KRIBB *focus*

15th ISSUE | 2024

From Discovery to Design
KRIBB's Six-Year Shift

Biology Reengineered
From Crisis to Computation

COVER STORY 1

Leading Through Crisis
KRIBB's Bold Turn in Bioscience

COVER STORY 2

KRIBB and the Evolution of Bioscience
A Co-Evolution of Researchers, Institutions, and Environments

FEATURE INTERVIEW

Six Years at the Helm
Director Kim Jang-sung Reflects on Six Years of Leadership

The Korea Research Institute of Bioscience and Biotechnology (KRIBB) is Korea's leading national research institute specializing in biotechnology.
KRIBB serves as a national hub for bioscience by conducting world-class fundamental research and providing public bio-infrastructure.

01

MISSION, FUNCTION & VISION

ADVANCING PUBLIC HEALTH AND THE BIOECONOMY THROUGH FUNDAMENTAL LIFE SCIENCE RESEARCH.

MISSION

To conduct bioscience R&D in collaboration with domestic and international partners, and to share research outcomes widely

FUNCTION

Develop and share core technologies in bioengineering and the bioeconomy
▶ Drive bio convergence, foster future growth, address key bio challenges

Support domestic and global bio R&D infrastructure
▶ Build infrastructure, advise policy, train talent, and aid bio SMEs

VISION

A Global Leader for Healthy Life and Bioeconomy

W — World-class R&D
Global impact, structured R&D support

A — Accelerating Open Innovation
Open bio R&D hub

V — Vitalizing Bio-industry
Driving innovation in the bioindustry

E — Enhancing Sustainability
Value-driven management

02

HISTORY OF KRIBB

1985. 2. Established as Genetic Engineering Research Center(Seoul)

1990. 7. Moved to Daejeon

1995. 3. Changed name to the Korea Research Institute of Bioscience and Biotechnology(KRIBB)

1999. 5. Became an independent legal entity under the Korea Research Council of Fundamental Science & Technology(KRCF)

2001.1. Renamed as Korea Research Institute of Bioscience and Biotechnology (KRIBB)

2005. 9. Established Ochang Branch Institute

2006. 11. Established Jeonbuk Branch Institute

SINCE 1985
Milestones in KRIBB's History

03

ORGANIZATION

대전본원
바이오융·복합

·바이오의약, 바이오융합, 바이오 아젠다 기초원천 기술 개발
·생명정보 인프라 거점
·국내·외 협력 구심체

- 노화융합연구단
- 중대질환진단융합연구단
- 국가생명연구자원정보센터
- 디지털바이오혁신센터
- 인공아체세포 기반 재생치료기술개발 사업단
- 유전자 세포치료 전략연구단

바이오의약연구소
- 유전체맞춤의료전문연구단
- 마이크로바이옴융합연구센터
- 희귀난치질환연구센터
- 바이오신약중개연구센터
- 면역치료제연구센터
- 질환표적구조연구센터
- 대사제어연구센터

합성생물학연구소
- 합성생물학연구센터
- 유전자교정연구센터
- 세포공장연구센터

국가아젠다연구부
- 감염병연구센터
- 환경질환연구센터
- 생물방어연구센터
- 줄기세포융합연구센터
- 바이오나노연구센터
- 식물시스템공학연구센터

바이오경제혁신사업부
- 기술사업화지원센터
- 중소벤처기업지원센터
- 바이오상용화지원센터
- 바이오평가센터
- 공동장비분석센터

연구전략본부
- 국가생명공학정책연구센터
- 바이오안전성정보센터
- 국가연구안전관리사업본부
- 첨단바이오 국가기술전략센터

오창분원
바이오의약

·천연물의약 R&D 및 산업화
·동·식물 자원 인프라 거점
·충북 바이오 클러스터 연계 발전

- 천연물연구센터
- 화학생물연구센터
- 핵산치료제연구센터

국가바이오인프라사업부
- 실험동물자원센터
- 국가영장류센터
- 미래형동물자원센터
- 생물자원중앙은행센터
- 해외생물소재센터
- 국가전임상시험지원센터

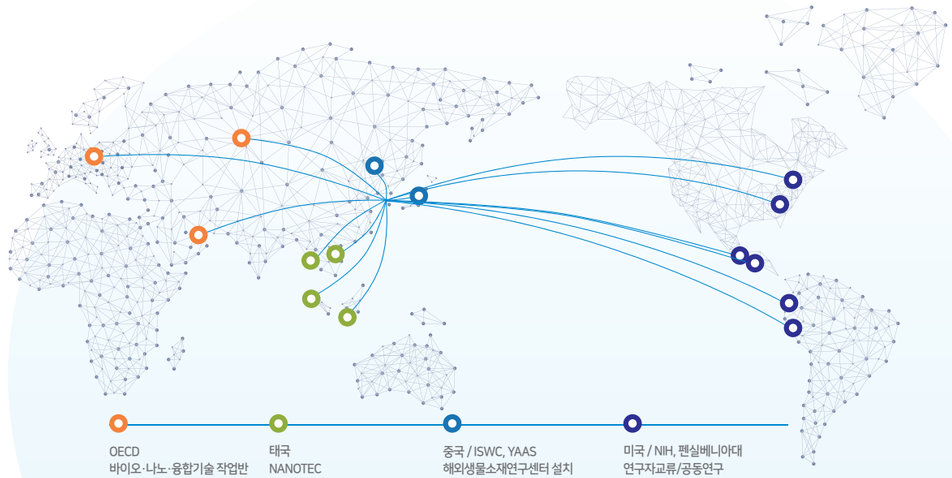
전북분원
친환경 바이오소재

·기능성 바이오소재 발굴 및 실용화 연구
·미생물·세포주 자원 인프라 거점
·전북 농생명융합 바이오 연구 연계 발전

- 기능성바이오소재연구센터
- 미생물기능연구센터
- 생물자원센터
- 영장류자원지원센터

04

INTERNATIONAL NETWORK



OECD
바이오·나노·융합기술 작업반 (BNCT)
카자흐스탄
NCB
이란
테헤란대학교

태국
NANOTEC
말레이시아
바이오 국제자문단(IAP) 역할
인도네시아 / BPPT
해외생물소재연구센터 설치
베트남 / IEBR
해외생물소재연구센터 설치

중국 / ISWC, YAAS
해외생물소재연구센터 설치
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미국 / NIH, 팬실베니아대
연구자교류/공동연구
미국
재미한인과학자기술자협회(KSEA)
코스타리카 / INBIO
해외생물소재연구센터 설치
니카라과 / UNAN-LEON
페루 / UNALM
에콰도르 / INABIO

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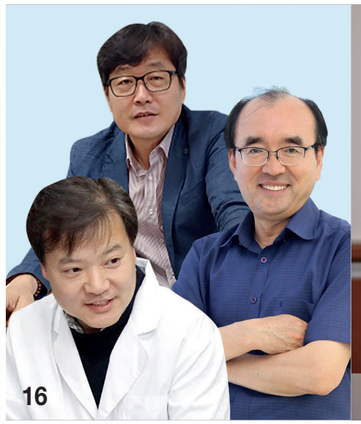

15th ISSUE

COVER STORY

KRIBB RESEARCH

KRIBB ECOSYSTEM

KRIBB *focus*

2024년, 15호

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Over the past decade, few industries have changed as rapidly—or as fundamentally—as biotechnology. While many might point to artificial intelligence as the most disruptive force, biology has undergone a transformation that has rewritten the rules entirely. This shift isn't just about COVID-19 vaccines or a growing market for eldercare. It reflects a deeper change in how biology itself is understood and practiced.

The stereotypical image of a life science lab—microscopes, petri dishes, and micropipettes—has given way to high-throughput data pipelines and genome-scale analytics. Wet bench work remains critical, but biology is increasingly fused with engineering—once a field defined by observation and iteration, now driven by precision, design, and computation.

At the heart of this transformation in Korea is the Korea Research Institute of Bioscience and Biotechnology (KRIBB). As the country's national research hub in life sciences, KRIBB has not only responded to these seismic shifts—it has helped shape them.

In a time when synthetic biology, genomic editing, and big data are converging, how did KRIBB evolve? And how did its researchers navigate a world where biology is no longer just discovery, but design?

From Discovery to Design
KRIBB's Six-Year Shift

Biology Reengineered
From Crisis to Computation

Leading Through Crisis
KRIBB's Bold Turn in Bioscience

From pandemic response to global ambition, the Korea Research Institute of Bioscience and Biotechnology (KRIBB) has undergone a bold transformation over the past six years. Under the leadership of President Jang-Seong Kim, KRIBB played a pivotal role in helping South Korea navigate the COVID-19 crisis—while simultaneously positioning itself to lead in biotechnology sovereignty and the emerging bioeconomy. What follows is a look at how the institute evolved during this critical period, and the milestones that marked its rise.

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Dr. Choong-Min Ryu (third from left) and the COVID-19 Response Task Force at KRIBB. The institute played a key role in testing the efficacy of vaccines and therapeutics.

Designing the Next KRIBB

Over the past six years, the Korea Research Institute of Bioscience and Biotechnology (KRIBB) has reshaped its institutional culture to engage more openly with society and extend its role beyond the lab. As the COVID-19 pandemic emerged, KRIBB stepped up not only as a national research institute responding to an infectious disease crisis, but also as a first mover cultivating a more innovative bio-industrial ecosystem.

KRIBB's core mandates include developing and disseminating cutting-edge biotechnologies, supporting public infrastructure for life science research, and leading the nation's bioeconomy. In recent years, its activities have expanded to encompass convergence research, strategic agenda-setting, public engagement, talent development, and science-based policy advising.

When President Jang-Seong Kim took office in 2018, the Korean government had declared biotechnology—alongside semiconductors and future mobility—a key national industry. This policy momentum was reinforced by President Moon Jae-in's announcement of a national strategy for biohealth innovation in 2019, followed by a series of cross-ministerial initiatives to support green bio, white bio, and bio-talent development.

KRIBB responded with an ambitious transformation. As the country's only dedicated national research institute in bioscience, it began elevating its global profile and consolidating its internal capabilities. Strategic reforms followed: a long-term development plan, redefinition of institutional roles (R&R), and major organizational and programmatic restructuring.

In 2019, KRIBB unveiled a bold mid-to-long-term strategy grounded in a clear vision: "A global leader in bioscience for healthier lives and a sustainable bioeconomy." This vision was supported by four guiding values—respect for life, innovation leadership, future orientation, and the pursuit of excellence.

The roadmap laid out four core operational goals: to secure world-class research capacity, to strengthen public engagement, to vitalize Korea's bioindustry ecosystem, and to build a smarter, more digital research environment. In parallel, KRIBB redefined its institutional responsibilities (R&R) around four national priorities: developing core bio-pharmaceutical technologies, fostering convergence platforms and materials for future industries, solving life-quality issues through bioscience, and expanding the infrastructure foundation for the bioeconomy.

To operationalize this shift, KRIBB launched the "KRIBB Bio+ 4.0" strategy—a forward-looking platform designed to integrate biotechnology with other key fields such as information technology and nanotechnology. The goal was not merely to respond to government policy but to lead the Fourth Industrial Revolution through biotech convergence, becoming a primary engine of growth for the bioeconomy era.

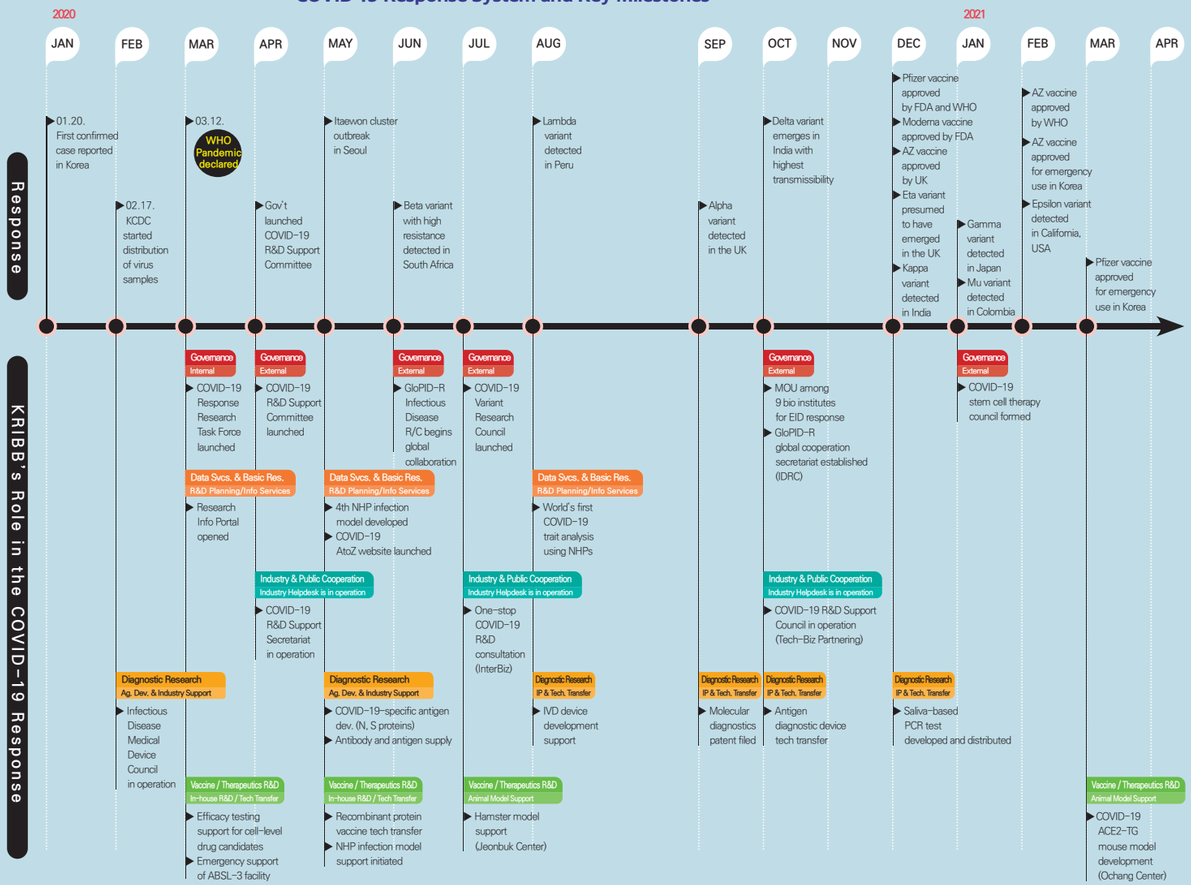
The transformation was not limited to vision statements. KRIBB restructured its internal organization, refined the functions of its research divisions, and aligned major projects with national strategic agendas. This proactive repositioning helped the institute strengthen both its domestic role as a national R&D hub and its international reputation as a center of innovation.

2018-2020: From Roadmap to Results

Following its strategic overhaul, KRIBB began to translate vision into action. Between 2018 and 2020, the institute achieved ten major milestones across research, industry collaboration, and public engagement. These included the rapid launch of a COVID-19 task force, the formation of mission-driven research groups, and recognition for workforce development excellence. KRIBB also became Korea's first government-funded research institute to adopt Robotic Process Automation (RPA) for administrative efficiency, enabling a shift toward deeper research immersion.

To reinforce its global standing in bioscience, KRIBB overhauled its R&D architecture during the first three years of its institutional transformation. It launched a three-tiered research system comprising Strategic Research Groups (for mission-oriented excellence), BIG Programs (for high-risk, long-horizon innovation), and Priority Investment Teams (targeting emerging technologies). This restructuring enabled the institute to focus resources on areas with the highest potential impact—both scientific and industrial.

COVID-19 Response System and Key Milestones



A prototype biofoundry lab under planning by KRIBB. The institute developed a small-scale model to validate core functions ahead of Korea's national biofoundry project.

Between 2018 and 2020, this framework delivered 10 major research breakthroughs—more than three times the output of the previous three-year cycle. Among these, seven were published in NSC-grade journals such as Nature Communications, Science, and Cell. Signature achievements included the identification of a novel microbial enzyme for nylon synthesis via gene circuit engineering, the development of maturation protocols for human organoids, and the world's first high-precision validation of gene-editing accuracy. The latter set a new benchmark in global CRISPR research.

Commercialization followed closely. Three technologies generated over KRW 1 billion in licensing fees, including a new tumor suppressor gene therapy candidate that was licensed to YD Life Science for KRW 2.75 billion. This surge reflected not just strong science, but an institutional shift toward strategic output and translational impact..

Complementing its technical innovations, KRIBB strengthened its R&D planning capabilities. Over the three-year period, it designed and secured 22 major national research projects—a 2.8-fold increase from the previous term. These included the pilot phase of Korea's National Bio Big Data initiative (KRW 8.2 billion), genomic analytics for marine organisms (KRW 5.6 billion), and infrastructure programs for genome analysis and bioresources.

To ensure long-term leadership, KRIBB launched the KRIBB STAR program—a comprehensive talent development system aimed at fostering globally competitive "star scientists." Within three years, 10 top-tier researchers were cultivated under this initiative, positioning the institute to lead large-scale, high-impact bioscience projects well into the next decade.

KRIBB also redefined how science can meet public needs. Through initiatives like the Bio Issue Conference and national idea contests, the institute invited citizens to help shape research agendas. This participatory approach led to 12 R&D projects addressing real-world problems—ranging from ultrafine dust exposure and regional livestock odor to

2018~2020	
Strategic Research Groups	(NSC) Novel nylon-synthesizing enzyme via gene circuit technology (Nature Comm., Nov 2018)
	(NSC) Membrane lipid remodeling and aging-related gene discovery (Nature Comm., Nov 2020)
	(5 papers, IF ≥10) Biomarker discovery for COVID-19 severity* and more * Signal Transduction and Targeted Therapy, '20.9, **IF 13.49**
BIG Programs	(NSC) Organoid maturation technology (Nature Comm., Aug 2018)
	(3 papers, IF ≥10) Stem cell–based liver organoid development* and more * Journal of Hepatology, '19.11, **IF 20.58** Selected as Top 5 Bio-Medical Achievement by BRIC (Dec 2019)
Priority Investment Teams	(NSC) First validation of CRISPR accuracy (Nature Comm., Aug 2020)
	(NSC) Mechanism of phenol-degrading protein (Nature Comm., Jun 2020)
	(NSC) Function of novel DNA repair enzyme (Nat. Chem. Biol., May 2019)
	(NSC) Detection of CRISPR target specificity (Nature Comm., Jul 2020)
	(IF ≥10) Novel genes linked to gastric cancer and gastritis (Gastroenterology, Mar 2019)
	(6 papers, IF ≥10) Development of ssRNA-based nano-adjuvants and more

pandemic resilience. In one standout case, KRIBB supported the development of a plant-based plankton strain that could degrade PET bottles, achieving proof-of-concept within a year of initial funding.

In parallel with its scientific and technological pursuits, KRIBB expanded its role as a facilitator of bio-policy reform and public dialogue. In 2018, it launched the Bio Regulation Reporting Portal—an open channel for identifying bottlenecks in biotechnology regulation. Over three years, the portal collected 153 policy issues submitted by stakeholders across academia, industry, and civil society. These inputs led to 11 amendments in national regulations, while 29 out of 63 formal petitions resulted in direct improvements. KRIBB's proactive stance helped shift the regulatory conversation from reactive to anticipatory—making the institute a respected mediator between innovation and oversight.

This regulatory engagement was matched by a deepened public interface. Through initiatives such as the Bio Innovation Growth Fair, the BIO Talk Talk campaign, and the KRIBB Online Supporters community, the institute created immersive, two-way science communication channels. These programs brought research out of the lab and into public view—making bioscience a part of everyday conversation, and giving citizens a role in shaping its direction.

Commercialization also accelerated. KRIBB's tech transfer revenue rose by 66%, and it launched seven ventures—including Aventi, which went from concept to company in eight months. KRIBB's family companies, such as PharmAbcine and Sugentech, reached IPO milestones, while the institute's startup incubator supported 25 firms with 370 jobs and over KRW 75 billion in combined revenue. The Bio Startup Booster and tailored accelerator support fueled this momentum, along with training for more than 200 biotech professionals.

Internally, KRIBB built systems to sustain progress. It established a digital helpdesk and integrated research support systems, lifting research immersion scores significantly. In 2020, KRIBB became the first government-funded research institute in Korea to deploy an RPA system for administrative workflows—saving valuable researcher time for scientific work.

Organizational reform focused on five cultural pillars: autonomy, recognition, collaboration, leadership, and institutional identity. Staff satisfaction rose in parallel with scientific output, signaling that KRIBB was evolving not just in mission, but in mindset.

2021-2023: Leading the Next Wave of K-Bio

When Jang-Seong Kim began his second term as president in 2021, KRIBB's transformation entered its defining stage. The institute moved beyond structural reorganization and strategic intent—toward systemic integration and long-horizon impact. Under the vision of "Leading the New Wave of K-Bio," KRIBB reframed its core pillars: from innovation and infrastructure to sustainable management and industrial growth. It introduced the R&CD model—combining research with connection and community—to unify actors across academia, hospitals, startups, and government. Unlike the first phase, which set the blueprint, the second phase laid the foundation stone. This time, the change took root.

To solidify its scientific backbone, KRIBB established the Synthetic Biology Research Center and built Korea's first beta-scale biofoundry. These infrastructures allowed programmable biology and automated biomanufacturing to move from concept to capacity. Between 2021 and 2023, KRIBB produced 10 NSC-grade publications—including the landmark development of CRISPR-Cas12f—and secured seven large-scale technology transfer deals. At the same time, the institute's interdisciplinary research programs delivered drug development pipelines across synthetic molecules, biologics, cell and gene therapies, and vaccines. From Regenus to Asclaps and Ellio, KRIBB-led ventures turned platform technologies

A researcher checks systems in the server room of KOBIC. KRIBB has prioritized strengthening its digital capabilities to meet the evolving needs of life science.

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A researcher at the National Primate Research Center prepares for work in the ABSL-3 facility. The center has become a core part of Korea's biotech infrastructure.

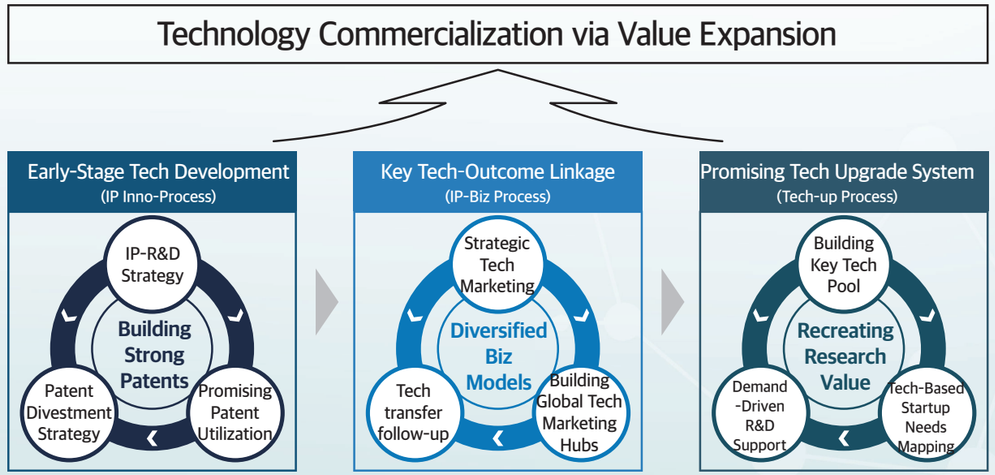
into therapeutic companies—anchoring the institute's shift from research to realization.

Having redefined its internal systems, KRIBB strengthened its external posture. It forged international agreements with leading institutions such as LBNL and the London Biofoundry, while boosting domestic collaboration through multi-institutional projects. Research infrastructure also evolved: Core Facilities improved operational efficiency, while a one-stop preclinical platform enhanced national response capacity. More importantly, KRIBB emerged as a central policy actor—co-authoring Korea's 4th Basic Plan for Biotechnology Promotion, the Digital Bio Innovation Strategy, and the Synthetic Biology Roadmap. The institute was no longer just implementing science policy; it was writing it.

KRIBB's industrial translation efforts matured into a resilient pipeline. Licensing revenue reached KRW 9.49 billion, and contract value jumped eightfold to KRW 233.5 billion. Thirteen new startups were launched, drawing KRW 210 billion in investment and generating global licensing deals worth USD 350 million. Success stories like Plasmapp's IPO demonstrated that KRIBB could now scale beyond lab-scale innovation. Meanwhile, regional collaboration flourished: in Ochang, a natural products infrastructure plan gained national approval; in Jeonbuk, water quality research addressed local environmental needs. National in scope, KRIBB remained rooted in place.

Sustainability and people-centered design defined the second phase. KRIBB recruited 19 top-tier researchers, implemented its Education System 2.0, and enhanced internal databases and knowledge-sharing platforms. Robotic Process Automation (RPA), first introduced in 2020, was upgraded to further reduce administrative load. Organizational culture also evolved through five strategic levers: autonomy, recognition, collaboration, leadership, and institutional identity. Where the first phase reimagined what KRIBB could be, the second phase quietly ensured it would endure.

Looking back, KRIBB's transformation over the past six years was not a single leap but a layered ascent—starting with structural reform, deepening through strategic science, and culminating in institutional maturity. It responded to crisis not as an exception but as an inflection point. Today, KRIBB stands not only as a national R&D leader, but as a blueprint for how a scientific institution can evolve—integrating vision, infrastructure, and social mission into a coherent whole. The next wave of K-Bio will arrive with new technologies and new challenges. But KRIBB, having already transformed itself, is now poised to shape that wave, not just ride it.



2021~2023	
Synthetic Biology	(IF ≥10) World's first synthetic biology technology enabling bio-manufacturing without antibiotics(Nucleic Acids Res., Dec 2022, IF 19.16, JCR 3.3%)
	(IF ≥10) Development of microalgae-based technology for wastewater treatment and pathogen control (Microbiome, Aug 2022, IF 15.5, JCR 4.8%)
Gene and Cell Therapy	(NSC) World's first production technology for human-induced natural killer cells: Clinical approval and commercialization of hard-to-treat cancer therapy (KRIBB-Seoul Asan Hospital-Ingenium) (Nat. Biomed. Eng., Nov 2021, IF 29.3, JCR 0.5%)
	(NSC) Development of novel immune response modulation technology to enhance cancer treatment efficacy (Nature Immunol., Mar 2023, IF 31.25, JCR 1.6%)
	(NSC) Ultra-small CRISPR tech for gene therapy: Impact on rare genetic diseases (Nat. Biotechnol., Jan 2022, IF 68.164, JCR 1.0%)
	(NSC) First evidence of lizard tissue regeneration in mammals: Advancements in stem cell tech, bio-artificial organs, and tissue evaluation (Sci. Adv., Oct 2022, IF 15.4, JCR 8.9%)
Digital Health	(IF ≥10) Development of blood-based early Alzheimer's diagnosis technology
Infectious Disease	(IF ≥10) Phone-based COVID-19 mutation detection (ACS Nano, Jun 2022, IF 18.027, JCR 5.7%)
	(IF ≥10, JCR Top 1%) Universal antiviral treatment for RNA viruses including COVID-19 (Signal Transduct. Target. Ther., Oct 2022, IF 39.3, JCR 0.9%)

Interview

KRIBB and the Evolution of Bioscience
A Co-Evolution of Researchers, Institutions, and Environments

Shifts in the life science ecosystem have brought new demands to institutions like KRIBB—and to the people driving innovation from within. As the field evolved, so did the roles of those working at its frontiers. What changes have KRIBB's researchers witnessed, and how have they adapted on the ground? We spoke with division leaders to hear their perspectives firsthand.

Ki-Chul Kim

Director, Center for Biosafety Information

How has public perception of life science changed?

The Center for Biosafety Information has been working on GMO and LMO-related policy and information for over two decades. For much of that time, public perception of our work has been largely negative—perhaps because of the term "genetic modification" itself. Technologies associated with GMOs, especially in the agri-food sector, have often evoked reactions similar to those toward chemical additives or processed foods—something artificial and engineered. Given the Center's role in public communication, we've conducted regular perception surveys over the years. Encouragingly, recent results show a gradual decline in negative sentiment toward GMOs. In particular, there's growing public acceptance of GMO applications in the red (medical) and white (industrial) biotech sectors. We're also seeing increasing interest in newer fields like synthetic biology and genome editing—an encouraging shift.

What changes have you seen in the environment—both external and internal—over the past six years?

The most striking change has been the surge in attention to GMOs alongside advances in emerging biotechnologies like synthetic biology and CRISPR. Globally, governments are actively debating how to update safety regulations and policy frameworks to reflect these new technologies. At the Center, we've expanded our role accordingly—not only addressing public awareness of GMOs, but also supporting legislative and policy development for next-generation biotech. As life science has taken on greater national importance, so too has our responsibility.

What do you consider the Center's most significant achievement during this time?

With our expanded mandate, things have gotten significantly busier. The Center serves as the secretariat for the working committee of the National Biosafety Committee, a multi-agency body involving seven ministries, including the Ministry of Science and ICT and the Ministry of Trade, Industry and Energy. We also operate the country's only GMO information portal, and through that platform, we help communicate national biosafety policy, promote public engagement, and support transparent governance of GMO and biotechnology oversight. In that sense, we've become a central point of coordination for Korea's approach to biosafety.

Interview

Kyoo-Seon Lee

Director, Division of Research Strategy

How has public perception of life science changed?

Life science and biotechnology have long been seen as high-risk, high-cost fields—requiring years of effort, significant investment, and often facing high failure rates. While breakthroughs can have huge impact, success has traditionally been difficult to guarantee. But recently, the integration of digital technology has made life science more accessible and dynamic. This shift is also evident in national policy. Korea's earlier Basic Plans for Biotechnology, including the third, focused primarily on strengthening basic science to catch up with advanced countries. In contrast, the fourth Basic Plan, announced in 2023, positions biotechnology as a core strategic technology in the era of digital transformation. We're now seeing practical strategies emerge to elevate Korea's biotech sector to the same global standing as semiconductors or display technology.

How have you experienced KRIBB's transformation on a personal level?

In the past, it was often difficult to communicate the value of KRIBB's research and infrastructure. We had to justify why what we did mattered. But the COVID-19 pandemic created a strong societal consensus around the importance of foundational research in biotechnology. While industry played a key role, I believe public research institutes like KRIBB were also widely recognized for their contributions. In fact, KRIBB's infrastructure—its corporate support systems, non-human primate testing, and preclinical platforms—were instrumental in the development of Korea's diagnostic kits, therapeutics, and vaccines. These outcomes significantly elevated our position as a government-funded institute. As biotech becomes a national priority, the expectations placed on us will only grow.

Looking back on the past six years, what stands out most for you?

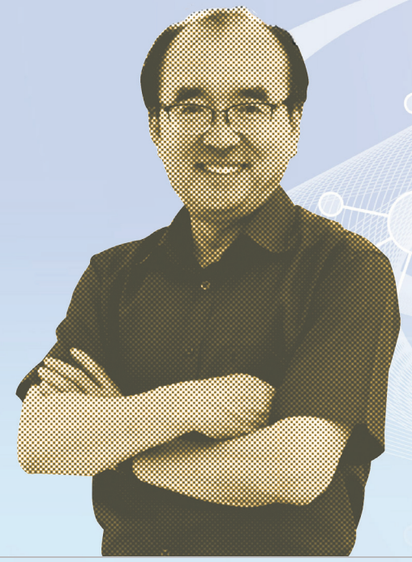
From a leadership perspective, our coordinated response to COVID-19 was most memorable. We mobilized the full capacity of our research divisions to support the development of diagnostic tools for more than 200 companies. On a personal level, I'm especially proud of our research on cancer complications, which led to new therapeutic strategies that could impact patient survival. One important outcome of the pandemic was the establishment of "mission-driven research" as a core approach. I hope we can sustain this momentum with more stable funding and workforce support. If Korea is to build true national competitiveness in biotech, institutions like KRIBB must be empowered to do what the private sector cannot.

Oh-Seok Kwon

Director, Center for SME and Venture Support

How have you personally experienced changes in life science and KRIBB?

The COVID-19 pandemic brought significant transformation to both the field of life science and KRIBB itself. During that time, KRIBB willingly stepped up as a central player in Korea's response efforts—alongside government-funded institutions and related companies. This reaffirmed KRIBB's value and elevated its national standing. I believe it was also a moment for the public to recognize the critical role of biotechnology and, more specifically, the contributions of KRIBB within that field.



What stands out most over the past six years, for both KRIBB and yourself?

One of our major achievements was preparing for and advancing new biotechnologies in response to shifts in science and industry. We laid the groundwork to take on a leading role in national priority areas like synthetic biology and advanced biomanufacturing. At our Center specifically, we've served as a hub for supporting biotech startups—helping launch a wide range of companies. What I'm most proud of is that we built a stable foundation for early-stage ventures, offering everything from preclinical support to investor matching. In a sector where sustainable early growth is rare, that's no small feat.

What are your thoughts on these changes, and what advice would you give to the next generation of researchers?

KRIBB has adapted to the changing landscape of the bioindustry through continuous transformation. Despite limited resources and tough conditions both inside and outside the organization, we succeeded by anticipating promising fields and applying a focused, strategic approach. Still, for those chosen areas to deliver real industrial impact, we must provide long-term support—so they can evolve into signature strengths of KRIBB. As individual researchers, we should constantly ask how our work can be applied industrially, and what value it can deliver. If KRIBB is to remain a public research institute in the truest sense, we must never stop questioning how our science can shape the world for the better.

Six Years at the Helm

Director Kim Jang-sung Reflects on Six Years of Leadership

Kim Jang-sung holds a unique distinction as KRIBB's first president hailing from an external institution, and the first to achieve reappointment within the landscape of government-funded research institutes. These accolades often precede any mention of the former KRIBB President. His six-year tenure oversaw a period of significant transformation for the institute, culminating in a rewarding conclusion despite its challenges. Now, President Kim transitions from a career rooted in research towards a new role as a coordinator, potentially in a leadership or advisory capacity. As he steps away from his weighty responsibilities and looks towards fresh endeavors, we explore the profound meaning of his six years at the helm.

A Retrospective and a Vision for KRIBB

"There are inevitably lingering feelings. As any endeavor concludes, circumstances evolve, and initial aspirations may seem to fade. Yet, my six years at KRIBB have been profoundly rewarding, witnessing our members grow in confidence as pivotal figures in the K-Bio sector, achieving remarkable individual successes that collectively elevate our institute."

The 2010s marked a significant turning point for South Korea's government-funded research institutes (GRIs). Established in the 1960s, GRIs were foundational to the nation's rapid economic growth, serving as vital incubators for strategic national technologies. For a nation striving to catch up and achieve economic parity, the GRI system, centralizing and fully supporting scientific talent, was undeniably the bedrock of this progress.

However, South Korea's comprehensive development across economic, academic, and societal spheres, coupled with the private sector's burgeoning research capabilities, necessitated a re-evaluation of the GRI model. The increasing complexity of technology rendered the reliance on a few exceptional individuals for breakthroughs obsolete. The ability of GRIs to effectively collaborate with and support the broader research and industrial ecosystems became paramount. Recognizing this shift, President Kim prioritized building a collaborative 'team' framework at KRIBB.

"Our early research landscape was intentionally diverse, a strategy that effectively narrowed the gap with global leaders. As KRIBB matured into a leading institution, a holistic strategy integrating the entire research and industrial ecosystem became crucial. Today's challenges—climate change, synthetic biology, gene therapies—demand a collaborative approach, exceeding the capacity of individual researchers or institutions. Addressing these requires robust synergy between researchers and institutions, fostering a team-oriented mindset among individual scientists."

This transition demanded a fundamental shift in KRIBB's organizational culture and research ethos. While individual researchers drive innovation, the underlying system shapes their actions. By cultivating an environment conducive to teamwork and embedding it within our structure, we fostered organic cultural change. This established collaborative spirit becomes a lasting legacy, ensuring sustainable progress beyond individual tenures. Our collective endeavor focused on transforming

the 'system' itself.

"Individual autonomy remains vital, the bedrock of creativity, and the intellectual pursuits of every researcher deserve respect. However, within a national research institution with clear objectives, a robust framework for strategic planning and execution is equally essential. I believe that collaboratively pursuing shared goals provides the optimal platform for researchers' creativity to flourish."

President Kim's corporate research background proved invaluable. Unlike his predecessors, his experience instilled a deep understanding of the goal-oriented principles that drive corporate innovation and collaboration. By thoughtfully integrating these principles into KRIBB's operational framework, the institute began to adapt to its evolving role within the national innovation ecosystem.

Navigating Crisis, Forging Collaboration: Lessons from the Pandemic

The evolution of organizational culture is typically gradual, particularly for established institutions like KRIBB. However, the collective commitment to a 'new KRIBB' found an unexpected catalyst in the COVID-19 pandemic.

"Initially, the emergence of COVID-19 seemed like a familiar challenge. However, its rapid escalation underscored the urgent need for a unified national response, far exceeding the capabilities of isolated efforts. A collective understanding emerged: preparedness for a national emergency was paramount. The dedication of every KRIBB member enabled an unexpectedly swift mobilization of our pandemic response."

KRIBB's core mission swiftly pivoted to address the crisis. A primary focus was combating misinformation by providing timely, credible information. The institute also became a crucial hub for collaboration across academia, industry, and government, leveraging its expertise to support private biotech firms in developing and validating new therapeutics.

"While a necessary undertaking, I remain deeply appreciative of the extraordinary dedication of our researchers. Their tireless efforts, from round-the-clock media review for accuracy to the demanding animal testing schedules for numerous companies, were truly commendable."

This challenging period proved transformative for KRIBB. The institute's heightened national significance led to a positive shift in external perceptions, most keenly felt by our researchers. The tangible sense of contributing to a critical national endeavor fostered immense pride and confidence, reinforcing the fundamental mission of a government-funded research institute.

"The COVID-19 experience provided invaluable lessons for KRIBB and the broader GRI network. The traditional model of individual institutions pursuing independent projects shifted towards a powerful demonstration of our collective capacity to address large-scale national challenges through unified action."

The pandemic also prompted a critical reassessment of industry partnerships. The traditional linear model of technology transfer often overlooked the differing needs of researchers and the market. Startups, the majority of the domestic bio-ecosystem, require more mature technologies and rapid returns on investment.

"Recognizing these challenges, we evolved our support for companies beyond mere technology transfer to encompass comprehensive, long-term assistance, from initial concept to securing investment. KRIBB's existing infrastructure and expertise proved readily adaptable to support a wide range of corporate activities."

Looking Ahead: Economic Autonomy and Collaborative Growth

Despite significant progress, President Kim emphasizes the ongoing need for evolution. Greater 'economic autonomy' is crucial for KRIBB to effectively support the bio-ecosystem. This requires a more flexible regulatory environment that facilitates active engagement with industry and the seamless translation of research into economic value.

"Personally, I advocate for increased opportunities for KRIBB researchers to immerse themselves in corporate environments. Experiencing the realities of industrial-scale operations firsthand provides invaluable context for understanding the challenges of commercializing research and the importance of translational research. KRIBB's Bio-Economy Innovation Business Division actively fosters such collaborations and provides relevant training programs, witnessing increasing engagement from our researchers."

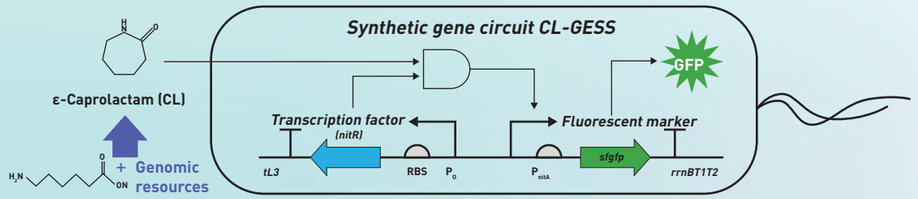
President Kim's six-year leadership at KRIBB marks a period of profound transformation for both the institution and himself. He reflects on his evolving role as a life scientist, shifting from direct research to empowering the next generation. His focus now is on illuminating the path for others.

"My focus has broadened from the specificities of KRIBB and life science to encompass global trends and the evolving research landscape. The complexity of modern science demands collaborative approaches across disciplines and institutions. It is my sincere hope that my experience will serve as a bridge, enabling junior researchers to fully realize their potential at the dynamic intersection of research and the wider world."

KRIBB's Six Years of Transformation
Illuminating Achievements in Core Research

The period from 2018 to 2023 was transformative for biotechnology, marked by a global pandemic that underscored its importance and spurred governmental focus on the bio-industry. The Korea Research Institute of Bioscience and Biotechnology (KRIBB) played a pivotal role, driving innovation and strengthening its global standing. Under President Kim Jang-sung's leadership, KRIBB strategically reorganized and modernized its research infrastructure, positioning itself as a leader in emerging bio-sectors and achieving significant research breakthroughs. This article highlights KRIBB's key accomplishments during this dynamic period.

An artificial gene circuit designed for genetic resource discovery



Rewriting the Rules of Synthetic Biology

Precision Discovery of Rare Genetic Resources

The Specialized Research Units are core to KRIBB's mission of achieving global excellence in biotechnology. In January 2019, Dr. Seung-Goo Lee's team at the Synthetic Biology and Metabolic Engineering Research Center published research that gained international attention.

They identified a novel enzyme gene within the metagenome of microorganisms from Korea's West Sea tidal flats. This gene enabled microbial synthesis of ε-caprolactam, a key nylon monomer traditionally produced from benzene, a petrochemical linked to volatile costs and environmental concerns. The discovery opened the door to more sustainable production alternatives.

To find the enzyme, the team used artificial gene circuit technology—a DNA engineering method that programs cells to emit signals under specific biochemical conditions. They created a gene circuit (CL-GESS) that fluoresces when enzymatic activity for nylon precursor synthesis is detected. Introducing this system into microbial cells enabled the eco-friendly, efficient production of ε-caprolactam.

The breakthrough also redefined enzyme discovery methods. Traditional approaches required slow, repetitive steps involving cell cultures and chemical analysis. The KRIBB team introduced a high-throughput screening system capable of sorting thousands of enzyme-active cells per second, enabling ultra-sensitive detection at the single-cell level. This leap in sensitivity and speed expanded access to microbial genetic resources, which make up over 60% of Earth's biomass.

Dr. Lee emphasized the growing global race to decode vast genetic resources and develop genome design capabilities. The team's work is not only a major advance in enzyme discovery but also holds potential for broader eco-friendly innovations, such as plastic-degrading genes and C1 compound conversion—offering both climate and economic benefits..

Leading the Charge Against Pandemic Threats

Rapid and Accurate COVID-19 Diagnostics

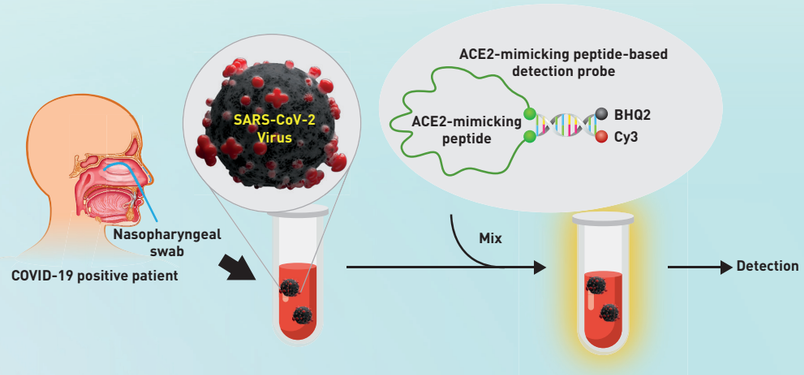
KRIBB played a vital role in pandemic response, notably through a new diagnostic technology for emerging and variant viruses. Announced in May 2022, the technology was developed by Dr. Eun-Kyung Lim and Dr. Myung-Hee Kim's joint team. It uses angiotensin-converting enzyme 2 (ACE2), a protein hijacked by pathogens to enter human cells.

Rapid and accurate diagnosis is essential for managing contagious diseases like COVID-19. While PCR tests offer accuracy, they are time-intensive and equipment-heavy. Faster antigen tests lack reliability. The KRIBB team bridged this gap by using a biomimetic approach: they engineered an ACE2-mimicking peptide that emits a fluorescent signal when binding to viral spike proteins.

Using a standard fluorescence reader, this biosensor enables infection confirmation within 50 minutes and achieves PCR-level accuracy in 3 hours. Tested against COVID-19, the system delivered high performance in both speed and sensitivity.

More importantly, the technology offers a flexible platform for broader infectious disease diagnostics. By designing peptides based on receptor-binding mechanisms of different pathogens, the approach holds promise for

Schematic of COVID-19 detection system



rapid response to zoonotic outbreaks—an increasingly urgent challenge due to global warming and habitat loss.

A New Era for Gene Therapy

Proving the Safety of Next-Generation Gene Editing

KRIBB's Focused Investment Groups play a key role in advancing breakthrough technologies that enhance national competitiveness. A notable milestone came in 2020, when the Genome Editing Research Center verified the precision and efficiency of prime editing—a next-generation gene editing tool first introduced by the Broad Institute in 2019.

Prime editing builds on third-generation CRISPR technologies, enabling highly targeted genetic corrections. Unlike the widely used CRISPR-Cas9, which cleaves both DNA strands and relies on error-prone repair, prime editing uses a modified Cas9 nickase to cut only one strand and insert precise edits. This innovation reduces off-target effects and improves reliability.

To verify its safety, KRIBB developed a novel sequencing method (nDigenome-seq) that locates single-strand breaks with high precision. The team confirmed that prime editing caused no unintended edits. In animal cell experiments, it outperformed conventional CRISPR-Cas9 in both accuracy and efficiency. They also engineered improved variants with even higher precision.

By validating the performance of prime editing, KRIBB helped position it as a leading fourth-generation technology in gene editing. Capable of targeting up to 90% of known genetic mutations, prime editing shows strong potential for treating rare and intractable diseases. As the applications of gene editing continue to expand, KRIBB's contribution marks a pivotal step toward safer, more precise gene therapies.

Environmental Stewardship for Future

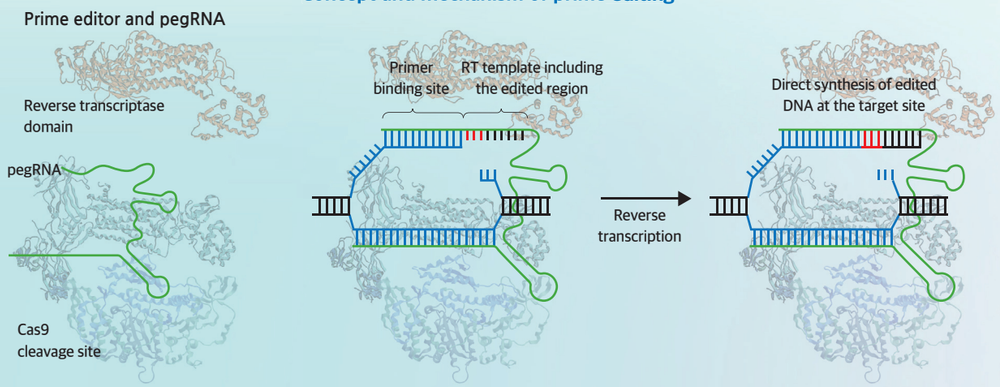
Eco-Friendly Wastewater Treatment Using Microalgae

In the push for sustainable biotech solutions, white biotechnology—using biological resources like microbes and enzymes to replace chemical processes—is gaining traction. A prime example is the September 2022 research led by Dr. An Chi-yong at KRIBB's Cell Factory Research Center.

The team developed a microalgae-based technology to purify pig farm wastewater while reducing pathogenic bacteria. Livestock waste, especially from pigs, contains high ammonia levels and harmful bacteria. Current treatment methods often require expensive and time-consuming pre-processing, such as ozone or anaerobic digestion.

The team focused on Coelastrella, a microalgae species specialized in removing ammonia. By engineering it under nitrogen-deprived conditions, they enhanced its nutrient uptake. In the lab, this strain removed 99% of ammonia and 92% of chemical oxygen demand (COD). Pilot-scale tests retained about 80% of that efficiency.

Concept and mechanism of prime editing



Notably, within just 96 hours, the system reduced risk group-2 pathogens to below 10% and Oligella bacteria to below 3%. Even without dilution or pre-treatment, the engineered microalgae effectively processed raw pig wastewater—demonstrating real-world scalability.

KRIBB's research not only enhances wastewater treatment technology but also offers a viable path to replacing costly chemical processes with eco-friendly biological solutions.

A Step Closer to Conquering Cancer

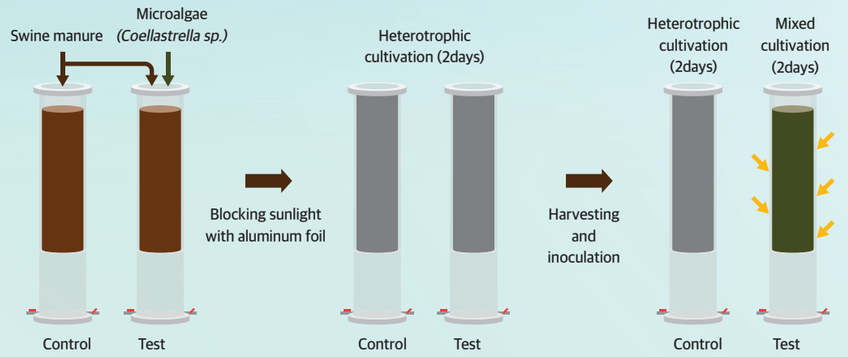
Engineering drNK Cells to Reprogram Somatic Cell

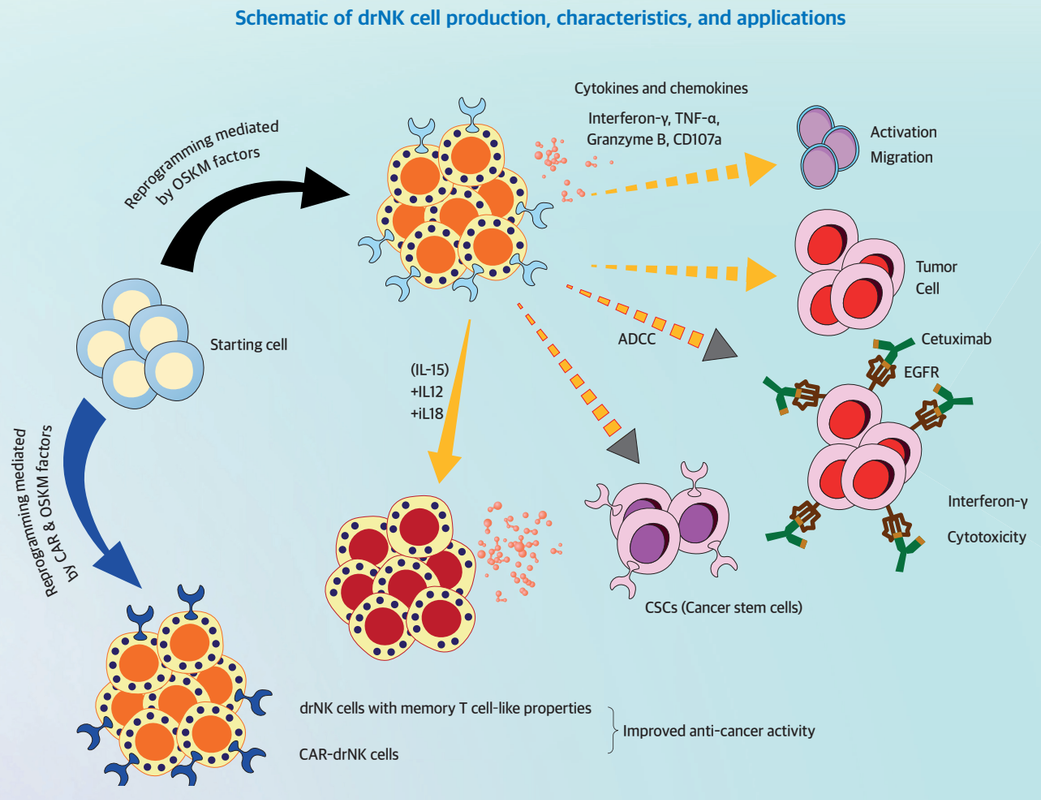
In August 2021, Dr. Joy Sook Juhn's team at KRIBB's Immunotherapeutics Research Center achieved a world-first: the development of a method to produce directed reprogramming Natural Killer (drNK) cells through somatic cell fate conversion. This breakthrough opened new possibilities for cancer immunotherapy.

Somatic cell reprogramming converts fully differentiated cells into other cell types. The KRIBB team used this approach to create drNK cells—immune cells with high cytotoxicity and cytokine-secreting capabilities—capable of targeting a broad range of solid tumors, including those of the brain, liver, breast, and lung. Importantly, drNK cells can selectively eliminate cancer stem cells (CSCs), which are often resistant to treatment and drive relapse.

While NK cell-based therapies are gaining attention as alternatives to chemotherapy, current manufacturing methods face scale and cost limitations. The KRIBB team addressed this by developing a method to produce drNK

Schematic of pig farm wastewater treatment process and monitoring of physicochemical changes





cells without additional purification or differentiation steps. Using transcription factors, small molecules, and signaling regulators, they streamlined the reprogramming process.

They also incorporated cancer-targeting CAR genes during cell conversion, producing highly functional CAR-NK cells without complex downstream processing. This method significantly improves the feasibility of scalable NK cell therapies.

KRIBB's research marks a key advance in gene and cell therapy. By enabling large-scale, functional drNK and CAR-NK cell production from common somatic cells, it lays the groundwork for next-generation immunotherapies targeting not only cancer, but also a range of intractable diseases.

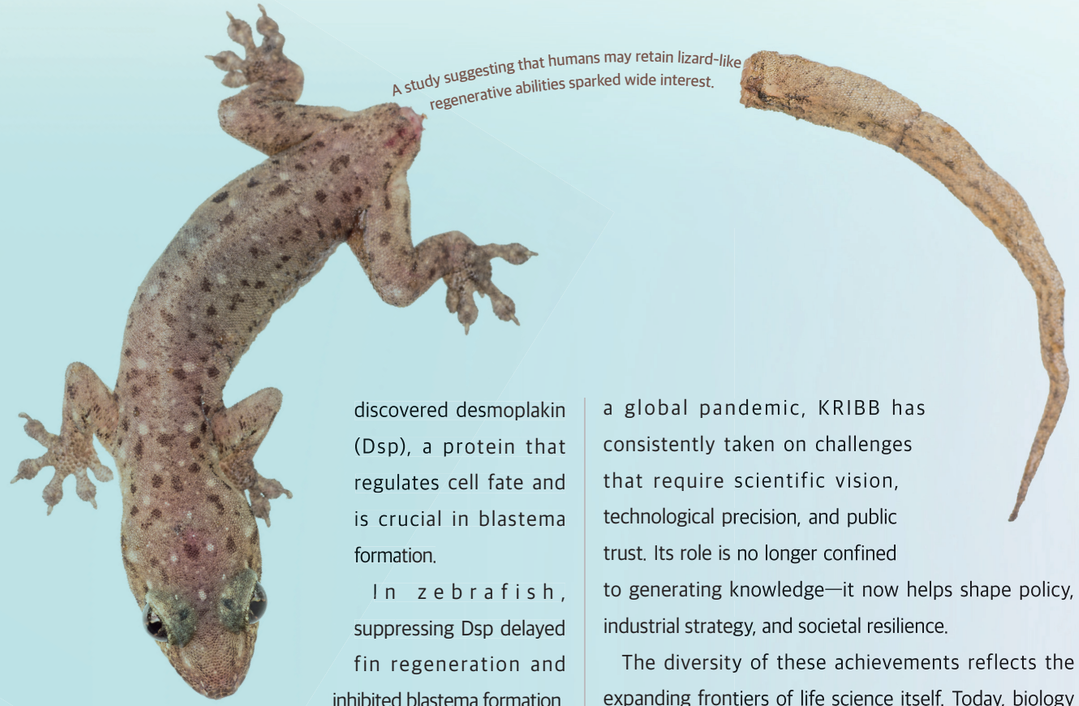
The Promise of Regenerative Medicine

Unlocking the Secrets of Lizard Regeneration

Some of the most profound scientific discoveries begin with a question. Dr. Jang-Hwan Kim and Dr. Jeong-Su Lee's team at KRIBB asked whether mammals, like lizards, might still retain latent regenerative capacity. Their research offers a compelling new angle in regenerative medicine.

Lizards can regrow severed tails using blastema cells, but mammals lack these regenerative cell types. To date, regenerative medicine has largely focused on transplanting therapeutic cells or generating induced pluripotent stem cells (iPS), which carry risks of uncontrolled growth.

An alternative is direct reprogramming—converting somatic cells into other types without going through the iPS stage. By comparing regeneration in lower vertebrates and reprogramming in mammals, the KRIBB team



A study suggesting that humans may retain lizard-like regenerative abilities sparked wide interest.

discovered desmoplakin (Dsp), a protein that regulates cell fate and is crucial in blastema formation.

In zebrafish, suppressing Dsp delayed fin regeneration and inhibited blastema formation. The team also identified "intermediate-stage cells" that arise during reprogramming in mammals and share regulatory traits with blastema cells—suggesting an evolutionarily conserved regenerative pathway.

This discovery sheds light on the long-assumed loss of regenerative capacity in mammals. It also opens a path toward new therapies for diseases like spinal cord injury, diabetes, and Alzheimer's—not just managing symptoms but potentially restoring tissue function.

The intermediate-stage cells identified by KRIBB may offer a new, safer resource for regenerative medicine, potentially replacing iPS cells. The team continues to explore this pathway to unlock foundational technologies for future therapeutic applications.

Taken together, these six breakthroughs illustrate KRIBB's transformation from a research institution into a strategic engine of national innovation. Whether decoding marine microbial genes, reprogramming immune cells, or building diagnostic platforms during a global pandemic, KRIBB has consistently taken on challenges that require scientific vision, technological precision, and public trust. Its role is no longer confined to generating knowledge—it now helps shape policy, industrial strategy, and societal resilience.

The diversity of these achievements reflects the expanding frontiers of life science itself. Today, biology intersects with digital engineering, environmental stewardship, and regenerative medicine. At these intersections, KRIBB's researchers are not simply observing change; they are architecting it. Each project exemplifies how cross-disciplinary collaboration and mission-driven research can yield tangible results with wide-reaching impact—from the lab bench to the clinic to the global stage. As biotechnology becomes central to the world's future, KRIBB stands poised to lead. Its commitment to long-term investment, open innovation, and responsible science ensures that Korea not only keeps pace with global developments but helps define them. In this era of uncertainty and transformation, KRIBB offers a model of how public research can deliver public good—through precision, purpose, and a persistent belief in what science can make possible.

Bridging Korean Biotechnology and the World
KRIBB's Global Cooperation Network

As with all modern scientific fields, life science today is a form of "big science"—a global endeavor that no individual or nation can advance alone. This is precisely why the world's leading research institutions prioritize international collaboration. As Korea's flagship public institute in biotechnology, KRIBB has long served as a bridge between the Korean life science community and the broader global bio ecosystem. This article explores the global partnerships that have helped shape what we now call K-Bio.

Navigating the Complexity of Bio Startups
KRIBB Is Here to Help

From National Institute to Global Innovation Hub for the Bioindustry

Empowering Bio Startups: KRIBB's Vision as a Global Innovation Hub

Biotechnology stands at the forefront of innovation, blending life science and engineering to drive new industries. According to the 2022 Survey on Korea's Bioindustry by the Ministry of Trade, Industry and Energy and the Korea Biotechnology Industry Organization, the Korean bioindustry reached KRW 23.47 trillion in production value, with a five-year average annual growth rate of 22%. This momentum is expected to continue, expanding the sector's footprint both domestically and globally.

As a technology-intensive field, biotechnology relies heavily on advanced R&D capabilities and highly skilled talent. However, persistent challenges—including limited cross-sector collaboration, a shortage of interdisciplinary professionals, and underdeveloped support structures for regional SMEs—continue to impede growth. The Korea Research Institute of Bioscience and Biotechnology (KRIBB), Korea's leading public bioscience institute, is tackling these gaps head-on through a range of strategic support systems.

KRIBB offers a full-spectrum support infrastructure, spanning from basic research to commercialization. Its goal is to build a self-reinforcing cycle in which foundational science seamlessly transitions into industrial value. By fostering an open innovation ecosystem, KRIBB is not only promoting startup formation but also acting as a vital link between academia, industry, government, and healthcare sectors to address national and societal challenges.

KRIBB as a Strategic Partner for Growth

Over the past several years, KRIBB has redefined its approach to industry collaboration, aiming for co-development models that foster mutual growth. Since 2017, it has operated the Bio Core Facility Program to support early-stage bio ventures. This initiative offers access to incubator space, advanced research instrumentation, seed funding, and tailored business advisory services.

From 2017 to 2023, the program has yielded measurable outcomes: KRIBB-supported companies achieved IPOs (such as Plasmapp), secured major licensing deals (including BioOrchestra's KRW 1.1 trillion agreement), created 397 jobs, and attracted over KRW 206 billion in investment.

In 2020, KRIBB launched the Open Innovation Startup Program to further strengthen Korea's startup ecosystem. This initiative supports the full lifecycle of startup development—from early ideation to commercialization—and

expands the scope of entrepreneurship beyond researcher-led ventures to include delegated and hybrid models. By connecting technology experts with experienced entrepreneurs, KRIBB is accelerating knowledge transfer and boosting industrial competitiveness.

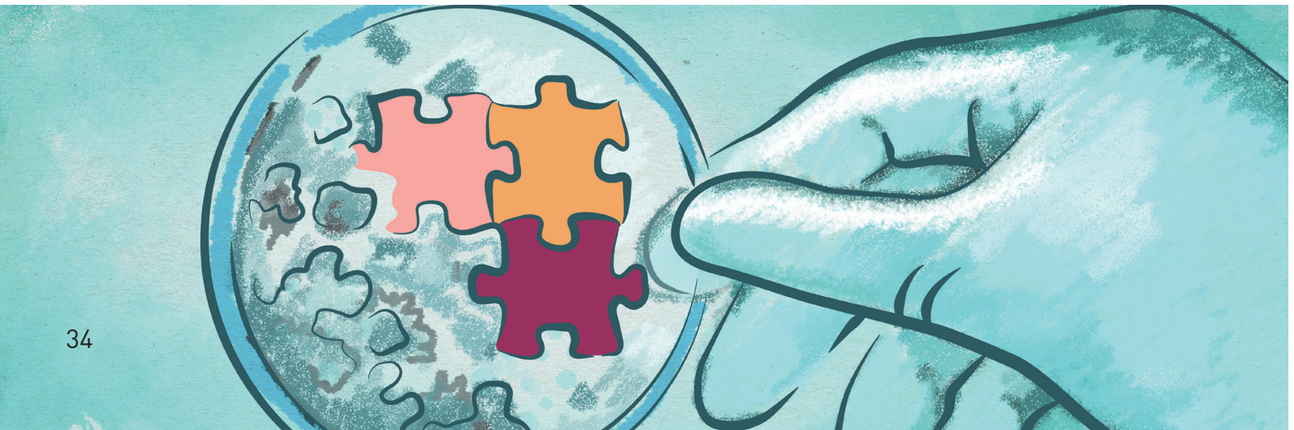
So far, KRIBB has launched 32 research-based startups, 15 of which have gone public on the Korea Exchange. This success reflects not only KRIBB's internal capabilities but also its ability to align national R&D output with real-world applications.

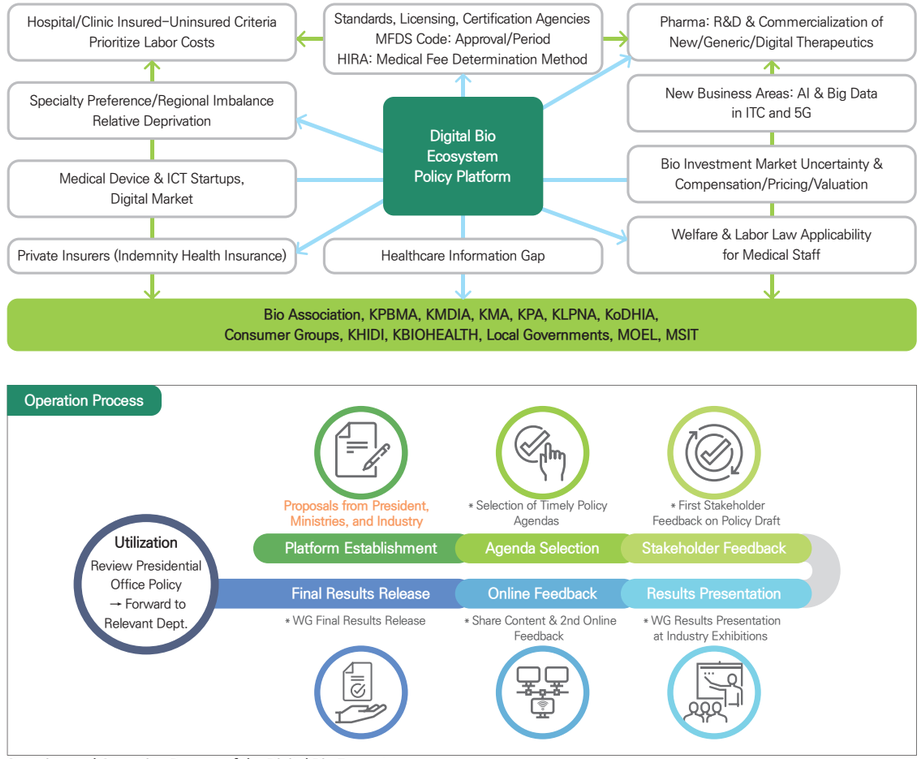
To further close the gap between innovation and impact, KRIBB has increased investment in translational research. By leveraging its in-house technologies and scientific advisory expertise, the institute helps industrial partners move more rapidly from discovery to deployment. Its cross-departmental collaboration model ensures flexibility and responsiveness throughout the process.

Charting the Future of Korea's Bio Innovation Ecosystem

As a central actor in Korea's biotechnology ecosystem, KRIBB has established itself as a hub for entrepreneurial activity and innovation. Yet, sustaining this role will require not only internal drive but also structural support. KRIBB currently operates on a one-year budget cycle, limiting its ability to engage in long-term R&D collaborations. The growing number of supported companies also places strain on staff capacity, potentially affecting the depth and quality of outcomes.

To address these issues, KRIBB leadership has proposed a multi-pronged strategy: introducing a quota system for company support, expanding participation in national projects, and securing longer-term, scalable funding models. Institutional investment is also needed to encourage deeper internal engagement from researchers, ensuring that entrepreneurial momentum is broadly shared across the organization.





Overview and Operation Process of the Digital Bio Ecosystem Policy Platform

Source: "Overview and Prospects of the Digital Bio Ecosystem" by In-Sook Kim / Korea Institute of Science and Technology Policy (STEPI)

Looking ahead, KRIBB's ambition is not just to support early-stage startups, but to serve as a national R&BD (Research and Business Development) platform—enhancing Korea's global standing in bioscience. To achieve this, the institute aims to expand open networks across academia, industry, and healthcare; modernize biotech infrastructure; and strengthen its role as a centralized research and development hub for small and mid-sized enterprises.

With high-value therapeutic development accelerating globally, and challenges like pandemics and climate change posing new threats, the need for science-driven solutions has never been greater. KRIBB is rising to meet this moment—not only as a national institute, but as a strategic force shaping the next wave of biotech innovation.

OrganoidSciences: Advancing Rare Disease Therapies Through Organoid Innovation

Miniature 3D versions of human organs—known as organoids—are drawing increasing attention for their potential to transform regenerative medicine. These lab-grown organ analogues are offering new hope in the treatment of intractable diseases. In Korea, one of the leading players developing organoid-based regenerative therapies is OrganoidSciences. We spoke with CEO Jongman Yoo to learn more about the company's vision and progress.

In the evolving landscape of regenerative medicine, organoids have emerged as one of the most promising innovations of the past decade. These three-dimensional, miniature organs grown from stem cells replicate not only the structure but also the function of real human tissues. Their physiological similarity to actual organs makes them highly valuable across a range of biomedical fields—from drug screening and disease modeling to toxicity testing. But perhaps the most groundbreaking shift lies in their potential to serve as therapeutics for diseases long deemed incurable.

In South Korea, the biotech startup OrganoidSciences is at the forefront of this transformation. Since its founding in 2018, the company has focused on developing regenerative treatments using organoid-based technology, with a particular emphasis on chronic and intractable diseases. At its helm is CEO Jongman Yoo, a physician-turned-scientist whose research background in stem cells at CHA University laid the foundation for this ambitious venture.

Yoo's motivations were both scientific and systemic. While working in academia, he grew increasingly frustrated with the limitations of conventional stem cell approaches. "Mesenchymal stem cells rarely differentiated into actual tissue cells," he explains, "so at best, you could hope for some anti-inflammatory effects." Embryonic and induced pluripotent stem cells (iPSCs), though more versatile, came with their own set of obstacles—ethical, technical, and regulatory.

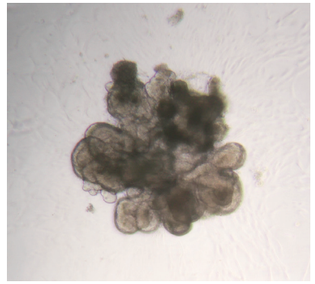
At the time, organoid research was just beginning to gain traction. A new method had been published for culturing gut-specific stem cells into organoids that resembled intestinal tissue. For Yoo, this was a turning point: a way to work with adult, tissue-specific stem cells to produce regenerative solutions that could potentially bypass the limitations of other cell types. But even with promising lab data, he knew that bringing organoid therapy to patients would require far more than academic insight.

"Universities are great for early-stage R&D," he says, "but you can't conduct clinical trials or scale manufacturing there. No one else in Korea—or the world, really—was developing therapeutic organoids at the time. So I decided to build it from scratch."

Two Pillars of Progress: Drug Testing and Regenerative Therapy

OrganoidSciences is structured around two central pillars: developing animal-alternative systems for drug screening and producing organoid-based regenerative therapies. These two trajectories may seem distinct, but they

© OrganoidSciences



Intestinal organoids cultivated at OrganoidSciences for regenerative therapy development.

share a common thread: both push the boundaries of how organoids can replicate human biology more faithfully than traditional models.

The first pillar responds to growing demands for alternatives to animal testing. Ethical concerns and the limited predictive value of animal models have prompted researchers and regulators alike to seek more accurate systems. Organoids, derived from patient tissue and structured in ways that mimic actual organs, offer a powerful solution. They allow for high-resolution modeling of drug responses, tailored to individual patient profiles.

OrganoidSciences has built a tumor organoid platform that re-creates the microenvironment of human cancers. This system enhances the precision of drug screening, particularly for anti-cancer agents. The platform is already being used in collaboration with pharmaceutical companies, as well as firms in the health supplement and cosmetics sectors, to improve efficacy predictions and reduce development risks.

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The OrganoidSciences laboratory—home to the company's foundational research in organoid technology.

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ATORM-C, OrganoidSciences' organoid-based treatment for inflammatory bowel disease.

On the therapeutic side, the company is developing regenerative treatments for organs such as the intestine, salivary glands, liver, and uterus. One of its most advanced applications is a treatment for Crohn's disease, a chronic inflammatory bowel disorder with no definitive cure. In this approach, healthy mucosal tissue is extracted from a patient, cultivated into gut organoids, and reintroduced into damaged intestinal regions. Once delivered, the organoids form a gel-like matrix, adhere to the injury site, and differentiate into functional tissue.

"The results so far are promising," says Yoo. "We're currently in the clinical research phase under Korea's Advanced Regenerative Medicine Act, and we hope to see hospital-based treatments begin as early as next year."

In October 2023, the company was selected for Germany's public funding program in regenerative and advanced therapies, securing KRW 2.3 billion in support over two years. The recognition is not only a financial boost, but also a signal of regulatory confidence from a country known for its stringent standards in regenerative medicine. "It's a validation of the value we're trying to create," Yoo adds.

Bridging Research and Application: Partnership with KRIBB

OrganoidSciences' progress has been accelerated through close collaboration with the Korea Research Institute of Bioscience and Biotechnology (KRIBB). Over the past two years, the company has received two major technology transfers from KRIBB that have expanded both its therapeutic and diagnostic capabilities.

The first, transferred in 2022, involves a method for maturing intestinal organoids. As Yoo explains, "When you first culture organoids, they resemble infant tissue. To use them as therapies or drug-testing platforms, they need to resemble adult tissue." KRIBB's method, which uses the cytokine interleukin-2 to promote this maturation, has become a key element in OrganoidSciences' pipeline.

Importantly, the technology can be applied not only to patient-derived cells, but also to organoids grown from iPSCs. This opens the door to off-the-shelf therapies that are pre-treated to minimize immune rejection and can be administered quickly to patients.

In 2023, OrganoidSciences received a second technology from KRIBB: a three-dimensional small intestinal epithelium model and its manufacturing method. Traditional intestinal organoids are complex to work with, particularly when it comes to delivering compounds into the intestinal lumen. KRIBB's model simplifies this process, enabling more effective testing of drugs, health supplements, and probiotics.

The company is already using the model to study how probiotic strains interact with intestinal tissue. "KRIBB's technologies are very commercialization-friendly," says Yoo. "We didn't have to redevelop them from scratch, which made a huge difference."

Regenerative Medicine and the Road Ahead

Organoid-based therapies are rapidly gaining ground in global healthcare. Countries like the United States, Japan, Germany, and Taiwan are racing to establish legal frameworks and industrial ecosystems to support regenerative medicine. Korea, with its strong research base and early leadership in stem cell therapy, is well-positioned to join this group of frontrunners.

Yoo believes that the opportunity is real—but so is the need for coordinated infrastructure. "We need an ecosystem that integrates science, manufacturing, regulation, and clinical application," he says. "Institutes like KRIBB can generate the seeds of technology. Companies like ours take them forward. And hospitals and regulators complete the loop."

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OrganoidSciences obtained human intestinal organoid maturation technology from KRIBB in 2022.

He also emphasizes that Korea's depth of experience in cell therapy should now translate into commercial impact. "We've done the research. Now it's time to develop therapies that truly work in the market."

As the field of regenerative medicine matures, companies like OrganoidSciences are helping redefine what is possible—not only in labs and clinical trials, but in the real lives of patients. And in doing so, they are building not just therapies, but new frameworks for how innovation reaches society.

As organoid technology continues to shift from the margins of experimental biology to the center of clinical innovation, companies like OrganoidSciences are not just advancing science—they are redefining what is possible within a national biomedical ecosystem. Their work stands as a case study in how basic research, institutional support, and entrepreneurial resolve can come together to turn bold ideas into patient-centered solutions. In that sense, OrganoidSciences is not merely developing therapies—it is helping shape the future of medicine in Korea and beyond.

High School Students Debate the Future of Biosafety and Biotechnology

Korea's only nationwide high school debate tournament dedicated to biosafety and biotechnology drew enthusiastic participation this year. The 14th National High School Biosafety and Bioindustry Debate Competition, organized by the Biosafety Information Center at KRIBB, was held on Saturday, September 7, at the KRIBB headquarters in Daejeon.

This debate series, recognized as one of the three major "game-changing" events in Korea's scientific education landscape, aims to cultivate scientific literacy and engagement among youth. This year's topic focused on the role of genetic modification technology in addressing the crisis facing the banana industry due to climate change and pest outbreaks. Sixty-six teams from 48 high schools nationwide participated, with each team randomly assigned to argue either for or against the use of GMOs—regardless of their personal views.

Participants also had the opportunity to tour KRIBB's facilities and attend a biotechnology seminar. Finalist teams received in-depth feedback, coaching, and career counseling from expert judges. The championship round included a live audience of over 60 youth participants who voted to select the event's "Audience Favorite Speaker," while the debate was also livestreamed via KRIBB's YouTube channel (GMO TV).

The grand prize, including a certificate from the Minister of Trade, Industry and Energy and a ₩1 million award, went to the team "Dodeumbyeol" from Dangjin High School. The KRIBB President's Award (₩800,000) was awarded to "Conatus" from Seoincheon High School. Individual honors went to Jin-Hyung Lee (Moonil High School) for Best Speaker, Hyo-Jun Shin (Seoincheon High School) for Outstanding Speaker, and Ye-Ji Park (Seoincheon High School) received the Audience's Favorite Speaker award.

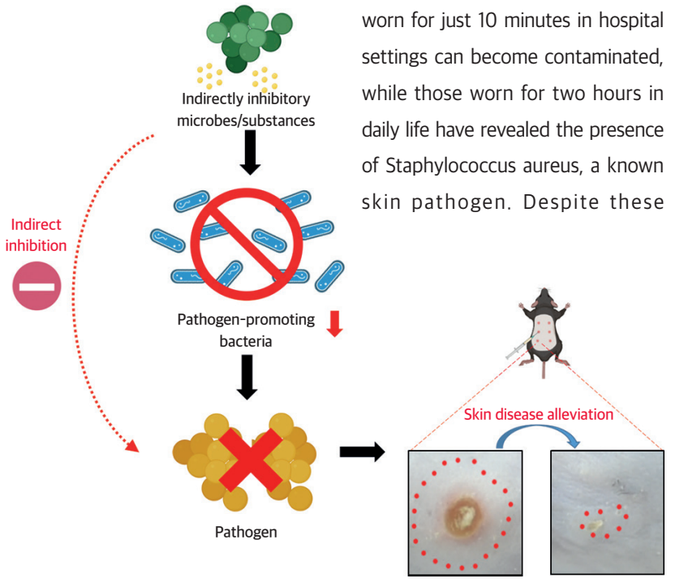
"Participating in this debate was incredibly meaningful," said the Dodeumbyeol team. "We're pursuing careers in bioscience, and it was thrilling to debate a topic we genuinely care about with students from across the country."

Fighting Microbes with Microbes: A New Strategy Against Maskne

A team led by Drs. Choong-Min Ryu and Hwi-Won Seo at KRIBB's Infectious Disease Research Center has identified, for the first time, skin microbiota and molecules that suppress inflammation caused by bacteria breeding in face masks. Their findings offer a promising alternative to antibiotic-based skin treatments.

While mask-wearing proved critical during the COVID-19 pandemic, it also introduced secondary health issues such as mask-induced acne—known as "maskne"—a blend of the words "mask" and "acne." Causes include physical irritation, elevated heat and humidity inside masks, and microbiome imbalances on the skin. Extended mask use has also drawn attention to microbial contamination.

Studies have shown that masks worn for just 10 minutes in hospital settings can become contaminated, while those worn for two hours in daily life have revealed the presence of Staphylococcus aureus, a known skin pathogen. Despite these concerns, few studies have analyzed actual microbes found in used masks.



KRIBB's team analyzed the microbiomes of 40 participants, including samples from masks, skin, and oral cavities. They identified more than 200 bacterial species in the masks—over 70% originating from skin, about 4% from the mouth. Approximately 33.5% triggered pustules or nodules in animal models, with Staphylococcus aureus proving the most pathogenic.

Interestingly, both growth-promoting and growth-inhibiting microbes were found. Older participants showed higher ratios of acne-related Cutibacterium acnes, while the most effective suppressive bacterium was Streptococcus parasanguinis, commonly found in the oral cavity.

Follow-up animal studies confirmed that inhibiting the growth-promoting bacteria reduced skin inflammation. This suggests that targeting microbial dynamics rather than pathogens directly could be a more efficient therapeutic strategy.

"Our approach doesn't rely on broad-spectrum antibiotics but rather on indirectly regulating bacterial behavior," said Dr. Ryu. "This

❶ Da-Yong Lee, Head of the Brain Disease Modeling Working Group at KRIBB, introduces the group's research focus.
❷ Jung-Yeon Kim, Head of the Emotional and Cognitive Disorders Research Group at KBRI, presents an overview of the group's work.

opens new doors for microbiome-based treatments for acne, atopic dermatitis, and other bacterial skin conditions."

The study was published on June 20 in npj Biofilms and Microbiomes (IF 9.2) and supported by Korea's Ministry of Science and ICT, the Nano-Connect Program, and KRIBB's internal research funding.

From Mind to Metabolism: Rethinking Disease via Brain-Body Crosstalk

As interest grows in understanding how the brain interacts with other organs in the human body, KRIBB and the Korea Brain Research Institute (KBRI) co-hosted a two-day symposium titled "Brain Disorders and Functional Interactions with Human Systems" from September 23-24 at KRIBB's main campus in Daejeon.

With an aging population and nearly 1 million Koreans currently estimated to suffer from dementia—a number projected to rise to 1.42 million by 2030—the need for innovative neuroscience research is urgent. Global governments are investing heavily in brain-related mega-projects, and Korea is following suit with its 4th Basic Plan for Brain Research Promotion launched last year.

The symposium highlighted the brain's critical role as the control center for homeostasis and disease management. Sessions explored how the nervous system interacts with vascular, lymphatic, digestive, metabolic, and sensory systems.

On Day 1, Dr. Gou-Young Koh of IBS opened with a keynote on angiogenesis and its relevance to cardiovascular diseases. Subsequent sessions covered brain-lymphatic interactions chaired by Dr. Do-Geun Kim (KBRI) and featured presentations by Dr. Jun-Young Heo (Chungnam National University) and Dr. Young-Jeon Lee (KRIBB). A digestive session chaired by Dr. Jae-Ran Lee (KRIBB) included speakers Dr. Jung-Soo Lee (KRIBB) and Prof. Sung-Yeon Kim (Seoul National University).

Group photo of key speakers. (From left) Yu Kwon, National Bioinfrastructure Project Division, KRIBB; Lee Jae-ran, Rare and Intractable Diseases Research Center, KRIBB; Kim Do-geun, Dementia Research Group, KBRI; Lee Young-jeon, National Primate Research Center, KRIBB; Kwon Seok-yoon, KRIBB; Lee Da-yong, Brain Disease Model Research Working Group, KRIBB; Kim Jeong-yeon, Emotional and Cognitive Disorders Research Group, KBRI; Kim Ki-wan, Convergence Research Division, NST; Koh Gou-young, Center for Vascular Research, IBS; Lee Jeong-soo, Microbiome Convergence Research Center, KRIBB; Kim Jang-hwan, Gene & Cell Therapy Strategy Research Center, KRIBB.

Day 2 featured a keynote by Dr. Chang-June Lee (IBS) on astrocyte-neuron interactions, followed by sessions on metabolic, peripheral, and sensory system interplay. Speakers included Dr. Hyung-Jin Choi (SNU), Dr. Choong-Wan Woo (IBS), Prof. Sun-Kwang Kim (Kyung Hee University), Dr. Min-Ho Nam (KIST), Prof. In-Sun Lee (Kyung Hee University), Dr. Mae-Soon Lim (KIST), Dr. Geun-Soo Kim (KBRI), and Dr. Seung-Hee Lee (IBS).

Dr. Da-Yong Lee of KRIBB emphasized, "The brain acts as a command center for bodily functions. Understanding its regulation is crucial to tackling complex diseases."

Dr. Jung-Yeon Kim of KBRI added, "Inter-organ communication, such as the gut-brain axis, is now central to disease understanding and treatment. This symposium is a step toward collaborative models for future research."

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ISSN 2734-0449