeutics
- Development of tissues and artificial organs based on stem cells
- Development of 3D devices mimicking stem cell microenvironment
- Development of functional biomaterials for inducing stem cell proliferation/differentiation

Major of Nano-Bioengineering

Creating Nano-Bio Convergence Technology to Lead the 4th Industrial Revolution

The Major of Nano-Bioengineering seeks to foster high-quality personnel for research and development and a workforce instilled with creative designing and problem-solving abilities to lead the growth of national industries by letting students develop a broad range of knowledge in nano-bio and nano-convergence technology fields that become the foundations of the country's new growth. Another purpose is to train and produce outstanding talent suitable for the global age by cultivating engineering students' fundamental traits, ethical thinking, a sense of responsibility, and capabilities for international tasks.

Major Fields



Nano-Bio Medicine
Understanding causes and treatment methods of diseases (cancer, brain diseases), understanding the production process and raw materials of nano-bio medicine and cosmetics, cell culture, cell strain production, analysis methods, protein separation and refinement techniques, medication production technology, new medicine synthesis technology, gene analysis technology, understanding nano-bio medicine effect evaluation, understanding animal testing methodologies



Nano-Biomaterials
Understanding organic and inorganic material synthesis and analysis methods, understanding human physiology, understanding nanomaterials with high body compatibility, understanding nano-thin film production process, nano-bio material analysis method and safety evaluation



Nano-Bio Medical Technology and Devices
Nano-bio medical device production technology, understanding human physiology, understanding disease diagnosis biomarkers, biosensor and circuit production technology, understanding bio-signal processing and analysis, understanding bio-imaging technology, understanding brain disease diagnosis and treatment equipment, analyzing nano-bio medical devices and technology's body compatibility, medical technology and device testing, safety evaluations



Major's Specialized Programs

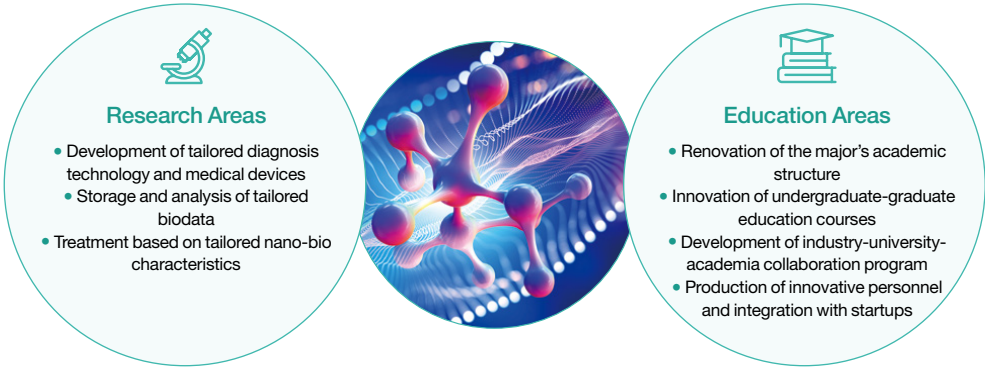
Program	Details
Exchange Meeting for Industry-University-Academia Cooperation	Exchange meetings for industry-university-academia cooperation are held between enrolled students, faculty in full service, and bio-related companies in the Incheon region, enabling a site of information exchange to seek technology cooperation and sharing each company's interests
Programs for Biotechnology Certification (e.g., HPLC)	Provides programs to learn areas required by industries, research institutes, etc., such as methods for bio-analysis device operation, experiments, and analysis
Professor-Student Idea Product Development Presentation	A professor and student form a single team to develop a product based on ideas related to the major field and an event to present the results is prepared to share the teams' thoughts and information
Field Trips to Companies and Research Institutes	Expands learning and field trip opportunities for students to give them exposure to the outside environment at companies and research institutes and adapt, while also allowing them to gain experience related to practical work in advance, aiming to achieve diversity in career-seeking and increase the employment rate
Career and Employment Mentoring	Provides companies' recruitment process information for students' career planning and employment preparation through actual company workers' career and employment mentoring sessions, alleviating students' worries regarding their careers

Careers After Graduation

Major	Fields of Employment	Recruiting Companies
Nano-Bio Medicine	Production, development, QC, QA, and GMP regarding nano-bio medicine and cosmetics	Samsung Biologics, SK Chemicals, LG Chemicals, Kolmar Korea, GC Cell, Hanmi Pharmaceutical, Chong Kun Dang Pharm., Shinpoong, Daewoong Pharm., Dong-A Science Technology, Yuhan Chemicals, Dongindang Pharmaceutical, Ahngook Newpharm, BONIF, and more
Nano-Biomaterials	Production and development of nano-biomaterials, development of new nano-biomaterials, development of pharmaceutical and cosmetic medication, development of material synthesis technology	
Nano-Bio Medical Technology and Devices	Production and development of nano-bio medical technology and devices, medical device effect evaluation	

Research and Education Vision

The Major of Nano-Bioengineering implements specialization for establishing personalized medical systems based on the diagnoses and data required in the age of well-aging, backed by convergent characteristics and the diverse research areas and expertise of its members



Faculty

- Key Experience
- Research Field and Details



Professor Lee, Seung-ho

- Doctor of Science from Osaka University
- Master of Agriculture from Seoul National University
- Bachelor of Agriculture from Sungkyunkwan University
- Sanford Burnham Prebys Medical Discovery Institute: Postdoctoral researcher
- Scripps Korea Antibody Institute: Principle Investigator
- Development of new medicine with improved cognitive and photoaging features
- Development of new anti-aging medicine based on the microbiome inside intestines
- Analysis of disease moderation mechanism based on functional sugar chain



Professor Song, Young-jun

- Doctor of Engineering from the University of California San Diego
- Master of Engineering from the University of California San Diego
- Bachelor of Engineering at Inha University
- Postdoctoral researcher at the University of California San Diego
- Gene analysis and editing based on semiconductor chips and MEMS
- BioMEMS, DNA Self-assembly

Professor Shim, Min-suk

- Doctor of Engineering from Case Western Reserve University
- Bachelor of Engineering from Seoul National University
- Postdoctoral researcher at the Georgia Institute of Technology
- Postdoctoral researcher at the Washington University in St. Louis
- Development of drug delivery system using organic and inorganic nanoparticles
- Development of anti-cancer and brain disease medicine
- Development of exosome and genetic medicine



Professor Song, Kwang-hoon

- Doctor of Engineering from the Pohang University of Science & Technology
- Master of Engineering from the Pohang University of Science & Technology
- Bachelor of Engineering from the University of Seoul
- Postdoctoral researcher at the University of Pennsylvania
- Development of biomaterials
- Development of biofabrication technologies
- Tissue engineering research utilizing biomaterials and biofabrication technologies





Professor Yang, Sung-gu

- Doctor of Science from the University of Illinois at Urbana-Champaign
- Master of Science from Inha University
- Bachelor of Science from Inha University
- Postdoctoral researcher at the Johns Hopkins University School of Medicine
- Development of a medical device for brain disease diagnosis and treatment based on brain-machine interface (BMI)
- Research on the theory and work memory mechanism of the brain's time and space conversion method



Professor Kim, Jun-seob

- Doctor of Science from the Sungkyunkwan University
- Master of Science from the Sungkyunkwan University
- Bachelor of Science from the Sungkyunkwan University
- Senior researcher at the Korea Research Institute of Bioscience and Biotechnology
- Postdoctoral researcher at the Pennsylvania State University
- Molecular microbiology, biotechnology, metabolic engineering, synthetic biology
- Microorganism communication, microbiome-related diseases



Professor Kim, Byeong-choul

- Doctor of Engineering from the University of Michigan
- Master of Engineering from the University of Michigan
- Bachelor of Engineering from Yonsei University
- Postdoctoral researcher at the Howard Hughes Medical Institute (HHMI), University of Illinois Urbana-Champaign (UIUC), and Johns Hopkins University
- Fundamental research on monomolecular cellular kinetics related to cancer metastasis and brain disease
- Development of monomolecular diagnosis and biochip technology



Professor Han, Sang-gil

Doctor of Engineering from the University of Cambridge

- Assistant Professor at Incheon National University
- Postdoc at the University of Cambridge
- Development of wearable and implantable biosensors
- Plantronics for precision agriculture and forestry
- "Internet of Living Things" (IoLT) for all-in-one healthcare platform (plants, forests, livestock, pets etc.)
- * Representative paper: S. Han et al. Adv. Mater. 32, 2004790 (2020).

Department of Life Sciences

Exploring Vital Phenomena at Various Levels, From Molecules to Individuals and Clusters

Incheon National University’s Graduate School of the Department of Life Sciences explores vital phenomena at various levels, from molecules to individuals and clusters. The Department consists of two areas: the “Major of Life Sciences,” which explores the secrets and phenomena of life in-depth and attempts to understand the principles of the ecosystem, and the “Major of Molecular & Medical Science,” which researches the wonders of life, aging, sickness, and death from medical and micro-level perspectives. Both areas’ majors and labs cooperate and interact with each other to conduct innovative research. Incheon National University’s Department of Life Sciences aims to foster creative talent who study the knowledge required in various fields of life sciences and can develop and apply practical technologies through cutting-edge research and innovative educational activities.



Laboratories and Research Institutes

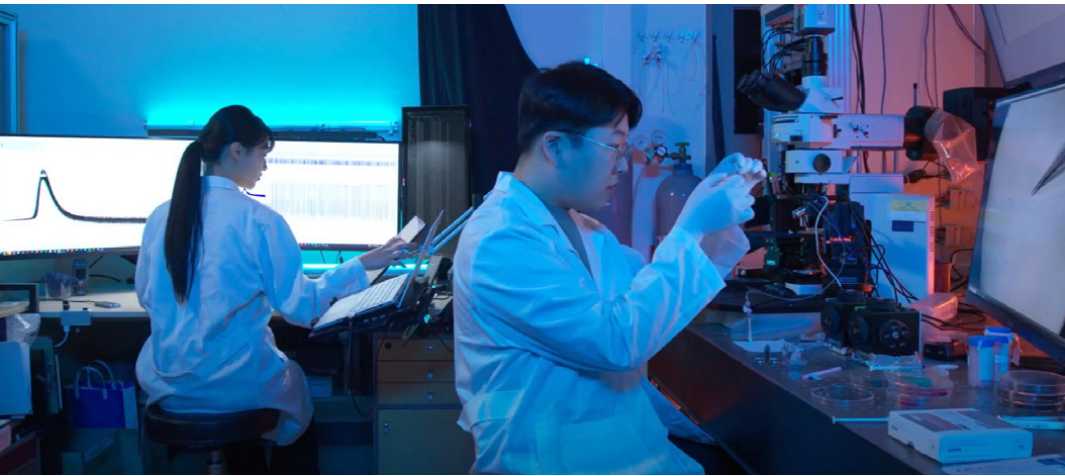
The department has 17 excellent professors in its faculty as well as numerous graduate students, playing a pivotal role in developing the most advanced technologies in quarantine, health, medicine, genetics, disease, and environment fields with various research institutes, including the Convergence Research Center for Insect Vectors, Organism Resource Environment Research Institute, and New Medicine Development Research Institute.

Zoological Taxonomy Experiment Lab	Ecology Information Modeling Experiment Lab	Neurometabolism Experiment Lab
Plant Molecule Genetics Experiment Lab	Immunology Experiment Lab	Cancer Translational Research Experiment Lab
Behavior Ecology Experiment Lab	Zoological Taxonomy Experiment Lab	Protein Engineering Research Lab
Plant Metabolism Experiment Lab	Molecular Cell Toxicology Experiment Lab	Organism Informatics and Cancer Genome Research Lab
Mold Network Experiment Lab	Molecular Cell Biology Experiment Lab	Medical Diagnosis Antibody Research Lab
Sensory and Cognitive Brain Science Research Lab	Virology Experiment Lab	

Department of Bioengineering and Nano-bio engineering

Leading the Country’s Bioindustry Development Through BT and NT-Based Technologies and Their Convergent Techniques

Many voice the necessity of bio-related fields to overcome imminent issues of humanity, such as aging societies, the rise of incurable diseases, food shortages, and environmental and energy problems. In line with this trend, the Department of Life and Nano-Bio Sciences operates research and education programs that foster talent that will lead the 21st-century bioindustry era with creative expertise in BT, NT, and their convergent fields and well-rounded character. The educational goal of Incheon National University’s Department of Life and Nano-Bio Sciences is to foster creative engineers that lead the country’s bioindustry development through BT and NT-based technologies and their convergent techniques and foster personnel who harmonize with their local areas as well as hold global capabilities.



Laboratories and Research Institutes

The department has 16 excellent professors on its faculty and numerous graduate students, along with infrastructure such as research labs, joint equipment rooms, and animal test labs to develop cutting-edge core technologies and foster research personnel. Based on such foundations, the department seeks to discover and foster engineers who will play pivotal roles in developing core technologies based on biology for the empowerment of the country’s competitive edge in fields of medicine, health, chemistry, electronics, food, energy, and the environment.

Microorganism Genetic Engineering Experiment Lab	Synthetic Biology and Evolutionary Bioengineering Lab	Monomolecular Cellular Kinetics Research Lab
Biologics and Diagnostics Engineering Lab	Stem Cells and Regenerative Biomedical Engineering Lab	Bio Electron Optics Research Lab
Microorganism Bioengineering Experiment Lab	Nano-Biochemistry Experiment Lab	Biomaterials & Translational Medicine Research Lab
Polymeric Biomaterials Lab	Nano-Biopolymer Experiment Lab	System & Synthetic Microbiology Research Lab
Biomolecular Diagnostic and Therapeutic Engineering Lab	Brain Engineering Experiment Lab	Bio Electronic Component Research Lab
Functional Nucleic Acid Nanomaterials Lab		

Other Research Institutes

Bioresource and Environmental center

Director: Professor
Bae, Yang-seop



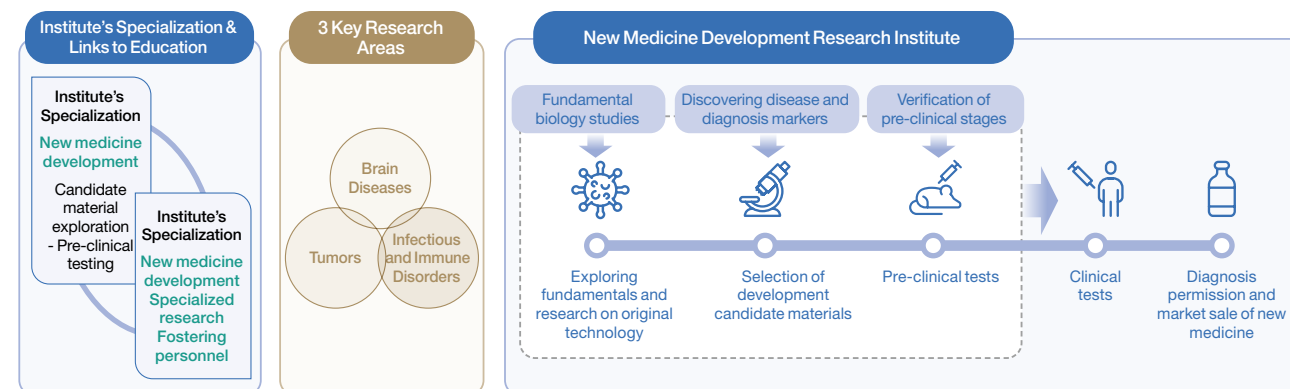
Establishes preservation and application technology regarding unique domestic organism resources for Korea's next-generation organism projects and environment preservation; fosters high-quality research personnel to contribute to the country and local community by expanding research foundations

New Medicine Development Research Institute

Director: Professor
Lee, Mi-su



- The New Medicine Development Research Institute aims to develop excellent new medicine candidate materials with high marketability and quality, the core of global new medicine development, by creating and anchoring itself to a research system that can combine the university's research capabilities with companies' systems.
- The institute conducts research beginning with fundamental biology studies for new medicine development, discovery of disease and diagnosis markers, and verification of pre-clinical stages. In particular, the institute focuses on the emergence, diagnosis methods, prevention, and treatment of brain tumors, degenerative diseases, and infectious diseases.



Convergence Research Center for Insect Vectors

Director: Professor
Kwon, Hyung-wook



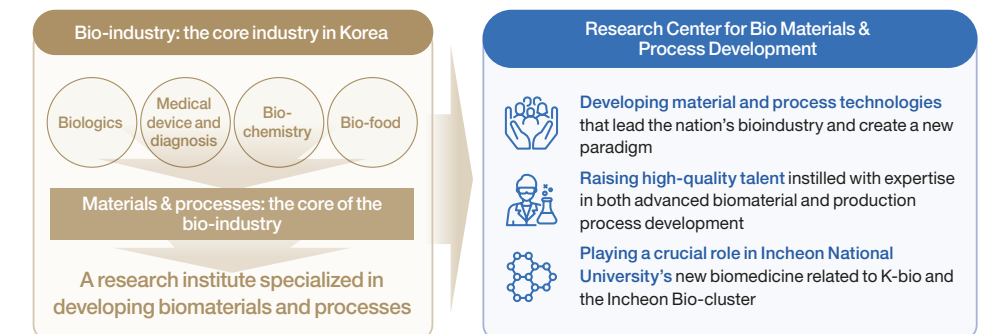
The center aims to contribute to the enhancement of human quality of life by researching mid-to-long-term countermeasures against climate change and international climate change response projects via systematic investigation and research on climate change regarding vector insects, developing resources related to vector insects, and conducting various related convergent studies and projects.

Research Center for Bio Materials & Process Development

Director: Professor
Won Jong Rhee



- The Research Center for Bio Materials & Process Development was established with the primary goal of enhancing the human health and well-being by focusing on the development of advanced biomaterials and efficient production processes, which are crucial components of the bio-industry.
- The Institute contributes to the growth of the Bio-cluster of Incheon and Korea, establishes Incheon National University's bio-brand, and builds a sustainable industry-university-academia cooperation system through education and by attracting outstanding research personnel.
- Its functions include material and process research, development, and education in core bioindustry areas, including next-generation new biomedicine, disease diagnosis and medical device development, biochemistry, and biofood.

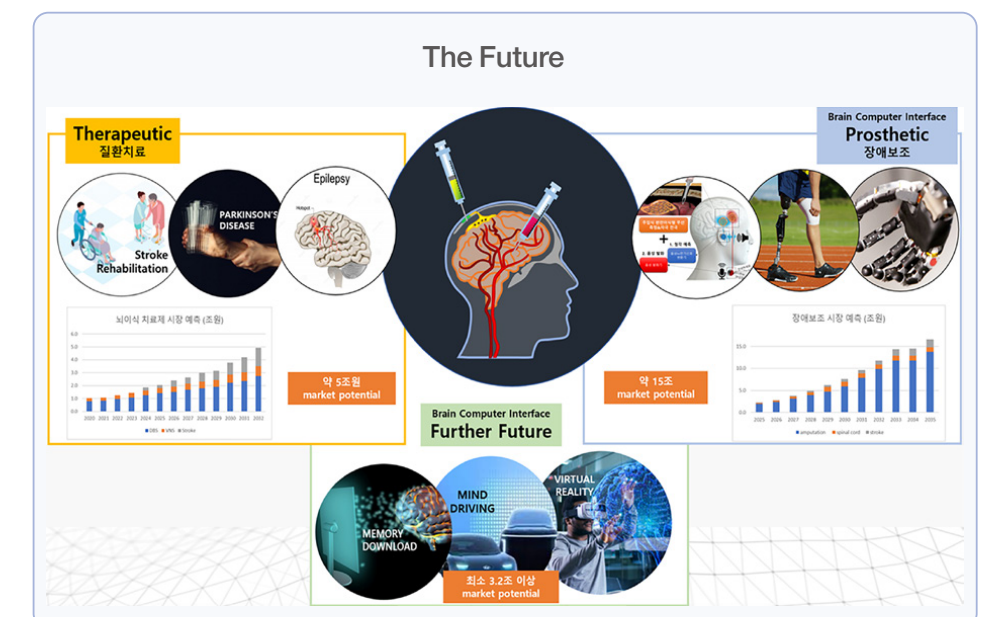


BMI Research Institute

Director: Professor
Yang, Sung-gu



- The population with incurable brain diseases is recently on the rise due to an aging society; however, the response in relevant diagnosis and treatment research is lacking. The BMI Research Institute was established for efficient and systematic brain-related studies and, ultimately, for the healthy life of people living in the modern world to enhance their quality of life.
- In Songdo, which is becoming the center of bio-related studies, the institute aims to lead brain-related research, raise the reputation of Incheon National University, win contracts for domestic and foreign research projects, and attract and foster outstanding research personnel.



Center for Innovative Human Resource Development

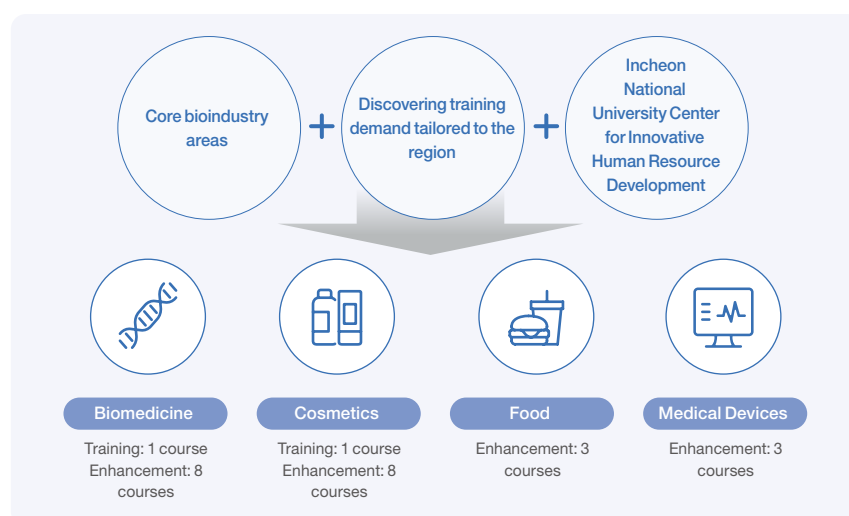
Leading and Fostering Bioindustry, the Flagship Business of Incheon

- Incheon National University's Center for Innovative Human Resource Development was established in 2017 centered around the Incheon National University's College of Life Sciences and Bioengineering to lead and foster bioindustry, Incheon's flagship business.
- Established with national support as a personnel development business operation institute tailored to local and industry needs, the Institute implements training programs to foster bioindustry experts, indispensable elements of the fields of bioindustry, which is the country's core strategic industry.
- By utilizing excellent facilities, equipment, and human resource infrastructure owned by Incheon National University's College of Life Sciences and Bioengineering, the institute provides expert-level Training in the four core bio-industry fields (biomedicine, biochemistry (cosmetics), food, and medical device) based on the national and local demands.



Education Content

Areas for Training	Focus on biomedicine, cosmetics, food, and medical devices
No. of Courses	Around 24 (all courses are free)
Eligible Applicants and Courses	Enhancement courses for current workers, training courses for job seekers (students)
Program Size	At least 600 trainees undergo and complete courses annually
Website	https://inuhrd.inu.ac.kr/



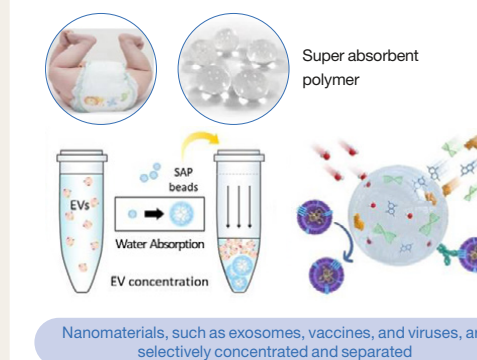
01

● Professor Won Jong Rhee's Team Develops Super-Simple Exosome Concentration Technology Using Diaper Material

- The team led by Professor Lee Won-jong of the Major of Bioengineering utilized the high-absorption polymer principles used in diapers' urine absorption to develop concentration and separation technology for nanomaterials that include exosomes.
- The technology is based on the fact that super absorbent polymer has microscopic channels with a size of a few nanometers, allowing it to absorb water and low molecular materials while not absorbing substances exceeding such sizes, including exosomes, vaccines, and viruses, leading to a selective concentration process.
- The technology boasts excellent efficiency and economic feasibility and is expected to replace the filter-based concentration process used in Biopharmaceutical drug production. The results of this research were presented in the "Journal of Extracellular Vesicles," the journal with the highest reputation in exosome-related areas, and the results were also widely spread through press releases and other media.

RESEARCH ARTICLE

Single-step equipment-free extracellular vesicle concentration using super absorbent polymer beads



WILEY

중형일보

Professor Won Jong Rhee's Team From Incheon National University Develops Super-Simple Exosome Concentration Technology

[The JoongAng Ilbo] Entered on Mar. 22, 2021 15:56

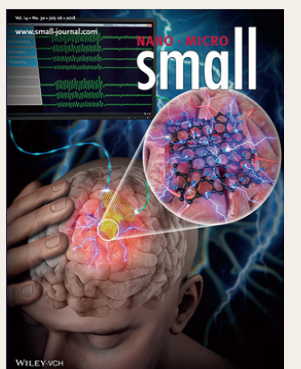


Professor Won Jong Rhee's team from Incheon National University's Major of Bioengineering developed a super-simple concentration technology using diaper materials for exosomes, next generation biomaterials

02

● Professor Yang, Sung-gu's Joint Research Team Develops Brain Disease Diagnosis and Treatment Equipment Based on Electronic Skin

- A medical device for brain disease diagnosis and treatment in the form of electronic skin has been developed by the teams of Professor Yang, Sung-gu from Incheon National University's Major of Bioengineering, Professor Ahn Jong-hyun from Yonsei University, and Professor Yang Sung-chil from the City University of Hong Kong.
- The needle-type electrodes used for existing brain disease treatment had the disadvantage of causing physical and biological damage to the brain. However, the electronic skin developed by our research team is stuck to the brain's surface to estimate spatial and temporal brain waves, enabling early diagnosis of brain disease and simultaneously instilling treatment stimulus to overcome various brain disorders, proving to be a revolutionary discovery. The technology can be applied to brain diseases such as Parkinson's disease, Huntington's disease, depression, schizophrenia, tinnitus, and phantom pain.
- The results of this research were published as the cover model for "Small," a world-renowned academic journal (impact factor=13.3) with the title, "Epidural Electrotherapy for Epilepsy."

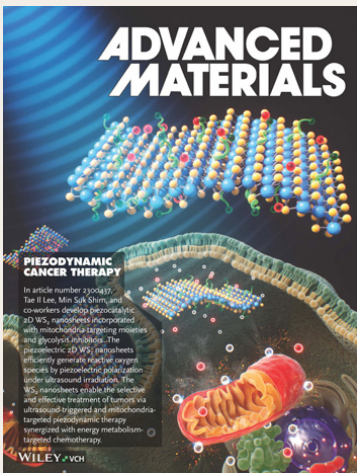


Excellent Performance Cases

03

● Professor Shim, Min-suk's Research Team
Develops Anticancer Medicine Based on
Piezoelectric Nanomaterial

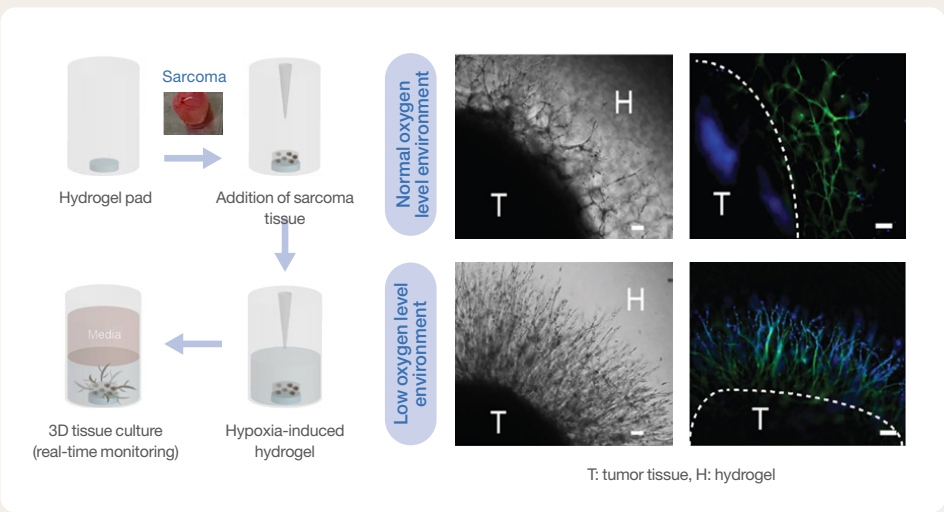
- Professor Shim, Min-suk's research team developed an innovative anticancer technology using ultrasonic waves by devising a piezoelectric nanomaterial equipped with metabolic anticancer medicine. This research was published in "Advanced Materials," one of the world's most prestigious journals in advanced material areas, showcasing the team's impressive progress in incorporating nanotechnology into medicine.



04

● Professor Kyung Min Park Develops Biomimetic Artificial Tumor Model

- Because cancer cells inside bodies also need oxygen to survive, there has been no research up to date on identifying the movement of cancer cells according to oxygen levels at the stage of the cancer cells' growth.
- The research team caught on to mice's sarcoma cells, going after spots with higher oxygen levels as if they were reaching for food. This idea led the team to devise a "hydrogel-cancer cell system," which uses polymer hydrogel with the ability to moderate oxygen levels to track how cancer cells react in different oxygen levels.
- The result of the research found that cancer cells also move from locations with low oxygen levels to sites with higher levels. Applying the result of this research may take some time; however, it is expected to contribute to next-generation artificial tumor models, early cancer treatment tests, and the development of new cancer diagnosis and treatment technologies.



05

● Professor Song, Young-jun's Team Develops
DNA Storage System with Data Editing Process
Programming Abilities

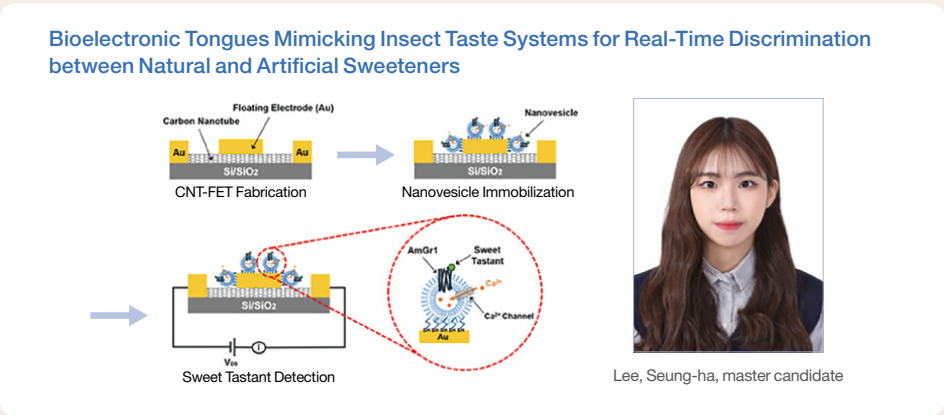
- Professor Song, Young-jun's (corresponding author) research team from the Major of Nano-bioengineering successfully created DNA storage with data processing abilities. DNA storage has been favored as the next-generation storage medium due to its long-term storage, the recent rise of digital data production, and the limitations of storage devices; however, due to the restrictions of molecular sequence structures, it has only been studied as cold data, often utilized for data backup. To overcome such issues, the research team used droplet fluid technology and sequence combination technology to create a "processing in memory" (PIM) technique that edits DNA data. The research enabled the DNA data processing technique based on fluid chips with DNA memory droplet-unit data editing and handling of DNA storage, which previously could only be implemented through cold data. The conducted research was officially published in the November issue of "Advanced Science" (IF=15.1, Processing DNA Storage through Programmable Assembly in a Droplet-Based Fluidics System).



06

● Research Paper of Professor Kwon, Hyung-wook's Team Published in ACS Sensors

- Lee, Seung-ha, a master's course student in the research team of Professor Kwon, Hyung-wook (Division of Life Sciences, Convergence Research Center for Insect Vectors), published a research paper in ACS Sensors (IF=8.57) after carrying out convergence research from the research team of Professor Hong Seung-hoon from Seoul National University's Department of Physics and Astronomy.
- She carried out research on biosensors that detect sweetness by producing nanovesicles from western honey bees' gustatory receptor 1 (AmGr10), which detects sweetness among insects' taste receptors, and putting them on carbon nano-tube field effect transistor (CNT-FET) B-ET cells.
- The biosensors that include gustatory receptors can detect up to 100 fM of natural sugar glucose; they can also differentiate artificial sugar sucralose, allowing quantitative detection of natural and artificial sweeteners in food in real-time.
- Lee aims to continue with the research to allow industries, beekeeping farms, and others to use biosensors that apply insect receptors.

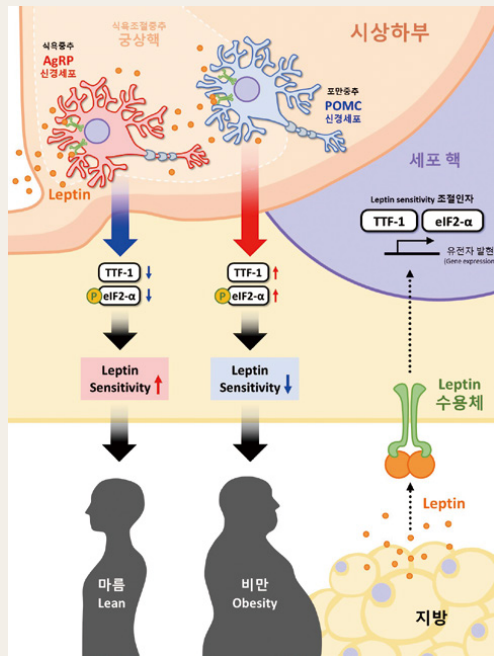


Excellent Performance Cases

07

● Professor Kim, Jae-geun's Research Paper Published in 2023 Diabetes

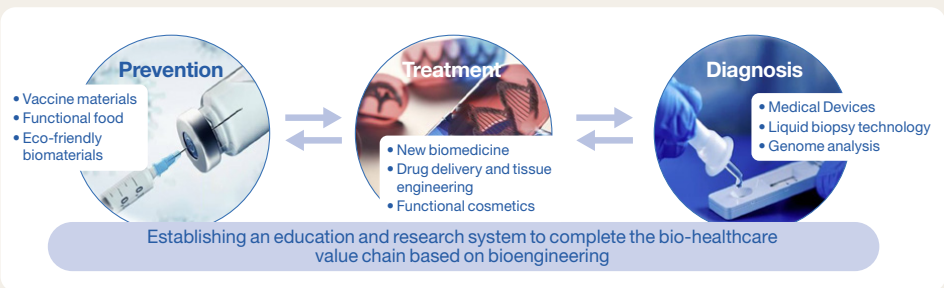
- This research paper investigates the complex mechanism of energy metabolism by applying a new concept. The research was conducted by focusing on how the hypothalamus' feeding center modulates the human body's energy homeostasis and leptin hormone signals, which play an integral role in the process. In particular, this research paper studied which crucial role leptin sensitivity within the hypothalamus' neuron network had in the modulation of vital energy homeostasis. It also became the world's first to discover that media molecules called eIF2-alpha and the thyroid transcription factor were indispensable in modulating leptin sensitivity. Furthermore, this paper newly proposed through eIF2-alpha's function that the autophagy that changes according to the cell's energy availability and endoplasmic reticulum's stress reaction work as essential signals to the energy metabolism modulation at the hypothalamus' neuron. We expect this research paper not only to provide valuable information to researchers attempting to understand the complex network of vital energy metabolism, but also to significantly aid in the development of obesity and appetite control agents.



08

● Establishment and Operation of Bio-Convergence Industry Collaboration Center (ICC)

- Within the national bio-healthcare industry, the collaboration between universities, companies, and local government is crucial for completing the value chain, including prevention, diagnosis, and treatment.
- As a part of Incheon National University's LINC3.0, the Bio-Convergence ICC was established in 2022 with the Major of Bioengineering in the lead to build a collaborative system between the university, industry, and academia.
- Bio-Convergence ICC supports joint industry-university technology development in bio-healthcare areas, including medicine, cosmetics, food, and medical devices. The Center also runs a wide range of R&DE activities, such as practical training programs to foster excellent personnel and supporting industry workers' education.



Map and Contact



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