SCIENCE FOR THE HUMAN BEING

Korea Research Institute of Bioscience and Biotechnology

Annual Report 2009

KRIBB

Deep dive into life

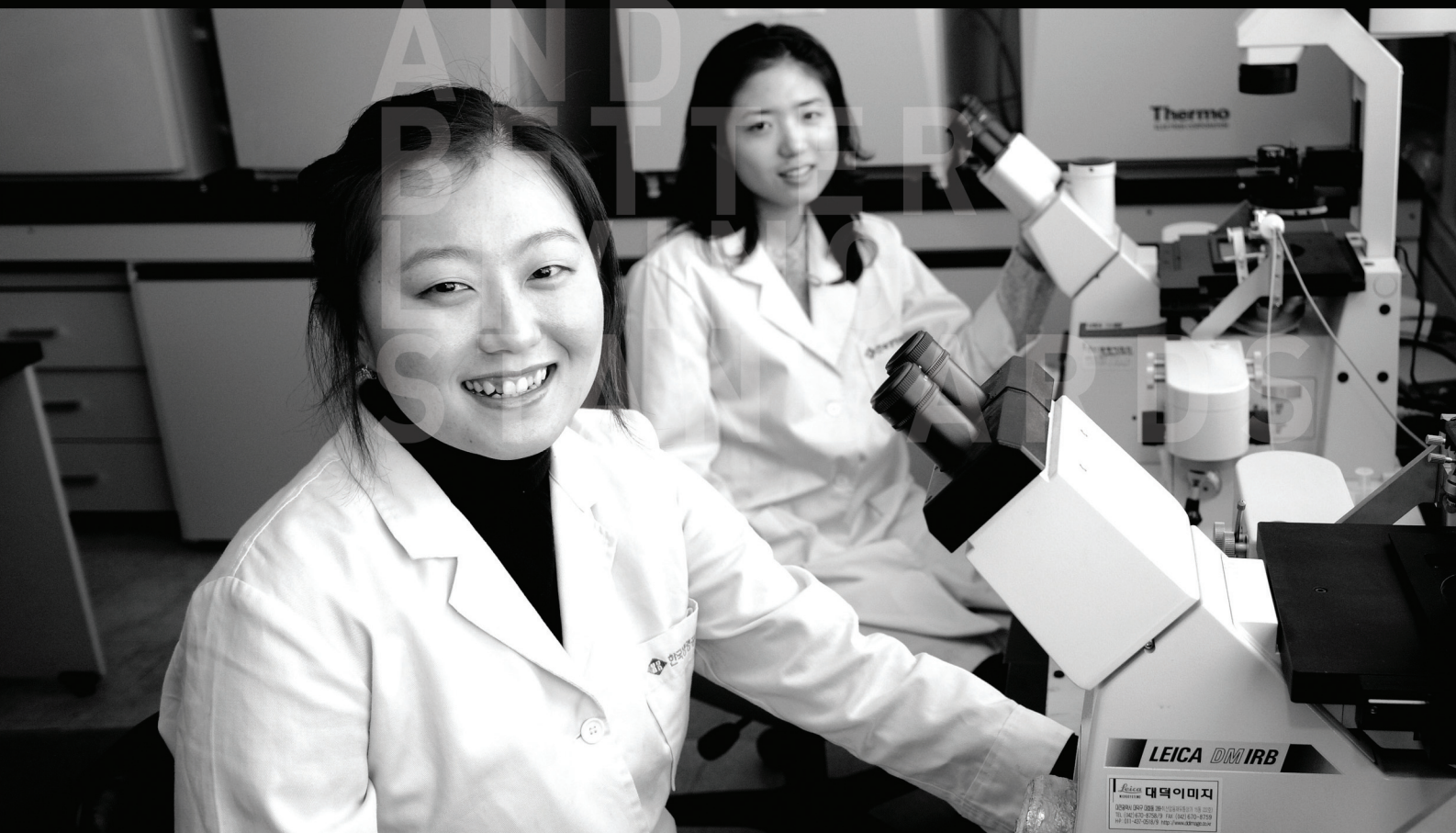
Korea Research Institute of Bioscience and Biotechnology

CONTENTS

BIOTECH FOR ECONOMIC GROWTH AND BETTER LIVING STANDARDS

BIOTECH FOR ECONOMIC GROWTH AND BETTER LIVING STANDARDS

From fundamental research exploring basic facts about life to cutting-edging technologies, our work is aimed at creating new engines for economic growth and bringing concrete improvements in the quality of life for Koreans all over. Our goal is to shape a brighter, better and healthier future for all, in Korea and around the world.



Young Hoon Park, Ph.D.
President & CEO

Biotech for Economic Growth and Better Living Standards

Message from the President

Biotechnology, hailed as an engine of the next economic revolution, is a field which can potentially provide solutions to the most critical challenges facing humanity. The work of biotechnology researchers is pushing the horizon in this area of human knowledge which can play an important role in shaping the future in store for our planet and its inhabitants. Founded in 1985, KRIBB has over its twenty-five years of history led innovation in public health, food productivity, development of new biomaterials, environmental remediation and new energy sources, and has earned, in the process, a place among the world's most competitive biotechnology research organizations.

In 2009, researchers at KRIBB made major breakthroughs with tremendous potential impact on human health, such as explaining the path of genomic evolution, thus providing crucial clues to the biological evolution of life forms (*Nature*); identifying DNA involved in the regulation of inflammation and establishing their correlation with diabetes (*Nature Immunology*); and tracing Asian populations to their genetic origins and providing scientific proof of their genetic diversity (*Science*). 2009 was also a year of lively international joint research activity for KRIBB. Another notable accomplishment was in the area of technology transfer, hitting a historic high of 30 billion won (30 million us dollar) for a single project. KRIBB has also afforded itself a stepping stone in its rise as a global research institution, by launching one of the three WCI (World Class Institutes) selected by the Korean government.

As the epicenter of the nation's R&D in the biotechnology field, KRIBB has been active in expanding its infrastructure as well. Last year, a biopharmaceutical research facility, offering four aboveground floors and one basement level, was completed on a 11,559m^2 lot, under a 19.7 billion won project. The new research center provides a setting for collaborative biopharmaceutical research among industry, universities and research institutions, along with the Primate Research Center and the Bio-evaluation Center. The new center is a hub notably for identifying lead pharmaceutical substances and testing drugs for their effectiveness and safety.

KRIBB's ambitions for the year 2010 are directly proportionate to the potential of this promising area. To spur progress as a leader of bio consolidation, we have established a new vision, 'Global Research Institute Leading Biotechnology Innovation for the Humankind.' Concrete goals under this vision are to develop new growth engines, to respond to the national agendas and to support and develop the advanced infrastructure. Meanwhile, to boost our global competitiveness as a research organization, we will further strengthen our human resource capabilities by bringing onboard top-notch researchers and strive to improve our support system to raise the quality of research outcomes, as well as to discover and design new research projects with the potential to produce major scientific and technological impacts. In our bid to rise as the new global leader in biotechnology research, we at KRIBB pledge to spare our best to find solutions for the challenges our planet is facing and a better future for people all over the world.

Mission & Vision

MISSION

To carry out research and development activities and related projects in the field of bioscience and biotechnology in joint effort with other research institutes, academic bodies, and businesses at home and abroad and to disseminate the results of its scientific research and technological development

VISION

Major Objectives

CORE DIRECTIONS FOR RESEARCH & BUSINESS PROJECTS

▸ Biotechnology to Create New Economic Growth Engines

- Development of BINT convergence technology
- Development of disease controlling technologies using stem cells and antibodies
- Identification of targets and development of candidate materials for the diagnosis and treatment of five major diseases.
- Development of the generic technology for cell factories and biomaterials

▸ Biotechnology to Address the National Agenda

- Technology Development for infection control
- Fostering R&D on cranial nerves and the aging society
- Development of biomass and bioenergy technology

▸ National Infrastructure to Enhance National Biotechnology Competitiveness

- Improvement of the infrastructure for compiling, managing and utilizing bio resources and data
- Consolidation of the infrastructure for biological assessment and GMO risk assessment

CORE DIRECTIONS FOR ORGANIZATIONAL MANAGEMENT

▸ Improvement of the Framework to Facilitate R&D

- Introduction of an open R&D system and acquisition of competitive human resources
- Strategical selection and concentration
- Expansion of global cooperation

▸ Contributions to the Society and the Country

- Improvement of the ability to respond to future Biotechnology demands
- Promotion of demand-based R&D and commercialization of technologies
- Raising public awareness of Biotechnology and public interest in science

▸ Improvement of the Management Efficiency

- Promotion of result- and objective-oriented management
- Augmentation and efficient allocation of the R&D budget
- Maintenance of an up-to-date data and facility infrastructure

General Information

FOUNDATION BASIS

Article 8, Act on the Establishment, Management and Promotion of Government- funded Research Institutions

KEY FUNCTIONS

Advanced R&D and development & distribution of generic technologies in bioscience and biotechnology

- Future bio-convergence, personalized bio-medicine, Bio green technology, bio-based national agenda

Public infrastructure development support for research on bioscience at home and abroad

- Public infrastructure development support, national policy think-tank, specialized education and training

HISTORY

FEB. 1985	Established as a Genetic Research Center(Seoul)
JUL. 1990	Moved to Daedeok Innopolis(Daejeon)
MAR. 1995	Changed its name to the Korea Research Institute of Bioscience & Biotechnology(KRIBB)
MAY. 1999	Became an independent legal entity under the Korea Research Council of Fundamental Science & Technology (KRCF)
SEP. 2005	Established Ochang Branch Institute
NOV. 2006	Established Jeonbuk Branch Institute

HUMAN RESOURCES

Descriptions	Executives	Researchers	Engineers	Administrators	Technicians	Total
Regular employees	1	192	50	28	45	316

BUDGET (Unit : Millions of Won)

Revenue

Descriptions	
Government funds	50,233
Institute revenues	60,680
Government - funded projects	55,740
Privately-funded projects	1,370
Other research projects	600
Technology supports	820
Royalties	800
Others	1,350
Total	110,913

Expenditure

Descriptions	
Personal expenses	24,132
Direct research expenses	72,961
Major projects	26,916
Government-funded projects	43,705
Private funded projects	1,090
Other research projects	600
Technology supports	650
General and administrative expenses	6,110
Facility expenses	6,482
Others	1,228
Total	110,913

FACILITIES (Unit : m^2)

Daejeon Headquarters

Site	100,978
Building	51,547
Research and support	46,568
Main Building	11,871
Research Building	17,008
Resource Building	6,554
Venture Building	3,044
Native plant Building(1)	1,134
Native plant Building(2)	1,077
Cafeteria Building	2,646
Green house research building, etc.	3,234
Residence	6,879
Single	909
Superintendence APT	991
Dormitory	4,979

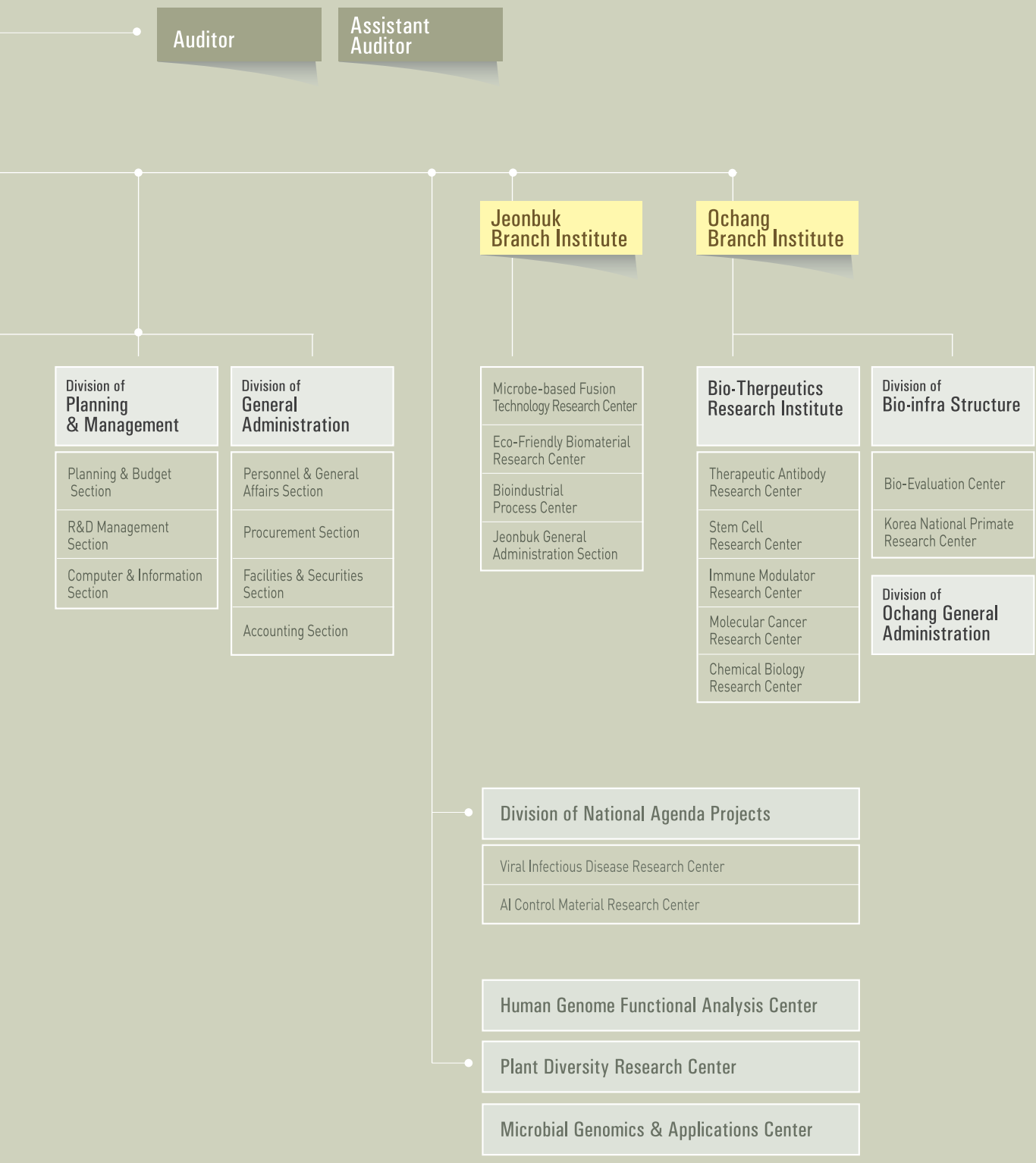
Ochang Branch Institute

Site	212,258
Building	26,548
Research	26,548
National Primates Research Center	4,774
Bio-Evaluation Center	9,636
Biomedical Research Center	11,558
Others	580

Jeonbuk Branch Institute

Site	18,522
Research Building	6,125
Administrative building and Dormitory	2,811

Organization


Auditor
Assistant Auditor
Jeonbuk Branch Institute
Ochang Branch Institute
Division of Planning & Management
Planning & Budget Section
R&D Management Section
Computer & Information Section
Division of General Administration
Personnel & General Affairs Section
Procurement Section
Facilities & Securities Section
Accounting Section
Microbe-based Fusion Technology Research Center
Eco-Friendly Biomaterial Research Center
Bioindustrial Process Center
Jeonbuk General Administration Section
Bio-Therpeutics Research Institute
Therapeutic Antibody Research Center
Stem Cell Research Center
Immune Modulator Research Center
Molecular Cancer Research Center
Chemical Biology Research Center
Division of Bio-infra Structure
Bio-Evaluation Center
Korea National Primate Research Center
Division of Ochang General Administration
Division of National Agenda Projects
Viral Infectious Disease Research Center
AI Control Material Research Center
Human Genome Functional Analysis Center
Plant Diversity Research Center
Microbial Genomics & Applications Center

Yearly Progress

PERSONNEL

Unit : Millions of won

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Regular Employees	243	280	290	300	297	295	294	293	316
Special Service Interns	343	353	461	510	547	530	639	657	650
Total	586	633	751	810	844	825	934	950	966

BUDGET

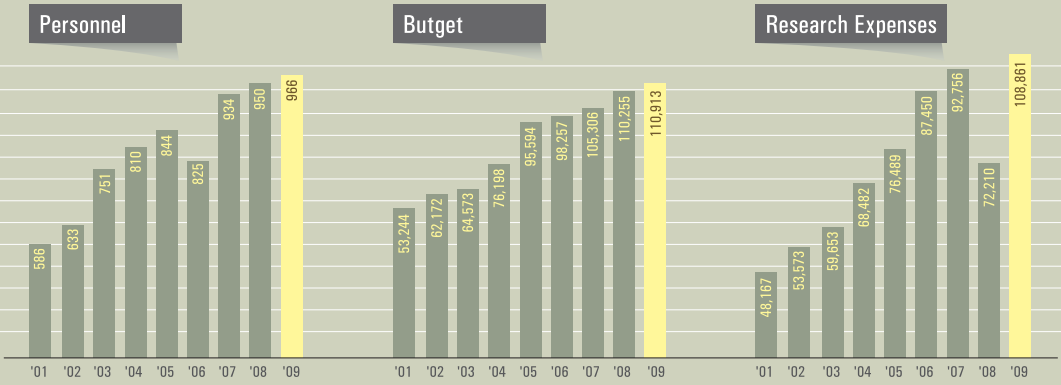
Unit : Millions of won

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	53,244	62,172	64,573	76,198	95,594	98,257	105,306	110,255	110,913

RESEARCH EXPENSES

Unit : Millions of won

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Government	37,525	43,085	37,888	44,008	47,041	50,941	50,686	42,930	63,140
Institutes	9,580	10,044	20,268	22,860	28,546	35,210	40,669	27,200	43,323
Private	1,023	444	757	709	702	1,299	1,401	990	2,398
Others	39	-	740	905	200	-	-	1,090	-
Total	48,167	53,573	59,653	68,482	76,489	87,450	92,756	72,210	108,861



PUBLICATIONS

Unit : Items

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Domestic	116	106	121	117	136	141	129	141	130
Overseas	188	170	229	271	303	360	287	364	354
Total	304	276	350	388	439	501	416	505	484

PATENTS

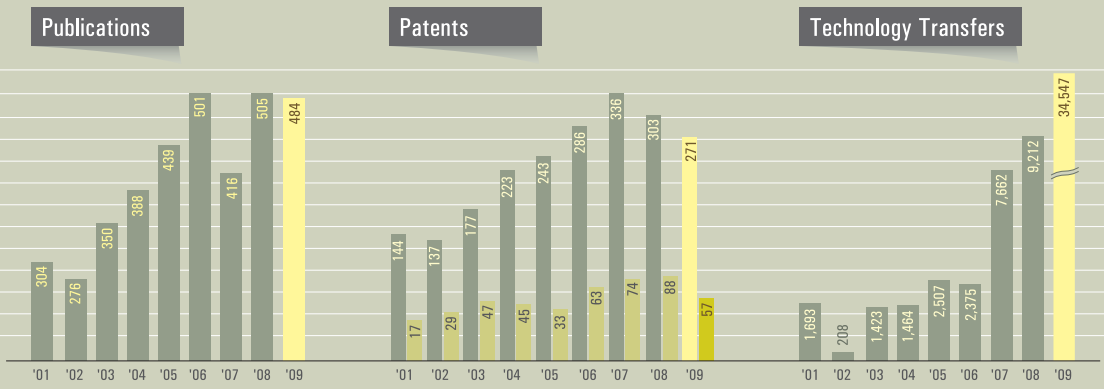
Unit : Items

		2001	2002	2003	2004	2005	2006	2007	2008	2009
Domestic	Application	116	106	121	117	136	141	129	141	130
	Registration	65	64	64	88	116	139	142	108	61
Overseas	Application	8	12	19	25	23	46	54	70	39
	Registration	9	17	28	20	10	17	20	18	18

TECHNOLOGY TRANSFERS

Unit : Items, Millions of won

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Domestic	20	2	11	8	15	13	17	17	5
Overseas	-	1	-	-	-	-	2	1	1
Total	20	3	11	8	15	13	19	18	6
Amount	1,693	208	1,423	1,464	2,507	2,375	7,662	9,212	34,547



CUTTING-EDGE RESEARCH AND INDUSTRIAL RESEARCH TO INNOVATIONS

At KRIBB, we conduct cutting-edge biotechnology research in areas essential for our society and critical for achieving sustainable economic growth such as public health, food, new biomaterials, the environment and new energy sources. Meanwhile, our basic industrial technology research underpins the development of Korean industry and contributes to the future prosperity of our nation.

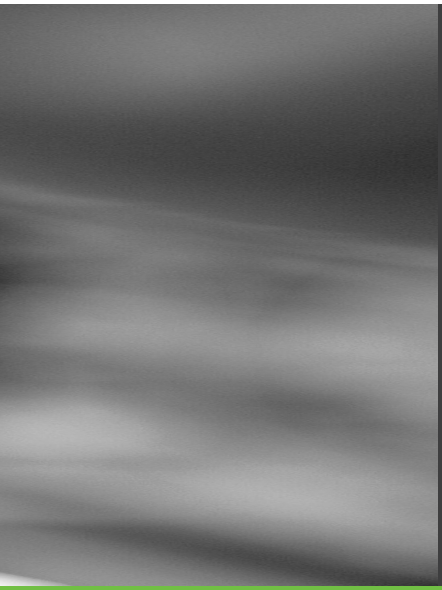
BIOTECH BASIC TECHNOLOGY LEAD

CUTTING-EDGE BIOTECH RESEARCH AND BASIC INDUSTRIAL TECHNOLOGY RESEARCH TO LEAD INNOVATIONS

Division of Bioconvergence Technology

A Healthier Future for People the World Over - That is Our Pledge and Promise

Our work in converging technologies to develop new bionanomaterial-based treatments, research into aging to prolong life and improve the health of senior citizens, brain and neurobiological research and omics technique-enabled biopharmaceutical research are all helping usher in a healthier society.



BioNanotechnology Research Center

Aging Research Center

Brain Research Center

Integrative Omics Research Center

BioMonitoring Research Center

Division of Bioconvergence Technology

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RESEARCH AREAS

Protein chips
- Development of platform technologies to construct a new generation of protein chips, whose detection system is free of fluorescence and radioisotope labeling.
- Creation of protein chips with bio-contents that can be employed in disease diagnosis and hence in the high throughput screening of potential pharmaceuticals.

Nanomaterials and Bioimaging

Conjugation of inorganic materials, such as metals or magnetic nano-particles, to various organic molecules in order to investigate the characteristics of proteins and develop new drugs

Nanobiosensors

Development of platform technologies to establish and practically use biosensors in the early diagnosis of diseases:
- Label-free based, ultrasensitive nanobiosensing
- Biocontents and hardware interfacing
- Disease diagnosis biomarker design and production

Mobile Life Care System

Development of technology for a Mobile Life Care System, enabling portable healthcare, via the incorporation of IT with biochips and biosensor technology

BioNanotechnology Research Center

Division of Bioconvergence Technology

Our research center is involved in the development of nano-biochips, nano-biosensors and nano-biomaterials based on the exploitation and utilization of bio-contents. By conducting integrated research in the fields of biotechnology (BT), nanotechnology (NT) and information technology (IT), we aim to conceive tools that will facilitate the discovery of new drugs as well as new technologies for the diagnosis and treatment of diseases, which will contribute to the creation of new businesses and realize our dream of prolonging human life.

ACHIEVEMENTS

Development of novel a photo-luminescent nano-particle

We have succeeded in synthesizing highly photo-luminescent, fullerene-based SNPs using the reverse micro-emulsion method. The nano-particles were spherical with a homogeneous diameter of ≈60 nm. These particles showed excellent properties for bio-imaging applications, such as high luminescence, easy penetration into live cells, remarkable photo-stability, and non-toxicity to cells. Because the silica surface of FSNPs can be easily modified with biomaterials, this novel material is an excellent candidate for use as a live-cell imaging agent

Multiplexed imaging of therapeutic cells with magnetofluorescent nanocomposite emulsions

We fabricated multi-spectrally encoded nano-probes, perfluorocarbon (PFC)/quantum dots (QDs) nano-composite emulsions, which can provide both multi-spectral MR and multi-color optical imaging modalities. Our strategy exploited the combination of the multi-spectral MR properties of four different PFC materials and the multi-color emission properties of three differently-colored CdSe/ZnS QDs. The PFC/QD nano-composite emulsions are expected to be a promising multi-modality nano-probe for the multiplexed detection and imaging of therapeutic cells both in vitro and in vivo

Development of Cascade enzyme-linked immunosorbent assay (CELISA)

To develop a novel amplification method in ELISA, an enzyme-cascading system was incorporated into an ELISA: The new assay is referred to as a "cascading enzyme-linked immunosorbent assay" or CELISA. This CELISA, which includes a trypsinogen-enterokinase combination as the cascading enzyme system, was used to detect alpha-fetoprotein (AFP), which is a marker of liver cancer, and a prostate-specific antigen (PSA).

SELECTED PUBLICATIONS

- **Bong Hyun Chung (Corresponding)** Synthesis and characterization of a photoluminescent nanoparticle based on fullerene-silica hybridization. *Angew. Chem. Int. Ed. Engl.* 48:5296-5299 (2009)
- **Bong Hyun Chung (Corresponding)** Multiplexed imaging of therapeutic cells with multispectrally encoded magnetofluorescent nanocomposite emulsions. *J. Am. Chem. Soc.* 131:17145-17154 (2009)
- **Bong Hyun Chung (Corresponding)** Multifunctional silica nanocapsule with a single surface hole. *Small* 5:324-328 (2009)
- **Bong Hyun Chung (Corresponding)** Photoactivable antibody binding protein: site-selective and covalent coupling of antibody. *Anal. Chem.* 81:936-942 (2009)
- **Bong Hyun Chung & Sang Jeon Chung (Corresponding)** Cascade enzyme-linked immunosorbent assay (CELISA). *Biosens. Bioelectron.* 25:332-337 (2009)

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- Targeting of age-associated genes in human muscular aging
- Molecular mechanisms in muscle cell differentiation

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- Molecular genetic studies on aging using the Drosophila model system
- Neurophysiological studies of neuropeptides using the Drosophila model system

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- Studies on cellular senescence using MEF cells on antioxidant enzymes and aging associated molecules
- Production of mouse models for aging study

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- Understanding the pathogenesis of muscle dysfunction
- Molecular mechanisms in neuronal cell death

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- Development of a Drosophila model system for studying age-related diseases such as diabetes and neurodegenerative diseases

RESEARCH AREAS

Bioinformatics/Omics-based research to discover novel molecular targets for anti-aging strategies

Molecular genetic research
- Studies on signaling pathways regulating cellular senescence during aging
- Studies on the functions of insulin signaling genes and stress-related genes during aging

Animal model research
- Production of model flies to study specific gene function during aging
- Development of aging model mice for studying in vivo age-related gene function
- Discovery of target genes for early detection of aging
- development of drug candidates

Aging Research Center

Division of Bioconvergence Technology

We study the genes and signaling pathways that regulate cellular senescence and organismal aging. We also develop animal models to study longevity and age-related degenerative disorders. The final goals of our center are to develop molecular markers of the aging process and to develop pharmaceutical and nutraceutical drugs for healthy aging.

ACHIEVEMENTS

Identification of age-related genes in human muscles

From the gene set analyses of human muscle, we found that upregulated genes in the aging process were involved in biological processes such as RNA binding, splicing, and transcription factor activities and that downregulated genes were involved in NADH dehydrogenase, receptor activities and mitochondrial electron transport chains. We are interested in several novel candidates of age-related genes by RT-PCR using human dermal fibroblasts and rat muscle tissues. Further research on these age-related markers may provide insight into the aging process and anti-aging strategies.

sNPF controls lifespan

Short neuropeptide F (sNPF) signaling regulated lifespan through ERK-mediated insulin signaling in Drosophila. Suppression of sNPF signaling in sensory neurons increased the median lifespan by 20% compared with the control flies, while over-expression of sNPF in sensory neurons did not decrease the lifespan.

Animal model research

Prx II maintains hippocampal synaptic plasticity against age-related oxidative damage. Age-dependent mitochondrial ROS generation and long-term potentiation (LTP) decline were more prominent in hippocampal neurons in Prx II(-/-) than in wild-type mice. Prx II(-/-) mice failed to activate synaptic plasticity-related cellular signaling pathways involving CREB, CaMKII, and ERK, or to maintain functional integrity of their mitochondria.

SELECTED PUBLICATIONS

- Chae Young HWANG, Cheolju LEE and Ki-sun Kwon* ERK2-dependent phosphorylation induces cytoplasmic localization and degradation of $p21^{Cip1}$. *Mol. Cell. Biol.* 29:3379-3389 (2009)
- Lee KS, Iijima-Ando K, Iijima K, Lee WJ, Lee JH, Yu K*, Lee DS*. 2009. JNK/FOXO-mediated neuronal expression of fly homologue of peroxiredoxin II reduces oxidative stress and extends life span. *J. Biol. Chem.* 284:29454-29461 (2009)
- JS HA, CS LEE, JS MAENG, KS KWON, SS PARK* Chronic glutamate toxicity in mouse cortical neuron culture. *Brain Res.* 1273:138-143 (2009)
- Dae-Yeul Yu (Corresponding) Non-structural 5A protein of hepatitis C virus induces a range of liver pathology in transgenic mice. *J. Pathol.* 219:253-262 (2009)

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RESEARCHERS

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- Transcriptional regulatory cascade of the catecholaminergic neuronal system
- Brain diseases of the CA neuronal system
- Embryonic and adult stem cells as potential platforms for developmental biological studies and cell replacement therapy

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- Screening and characterization of neuro-protective substances derived from natural sources

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- Protein tyrosine phosphatases and neuronal synaptogenesis
- Novel neuroprotective function of microglia in the brain

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- The role of nuclear receptors in neuroinflammation
- Research on natural compounds which activate nuclear receptors from plant extracts

Kyoung-Shim Kim kskim@kribb.re.kr
- Study of the mechanism of neurodegenerative and psychiatric diseases using animal models
- Research on neuro-protective compounds derived from plant extracts

RESEARCH AREAS

Brain diseases of the catecholamine system
Application of molecular and developmental studies on catecholamine neurons to translational and preclinical research with potential clinical benefits

Embryonic and adult stem cells
Genetic manipulation of stem cells for differentiation to the dopaminergic neuronal lineage

Protein tyrosine phosphatases in synapse formation
Regulation of neuronal synapse formation through tyrosine dephosphorylation

Neuroprotective functions of microglia
Understanding the functions of resting microglia and their application to neuronal diseases

Role of nuclear receptors in neuro-inflammation
Understanding the anti-neuro-inflammation function of nuclear receptors in neuro-degenerative diseases

Searching natural compounds having activity for nuclear receptors in plant extracts
Screening and identifying nuclear receptor ligands which can activate nuclear receptors derived from plant extracts

Regulatory mechanism of anxiety and depression
The application of molecular and behavioral studies using animal models

Brain Research Center

Division of Bioconvergence Technology

Our mission is to acquire understanding of and develop treatments for neuro-degerative diseases by conducting basic and clinical research. To improve public mental health, We foster exploration in the fields of cerebral, behavioral, and stem cell science.

ACHIEVEMENTS

New function of brain-specific protein tyrosine phosphatase receptor T

PTPRT was found to control the development of the human brain by inducing synaptogenesis which underlies the learning memory. PTPRT interacts via its extracellular domain with neuronal cell adhesion molecules and its activity is regulated by Fyn tyrosine kinase.

Discovery of a new regulatory system for anxiety and stress responses

The AC5-associated signal system and neural network were found to be involved in the regulation of responses for coping with anxiety and stress

Role of stress in the pathogenesis of Alzheimer's disease

Behavioral stress was found to accelerate plaque pathogenesis in the brain of Tg2576 mice via the generation of metabolic oxidative stress.

SELECTED PUBLICATIONS

- Jae-Ran Lee (Corresponding) Synapse formation regulated by the protein tyrosine phosphatase receptor T through interaction with cell adhesion molecules and Fyn. *EMBO J.* 28:3564-3578 (2009)

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- Genome-wide gene deletion of fission yeast

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- Drug-protein interaction using network algorithm

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- Development of glycan remodeling technology
- Glycomics study for stem cell and cellular senescence

RESEARCH AREAS

Genomics-based gene deletion research
Construction of genome-wide deletion in fission yeast for functional genomics and drug target screening

Proteomics-based therapeutic antibody research
Target validation and confirmation of cancer targets, production of human antibodies, identification of rheumatoid arthritis modulators

Glycomics-based cellular remodeling research
Integrated genomic analysis of the metabolic regulatory networks and stress response mechanisms; development of glycan remodeling technology and high-throughput glycan analysis system

Integrative Omics Research Center

Division of Bioconvergence Technology

Our goal is to develop platform technology useful for the production of next-generation bio-therapeutics and high-value added omics products, such as genome-deleted yeast strains, human therapeutic antibodies, and glycosylated therapeutic proteins. We focus on intelligent cellular engineering and molecular reconstruction technology based on the understanding of bio phenomena on a systemic level based on integrated analysis of various “Omics” data such as functional genomics, proteomics and glycomics.

ACHIEVEMENTS

Construction of genome-wide gene deletion in fission yeast

Almost 99% of the fission yeast genome have been deleted, and their essentiality has been confirmed by tetrad analysis. Using the mutants and GeneChip, a drug target screening system also has been set-up.

Development of yeast cell factory for production of therapeutic proteins

Whole genome sequence of the methylotrophic yeast *H. polymorpha* has been determined and applied for functional genomics and transcriptomics studies, which are useful for cell factory remodeling. In addition, glycosylation pathways have been elucidated and reconstructed in order to produce human-compatible high-value added therapeutic glycoproteins.

Development of human antibodies for novel cancer therapeutic targets

The first fully human neutralizing antibodies for TMPRSS4 and CD9 (novel targets for cancer angiogenesis and metastasis), has been evaluated and developed for cancer diagnosis and treatment.

SELECTED PUBLICATIONS

- Ohsuk Kwon (First author) Characterization of the Streptococcus pneumoniae BgaC protein as a novel surface β-galactosidase with specific hydrolysis activity for the Galβ1-3GlcNAc moiety of oligosaccharides. *J. Bacteriol.* 191:3011-3023 (2009)
- Doo-Byoung Oh (Corresponding) High-throughput quantitative analysis of plant N-glycan using a DNA sequencer. *Biochem. Biophys. Res. Comm.* 380:223-229 (2009)
- Young Woo Park (Corresponding) Type II transmembrane serine proteases in cancer and viral infections. *Trends Mol. Med.* 15:303-312 (2009)

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- Therapeutic protein production using mammalian expression systems

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- Developing nanobiomaterials for biosensor applications
- Syntheses of organic materials for biodevices

RESEARCH AREAS

Development of a detection platform for harmful chemicals in food
Constructing novel platform technologies for the detection of harmful materials such as small endocrine disrupting chemicals or pathogenic bacteria

Building biomaterials-based devices of high efficiency and sensitivity
Developing detection devices based on the integration of biomaterials such as antibodies, peptides, and oligonucleotides with microelectronics and microfluidic devices

Mode of action research of harmful materials
Studying the behavior of environmentally harmful materials in living organisms

BioMonitoring Research Center

Division of Bioconvergence Technology

As an inevitable side effect of a highly industrialized society, plenty of chemical compounds and micro-organisms such as multi-drug resistant bacteria have been threatening hopes maintaining healthy human life. The BioMonitoring research centre attempts to build versatile and intelligent biomonitoring systems not only for monitoring conventional food and the environment but also for needs of national security such as facing biochemical terrorism.

ACHIEVEMENTS

Development of a dual gold nanoparticle conjugate-based LFA sensor

For signal amplification without an additional operation step in a gold nanoparticle (AuNP)-based lateral flow assay (LFA), a new and simple method utilizing two AuNP-antibody conjugates was developed. The 1st conjugate was the AuNP immobilized with an anti-troponin I antibody and blocked with bovine serum albumin (BSA), and the 2nd conjugate was the AuNP immobilized with an anti-BSA antibody and blocked with human serum albumin. The two conjugates were encapsulated in different pads, respectively. When 10 nm for the 1st and 40 nm for the 2nd were used, the detection sensitivity increased about a 100 fold compared to the conventional LFA. We could detect as low as 0.01 ng/mL troponin I in 10 min using the dual AuNP conjugate-based LFA.

Development of a palm-sized SPR sensor system

A portable surface plasmon resonance (SPR) biosensor system was developed using a rotating mirror. This method can eliminate the deterioration of image quality of reflected laser light, originating from the coherency of the laser source. A novel portable palm-sized SPR sensor system operated by three batteries (4.5 V) was constructed. It's patent was registered in Korea and PCT (PCT/KR2008/004701), and this technology was transferred to KoMiCo corporation with an agreement for $3 million in loyalties. This project was achieved in collaboration with the BioNanotechnology Research Center.

SELECTED PUBLICATIONS

- Hyung Min Kim, Seung Min Jin, Seok Kee Lee, Min-Gon Kim and Yong-Beom Shin Detection of biomolecular binding through enhancement of localized surface plasmon resonance (LSPR) by gold nanoparticles. *Sensors*. 9:2334-2344 (2009)

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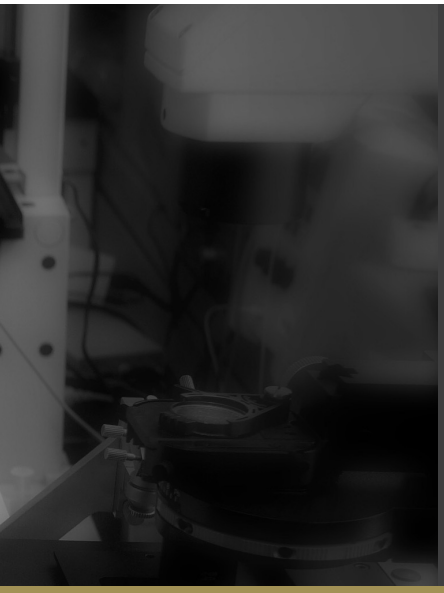
Division of Translational Research

Spurring Progress in Biotreatment Technology

Our work in such pioneering fields as development of biomarkers for pathogenic research on cancer and other common types of life-threatening diseases, and basic technology research in regenerative medicine, harnessing the body's own regenerative capabilities, are contributing to broaden horizons in medical science.



Medical Genomics Research Center

Development and Differentiation Research Center

Medical Proteomics Research Center

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RESEARCHERS

Young Il Yeom yeomyi@kribb.re.kr
- Genomic analysis of cancers and identification and functional validation of therapeutic targets

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- Chemical genomic study using cell- or phenotype-based assay, gene and protein expression profiling for identification of the genes and proteins involved in tumor progression and metastasis

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- Functional analysis of genes associated with cancer

RESEARCH AREAS

- Establishment of a functional and chemical genomics research infrastructure and technology platforms
- Large-scale screening and identification of disease-related genes
- Functional validation of candidate target genes and biomarkers for therapeutics / diagnostics development
- Development of tools and strategies for modulating therapeutic targets and monitoring biomarkers
- Development of a diagnostic assay system
- Production and application of antibodies for functional analysis of novel genes

Medical Genomics Research Center

Division of Translational Research

Our goal is to establish top-quality genomics-based technology platforms and apply them to biomedical research programs in order to achieve a high-throughput identification and global function analysis of the genes associated with diseases which are most prevalent in the Korean population such as stomach and liver cancers. We also conduct functional and chemical genomics research to discover validated targets and biomarkers for the development of effective diagnostics and therapeutics.

ACHIEVEMENTS

Development of therapeutic target genes for liver cancer

We analyzed human HCC tissues using a combination of DNA chip and cell chip technologies and identified 682 genes showing frequent expression changes in HCC and bearing functional relevance to the development of liver cancer. Currently, we are collaborating with Pfizer in order to define therapeutically valid targets for anticancer drug development for HCC using these omics data.

Identification of a novel tumor suppressor gene, POPDC3, in gastric cancer

We found that the promoter region of Popeye domain-containing protein 3 (POPDC3) was aberrantly methylated in gastric cancer. POPDC3 expression was reduced in 87% of gastric tumors compared with normal adjacent tissues. Combination treatment with a DNA methylation inhibitor and histone deacetylase inhibitor strongly induced *POPDC3* expression. *POPDC3* were hypermethylated in 64% of gastric cancer tissues. Knockdown of POPDC3 in SNU-216 cells caused increased cell migration and invasion.

Development of tools and algorithms for analyzing omics data

A comprehensive gene expression database comprising more than 35,000 human tissues samples was constructed and is being updated regularly. Also, a gene expression database providing differential expression information after treatment of diverse drugs is being constructed. Many potential drug targets and biomarkers were identified by mining these databases and are being experimentally validated.

Identification of roles of PDLIM7 Enigma in tumorigenesis

We found that Enigma forms a complex with Mdm2 directly, inhibits Mdm2 self-ubiquitination and stimulates degradation of p53. Expression of Enigma was induced by SRF and co-expression of SRF-Enigma proteins with Mdm2 was detected in cancer tissues. Our findings suggest a potential role of Enigma in tumorigenesis, and uncover a novel mechanism to attenuate the function of p53 through the SRF-Enigma-Mdm2 pathway.

SELECTED PUBLICATIONS

- Byoung-Mog Kwon & Dong Cho Han (co-Corresponding) Cryptotanshinone inhibits constitutive STAT3 function through blocking the dimerization in DU145 prostate cancer cells. *Cancer Res.* 69:193-202 (2009)
- Nam-Soon Kim (Corresponding) Human ZNF312b promotes the progression of gastric cancer by transcriptional activation of the K-ras gene. *Cancer Res.* 69:313-319 (2009)
- Jae Wha Kim (Corresponding) NDRG2 expression decreases with tumor stages and regulates TCF/b-catenin signaling in human colon carcinoma. *Carcinogenesis* 30:598–605 (2009)
- Misun Won (Corresponding) & Kyung-Sook Chung (First) RhoB induces apoptosis via direct interaction with TNFAIP1 in HeLa cells. *Int. J. Cancer* 255:2520-2527 (2009)
- Seon-Young Kim (Corresponding) Effects of sample size on robustness and prediction accuracy of a prognostic gene signature. *BMC Bioinformatics* 10:147 (2009)
- Eun Young Song (Corresponding) Monoclonal antibody against Asialo Alpha 1-Acid glycoprotein, immunochromatographic strip comprising the monoclonal antibody, and method for diagnosing, *US patent registered number* 7,575,938 (2009)
- Nam-Soon Kim (Corresponding) Peroxiredoxin I contributes to TRAIL resistance through suppression of redox-sensitive caspase activation in human hepatoma cells. *Carcinogenesis* 30:1106-1114 (2009)

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- Somatic cell nuclear transfer
- Micromanipulation of mouse, porcine and bovine eggs

RESEARCH AREAS

Stem cell biology
- A molecular basis of ESC pluripotency
- Signaling pathways that contribute to the ESC self-renewal and differentiation
- Molecular mechanisms of iPS cell generation

Studying molecular and epigenetic mechanisms of early embryo development

Organogenesis and xenotransplantation
- Researching the molecular development of organogenesis to gain a better understanding of organ development
- Studying production of knock-out clone pigs for xenotransplantation

Development and Differentiation Research Center

Division of Translational Research

Our goal is to develop platform technologies for regenerative biology through fundamental studies on development and differentiation in human and mammalian life forms.

ACHIEVEMENTS

Molecular control of early embryonic development

- Synchronizing meiotic resumption by dbcAMP treatment improves the developmental capacity and embryonic qualities of IVF and SCNT porcine embryos.
- In bovines, the compound processes of active DNA demethylation and de novo DNA methylation, along with de novo H3-K9 trimethylation, take place altogether within this very narrow window of pronucleus development.

Organogenesis and xenotransplantation

- The accumulation of reactive oxygen species (ROS) in the pancreas of an adult cloned pig leads to apoptosis.
- Production of alpha 1,3 galactosyltransferase gene knock-out cloned mini-pig

A molecular basis of ESC pluripotency

- Characterization of signaling pathways that control ESC fate
- Lineage specific differentiation of hESCs using small molecules

SELECTED PUBLICATIONS

- Jeong YS, Oh KB, Park JS, Kim JS, Kang YK. Cytoplasmic localization of oocyte-specific variant of porcine DNA methyltransferase-1 during early development. *Dev Dyn.* 238:1666-1673 (2009)
- Chae JI, Kim J, Woo SM, Han HW, Cho YK, Oh KB, Nam KH, Kang YK. Cytoskeleton-associated proteins are enriched in human embryonic-stem cell-derived neuroectodermal spheres. *Proteomics.* 9:1128-1141 (2009)
- Yong-Kook Kang (Corresponding) Notch signaling is required for maintaining stem-cell features of neuroprogenitor cells derived from human embryonic stem cells. *BMC Neurosci.* 10:97 (2009)
- Woo SM, Kim J, Han HW, Chae JI, Son MY, Cho S, Chung HM, Han YM, Kang YK. Notch signaling is required for maintaining stem-cell features of neuroprogenitor cells derived from human embryonic stem cells. *BMC Neurosci.* 10:97 (2009)
- Jeong YS, Oh KB, Park JS, Kim JS, Kang YK. Cytoplasmic localization of oocyte-specific variant of porcine DNA methyltransferase-1 during early development. *Dev Dyn.* 238:1666-773 (2009)
- Chae JI, Kim J, Woo SM, Han HW, Cho YK, Oh KB, Nam KH, Kang YK. Cytoskeleton-associated proteins are enriched in human embryonic-stem cell-derived neuroectodermal spheres. *Proteomics.* 9:1128-541 (2009)

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RESEARCH AREAS

Autoimmune disorder
Discoveries and functional verifications of biomarkers from patients suffering from immune diseases, e.g. atopic dermatitis, asthma, and rheumatoid arthritis.

Apoptosis
Identification and functional studies on new substrates of caspases, key regulators of apoptosis.

Neuroscience and neurodegenerative diseases
Proteomic research on neuronal cell functions and neurodegenerative diseases

Medical Proteomics Research Center

Division of Translational Research

We are set to establish ourselves as the R&D hub of nationwide translational research in Korea using functional and structural proteomics as a research tool. We are establishing close collaborations with many partner groups in basic research and clinical medicine. Our major research interests include immune diseases, apoptosis, neurodegenerative diseases, stem cell differentiation, and cell signaling.

Differentiation of stem cells
Discovery and functional verification of genes and marker proteins, which are involved in the differentiation of stem cells into various lineages including adipocytes and osteoblasts.

Cell signaling
Research on the mechanisms of key cell signaling pathways, e.g. MAPK and NF-kB pathway.

Research on structures and functions
Ascertainment of structures based on X-ray crystallography and NMR leading to findings concerning the unique functions and mechanisms of various proteins (such as protein tyrosine phosphatases and hormone receptors) holding medical and industrial importance.

ACHIEVEMENTS

Proteomic research on neuronal cell death
Proteomic research led to the discovery of key proteins involved in the apoptosis of neuronal cells. Functional studies of these proteins were conducted.

Research on apoptosis and cell signaling
Proteomic research led to the discovery of regulators of cellular apoptosis and cell signaling. Results were published in major scientific journals.

Structural studies on human protein tyrosine phosphatases (PTPs)
Efforts to determine the whole PTP structure broadened our understanding of function of human PTPs.

SELECTED PUBLICATIONS

- Kwang-Hee Bae & Sung Goo Park (Co-corresponding) Far upstream element-binding protein-1, a novel caspase substrate, acts as a cross-talker between apoptosis and *c-myc* oncogene. *Oncogene* 28:1529-1536 (2009)
- Dae Gwin Jeong (First) & Seung Jun Kim (Corresponding) Dephosphorylation of the C-terminal tyrosyl residue of the DNA damage-related histone H2AX is mediated by the protein phosphatase eyes absent. *J. Biol. Chem.* 284:16066-16070 (2009)
- Kwang-Hee Bae & Sang Chul Lee (Co-corresponding) Regulation of adipogenic differentiation by LAR tyrosine phosphatase in human mesenchymal stem cells and 3T3-L1 preadipocytes. *J. Cell Sci.* 122:4160-4167 (2009)
- Jeong Hee Moon (Corresponding) Temperature of peptide ions generated by matrix-assisted laser desorption ionization and their dissociation kinetic parameters. *J. Phys. Chem. B* 113:2071-2076 (2009)
- Kwang-Hee Bae & Sang Chul Lee (Co-corresponding) Proteomic analysis of liver from *HBx*-transgenic mice at early stages of hepatocarcinogenesis. *Proteomics* 9:5056-5066 (2009)
- Seung-Wook Chi (Corresponding) Broadly neutralizing anti-HBV antibody binds to non-epitope regions of preS1. *FEBS Lett.* 583:3095-3100 (2009)
- Byoung Chul Park & Sung Goo Park (Co-corresponding) Reduced formation of advanced glycation endproducts via interactions between glutathione peroxidase 3 and dihydroxyacetone kinase 1. *Biochem. Biophys. Res. Comm.* 389:177-180 (2009)

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Division of Biosystems Research

A More Prosperous Future

Solving critical problems faced by our planet and making the most out of its natural resources for a sustainable future make up an important area of activity at KRIBB. Unveiling hidden properties of plants, microorganisms and insects and using them to make new biomaterials, researching in basic bioenergy technology and extracting industrial materials from bioresources are some examples of our endeavors in this area.

Industrial Biotechnology & Bioenergy Research Center

Plant Systems Engineering Research Center

Bioinformatics Research Center

Industrial Bio-materials Research Center

Environmental Biotechnology Research Center

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- Metabolic engineering, systems biology

RESEARCH AREAS

Microbial genome analysis
- Genome sequencing and functional genomics of industrial microorganisms; deciphering microbial diversity on a metagenomic scale

Microbial cell/protein factory
- Developing novel expression systems with yeast and bacteria, metabolic pathway engineering, and molecular bacteria-plant interaction

Systems/synthetic biology
- Systems analysis and synthesis of novel biological functions, systems, and life forms by utilizing bio-parts, genetic circuitries, and metabolic pathways

Biocatalyst innovation
- Custom-made enzymes, biomolecular engineering, and innovative biocatalysis processes

Genome/EST sequencing
- High-throughput DNA sequencing of animal, plant, and microbial genomes/ESTs

Industrial Biotechnology & Bioenergy Research Center

Division of Biosystems Research

Our aim is to become a world-class research and development center specializing in microbial biotechnology by developing core technologies required for endowing microbial cell factories with novel functions through omics/systems analyses and synthetic biology. The center has established a solid platform for genomic sciences and biotechnological applications. We have established a number of international collaboration, and are actively cooperating with many academic and industrial R&D groups.

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ACHIEVEMENTS

Continued discovery of bacterial biodiversity - maintaining top ranking in the field
Dozens of new bacterial taxa and a novel class of metagenome-derived lipases were identified

Genome analysis of microbes and omics/systems analysis of the *E. coli* cell factory
Microbial genomes of a marine microbe from Dokdo, a probiotic bacterium, and the *E. coli* protein factory have been sequenced and analyzed; Genomic trajectory of adaptation was revealed in a long-term evolution experiment

Construction of a yeast protein factory for the efficient production of recombinant proteins for therapeutics and industrial enzymes
Genome-wide screening of the TFP library and efficient secretion of 'difficult-to-express' proteins and enzymes

FRET-based biosensors exhibiting increased signal intensity and novel specificity
A highly-responsive FRET signal in living cells was developed by combinatorial engineering of the domain linker and binding moiety of CFP-bp-YFP proteins

Development of biocatalytic processes
Biodiesel production with an immobilized and improved lipase; whole-cell biocatalysis

Dissecting probiotic *Paenibacillus*-plant interactions and their genome analysis
Understanding and application of *Paenibacillus*-elicited plant growth promotion and induced resistance as well as polymyxin and fusaricidin biosynthesis

Construction of automatic systems for EST analysis
PESTAS(Pipeline for EST analysis system): a web server for EST analysis and sequence mining, EKIS(EST Knowledge Integrated System): a public web server for EST data

SELECTED PUBLICATIONS

- Barrick, J. E., D.-S. Yu, ..., R. E. Lenski, J. F. Kim. Genome evolution and adaptation in a long-term experiment with *Escherichia coli*. *Nature* 461:1243-1247 (2009)
- Choi, S.-K., S.-Y. Park, ..., S.-H. Park. Identification of polymyxin synthetase gene cluster of *Paenibacillus polymyxa* and heterologous expression of the gene in *Bacillus subtilis*. *J. Bacteriol.* 191:3350-3358 (2009)
- Jeong, H., ..., F. W. Studier, P. Daegelen, J. F. Kim. Genome sequences of *Escherichia coli* B strains REL606 and BL21(DE3). *J. Mol. Biol.* 394:644-652 (2009)
- Kim, E.-Y., K.-H. Oh, ..., J.-H. Yoon. Novel cold-adapted alkaline lipase from an intertidal flat metagenome and proposal for a new family of bacterial lipases. *Appl. Environ. Microbiol.* 75:257-260 (2009)
- Kim, J. F., ..., H.-S. Park, T. K. Oh. Genome sequence of the probiotic bacterium *Bifidobacterium animalis* subsp. *lactis* AD011. *J. Bacteriol.* 191:678-679 (2009)
- Nam, S.-H, D.-W. Kim, T.-S. Jung, ..., H.-S. Park. PESTAS: a web server for EST analysis and sequence mining. *Bioinformatics* 25:1846-1848 (2009)
- Rha, E., ..., J. J. Song, S. G. Lee. Simultaneous improvement of catalytic activity and thermal stability of tyrosine phenol-lyase by directed evolution. *FEBS J.* 276:6187-6194 (2009)
- Whang, J., ..., E.-S. Choi. Efficient, galactose-free production of *Candida antarctica* lipase B by *GAL10* promoter in *⊿gal80* mutant of *Saccharomyces cerevisiae*. *Process Biochem.* 44:1190-1192 (2009)
- Yi, H.-S., ..., C.-M. Ryu. Airborne induction and priming of plant defenses against a bacterial pathogen. *Plant Physiol.* 151:2152-2161 (2009)
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- Yoon, J.-H., et al. *Seohaeicola saemankumensis* gen. nov., sp. nov., isolated from a tidal flat. *Int. J. Syst. Evol. Microbiol.* 59:2675-2679 (2009)

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- Development of "CyanoCrops" by introducing cyanobacterial genes into the chloroplast genome of crops
- Cloning of salt resistant genes from marine cyanobacteria via a functional genomics approach and the development of salt-tolerant crops
- Development of new cultivars of strawberry via genetic transformation

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- Development of an edible vaccine for Alzheimer's disease
- Development of transgenic crops
- Development of novel binary vectors for molecular farming

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- Molecular plant-microbe interactions
- Development of an oligo DNA chip for the diagnosis of pathogens
- Identification of the genes involved in the development by virus-induced gene silencing

RESEARCH AREAS

- Plant genome structure
- Functional genomics of plant-microbe interactions
- Development of an environmentally-friendly binary vector system
- Signal transduction network of plant cell death
- CyanoCrop using cyanobacterial genes

Plant Systems Engineering Research Center

Division of Biosystems Research

The center focuses on the development of green technology for the industrial application of a novel transformation system, functionally important genes, and new transgenic plants with useful traits. We have conducted research on the structure and functional genomics of economically important plants of the *Solanaceae* family (e.g. peppers, tomatoes, potatoes), and have secured successful results and platform technologies for their commercial application.

ACHIEVEMENTS

International collaboration on the analysis of the *Solanaceae* genome

Launched in 2004, this ten-year project involves twenty nations, ten of which are participating in the primary operations to decode the genomic sequence. Korea is responsible for the 2nd chromosome, which consists of 12% of the entire genome. So far, we have accomplished about 60% of our designated task.

Large-scale isolation of pepper genes and public release

We have undertaken the task of gene identification in peppers, Korea's most important vegetable product, and have finished analyzing about 120,000 expressed sequence tags. A database containing this information has been built and opened to the public. We believe that we have secured more than two-thirds of the pepper genome, which consists of 30,000 uni-genes, and expect information of varieties to be helpful in the development of new strains. (http://sol.pdrc.re.kr)

Development of platform technology for research on plant functional genomics

Virus-induced gene silencing technology, developed for the large-scale screening of genes is currently being used in the screening of many types of *Solanaceae* plants including *Nicotiana benthamiana*, peppers, and tomatoes.

Development of transplastomic technology

We have succeeded in developing transformation technology for foreign gene expression in plastids. These genes can only be inherited from the maternal line, which cannot be spread through pollen, thereby ensuring a low environmental risk.

Development of an edible plant-derived vaccine for Alzheimer's disease

Antigens for mutant β-amyloid proteins, which are known to be a cause of Alzheimer's disease, were overexpressed in potatoes as an edible vaccine. We have developed the transgenic potato, and have confirmed through experiments with mice that the potato vaccine does produce specific antibodies for β-amyloids.

SELECTED PUBLICATIONS

- JH Jeon (Corresponding) Reactive oxygen species: Regulation of plant growth and development. *Adv. Bot. Res.* 52:25-46 (2009)
- JS Moon (Corresponding) Nucleotide sequences and genome organization of a newly identified member of the genus *Carmovirus*, Soybean yellow mottle mosaic virus, from soybean. *Arch. Virol.* 154:1679-1684 (2009)
- WJ Jeong (Corresponding) Rapid and simple method for DNA extraction from plant and algal species suitable for PCR amplification using a chelating resin Chelex 100 *Plant Biotechnology Reports* 4(1):49-52 (2010)
- JH Jeon (Corresponding) Metabolic profiles of genetically modified potatoes using a combination of metabolite fingerprinting and multivariate analysis *Biotechnology and Bioprocess engineering* 14(6):738-747 (2009)

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- Tissue-specific alternative splicing for disease related gene and cancer-gene function
- Microbial analysis for Plant innate immunity

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- Gene prediction for alternative splicing & evolution of exon and intron
- Next generation sequencing data analysis for variome & Transcriptome

RESEARCH AREAS

Microarray analysis
Integrative functional genomics based on microarray expression profiling data of Korean cancer patients.

Medical informatics
Constructing an integrated DB of oriental medicine, genomics and medicine

Systems biology
Developing a disease associated protein network analysis system

Structural Bioinformatics
Establishment of structural databases on protein-protein interactions or receptor-ligand interactions for intrinsically unfolded proteins (IUPs), p53 and nicotinic acetylcholine receptors using NMR, molecular dynamics, homology modeling and ligand docking.

Next Generation Sequencing Data Analysis
Research & Development of bioinformatics algorithms and tools for next generation sequencing data: whole/targeted genome, transcriptome & RNA-Seq, miRNA, metagenome, epigenetics etc.

Bioinformatics Research Center

Division of Biosystems Research

From the high throughput sequences throughout the genomes of humans, mammals, plants and microbes, we develop databases, algorithms and application software programs for such things as analyzing diseases, cancer gene screening and plant breeding. Pathogenic and natural substance data are gained from microarray, protein sequences and structures and metabolic data at the genetic and proteomic levels.
Based on these analyses, we concentrate upon future oriented systems biology.

ACHIEVEMENTS

A world's pioneer in intrinsically unfolded proteins

The first to discover intrinsically unfolded proteins (IUPs) in the world and to report the existence of Pre-Structured Motifs (PreSMos) in IUPs and their biological significance in protein-protein interactions. Listed in Marquis Who's Who in Science & Engineering, 10th Anniversary Edition.

Gene prediction for alternative splicing &evolution of exons and introns

For the purpose of analysis and comparative genomics of alternative splicing in 15 animal species, the ASAP II database was updated. It has been widely used for assessing the evolution of exons and introns in mammalian species. With the aid of Pygr (The Python Framework for Bioinformatics), ASAP II and huge multigenome alignments were integrated and made readily accessible to users.

SELECTED PUBLICATIONS

- Jo SH, Koo DH, Kim JF, Hur CG, Lee S, Yang TJ, Kwon SY, Choi D, Evolution of ribosomal DNA-derived satellite repeat in tomato genome, *BMC Plant Biol.* 9:42 (2009)
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- Vatakis DN, Kim S, Kim N, Chow SA, Zack JA. Human immunodeficiency virus integration efficiency and site selection in quiescent CD4+ T cells. *J. Virol.* 83:6222-1233 (2009)

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RESEARCHERS

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- Search, in vivo efficacy test, mechanism study, and development of bioactive materials for prevention and treatment of metabolic syndroms (including obesity, hyperlipidemia, atherosclerosis)

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- Molecular Biology, Hepathology
- Development of antiviral, anti-cirrhosis and anti-liver cancer agents using recombinant DNA techniques and identifying active compounds from natural resources

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- Search and development of bio-materials for agriculture including biological control agents, fungicides, and TTSS inhibitors from natural resources

Ho-Yong Park hypark@kribb.re.kr
- Highly active enzymes and bio-materials from invertebrates & microbes for industrial application
- Development of bio-insecticides for the control of agricultural insects by insect pathogens

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- Microbial Biotechnology
- Enzymes for industrial and bio-energy applications
- Microbial natural products for pharmaceutical uses

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- Search and development of bio-materials for agriculture including biological control agents, insecticides and insect repellents from natural resources
- Provide imaging and analytical services, including scanning and transmission EM for bio-research

RESEARCH AREAS

Development of biodiversity-based bio-materials by convergence technology
- Development of highly active industrial enzymes from insects and microbes
- Biological catalysts to solve the biomass recalcitrance for bio-fuels
- Functional study of bio-active substances from insects and microbes

Development of antiviral agents for the treatment of hepatitis (caused by the hepatitis B virus)
- Three different antiviral agents were isolated from natural domestic plants.
- These antiviral agents which function differently on the HBV life cycle will prevent the appearance of the drug resistance effect caused by mutants which commonly occurs during antiviral agent treatment

Development of platform technology for metabolic syndrome
- Investigation of the cause and the discovery of targets for metabolic syndrome
- Screening of bioactive substances for prevention and treatment of metabolic syndrome and using them for the development of functional foods and nutraceuticals

Development of bio-materials from natural resources inhibiting microbial functions
- Search and development of inhibitors for type III secretion system responsible for the virulence of phytopathogenic bacteria
- Search and development of novel bio-materials from natural resources exhibiting biological control affects against phytopathogenic fungi

Industrial Bio-materials Research Center

Division of Biosystems Research

Research at the Industrial Bio-materials Research Center focuses on the basic and applied studies for the development highly active enzymes for industry such as potent functional bio-materials for functional foods and therapeutic agents, and biological control agents for agriculture. The objectives of our research activity are to discover and develop bio-materials from natural resources and make them available to industry, and thus to contribute to the promotion of quality of life and welfare.

ACHIEVEMENTS

Development of a proteinase, Arazyme

An enzyme that can degrade proteins even under harsh conditions was developed through a biodiversity-oriented screening system. Through some steps of translational research, the enzyme was customized to become an integral part of therapeutics, bio-functional cosmetics, feed additives, detergents, waste-treatment and leather processing. Presently arazyme-related products are being introduced to the global market by a spin-off company.

Development of highly active xylanase and lipase from insect microbes

Highly active xylanase and lipase were developed from insects and microbes. These technologies were also transferred to a related corporation for industrialization.

Development of anti-atherogenic agents for the prevention/treatment of cardiovascular disease

The abietane compounds from *Torreya nucifera* leaves and new O-acyl oxime derivatives were developed as anti-atherogenic agents. Especially, abietane compounds reduced atherosclerotic lesions and improved inflammatory conditions in high cholesterol-fed LDLr-deficient mice. These active materials can be utilized for development of nutraceuticals and new drugs for prevention and treatment of cardiovascular disease.

Development of bio-materials inhibiting liver diseases

- Establishment of screening systems for the isolation of the bio-materials treating liver diseases (promoting liver functions, hepatitis B virus diseases, liver cirrhosis, liver cancer)
- Isolation and structural determination of biomaterials for curing liver diseases
- Evaluation of efficacy in animal models and in human beings

Development of bio-materials exhibiting potent antifungal affects against phytopathogeic fungi

The dimeric sesquiterpene CHE-23C isolated from *Chloranthus henryi* exhibited 91% and 100% disease-control activity *in vivo* against tomato late blight and wheat leaf rust at concentrations of 33 and 100 μg/ml, respectively. The disease-control activity of this compound was stronger than that of the commercially available fungicide chlorothalonil, but weaker than dimethomorph. Therefore, the compound might serve as an interesting link in developing effective fungicides.

SELECTED PUBLICATIONS

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- Kwang-Hee Son and Ho-Yong Park (Corresponding) Novel GH10 xylanase, with a fibronectin type 3 domain, from *Cellulosimicrobium* sp. strain HY-13, a bacterium in the gut of *Eisenia fetida*. *Appl. Environ. Microbiol.* 75:7275-7279 (2009)
- Sung Uk Kim (Corresponding) Antifungal activity of CHE-23C, a dimeric sesquiterpene from *Chloranthus henryi*. *J. Agric. Food Chem.* 57:5750-5755 (2009)
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- Young-Ik Lee (Corresponding) Hepatitis B virus-X protein recruits histone deacetylase 1 to repress insulin-like growth factor binding 3 transcription. *Virus Res.* 139:14-21 (2009)

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- Enhancement of multi-resistances of plants using natural lipids and plant green biotechnology on natural rubber

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- Characterization of bioactive substances from microorganisms and environmental sources

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- Molecular analysis of microbial diversity and functions in contaminated environments

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- Transgenic plants with enhanced tolerance to drought stress for combating desertification

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- Molecular breeding of sweetpotato and potato plants for sustainable agriculture

RESEARCH AREAS

Plant antioxidation research
Developing industrial transgenic plants with enhanced tolerance to multiple environmental stresses for sustainable agriculture in marginal lands

Microalgae research
Using diverse microalgae in carbon dioxide sequestration and developing environmentally-friendly production technology for useful materials

Microbial community research
Developing functional microbial communities for bioremediation of contaminated soil and monitoring microbial diversity and functions

Biomaterials research
Screening, characterization, and mode-of-action studies of bioactive substances from microorganisms, plants, and environmental sources.

Environmental Biotechnology Research Center

Division of Biosystems Research

We aim to develop industrial platform technology using high-tech ecogenomics and biological resources in response to the United Nations Framework Convention on Climate Change, water pollution and soil pollution for sustainable development. To achieve this goal, we focus on the development of integrated fusion technology combined with plant science, microbial science including microalgae, and environmentally-friendly materials science.

ACHIEVEMENTS

Development of industrial plants with enhanced tolerance to multiple environmental stresses
Various transgenic crops (e.g. sweet potato, potato, poplar) through the gene manipulation of their antioxidative mechanisms were developed for sustainable agriculture on marginal lands. Root-specific promoters are under study for the production of bioenergy and functional feed materials in transgenic sweet potato plants.

Greenhouse gas reduction and beneficial material production
Outdoor mass bioreactors and cyanobacteria harvesting apparatuses were successfully developed and they showed improved efficiency in carbon dioxide fixation. The produced cyanobacterial biomass could be used in biofuel, health foods, cosmetics, and medicines.

Development of functional microbial communities for bioremediation
Dozens of functional microbial communities (FMCs), degrading petroleum oil, were obtained from oil-contaminated soil. We developed an effective technology of FMC preservation and field applications.

New bioactive metabolites from microorganisms
Microorganisms including microalgae and cyanobacteria are rich in secondary metabolites with diverse chemical structures and various biological functions. New inhibitors of bacterial fatty acid synthase (FabI, K, G) and peptide deformylase were found from microorganisms for the first time in this study and have potential for new antibacterials.

Environmentally safe natural bioactive substances from plants
Bioactive lipid compounds that enhance multi-resistances of plants to abiotic and biotic stresses were found and are being applied to agricultural fields.

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- Won-Gon Kim (Corresponding) Vinaxanthone, a new FabI inhibitor from *Penicillium* sp. *J. Antimicrob. Chemother.* 63:949-953 (2009)
- Hee-Sik Kim (Corresponding) Monitoring bacterial population dynamics using real-time PCR during the bioremediation of crude oil-contaminated soil. *J. Microbiol. Biotechnol.* 19:339-345 (2009)

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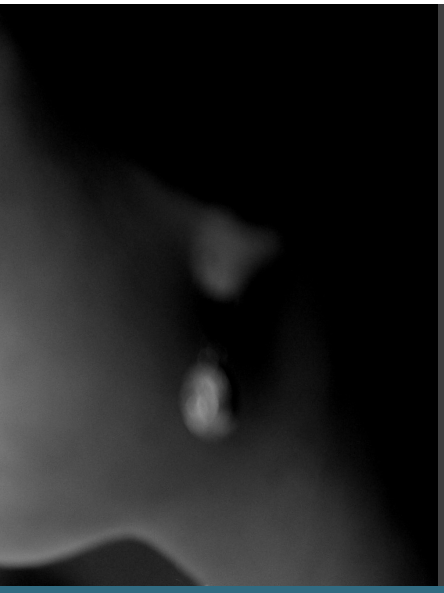
Division of Bio R&D Infrastructure

Building Infrastructure for Bio-Competitiveness

As a critical component of Korea's national information infrastructure and an organization playing a key role in national bioresource management, KRIBB carries out activities aimed at laying solid foundations for biotechnology research in our nation. Building an efficient and close-knit cooperation network for sharing bioresource information, ensuring continuous development of bioresources and better managing existing bioresources, and providing support to industrialization-related research and human resource development are some of the efforts by KRIBB in this direction.



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Biological Resource Center

Biotechnology Process Engineering Center

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- Contructing an infrastructure system supporting bioengine and biogrid
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- Development of Biodiversity Information Network
- Development of DNA barcode system aiding species identification through the analysis of standardized gene regions

RESEARCH AREAS

Development of an integrated national genomics database
- Developing an integrated database of genomic information on humans, animals, plants, and microorganisms, and a platform for joint use
- Developing support systems for the identification/analysis of useful genes and core platform technology for bioinformatics

Development of a tight network and database transaction system for major research organizations
- Building a network among genome research institutions to serve as a center for sharing genomic information
- Cyber community (BioWiki, BioBlog, BioNews, etc.) to facilitate sharing of researchers' interests and resources

Distribution of bioinformatics research, analytical tools, and package development
- Distribution of an EST cluster and alternative splicing analysis software
- Integrated platform (BioWorkbench) for analyzing biological data upon an automated bioinformatics infrastructure
- Framework system(BioPipe) oriented by workflows and WEB 2.0 to analyze large-scale biological problems

Support of large-scale bioinformatics analysis and collaborative research
- Personal genomics for individual genome sequencing and SNP analysis
- Offering support for the *Brassica* genome analysis map

Development of bioinformatics technology and support
- Developing/distributing software for information analysis of gene regulation/function
- Analyzing genome function and proteomes

Korean Bioinformation Center

Division of Bio R&D Infrastructure

Our goal is to develop a bioinformation infrastructure that will facilitate efficient acquisition, analysis, and circulation of the ever-increasing flow of bioinformation. We are developing a coherent network among the major genome research organizations, building integrated databases, and supplying an information analysis system. By providing a shared infrastructure, we intend to raise the standard of Korean bioinformatics research facilities in order to lift Korea into world's top five bioinformation hub in terms of quality and quantity of output.

ACHIEVEMENTS

- Integrated database construction of the genomic information generated in Korea
- Domestic and international bioinformatics educational services
- Establishment of the Collaborative Bio-Research Network
- The first Korean genome sequencing and analysis

We have developed the following bioinformatics tools, databases, and services :
Genomics GAzer / ADGO / WITA / WSPMaker / Mitome / TFExplorer / Clustalw-MP / Expressome ArrayRetriever / NormPipe / ArrayCluster / SAGED / ESTpass / EzTaxon(SNU) / Proteome Localizome / DNA to protein translation / Protein sequence / information / Interactome InterPare / InterFunc / PsiBase / GSnet / SynechoNET / XooNET / MassNet / Variome Variome.NET / SNP@WEB / SNP@Domain / SNP@Ethnos / SNP2NMD / SNP@Promoter / FESD
Diseasome WIGED / Centi / Textome Patome

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- Byung Wook Lee (First author) CleanEST: a database of cleansed EST libraries. *Nucleic Acids Res.* 37:D686-D689 (2009)
- Sung Hoon Lee (First author) The first Korean genome sequence and analysis: Full genome sequencing for a socio-ethnic group. *Genome Res.* 19:1622-1629 (2009)
- Byung Wook Lee (Corresponding) Protein comparison at the domain architecture level. *BMC Bioinformatics.* 10:s5 (2009)

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RESEARCH AREAS

Management of Biological Resources
Collection and preservation of core biological resources, both foreign and domestic, offering public support by distributing biological resources to academia, industry and research institutions, and organizing patent strain deposits

Development of core technologies for valuable bio resources
Developing platform technology for the identification and preservation of useful biological resources, the constant screening of new species

Construction of an information network and support of various services
Building local and international information networks for biological resources and providing support for workshops, conferences, consultations, and etc.

Biological Resource Center

Division of Bio R&D Infrastructure

As a national bio-infrastructure for biological resources, we perform the roles of biotechnology think-tank and bio R&D. The main goal of the BRC, as a national infrastructure, is to collect, preserve and distribute biological resources.

ACHIEVEMENTS

Collection, preservation and distribution of biological resources

We acquired over 1,700 strains, including bacteria, actinomycetes, yeasts, filamentous fungi, anaerobes, cell lines and patent strains, and preserved about 64,000 cases for long-term preservation of biological resources. KCTC is the second culture collection in the world in acquiring new microbial resources in 2009 of the world. We distributed over 5,000 strains to academia, industry, and research institutions.

Research activities

We published 45 papers concerning biological resources, and described 24 new species. We also generated and registered 9 patents, including one international patent. We established a management system for biological resources using barcodes (IRIS, Information of Resource-Indexing System, v3.0) for the implementation of systematic and efficient management. We developed an automation system (automatic sealer for freeze-drying ampoules) for the efficient management of biological resources.

Construction of local and international networks for biological resources and information

We held four workshops and two conferences, and offered consultation and technical support for more than 7,000 cases

SELECTED PUBLICATIONS

- Jung-Sook Lee (Corresponding) *Gordonia kroppenstedtii* sp. nov., a phenol-degrading actinomycete isolated from a polluted stream. *Int. J. Syst. Evol. Microbiol.* 59:1992-1996 (2009)
- Chang-Jin Kim (Corresponding) *Nocardioides sediminis* sp. nov., isolated from a sediment sample. *Int. J. Syst. Evol. Microbiol.* 59:280-284 (2009)
- Song-Gun Kim (Corresponding) A simple technique to convert sitting-drop vapor diffusion into hanging-drop vapor diffusion by solidifying the reservoir solution with agarose. *J. Appl. Crystallography* 42:975-976 (2009)
- Young-Hyo Chang (Corresponding) *Bacillus acidiproducens* sp. nov., vineyard soil isolates that produce lactic acid. *Int. J. Syst. Evol. Microbiol.* 59:2226-2231 (2009)
- Kyung Sook Bae (Corresponding) The rust fungus Gymnosporangium in Korea including two new species, G. monticola and G. unicorne. *Mycologia* 101:790-809 (2009)

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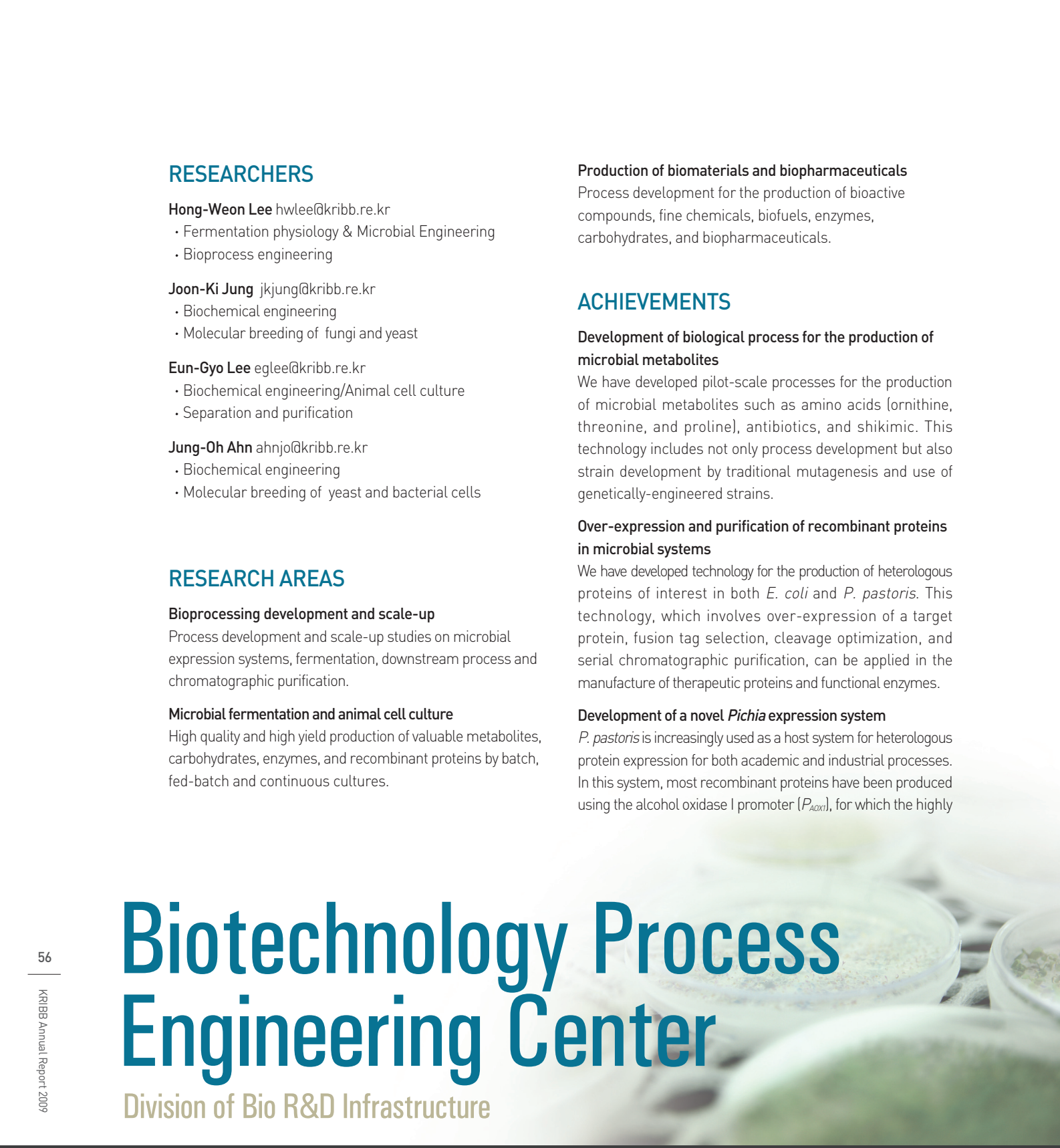
Biotechnology Process Engineering Center

Division of Bio R&D Infrastructure



We aim to develop industrial platform technology for biologically processed goods and materials. In particular we are intensively carrying out a process scale-up towards the optimization and commercialization for the production of biomaterials and biopharmaceuticals through pilot-plant facilities in order to expand research outcomes and to stimulate commercialization. Additionally, we are systematically supporting the business activities of the bioindustry and cultivating human resources through academic-industrial collaboration.

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- Separation and purification

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- Biochemical engineering
- Molecular breeding of yeast and bacterial cells

RESEARCH AREAS

Bioprocessing development and scale-up
Process development and scale-up studies on microbial expression systems, fermentation, downstream process and chromatographic purification.

Microbial fermentation and animal cell culture
High quality and high yield production of valuable metabolites, carbohydrates, enzymes, and recombinant proteins by batch, fed-batch and continuous cultures.

Production of biomaterials and biopharmaceuticals
Process development for the production of bioactive compounds, fine chemicals, biofuels, enzymes, carbohydrates, and biopharmaceuticals.

ACHIEVEMENTS

Development of biological process for the production of microbial metabolites
We have developed pilot-scale processes for the production of microbial metabolites such as amino acids (ornithine, threonine, and proline), antibiotics, and shikimic. This technology includes not only process development but also strain development by traditional mutagenesis and use of genetically-engineered strains.

Over-expression and purification of recombinant proteins in microbial systems
We have developed technology for the production of heterologous proteins of interest in both *E. coli* and *P. pastoris*. This technology, which involves over-expression of a target protein, fusion tag selection, cleavage optimization, and serial chromatographic purification, can be applied in the manufacture of therapeutic proteins and functional enzymes.

Development of a novel *Pichia* expression system
P. pastoris is increasingly used as a host system for heterologous protein expression for both academic and industrial processes. In this system, most recombinant proteins have been produced using the alcohol oxidase I promoter (P_{AOX1}), for which the highly

volatile and inflammable compound methanol is required for transcription. As alternatives to P_{AOX1}, we developed two strong methanol-free promoters: translation elongation factor 1a promoter (P_{TEF1}) with highly growth-associated expression characteristics and phosphate-responsive promoter (P_{PHO89}) of a sodium phosphate symporter. Also, a cost-effective and simple P_{TEF1}- and P_{PHO89}-based fermentation process was developed for industrial applications. Furthermore, we developed an easy-to-use multicopy system in *P. pastoris* using autonomous replication sequences (ARS) and an episomal plasmid to maintain multiple genes of interest in *P. pastoris* and enhance heterologous expression 5-fold higher than achievable using a single copy integration in *P. pastoris*.

Development of recombinant vaccines for livestock

Apx toxins are highly immunogenic and essential for protection against *Actinobacillus pleuropneumoniae* infection. Recently, commercialized vaccines against major Apx toxins (ApxI–ApxIII) produced either by pathogenic *A. pleuropneumoniae* or genetically-engineered strains have become available. We developed an integrated system for the expression of Apx toxins as subunit antigens against porcine pleuropneumonia that makes it possible to obtain soluble and biologically active Apx toxins in *E. coli* without additional refolding steps. Additionally, the products from the developed expression vectors elicited immunological responses and protective immunity against *A. pleuropneumoniae* infection in an infected guinea pig model.

Production of therapeutic proteins in mammalian cell culture

Mammalian cell culture has become the dominant system for the production of recombinant human proteins for clinical applications because of their proper protein folding and complete post-translational modification. We are currently developing rCHO cell culture technology for the manufacture of therapeutic proteins in a suspension bioreactor. Additionally, we are improving upon available boosting technology for high-quality proteins using genetically engineered cells. Furthermore, we have developed chromatographic purification technologies and high-throughput precision analysis.

SELECTED PUBLICATIONS

- Hong-Weon Lee (Corresponding) Phosphate-responsive promoter of a *Pichia pastoris* sodium phosphate symporter. *Appl. Environ. Microbiol.* 75:3528-3534 (2009)
- Eun-Gyo Lee (First author) Efficient proteolytic cleavage by insertion of oligopeptide linkers and its application to production of recombinant human interleukin-6 in *E. coli*. *Enzyme Microb. Technol.* 44:254-262 (2009)
- Eun-Gyo Lee (First author) Purification and characterization of recombinant human erythropoietin from milk of transgenic pigs. *J. Chem. Technol. Biotechnol.* 84:643-649 (2009)
- Joon-Ki Jung (Corresponding) High-level production of lycopene in metabolically engineered E. coli. *Process Biochem.* 44:899-905 (2009)

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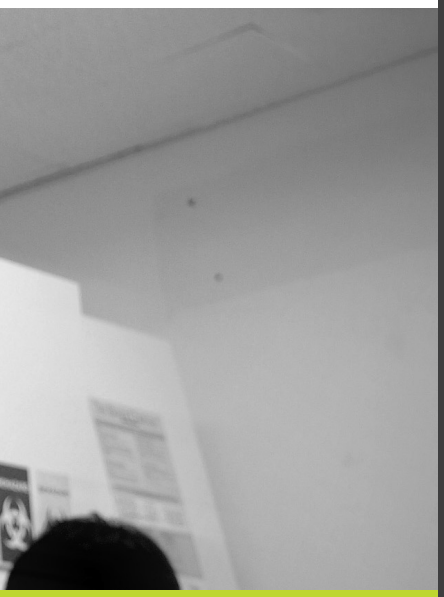
Ochang Branch Institute

Biotech, the New Engine Driving Future Economic Growth

At KRIBB, we work hard to unleash the vast potential of biotechnology to enable medical breakthroughs, through activities like developing antibodies useful for cancer treatment and anti-cancer candidates using functional immune cell techniques. Developing biomarkers related to difficult-to-cure diseases and researching their functions, identifying new drug candidates and evaluating their effectiveness, building a data bank of biopharmaceutical materials and providing support for new drug development are also among the core activities at KRIBB, helping push back the limits in biomedical research.



BIO-THERPEUTICS RESEARCH INSTITUTE

Therapeutic Antibody Research Center

Stem Cell Research Center

Immune Modulator Research Center

Molecular Cancer Research Center

Chemical Biology Research Center

DIVISION OF BIO-INFRA STRUCTURE

Bio-Evaluation Center

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RESEARCH AREAS

Cancer cell biology
- Tumor progression and metastasis
- Apoptosis
- Intracellular signaling
- Stem cells

Discovery and validation of drug targets for antibody-based cancer therapy
- Discovery of drug targets through genomics and antibody approaches
- Studies on the role of identified targets in tumor progression
- Validation of drug targets as anti-cancer agents

Development of therapeutic antibodies
- Development of therapeutic antibodies such as human monoclonal antibodies and humanized antibodies
- Optimization of therapeutic antibodies through affinity maturation
- Construction of a mammalian cell line producing therapeutic antibodies and proteins
- Production and purification of therapeutic antibodies and proteins
- In vitro and in vivo study of therapeutic antibodies and proteins

Therapeutic Antibody Research Center

Ochang Branch Institute

Our goal is to discover new targets for antibody-based cancer therapy and to develop therapeutic antibodies. We also study the molecular mechanism of cancer progression and validate anti-cancer drug targets

ACHIEVEMENTS

Discovery of therapeutic target PAUF for pancreatic cancer therapy and development of human anti-PAUF monoclonal antibodies

The mining of a DNA microarray expression database allowed us to identify that PAUF is overexpressed in pancreatic cancer and plays an important role in progression and metastasis of the tumor. Human antibodies targeting PAUF inhibited tumor growth in nude mice bearing human pancreatic cancer.

Discovery of therapeutic target TMPRSS4 for cancer therapy and development of human anti-TMPRSS4 monoclonal antibodies

A Novel type II transmembrane serine protease TMPRSS4 was identified and characterized as a cancer therapeutic target. The new protease has proven to be highly up-regulated in lung cancer tissues and is associated with the invasiveness, motility, and cell-matrix adhesion of cancer cells. Human monoclonal antibodies to TMPRSS4 have been developed and their anti-cancer properties are under investigation.

Technology transfer

- Human anti-PAUF monoclonal antibodies (L/O to Rexbio, Inc, fee 1 billion Won)
- Human anti-VEGR2 monoclonal antibody (L/O to PharmAbcine, Inc, fee 1 billion Won)
- Human anti-VCAM1 monoclonal antibodies (L/O to Hanwha, Inc, fee 500 million Won)

SELECTED PUBLICATIONS

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- Suyong Choi, Sin-Ae Lee, Tae Kyoung Kwak, Hyeon Jung Kim, Mi Ji Lee, Sang-Kyu Ye, Sung-Hoon Kim, Semi Kim, and Jung Weon Lee Cooperation between integrin α5 and tetraspan TM4SF5 regulates VEGF-mediated angiogenic activity. *Blood* 113, 1845-1855 (2009)

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- Regulation of NK differentiation from hematopoietic stem cells

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- Molecular mechanism and regulation of NK activation

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- Functional studies of the genes involved in NK differentiation

RESEARCH AREAS

NK cell differentiation
- Developing platform technology for the differentiation of stem cells
- Developing platform technology for the regulation of NK cell differentiation

NK cell therapy
- Developing NKcell therapy for cancer treatment
- Developing customized NK cell therapy through preclinical Study

Stem Cell Research Center

Ochang Branch Institute

Our goal is to identify the differentiating factors between adult stem cells and immune cells, and by researching their functions, develop core platform technology for immune cell therapies for targeting cancer.

ACHIEVEMENTS

Molecular profiling for NK cell differentiation from stem cells

NK cells develop from hematopoietic stem cells (HSCs) in the bone marrow. To understand the molecular regulation of NK cell development, serial analysis of gene expression (SAGE) was applied to HSCs, pNK, mature NK cells cultured without (-OP9) or with (+OP9) stromal cells, OP9. From 170,464 total individual tags from four SAGE libraries, 35,385 unique genes were identified. The Identification of genome-wide profiles of gene expression in different stages of NK cell development affords us a fundamental basis for defining the molecular network during NK cell development.

Molecular mechanism of VDUP1 during NK cell differentiation from stem cells

In order to observe the mechanism of VDUP1, the differentiation gene of NK cells, knock-out mice for this gene were developed. Observation of their small intestines revealed abnormal proliferation and a 70% decrease in the number and activity of NK cells, leading to depressed anticancer activity, and thus proving that this gene does in fact play a critical role in NK cell differentiation.

Development of immune therapy techniques utilizing NK cells

Based on the observations in NK differentiation, immunotherapy for cancer has been designed. Platform technology for drug development of cancer immune therapy was established and has been used in the treatment of incurable diseases involving immune cells.

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- Inpyo Choi (Corresponding) VDUP1 potentiates Ras-mediated angiogenesis via ROS production in endothelial cells. *Cell. Mol. Biol.* 55:1096-1103 (2009)
- Inpyo Choi (Corresponding) Tumor necrosis factor-α enhances IL-15-induced natural killer cell differentiation. *BBRC* 386:718-723 (2009)
- Inpyo Choi (Corresponding) Pseudomonas aeruginosa eliminates natural killer cells via phagocytosis-induced apoptosis. *PLos Pathogens* 5:e1000561 (2009)
- Inpyo Choi (Corresponding) RasGRP1 is required for human NK cell function. *J. Immunol.* 183:7931-7938 (2009)

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- Identification of biologically active compounds from natural sources.
- Evaluation of natural products and/or extracts against chronic inflammatory diseases.

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- Identification of new molecular targets related to immune diseases and evaluation of natural products for development of active compounds.
- Construction of natural product library

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- Establishment of screening systems for metabolic diseases including atherosclerosis and obesity.
- Development bio-active compounds for treatment of metabolic diseases.

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- Evaluation of anti-inflammatory and anti-asthmatic activity of natural products using asthmatic murine model and cell-based assay.
- Identification of new bio-markers for asthma treatment.

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- Chemical modification of natural compounds for improvement of biological activity.
- Organic synthesis for development of new drug candidates.

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- Evaluation natural products for anti-viral activity in vitro & in vivo.
- Development of new active compounds against viral diseases including influenza virus, rotavirus, coronavirus, rhinovirus and enterovirus.

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- Identification of biologically active compounds from natural sources.
- Structure elucidation of natural products using NMR, MS

RESEARCH AREAS

Molecular targets related to immune diseases
- Identification of major genes & proteins involved in asthma and their functional analysis.
- Establishment of bioassay/screening systems using the molecular targets of asthmatic process.

Chronic disease modulation
- Researches of cellular response modulators involved in immune cell activation.
- Researches of the inhibitory activity of respiratory viruses.
- Researches of molecular targets of metabolic diseases or cancers.

Immune Modulator Research Center

Ochang Branch Institute

Our aim is to develop natural drugs/ drug candidates from medicinal plants and other natural sources which are effective against chronic diseases such as chronic inflammation (asthma), metabolic diseases, viral infection and cancers.

Natural product Chemistry

- Isolation of bio-active metabolomes from medicinal plants and other natural sources.
- Elucidation of natural product structure using analytical instruments (HPLC, LCMS, NMR)
- Modification of natural products and organic synthesis for improving biological activity.

Natural product library

- Production of plant extracts using domestic and foreign medicinal plants.
- Management of plant extracts bank and natural compound library.

ACHIEVEMENTS

Identification of natural products effective on chronic diseases

Development of active compounds from natural sources and evaluated their biological activities especially for asthma, cancer or metabolic disorders.

Development of anti-viral agents

For natural anti-viral agents, several kinds of natural products showing significant activity against white-spot syndrome virus was discovered. Preparations are now being made for its industrialization.

Construction of biomaterial infrastructure

Plant materials are collected and the extracts of them have been manufactured and deposited in Plant Extract Bank (over 5,000 extracts; domestic, 11,000 extracts; international) and distribute them to researchers.

Industrial research

We have developed a natural drug for asthma, a neutraceutical for atherosclerosis and drug candidates for cholesterol lowering agents and licensed-out them to pharmaceutical companies.

SELECTED PUBLICATIONS

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- Lee, M.-Y., Park B.-Y., Kwon, O.-K., Yuk, J.-E., Oh, S.-R., Kim, H.-S., Lee, H.-K. and Ahn K.-S. Anti-inflammatory activity of (-)-aptosimon isolated from *Daphne genkwa* in Raw264.7 cells. *Int. Immunopharmacol.* 9:878-883 (2009)
- Choi, H. J., Song, J. H., Park K. S., Kwon D. H. Inhibitory effects of quercetin 3-rhamnoside on influenza A virus replication. *Eur. J. Pharm. Sci.* 37:329-333 (2009)
- Lee, M.-Y., Kim, S., Kwon, O.-K., Oh, S.-R., Lee, H.-K. and Ahn, K.-S. Anti-inflammatory and anti-asthmatic effects of resveratrol, a polyphenolic stilbene, in a mouse model of allergic asthma. *Int. Immunopharmacol.* 9:418-424 (2009)

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- Isolation and structure determination of biologically active substances from natural products.
- Development of drug candidates/nutraceuticals for the prevention and treatment of metabolic diseases such as obesity and type 2 diabetes

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- Discovery and optimization of anti-cancer drugs-lead from chemical library and natural products targeted NF-kB, HIF-1, and PPAR and evaluation of their efficacy in animal models
- Molecular pharmacology and target discovery of bioactive natural products

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- Molecular genetic analysis of natural products biosynthesis.
- Synthetic biotechnology of artificial biosynthetic pathways.
- Discovery and optimization of anti-cancer drugs-lead from Microbial metabolites targeted Hsp90 protein

Kyeong Lee kaylee@kribb.re.kr
- Medicinal chemistry and chemical biology of a small molecule inhibitor of HIF(Hypoxia Inducible Factor) pathway as a potential anticancer agent
- Development of ansamycin analogues as a potent HSP90 inhibitor
- Total synthesis of biologically active natural products

RESEARCH AREAS

- Target identification and validation
- Discovery of molecular target for anti-cancer drug development and biological and chemical validation of the target
- Discovery and optimization of anti-cancer drugs from chemical libraries and natural products and evaluation of their efficacy
- Elucidation of molecular mechanism of drug candidates
- Molecular genetic manipulation of natural products Biosynthesis

Molecular Cancer Research Center

Ochang Branch Institute

The goals of the molecular cancer research center are to discover novel molecular targets for anticancer drug screening and to develop anti-cancer drug candidates against the novel targets. We apply functional and chemical genomics in order to identify the gene or protein involved in tumor progression and metastasis. To find novel anti-cancer agents, we screen chemical libraries and natural products using cell-based assay systems.

ACHIEVEMENTS

Development of a small molecule inhibitor of HIF pathway

Structural modification of a hit compound discovered during high-throughput screening using an HRE-dependent reporter assay has revealed a novel class of HIF-1 inhibitors, which potently inhibit the HIF-1a protein accumulation and its target gene expression under hypoxic conditions in human hepatocellular carcinoma Hep3B cells.

Validation of DRG9 in an animal model as an oncogene

A novel protein, DRG9, has been identified via the elucidation of a molecular mechanism of a p50 selective inhibitor, a natural diterpene compound. This protein, which is induced by a variety of kB activators, potently stimulates kB target gene expression, p65/RelA transcriptional activity, and HIF-1a accumulation. Furthermore, over-expression of DRG9 in cancer cells significantly increased its anchorage independent growth, invasiveness, and angiogenic activity, suggesting that DRG9 could be an oncogenic protein.

Improved Hsp90 inhibitors via Engineering of the geldanamycin Biosynthetic Genes

We developed a series of potent heat shock protein (Hsp) 90 inhibitors based on the polyketide natural product geldanamycin via biosynthetic gene engineering techniques. There is huge potential to create novel organic molecules through deliberate in vivo and in vitro engineering of these pathways for production of human and veterinary pharmaceuticals, specialty chemicals, and high value biomaterials.

SELECTED PUBLICATIONS

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- Jung Joon Lee (Corresponding) Hypoxia-inducible factor-1 inhibitory benzofurans and chalcone-derived diels-alder adducts from Morus species. *J. Nat. Prod.* 72:39-43 (2009)
- Young-Soo Hong (Corresponding) Rational biosynthetic engineering for optimization of geldanamycin analogues. *ChemBioChem* 10:1243-1251 (2009)
- Kyeong Lee (Corresponding) The first total synthesis of moracin O and moracin P, and establishment of the absolute configuration of moracin O. *Chem. Commun.* 14:1879–1881 (2009)
- Hyun Sun Lee (Corresponding) Diacylglycerol acyltransferase-inhibitory compounds from Erythrina senegalensis. *Arch. Pharm. Res.* 32:43-47 (2009)

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- Cosmetics material science

RESEARCH AREAS

Obesity/Diabetes
Developing anti-obesity and anti-diabetic lead compounds with regulatory roles in the metabolism and gene expression

Anti-osteoporosis
Developing new bioactive compounds inhibiting osteoclast differentiation from oriental herbs and plant sources

Epigenomic modulators
Developing bioactive compounds regulating DNA methyltransferase-mediated gene expression and carcinogenesis

Beauty
Discovering novel inhibitory compounds against melanin synthesis and skin damage

Microbial metabolite biotechnology
Discovering bioactive secondary metabolites and constructing library of microbial secondary metabolites

Chemical Biology Research Center

Ochang Branch Institute

The goal of the research center is discovering the bio-functional drug candidates from the metabolites of microorganisms and plants and defining the function of their cellular targets for application to chemotherapeutics development. In order to accomplish this goal, we adopt chemical biology techniques based on biometabolites and cellulomics technology to develop medicinal and bio-functional compounds.

ACHIEVEMENTS

Isolation of ER-stress inducer and inhibitor

An endoplasmic reticulum (ER)-stress inducer was isolated from a plant extract. This compound strongly induced the expression of ER-stress-associated proteins, including GRP78 chaperone, and splicing of XBP-1 mRNA, a hallmark of ER-stress-induced IRE-1a activation. On the other hand, an inhibitor of ER-stress was also isolated to be used as an inhibitor of type II diabetes mellitus. Both of them are expected to be challenging in cancer therapeutics and anti-diabetes.

Isolation of osteoclast differentiation inhibitors

Bone marrow cells were isolated from mice and induced to differentiation into osteoclasts. Metabolites were screened and purified from oriental herbs including black ginseng to be effective utilizing TRAP assay and staining methods. These compounds are promising candidates for osteoporosis treatment.

Isolation of DNA methyltransferase inhibitors and new target tumor suppressors genes

Purified compounds from a fungus was found to have an inhibitory activity against human DNA methyltransferase-1 in vitro and cellular system. The compounds elevated tumor suppressor gene expression in HCT116 cells. In addition, a few tumor suppressor genes were revealed to be regulated by DNA methylation in K-ras overexpressing prostate cancer cells. Hence the compounds and the targets are valuable for chemotherapeutics development.

SELECTED PUBLICATIONS

- Jong-Seog Ahn (Corresponding) Isolation of the protein tyrosine phosphatase 1B inhibitory metabolite from the marine-derived fungus *Cosmospora* sp. SR-5060. *Bioorg. Med. Chem. Lett.* 19:6095-6097 (2009)
- Bo-Yeon Kim (Corresponding) ATM blocks tunicamycin-induced endoplasmic reticulum stress. *FEBS Letters*, 583:903-908 (2009)
- Jae-Hyuk Jang (Second) *Psychromonas agarivorans* sp. Nov., a novel agarolytic bacterium. *Int. J. Sys. Evol. Microbiol.* 59:1262-1266 (2009)
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- Efficacy evaluation of immunomodulatory and anti-cancer agents

RESEARCH AREAS

Living modified organisms (LMOs)
Conducting genetic analysis of LMOs as well as assessment of risk on both human and environment of LMOs

New drugs
Discovery and preclinical evaluation/optimization of new drug candidates

Laboratory animals
Role as a national laboratory animal bank and technical service center, Development and and evaluation of genetically modified animals

Bio-Evaluation Center

Ochang Branch Institute

Our aim is to establish collective as well as specific infra-structure of techniques, facilities, and manpower to support effective and successful development of biotech products. For this purpose, we have not only constructed developmental- & evaluation-infra for optimizing, analyzing, and standardizing living modified organisms, drug candidates and laboratory animals, but also assessed the usefulness and risks of biotech research & development processes as well as biotech products themselves so as to help and facilitate their commercialization.

ACHIEVEMENTS

Living modified organisms

We have established and developed infrastructures for genetic analysis and assessment of risks on human and environment of living modified organisms. In particular, we have been assessing the potential risks of domestically developed transgenic rices, chilli peppers, potatoes, poplars and rootstocks for watermelons. We have also conducted National Environmental Monitoring on domestic soybeans, corns and oilseed rapes and inspected the extent of their genetic contamination by imported LMOs.

Drug discovery

We developed and implemented an integrated infra structure for drug discovery encompassing preclinical efficacy, ADME and toxicity evaluations. We have been applied this technology platform to the discovery and preclinical evaluation of drug candidates in the areas of cancer and immune-related diseases and supported drug discovery of pharmaceutical industry as well as academia and research institutes.

Laboratory animal resources

We are the only laboratory animal resource bank in Korea. Our main activities are development, collection, maintenance, distribution and standardization of laboratory animals to to support domestic bio-researches using laboratory animals. Also, we are providing public services such as environmental, genetic and health monitoring of animals to up-grade experimental environment using laboratory animals.

SELECTED PUBLICATIONS

- Chang-Gi Kim (First) & Hwan Mook Kim (Corresponding) Gene flow from genetically modified to conventional chili pepper (*Capsicum annuum L.*). *Plant Sci.* 176:406-412 (2009)
- Soon-Chun Jeong (Corresponding) & Hwan Mook Kim (Corresponding) A framework for molecular genetic assessment of a transgenic watermelon rootstock line. *Plant Sci.* 176:805-811 (2009)
- Jong Soon Kang (First) & Hwan Mook Kim & Song-Kyu Park (Corresponding) A novel δ-lactam-based histone deacetylase inhibitor, KBH-A42, induces cell cycle arrest and apoptosis in colon cancer cells. *Biochem. Pharmacol.* 78:486-494 (2009)
- Kiho Lee (First) & Hwan Mook Kim (Corresponding) Transport and metabolism of the antitumor drug candidate 2'-benzoyloxycinnamaldehyde in Caco-2 cells. *Xenobiotica* 39: 881-888 (2009)

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- Developing cell and tissue resources derived from non-human primates and conducting research for their applications
- Developing new breeder miniature pigs for research and development of bio-organs

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- Study on the functional relationship of membrane proteins involved in mammalian fertilization
- Down-regulation of membrane proteins through endocytosis mechanism

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- Development of specific detection methods for pathogen identification from animal samples
- Structure/function studies of lipopolysaccharides (*Salmonella*, *Yersinia* spp.)

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- Oxidative stress signaling in mammals

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- Non-human primate pathology

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RESEARCH AREAS

Acquisition/propagation/distribution of specific pathogen free (SPF) primate resources
Acquiring and propagating SPF primate resources, and then distributing them to industrial/academic/research institutions

Standardization in handling and regulating lab requirementsfor primate research
- Maintaining quality standards of primate resources by monitoring bacteria, viruses and general health parameters
- Establishing a standard operating procedure (SOP) for providing guidelines for the breeding and management of primate resources at the international level

***Xenotransplantation* research**
Transplanting organs (e.g. pancreatic islet, heart) from transgenic germ-free pigs into SPF primates and analyzing the efficacy and safety of the organs transplanted

Regenerative medical research and applications
Using primate disease models in cell therapy and gene therapy research, and evaluating their efficacy/safety for the treatment of incurable diseases

Preclinical efficacy assessment of newly-developed drug candidates
Applying various biodrugs and biomaterials to SPF primates in order to evaluate their efficacy

Korea National Primate Research Center

Ochang Branch Institute

The NPRC was established in the KRIBB as a major national infrastructure for purposes of supporting industrial/academic/research institutions in their pursuit of developing xenotransplant organs, providing animal models for research in regenerative medicine and incurable diseases, and evaluating the preclinical trials of new drug candidates.

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Evaluation of immunogenicity and safety of vaccine candidates
Testing various vaccines and AIDS vaccines and assessing their immunogenicity, efficacy and safety

Development of disease models
Constructing disease models for incurable diseases from primates, which have metabolic pathways most similar to man, and thus developing new drugs and applications for organ and regenerative research

Developmental biotechnology and applications Establishing cell resources, including embryonic stem cells and a variety of tissue cells, and applying them to cell therapy, nuclear transfer, and molecular mechanism study

Molecular identification and characterization of non-human primate genes
Investigation of molecular mechanisms of gain or loss of genes in various primates

Collaboration/support for nationwide non-institutional research involving primates
Providing specialized technology and information about primate care and facilities to other researchers, and conducting collaborative research for the development of related technologies

ACHIEVEMENTS

Acquisition of primate resources
Primates give us valuable opportunities in providing non-human physiological/anatomical data required for biomedical research and its applications. The NPRC currently houses six types of SPF primates: Rhesus monkeys, Cynomolgus monkeys, African green monkeys, Japanese monkeys, Squirrel monkeys and Common marmosets for a total of 188 animals.

Transfer of primate-related resources and techniques to national partners of industrial /academic/research institutions
The NPRC shares its primate-related expertise with researchers nationwide, in fields such as neuroscience, pharmacokinetics, etc. We provide services for the upkeep of SPF primates, including microbiological monitoring, quarantine and maintenance workshops, and also train the personnel (e.g. veterinarians and breeders) who work with the primates.

Collaboration with national and international research teams
We conducted collaborative studies in various fields, including xenotransplantation and the pharmacokinetic evaluation of therapeutic drugs against aplastic anemia. For introduction of the baboon monkey, we cooperated with the Washington, Tulane, and Southwest National Primate Research Centers, and are currently collaborating with world-renownresearchers in embryo implantation and development. We are also working together with domestic companies for the development of mini-pigs useful in generation of *Xenotransplantational* organs.

SELECTED PUBLICATIONS

- Sang-Hyun Kim (First) & Kyu-Tae Chang (Corresponding) Structural modifications of outer membrane vesicles to refine them as vaccine delivery vehicles. *Biochim. Biophys. Acta* 1788:2150-2159 (2009)
- Sang-Rae Lee (First) & Kyu-Tae Chang (Corresponding) Multi-immunogenic outer membrane vesicles derived from an MsbB-deficient Salmonella enterica Serovar Typhimurium Mutant. *J. Microbiol. Biotechnol.* 19:1271-1279 (2009)
- Jae-Won Huh (First) & Kyu-Tae Chang (Corresponding) Gain of new exons and promoters by lineage-specific transposable elements-integration and conservation event on CHRM3 gene. *Mol. Cells* 28:111-117 (2009)
- Jae-Won Huh (First) Lineage specific evolutionary events on SFTPB gene: Alu recombination-mediated deletion (ARMD), exonization, and alternative splicing events. *Gene* 435:29-35 (2009)
- Kyu-Tae Chang (Corresponding) Importance of the porcine ADAM3 disintegrin domain in sperm-egg interaction. *J. Reprod. Devel.* 55:156-162 (2009)

Jeonbuk Branch Institute

Enhancing Industrial Value of Biotechnology through Development of New Biomaterials Technologies

The researcher team at the Jeonbuk Branch Institute develops industrially-applicable microorganisms and enzymes as well as their processing techniques, to provide total solutions for production of useful biomaterials and build a production system for high value-added biomaterials. The institute's research activities are largely geared toward the industrialization of biomaterials extracted from natural sources and development of practical technologies. By providing technical support to firms for application of cutting-edge technologies for production and mass-production, the institute is contributing to the growth of the Korean bioindustry.

Microbe-based Fusion Technology Research Center

Eco-Friendly Biomaterial Research Center

Bioindustrial Process Center

Jeonbuk Branch Institute

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- Development of the technology to prepare a genomic library from single unculturable microorganisms sorted from nature

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- Development of protocol to screen industrial enzymes from metagenome

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- Development of platform technologies for screening useful enzymes using High Thoughput Screening System
- Development of the tool box applicable to the white biotechnology based on systems biotechnology

RESEARCH AREAS

Microbial metabolic engineering
- Production of microbial metabolites
- Metabolic engineering of industrial microorganisms

Bioconversion technology
- High throughput screening of novel biocatalysts
- Directed evolution of industrial enzymes
- Production of useful biomaterials by bioconversion

Molecular bioprocess engineering
- Production of therapeutic recombinant proteins
- Development of bio-refinery technologies

Microbe-based Fusion Technology Research Center

Jeonbuk Branch Institute

Our goal is to develop biotechnologies and bioprocesses for the production of microbial metabolites, proteins, industrial enzymes and bioenergy, all of which are useful for the phamaceutic, nutraceutic, dietetic, cosmetic, feed and fine chemical industries, etc.

ACHIEVEMENTS

Development of 1,3-propanediol producing microbial strains

Recombinant strains optimized to produce 1,3-propanediol using crude glycerol derived from the biodiesel industry as a by-product were developed through metabolic pathway engineering. Notably, the occurrence of by-products which are usually an obstacle in the purification process of 1,3-propandiol was completely abolished in the engineered strains, resulting in a conversion yield which is the highest level reported to date.

Development of human papillomavirus vaccine

Several types of human papillomavirus L1 genes encoding the major capsid protein were expressed in *Escherichia coli*. The structural proteins were found to be immuno-active by western blotting analysis and synthesized the virus-like particles by self-assembly in the heterologous host.

Screening of the novel enzymes

Novel 2-deoxyribosephosphate aldolases, glycosyltransferases, cellulases, lipases, and proteases were screened and isolated from nature, and cloned into *E. coli*.

Preparation of a genomic library from a single microorganism

Multiple Displacement Amplification technology was applied to the amplification of genomic DNA isolated from single cell, from which novel cellulase was selected.

SELECTED PUBLICATIONS

- Jae Jun Song (Corresponding) Mixed-substrate (glycerol tributyrate and fibrin) zymography for simultaneous detection of lipolytic and proteolytic enzymes on a single gel. *Electrophoresis* 30:2234-2237 (2009)
- Jae Jun Song (Corresponding) Multiple-layer substrate zymography for detection of several enzymes in a single SDS gel. *Anal. Biochem.* 386:121-122 (2009)
- Chul Ho Kim (Corresponding) Elimination of by-product formation during production of 1,3-propanediol in *Klebsiella pneumoniae* by inactivation of glycerol oxidative pathway. *Appl. Microbiol. Biotechnol.* 84:527-534 (2009)
- Joong Su Kim (Corresponding) Cloning, expression, and characterization of a new deoxyribose 5-phosphate 3 aldolase from Yersinia sp. EA015. *Protein Expr. Purif.* 68:196-200 (2009)

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- Identification of infection related target molecules and establishment of screening systems for infection related diseases
- Isolation and structure elucidation of active compounds
- Synthesis of active compounds

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- Identification of inflammation related target molecules and establishment of screening systems for inflammation related diseases
- Isolation and structure elucidation of active compounds

Su-Jin Park sjpark@kribb.re.kr
- Isolation and bulk culture of viruses (Coronavirus, Rotavirus, Influenzavirus, etc) and genetic and phylogenic analysis of isolated viruses
- Pathologic, immunohistochemical, electron microscopic studies using animals

Jong Sun Chang changjs@kribb.re.kr
- Finding new targets in inflammation
- Development and operation of an assay systems for anti-inflammatory materials
- Identification of the molecular mechanisms of anti-inflammatory materials

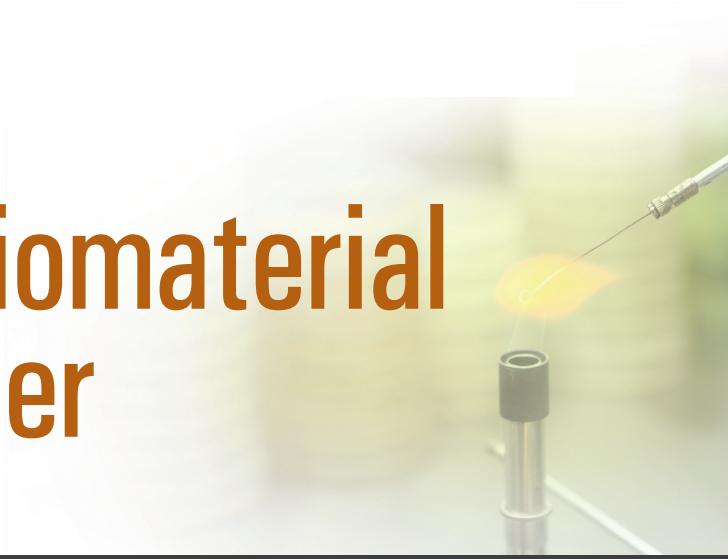
Young Bae Ryu ybryu@kribb.re.kr
- Isolation and identification of secondary metabolites from natural sources
- Identification of infection related target molecules and establishment of screening systems for infection related diseases

RESEARCH AREAS

Construction of a bioassay system related to infectious diseases
- Establishment of a bioassay/screening system for such compounds against infectious (virus, bacteria and malaria)
- Development of specifically active compounds such as inhibitors of neuraminidase for the anti-avian influenza virus.

Construction of a bioassay system related to inflammatory diseases
- Establishment of a bioassay/screening system for such compounds against inflammatory diseases (pneumonia, asthma, arthritis, etc.)
- Development of specifically active compounds such as inhibitors of cell adhesion molecules, cytokine and chemokine.

Construction of a natural product fraction library
- Construction and utilization of both a fraction from plant and microbial culture extracts and a natural compound library



Eco-Friendly Biomaterial Research Center

Jeonbuk Branch Institute

Our aim is to develop functional foods, natural feeds and therapeutic materials against infectious (viruses, bacteria and malaria) and inflammatory (pneumonia, asthma, arthritis, etc.) diseases from the natural product library, starting with traditional medicines.

ACHIEVEMENTS

Identification of biomaterials for infectious and inflammatory diseases

Influenza viruses bind to sialic acid on the surface of the host cell to initiate infection. Since sialic acids are ubiquitous, this presents two problems for the virus: (1) the virus may bind to a wide variety of cells, regardless of whether the cell can support virus replication, and (2) the virus particles themselves have sialic acid incorporated into their surface glycoproteins, so potential virus particles will bind to each other. Neuraminidase promotes the release of the influenza virus from infected cells and facilitates the spread of the virus within the respiratory tract. And, cell adhesion molecules (ICAM-1/LFA-1, VCAM-1/VLA-4), cytokines and chemokines, participate in cell to cell interaction, which is important in the progression of the inflammatory response in diseases such as pneumonia and asthma, etc. Therefore, we have developed active biomaterials from natural sources by *in vitro* assay systems for infectious and inflammatory diseases, and have obtained bioactive compounds from selected biomaterials using chromatographic techniques.

Identification of new molecular targets related to infectious and inflammatory diseases

By conducting research into molecular targets such as proteomics and genomics, new target candidates of inflammatory and viral infection disease have been identified. We have established assay/screening systems for inflammation and viral related diseases.

***In vitro* and *In vivo* antiviral evaluations**

We have established the identification of a method of culture and quantitative titration for several viruses including influenza virus, rotavirus, coranvirus, rhinovirus and enterovirus, as well as developing new active biomaterials and immune-therapies against viruses, including virology, mechanism of action, *in vitro* activity and animal models.

Natural product fraction library

We have built a natural product fraction library, and are collecting plant resources and utilizing both a plant extract through open column chromatography and a natural product library.

SELECTED PUBLICATIONS

- Woo Song Lee (Corresponding) Neuraminidase inhibitory activities of flavonols isolated from *Rhodiola rosea* roots and their in vitro anti-influenza viral activities. *Bioorg. Med. Chem. 17*:6816-6823 (2009)
- Woo Song Lee (Corresponding) Structural characteristics of flavanones and flavones from *Cudarania tricuspidata* for neuraminidase inhibition. *Bioorg. Med. Chem. Lett. 19*:4912-4915 (2009)
- Woo Song Lee (Corresponding) Characteristic of neuraminidase inhibitory xanthones derived from *Cudrania tricuspidata*. *Bioorg. Med. Chem. 17*:2744-2750 (2009)
- Woo Song Lee (Coauthors) Tyrosinase inhibitory polyphenols from the roots of *Morus lhou*. *J. Agric. Food Chem. 57*:1195-1203 (2009)
- Su-Jin Park (Corresponding) Sequence analysis of unusual P[7]G5 bovine rotavirus strains reveals evidence of inter-species transmission. *J. Clin. Microbiol. 47*:3329-3332 (2009)
- Jon Sun Chang (first author) Mice deficient in PKCbeta and apolipoprotein E display decreased atherosclerosis. *FASEB J. 23*:1081-1091 (2009)

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RESEARCHERS

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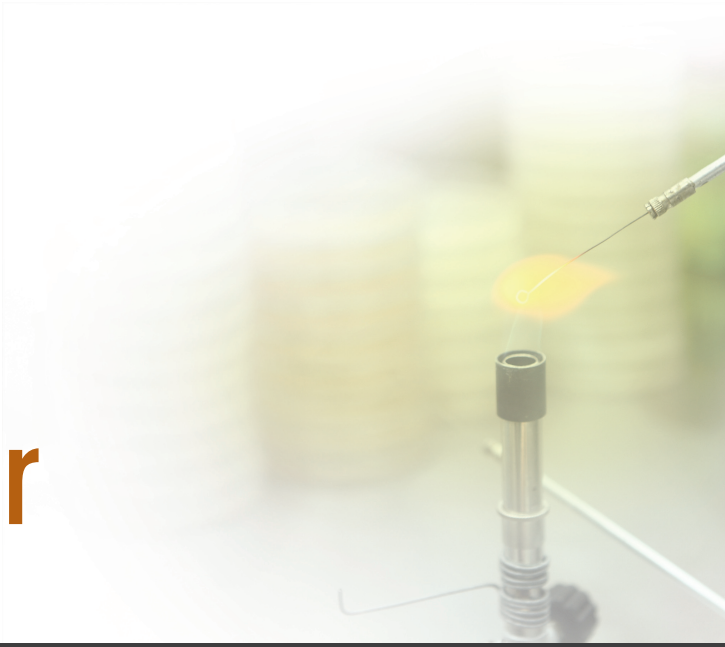
- Construction of a base for the development of the regional bio-industry based on research into microbial-materials for agriculture and stockbreeding
- Development of mass production processes and analysis of immune activity of β-glucan purified from Aureobasidium sp.

Min Soo Kim ms5732@kribb.re.kr
- Development of a microbial fermentation process
- Bioconversion of a highly intensive sweetener derived from waste orange Peel
- Screening and application of useful microorganisms derived from Korean traditional fermented foods

Cha Young Kim kimcy@kribb.re.kr
- Molecular metabolic engineering for production of secondary metabolites in microbe and plant systems
- Development of intragenic vector systems using all-native DNA and production of intragenic plants
- Understanding of molecular mechanisms for the biosynthesis of plant pigments
- Molecular plant-microbe interactions
- Molecular farming for the production of valuable proteins in plant systems

RESEARCH AREAS

Development of a mass-production technology for useful biological compounds and research into practical technology via in-the-field application
- Search for new functional biological compounds
- Development of a mass-production technology for useful biological compounds using pilot plants
- Development of technology for application in the field, and for the commercialization of useful compounds



Bioindustrial Process Center

Jeonbuk Branch Institute

Our goal is to develop the technology required for the mass-production of microorganisms and their metabolites. Additional objectives of the center include the construction of a base for the development of regional bio-industry via a technical support business aimed at the activation of agriculture and stockbreeding, and research into the industrialization and mass-production of useful bio-materials.

ACHIEVEMENTS

Environmentally-friendly agriculture based on biological control technology

In order to meet the demands of an ever-rising global population, agriculture in the next decade will have to produce more food from less land based on a more efficient and sustainable use of natural resources, while having a minimal impact on the environment. Promoting and adopting "environmentally-friendly agriculture via biological control technology and its management systems" could help us to reach this goal. As such, we are focusing on conservation agriculture, defined as mineral disturbance combined with microorganisms in soils, as a more sustainable system of cultivation for the future.

Application of immunostimulators for pig-breeding without the use of antibiotics

β-Glucan, an endogenous polysaccharide immune-stimulator, exhibits high adjuvant activity in domestic breeding animals. It is one of the relatively few non-toxic, non-pyrogenic, water-soluble immune-stimulators. We have discovered that β-glucan has an immune-enhancing effect on pigs both as an adjuvant and as a non-specific immune-stimulant. As such, further investigation into isolating and characterizing new biological agents as immune-modulators should continue in view of this success.

Search for industrially useful microbial resources derived from Korean traditional fermented foods

We have studied the functional effects of Korean-style fermented foods such as kimchi, soy sauce, etc. Traditional Korean fermented foods promote good digestion, because the consumption of a cup of clear soup containing soy sauce enhances the secretion of gastric juice in human beings. Fermented soy sauce contains three tartaric isoflavone derivatives called soy flavones. These soy flavones were shown to have inhibitory activities against histidine decarboxylase, which produces histamine, a mediator of inflammation, allergy and gastric acid secretion. Soy sauce also exhibits anti-platelet activity. Beta-Carbolines were isolated from soy sauce as the active compounds. Soybeans and wheat, the main raw ingredients of soy sauce, are allergenic foods.

Development of a high-intensity sweetener using waste citrus peel

High-intensity sweetener, a low-calorie, full-bulk natural sugar was recently accorded GRAS (Generally Recognized As Safe) status under the U.S. Food and Drug Administration (FDA) regulations, thereby permitting its use as a sweetener in foods and beverages. We have studied the development of NHDC produced from citrus peel waste with regard to its demonstrated food and beverage applications, as well as the potential health and medical benefits of this unique substance. NHDC has been found to be safe and efficacious for use as a low-calorie, full-bulk sweetener in a wide variety of foods, beverages, health foods, and dietary supplements. It fills broad, hitherto unmet needs for a low-calorie sweetener in products whose bulk sugar content is important, such as chocolate, chewing gum, cakes, ice cream, and frosted cereals. Its synergism with other sweeteners also makes it useful in various foods. The various health and medical benefits of NHDC have been indicated, including the treatment of type 2 diabetes, hyperglycemia, anemia, and hemophilia, as well as the improvement of fetal development.

SELECTED PUBLICATIONS

- Cha Young Kim (first author) Identification and characterization of the rice blast fungal elicitor-inducible *OsHin1* gene. *J. Plant Biotechnol.* 36:45-52 (2009)

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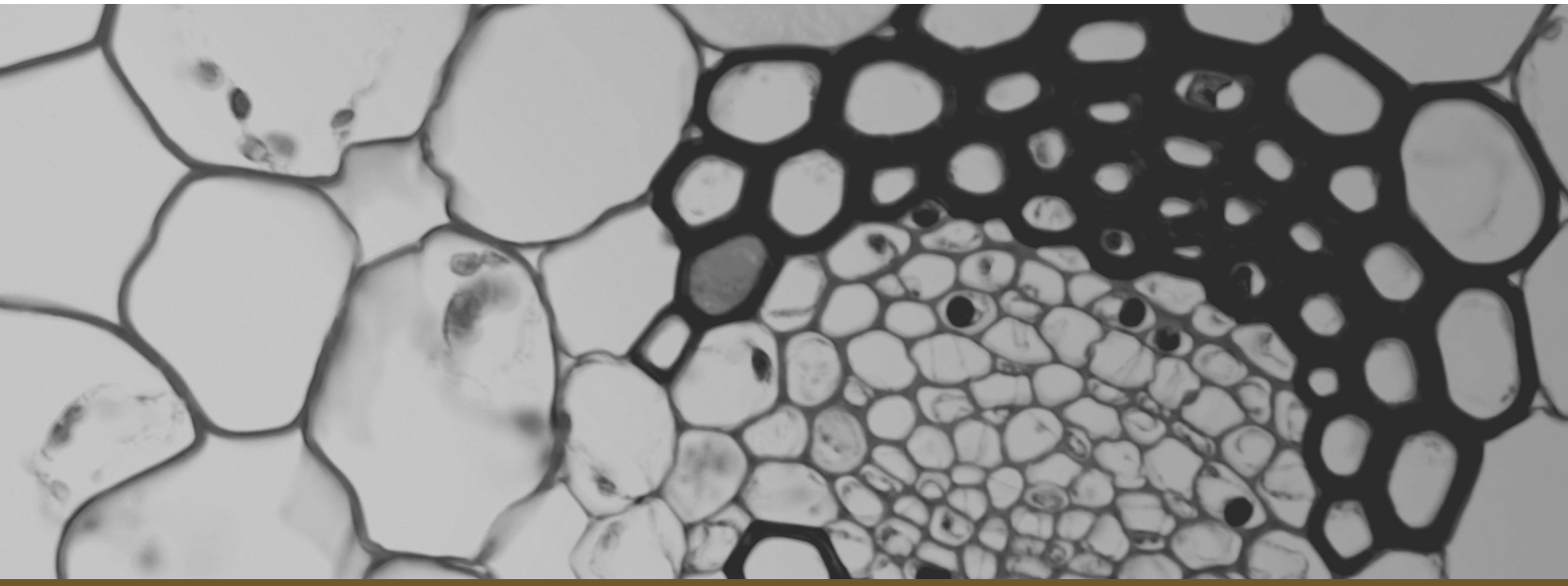
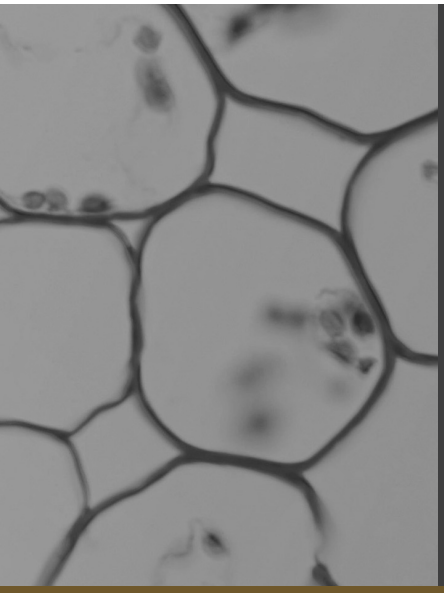
Division of National Agenda Projects



We pursue a better world by conducting basic and translational research designed to prevent influenza virus such as Avian influenza and develop new vaccines and antivirals based on our research in the field of biotechnology.



Viral Infectious Disease Research Center

AI Control Material Research Center

National Agenda Projects

RESEARCHERS

Haryoung Poo haryoung@kribb.re.kr
- Development of a new vaccine adjuvant and study of its mechanism
- Development of new candidates for universal vaccines

Jeong-Ki Kim jkim@kribb.re.kr
- Evaluation of the efficacy of newly developed vaccines in animal models
- Evaluation of the efficacy of the vaccine adjuvant in animal models
- Surveillance and genetic characterization of influenza viruses circulating in our circumstance

RESEARCH AREAS

- Development of new vaccine technologies including subunit, virus-like particle,and universal vaccines against viral infectious diseases
- Development of a new vaccine adjuvant for influenza vaccines, using polymer (poly-gamma-glutamate) nano-particles, together with investigation of the immune mechanism of the adjuvant.
- Basic research on influenza pandemics, including surveillance and genetic characterization studies of influenza viruses.

ACHIEVEMENTS

Development of new vaccine technologies, including subunit, virus-like particle (VLP), and universal vaccines, against the current and future pandemic influenza viruses. Several candidates of sub-unit vaccines have been developed via prokaryotic and eukaryotic protein expression systems, using the H5 HA of a highly pathogenic influenza virus or the H1 N1 of the recent pandemic influenza A (H1N1) 2009 virus. We have succeeded in the mass production of highly pure HA proteins for use as antigens on vaccination. A bovine papilloma virus-M2e chimeric VLP vaccine has also been developed. The immune-genicity and efficacy of both the sub-unit and VLP vaccines have been evaluated in animal models.

Viral Infectious Disease Research Center

Division of National Agenda Projects

Influenza pandemics generally occur following the emergence of new strains of influenza virus that can be transmitted to humans from other animal species and spread easily within the human population on a worldwide scale. An influenza pandemic of this nature is regarded as a global disaster, threatening public health with a high incidence of morbidity and mortality. Therefore, it is necessary to formulate plans to counter current and future influenza pandemics. The overall objective of our center is to generate new vaccine technologies and antiviral strategies that can broadly address protective immune responses against various sub-types of influenza viruses,

Development of a new vaccine adjuvant for influenza vaccines, using polymer (poly-gamma-glutamate) nano-particles, together with the investigation of the immune mechanism of the adjuvant.

As an efficacious vaccine adjuvant candidate, we have developed nano-particles conjugated with poly-gamma-glutamate, which induced a high level of NK cell-mediated cytotoxicity and IFN-γ secretion in a mouse model in our previous study. Study of the immune mechanism of the adjuvant has revealed that it strongly induces both humoral and cellular immune responses. The *in vivo* efficacy of the polymer nano-particles has been examined in various animal models.

Basic research on pandemic influenza, including surveillance and genetic characterization studies of influenza viruses.

We have isolated influenza viruses from fecal samples taken from wild migratory birds-including ducks, teals, and geese-on a regular basis. So far, we have identified certain sub-types of influenza viruses, including H5N2, H6N5, and H11N3. We have continued to isolate influenza viruses and have genetically and pathogenically characterized them.

SELECTED PUBLICATIONS

- Haryoung Poo (Co-Author) Evaluation of the efficacy and cross-protectivity of recent human and swine vaccines against the pandemic (H1N1) 2009 virus infection. *PLoS One* 4:e8431 (2009)
- Haryoung Poo (Co-Author) Investigation of the biological indicator for vaccine efficacy against highly pathogenic avian influenza (HPAI) H5N1 virus challenge in mice and ferrets. *Vaccine* 27:3145-3152 (2009)
- Haryoung Poo (Co-Author) Isolation and genetic characterization of H5N2 influenza viruses from pigs in Korea. *J. Virol.* 83: 4205-4215 (2009)
- Haryoung Poo (Corresponding) Oral administration of poly-gamma-glutamate induces TLR4- and dendritic cell- dependent antitumor effect. *Cancer Immunol. Immunother.* 58:1781-1794 (2009)

especially the current pandemic influenza virus (novel 2009 influenza A [H1N1]) and the highly pathogenic avian influenza virus, which are potential candidate viruses of future influenza pandemics

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- Identification of infection related target molecules and establishment of screening systems for infection related diseases
- Isolation and structure elucidation of active compounds
- Synthesis of active compounds

Mun-Chual Rho rho-m@kribb.re.kr
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Jong Sun Chang changjs@kribb.re.kr
- Finding new targets in inflammation
- Development and operation of assay systems for anti-inflammatory materials
- Identify molecular mechanisms of anti-inflammatory materials

RESEARCH AREAS

Construction of bioassay systems related to infectious diseases
- Establishing a bioassay/screening system for compounds against infectious diseases (virus, bacteria and malaria)
- Developing specifically active compounds such as inhibitors of neuraminidase to combat the avian influenza virus.

Construction of bioassay systems related to inflammatory diseases
- Establishing a bioassay/screening system for compounds against inflammatory diseases (pneumonia, asthma, arthritis, etc.)
- Developing specifically active compounds such as inhibitors of cell adhesion molecules, cytokines and chemokines.

Construction of a natural product fraction library
- Constructing and utilizing both a fraction from plant and microbial culture extracts and a natural compound library

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Division of National Agenda Projects

Our aim is to develop functional food, natural feed and therapeutic materials against infectious (virus, bacteria and malaria) and inflammatory (pneumonia, asthma, arthritis, etc.) diseases from the natural product library, starting with traditional medicines.

ACHIEVEMENTS

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Identification of new molecular targets related to infectious and inflammatory diseases

Through research of molecular targets such as proteomics and genomics, new target candidates of inflammatory and viral infectious diseases have been identified. We established assay/screening systems for inflammation and virus related diseases.

***In vitro* and *In vivo* antiviral evaluations**

We established the identification of cultures and quantitative titration methods for several viruses including the influenza virus, rotavirus, coranvirus, rhinovirus and enterovirus, and developed new active biomaterials and immunotherapies against viruses, utilizing virology, mechanism of action, *in vitro* activity and animal models.

Natural product fraction library

Construction of a natural product fraction library, we are collecting plant resources and utilizing plant extracts through open column chromatography and a natural product library.

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The 21st Century Frontier R&D Program

Strong R&D Competitiveness for Building a Biotech Nation

To vault Korea to the forefront of the global biotech industry, KRIBB is concentrating its research effort on cutting-edge fields, such as development of cancer therapies capable of effectively improving patients' survival rates, creation of new medicinal plants through genetic modification of native plants of Korea and new and innovative applications of genome resources.

Human Genome Functional Analysis Center

Plant Diversity Research Center

Microbial Genomics & Applications Center

The 21C Frontier R&D Program

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- Identification and validation of target for cancer therapy
- Gene therapy of cancer and ischemic diseases

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- Genomic analysis of cancers and identification and functional validation of therapeutic targets
- Cancer gene therapy

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- Epigenomics in gastric and colon cancers
- High-throughput LOH genotyping associated with gastric cancer

Jeong-Heon Ko jhko@kribb.re.kr
- Discovery of biomarkers that show a change both in quantity and quality with a highly positive prediction value in various cancers
- Functional studies that relate candidate biomarkers to the biology of cancer

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- Functional analysis and validation of a new gene for cancer therapeutics

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- Preparation and production of antibodies against peptides, recombinant or fusion proteins from novel genes
- Identification and application of biomarkers to cancer diagnostics

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- Genomic analysis of cancers
- Development of human monoclonal antibodies for cancer therapeutics

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- Functional analysis and validation of genes associated with tumor
- Gene therapy of cancer

RESEARCH AREAS

- Development of cancer diagnostics
- Functional analysis of molecular targets for innovative cancer-therapeutics
- Development of small molecules and antibodies for targeted cancer therapy

Human Genome Functional Analysis Center

The 21C Frontier R&D Program

The completion of the human genome sequence and the recent improvements made in chip technologies and bio-informatic approaches have provided enormous opportunities for the prevention and treatment of incurable diseases such as cancer. Our aims are i) to collect on a large scale and analyze functionally and clinically the novel biomarkers and molecular targets more closely associated with tumorigenesis by genomic approaches, and thereby ii) to develop diagnostics and candidates for the targeted therapy of stomach and liver cancers.

ACHIEVEMENTS

Human gene bank

We established a human gene bank at KRIBB that possesses 38,000 Korean unigenes and 10,000 full-length human cDNAs, and have distributed the genes to the interested parties. Hundreds of thousands of genes have been sent out domestically and to foreign countries. We will continue this service to activate research in functional genomics.

Identification of novel transcription factor that promotes gastric cancer

We found that ZNF312b activates transcription of the K-ras oncogene, resulting in an enhancement of the extracellular signal-regulated kinase signaling pathway that regulates cell proliferation. ZNF312b overexpression induces cancer-like phenotypes, including accelerated proliferation and increased tumor masses in nude mice. These phenotypes are completely reversed by ZNF312b-knockdown in gastric cancer cell lines. ZNF312b seems to be specifically overexpressed in gastric cancer tissues and cell lines. These results suggest that ZNF312b plays a role in progress and metastasis of gastric cancer, and may provide new insight into the development of new therapeutic modalities for stomach cancer (Cancer Research, 2009).

Novel biomarkers and therapeutic targets for liver cancer

The hepatitis B virus X-protein (HBx) associates with the development of hepatocellular carcinoma (HCC). We analyzed quantitative changes of proteins from the liver tissue of HBx-transgenic mice at early stages of carcinogenesis (dysplasia and hepatocellular adenoma) by 2-DE and LC-MS/MS. Several proteins involved in glucose and fatty acid metabolisms, such as mitochondrial 3-ketoacyl-CoA thiolase, intestinal fatty acid-binding protein 2 and cytoplasmic malate dehydrogenase, were differentially expressed, suggesting that significant metabolic alterations occurred during the early stages of hepatocarcinogenesis. These results provide insights into the mechanism of HBx-mediated hepatocarcinogenesis. Besides, this study identifies possible biomarkers and therapeutic targets for HCC diagnosis and drug development for treatment of the disease (Proteomics, 2009).

Discovery of novel enzyme that stabilizes NF-κB inducing kinase

The transcription factor NF-κB is a crucial mediator of linking inflammation and immune responses to cancer development and progression. The NF-κB inducing kinase (NIK) is essential for non-canonical NF-κB activation. However, it is unclear how NF-κB stimuli stabilize and activate NIK. We discovered the ZFP91 zinc-finger protein is an atypical E3 ubiquitin ligase that catalyzes Lys63-ubiquitination of NIK, thereby stabilizing and activating NIK. These results suggest that ZFP91 may act as a molecular switch to divert from transient NF-κB activation to persistent one, which associates with a variety of pathological processes including cancers (Patent filed).

Discovery of new factor that regulates the Mdm2-p53 pathway

The ability of p53 tumor suppressor to induce cell growth arrest and apoptosis is tightly regulated for normal cell viability. This is mostly achieved by the Mdm2 E3 ubiquitin ligase that targets p53 for degradation. We found that cellular factor interacts with p53 via Mdm2, thereby promoting Mdm2-dependent p53 ubiquitination and degradation. The factor may serve a new molecule for targeted cancer therapy (Patent filed).

Novel human antibody for pancreatic cancer therapy

PAUF protein, a secreted antigen, is highly expressed in pancreatic cancer and cell lines, and promotes progress and metastasis of pancreatic cancer (Cancer Sci, 2009). An anti-PAUF antibody, isolated from a human antibody library, inhibits pancreatic cancer cell growth in mice. This antibody technology was transferred to RexBio Inc, which will develop therapeutic antibody for the treatment of pancreatic cancer (Patent pending).

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- Establishment of the plant extract bank of Korea
- Natural Product Chemistry
- Immunology

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- Development of nutraceuticals improving erectile dysfunction
- Discovery of bioactive molecules
- Molecular mechanism of bioactive molecules

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- Chemical genomics
- Natural products

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- Cholesterol acyltransferase
- Cholesterol metabolism

RESEARCH AREAS

Infra projects

Constructing and managing the plant extract bank, plant bioinformatics systems and seed bank for wild and endangered plant species

Development of plant-derived natural drugs and nutraceuticals
- Grafting plant resources and modern bioengineering technology to create natural drug materials for treatment and prevention of disease
- Developing high value-added nutraceuticals

Development of high value-added transgenic plants
- Analyzing useful genes in plants, and using gene isolation and manipulation technology to create new types of value -added transgenic medicinal plants

Collection, preservation and cultivation of plant species
- Collecting and classification of plant resources from the Korean peninsula
- Nurturing superior wild flower and tree cultivars

Plant Diversity Research Center

The 21C Frontier R&D Program

We graft plant resources and modern bioengineering technology to create high value-added products such as natural drugs and nutraceuticals. We also apply gene isolation and manipulation technology to develop new types of transgenic medicinal plants.

ACHIEVEMENTS

Technology transfer with corporations

In the area of natural drugs and nutraceuticals research, we registered 38 patents and transferred one different technology, resulting in 1,375 million won of technical fees, thus contributing to the activity of natural drugs development and related industries. We also secured and accumulated important infra-technologies.

Preclinical/clinical trials of natural drugs and nutraceuticals

6 candidates for natural medicines and nutraceuticals were advanced and six are currently in clinical trials, and six are currently in preclinical testing. These are the results of extensive knowledge and preclinical experience of plant resources and oriental medicine. We believe that this serves as an example, showing the possibility of developing high value added natural medicines/ nutraceuticals valued at billions of won in a short period.

SELECTED PUBLICATIONS

- Byoung-Mog Kwon (Corresponding) 2'-Benzoyloxycinnamaldehyde inhibits tumor growth in H-ras12V transgenic mice via downregulation of metallothionein. *Nutr. Cancer* 61:723-734 (2009)
- Byoung-Mok Kwon (Corresponding) Cryptotanshinone inhibits constitutive signal transducer and activator of transcription 3 fintion through blocking the dimerization in DU145. *Cancer Res.* 69:193-202 (2009)
- Jae-Heung Jeon (Corresponding) Reactive oxygen species:regulation of plant growth and development. *Adv. Bot. Res.* 52:25-46 (2009)
- Hyun Soon Kim (Corresponding) Potato-derived atigens for use as a vaccine against Alzheimer's disease. Fruit *Veget. Cereal Sci. Biotechnol.* 3:s128-132 (2009)

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- Biodiversity
- metagenome

Myung Hee Kim mhk8n@kribb.re.kr
- Protein structure and function
- Macromolecular crystallography
- Mechanism of signaling by histidine kinase

RESEARCH AREAS

Microbial diversity and metagenomes
- Screening of extremophiles and interaction microbes
- Development of isolation and screening techniques for uncultivated microbes
- Screening of goal-directed and beneficial microbes
- Metagenome analysis and beneficial gene screening
- Analysis of viral metagenomes and development of beneficial genes

Integrated functional analysis of microbial genomes
- Genomic Network of Model Systems
- Regulatory Network of Interactive Microbes
- Applications of Microbial Interactions
- Redesign of Metabolic Circuits
- Microbial Technological Convergence
- Future Technologies for Bioenergy
- Microbial Protein Structure and Function

Microbial Genomics & Applications Center

The 21C Frontier R&D Program

We aim to promote the discovery of novel genes, valuable biomolecules, engineered microbes and innovative bioprocesses. The Microbial Genomics and Applications Center focuses on developing technology platforms to utilize information about genome function obtained from analyses of microbial genomes isolated from diverse environments.

Industrial application of microbial genomes

- Development of fermentation and bioprocessing technologies based on cell reengineering
- Development of highly functional enzymes
- Investigation of novel physiologically active materials
- Platform biomaterial development suitable for genome reengineering
- Synthetic biology-based novel biomaterial development
- Identification of novel enzymes and development of application technology

Infrastructure

- Microbial Genome InfoBase / www.gem.re.kr
- Microbial Resources Bank / www.microbank.re.kr
- Protein Bank / www.pbsb.re.kr

ACHIEVEMENTS

We made complete genome sequences of *Escherichia coli* B derivatives REL606 and BL21(DE3) as well as in-depth analysis of their genome information and investigation into the history of strain succession. And the genomic trajectory of adaptation was revealed in a long-term experimental evolution simulation (publically available through Nature and Journal of Molecular Biology)

We also secured omics information in order to construct a data analysis system for the omics, and were successful in completing a genome sequence database and a comparative analysis system.(KRIBB)

We designed an aptamer which is able to efficiently remove arsenic from samples of groundwater collected in different areas.(published at Environ. Sci. Technol. and introduced by Nature as part of research highlights in environmental chemistry, Chonbuk National Univ.) And we got a highly sensitive and selective diagnostic assay based on virus nanoparticles (publically available through Nature Nanotechnology)

We developed *Corynebacterium glutamicum* an amino acid producing strain and bioprocess for low cost/high yields/high productivity using Genome-based cell reconstruction technology (CJ Co., Ltd), created from indigo derivatives using oxygenase genes from a methylotrophic bacterium (Chosun Univ.) and we developed 2,3-sialyllactose, which was registered with the FDA, USA in January, 2009 (GeneChem Inc)

SELECTED PUBLICATIONS

- **Chul Ho Kim (Corresponding)** Bacterial expression and purification of human papillomavirus type 18 L1 *Biotechnol. Bioprocess Eng.* 14(2):168-174 (2009)

- Elevate Korea to being one of the top countries in the world of microbial industry
- Create a market exceeding one billion dollars
- Construct a global knowledge infrastructure by acquiring key intellectual property rights

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Biotechnology R&D Infrastructure

Sharing Biotech Value by Expanding Bioinfrastructure and Providing Information Support

To enhance the public awareness of biosafety, contribute to the growth of the bioindustry and extend the benefits of biotechnology to broader segments of society, KRIBB supplies up-to-date information on biotech policies in Korea and worldwide through its information-sharing network. KRIBB also procures biomaterials not available in Korea, from overseas sources, and distributes them to the industry and academia for industrial or research use.

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Daejeon-KRIBB-FHCRC Research Cooperation Center

International Biological Material Research Center

Biotech Policy Research Center

Korea Biosafety Clearing House

Biotechnology R&D Infrastructure

RESEARCHERS

Hyang-Sook Yoo yoohyang@kribb.re.kr
- Cancer genomics
- Cell cycle and signaling, yeast genetics and gene expression

Jeong-Heon Ko jhko@kribb.re.kr
- Discovery of cancer biomarkers that show changes both in quantity and quality, with highly positive prediction values.
- Functional studies that relate the candidate biomarker proteins to the biology of a cancer

Eun Wie Cho ewcho@kribb.re.kr
- Discovery of auto-antibody-based biomarkers that show changes in the serum of cancer patients

Yong-Sam Kim omsys1@kribb.re.kr
- Discovery of biomarkers that show changes in terms of both quantity (amount of protein in serum level) and quality (aberrant glycosylation), with highly positive prediction values
- Biological validation of candidate cancer biomarkers
- Discovery of an anticancer drug target based on biomarker discovery study

RESEARCH AREAS

- Discovery of biomarkers that show changes both in quantity, and quality with highly positive prediction values in gastric, liver, colon and lung cancers
- Functional studies that relate candidate biomarkers to the biology of a cancer
- Role of glycolipid in the apoptotic death of mammalian cells
- Discovery of auto-antibodies produced during the progression of a cancer as cancer biomarkers
- Identification of drug targets for use in the treatment of cancer patients

Daejeon-KRIBB-FHCRC Research Cooperation Center

Biotechnology R&D Infrastructure

Our goal is to discover cancer biomarkers of high sensitivity and specificity that are useful for diagnosing and predicting cancers at the earliest possible stage as well as for monitoring the effects of drugs. In collaboration with the teams of the International Cancer Biomarker Consortium led by Dr. Lee Hartwell of the Fred Hutchinson Cancer Research Center, we are focusing on identifying biomarkers for the early detection of liver, stomach, colon and other cancers, which will help to treat cancer patients more effectively and efficiently, and which will, ultimately, raise the survival rate of cancer patients.

ACHIEVEMENTS

Identification of candidate biomarkers for liver cancer

The multi-lectin approach was employed to mine liver cancer-specific serological glycoproteins, 8 proteins were found to be identified only from the sera of HCC patients. The list of candidate HCC biomarkers was patented and will be validated for the narrowing down of 'good biomarkers'.

Effect of an aberrant glycosylation of TIMP-1 on cancer metastasis

To identify cancer-related glycoproteins, the systematic coupling of L-PHA lectin enrichment followed by stable isotope standards and capture by anti-peptide antibodies (SISCAPA) with MRM mass analysis was employed, enabling the a quantification of TIMP-1 at attomolar levels in sera. This approach provides a useful tool for the quantification of a specific aberrant glycoform from human serum containing a variety of protein isoforms and may be helpful in studies of biological function as it pertains to protein glycan heterogeneity.

Identification of an anti-fatty acid synthase autoantibody in the HCC mouse model and its application to the diagnosis of HCC.

We reported the anti-fatty acid synthase (FASN) auto-antibody in hepatocellular carcinoma (HCC) using the HCC mouse model and suggested a novel method for the detection of anti-FASN auto-antibody in patient sera, which is very effective for the diagnosis of HCC.

SELECTED PUBLICATIONS

- Y-S Kim et al. Implication of aberrant glycosylation in cancer and use of lectin for the discovery of cancer biomarkers. *Protein Pept. Lett.* 16:499-507 (2009)
- Hyang-Sook Yoo (Co-Author) Mapping human genetic diversity in asia. *Science* 326:1541-1545 (2009)

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- Plant taxonomy
- Biodiversity

RESEARCH AREAS

- Establishment of four collaborative biological material research centers for collection and preparation of biological materials worldwide
- Establishment and operation of a comprehensive system and database in order to manage biological materials and related traditional medicinal knowledge procured from four regional centers and their neighboring countries
- Establishment and operation of a supply system for efficient provision of biological materials to leading research groups within the scope of the assigned project
- Development of new natural drugs, nutraceuticals and other commercially-important natural inventions

International Biological Material Research Center (IBMRC)

Biotechnology R&D Infrastructure

We are aiming at procuring indigenous biological materials from four overseas regional centers and their neighboring countries through legal routes within the scope of international collaborative research projects. Our mission is to provide researchers with a biodiversity of materials and ethnobotanical information including indigenous medicinal knowledge and also to establish the nation's core infrastructure for developing new natural drugs and nutraceutical products, along with other commercially important natural products.

ACHIEVEMENTS

Establishment of the International Biological Material Research Center

Center organization has been completed. Equipment and facilities have been set up: highly-sensitive equipment (LC/MS and electric microscopes) and an expanded herbarium(storage capacity over 100,000 voucher specimens). In addition, nearly 55,328 plant extracts have been distributed so far.

Procurement of Foreign Biological Materials China

- Establishment of Korea-China Biological Material Research Center in Cumming, Yunnan
- Personnel(2 Experts from Korea, 1 from China) and research equipment set up
- Biological materials: 5,721 dried plant species and extracts with ethnobotanical information

Central and South America

- Establishment of Korea-Costa Rica Biological Material Research Center in Santo Domingo de Heredia
- Personnel(2 Experts from Korea) and research equipment set up
- Biological materials: 1,539 dried plant species and extracts with ethnobotanical information

South-East Asia

- Establishment of Korea-Indonesia Biological Material Research Center (Opening Ceremony Mar. 2009)
- Personnel(1 Expert from Korea) and research equipment set up
- Biological materials: 1,530 dried plant species and extracts including oceanic biological materials from Micronesia

Africa

- Searching for potential research partners (such as Congo and Kenya)
- Biological materials: 1,785 dried plant species and extracts with ethnobotanical information

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Biotech Policy Research Center

Biotechnology R&D Infrastructure

Nominated and established by the Ministry of Science and Technology in 2004, the Biotechnology Policy Research Center aims to assist government in establishing policies on Biotechnology. To do so, the center investigates domestic and international policy information regarding biotechnology and runs a portal site to enhance the public understanding of biotechnology and biotechnology policy. The center also develops and provides biotechnology statistics, patents, bibliometrics, and market analysis. Additionally, the center organizes and supports various networks among expert groups related to biotechnology.

RESEARCH AREAS

Policy Planning
To plan comprehensive national policy and strategies to foster the research and development of biotechnology

Policy Research
To investigate technology, industry, institutional policy information as well as to conduct relevant statistics, patent maps, and bibliometric analysis

Information Gathering/Disseminating
To run portal sites in order to provide systematic information regarding biotechnology and biotechnology policy at large

Public Relations
To publish biotechnology white papers and to organize public workshops in order to enhance public understanding of biotechnology

International Collaboration
To facilitate effective international collaborations with foreign policy institutes and to establish foreign bases of operation; Participate in the activities of OECD Working Party on Biotechnology

ACHIEVEMENTS

Policy Planning
The Action Plan for Bio-Vision2016, as well as Stem Cell
Research / Policy-Planning for the Cooperative studies of M.Ds-Ph.Ds / Policy-Planning for the Promotion of Stem Cell research / Policy-Planning towards solutions to bottlenecking on New drug development

Bibliometric Analysis and Statistical Development
- Patent maps and article analysis systems are devised to assist the government in planning R&D strategies on national projects and to set the direction for BT research projects.
- The center has published annual reports on domestic and overseas statistical data on biotechnology categorized by investment, human resources, industry, and technology.

Policy Website
- A one-stop website has been created with regard to BT policies, assisting policymakers in gaining in-depth data on domestic and overseas BT policies.
- The site currently has 75,000 pieces of information data.

Expert Network
Operate the Korean Association of Biotechnology Research

International Collaboration
Participate in the 25th Session of the OECD Working Party on Biotechology / Participate in BAKAS 2009 Symposium and KRIBB-Kolis Symposium

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RESEARCH AREAS

The Biosafety Protocol & LMO Law Implementation
- Abiding by Information Duties
- Implementing Administrative Issues (Making out Country Report, Analyzing major issues in COP-MOP, Operating Expert Forum about major issues, etc.)
- Support Developing Country's Capacity-Building
- Implementation of LMO Law(Operation of Biosafety Committee, Support operation of LMO Law's Scheme and its Improvement, etc.)

Improvement of Public Awareness and Participation
- Operation of Biosafety Korean/English Portal
- Publications of *Biosafety Whitepaper, The Biosafety Journal*, etc.
- Host of Communication Activity(Seminars & Panel discussions, Biosafety essay competition, etc.)

Survey & Research
- Survey on public perception
- Database Establishment of LMO and BIO related statistics
- LMO and Bioindustry trend analysis

Korea Biosafety Clearing House

Biotechnology R&D Infrastructure

Korea Biosafety Clearing House(KBCH) specializes in public awareness and participation, survey and research, international cooperation as well as abiding by legal requirements concerning LMOs information which is needed for implementation of the "Cartagena Protocol on Biosafety" and the "Act on transboundary movements, etc. of LMOs"

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ACHIEVEMENTS

Compliance with the Law on LMO Law and the Biosafety Protocol

The KBCH began carrying out its official role as a legal organization in January 2008, although it had actually worked on related issues for the six preceding years. The KBCH's primary mission is to undertake those duties enforced by the LMO Law and the Biosafety Protocol as regards information on the transfer, handling and use of LMOs. Its mission largely consists of the collection and distribution of authentic information on LMOs and the promotion of public awareness of LMOs and participation in related matters.
For the past two years, the KBCH has operated the National LMO Information Network in cooperation with the Ministries responsible for dealing with LMOs, collecting information on approximately 8,000 cases including import approvals for LMOs-FFP (food and feed, and for processing) and facilities reports, etc. The KBCH has reported some of the information thus gathered to the Secretary of the Protocol in Canada, and has also upheld the obligation to disclose all of the collected information to the public by any means, via the Internet or in printed form.

Improvement of Public awareness and Participation.

For the purpose of promoting awareness and participation, with particular emphasis on the public, the KBCH is doingits best as an indispensable element for assuring bio-safety, as stipulated in the Protocol. Above all, the KBCH is trying to get across to the public both the positive and negative aspects of LMOs, so public communications concerning LMOs have to be conducted on the basis of the bare facts. As regards the KBCH's attempts to realize this mission, it has operated the national "Biosafety Portal", participated in the discussions on famous private Internet sites such as "Agora in DAUM" and "Knowledge IN in NAVER" etc.; and distributed printed materials published by the KBCH, such as the quarterly *"Biosafety"*, the *"White paper on Biosafety"*, and various booklets and pamphlets. Its other activities include the staging of seminars, which anyone can attend and share their opinions, and the *"Biosafety Essay Competition"* for middle and high school students which attracted 2,500 Korean applicants this year.

Other Activities

The KBCH has volunteered its services to the Ministries responsible for LMOs issues. Thus, the KBCH has established and held meetings on a regular basis, with the related government officials in attendance.

The KBCH is also pursuing international cooperation on LMOs. To this end, the KBCH has staged such events as the UNEP-KBCH co-sponsored seminar in Daejeon, 2008 which was held to support developing countries' efforts to support capacity building of information on LMOs. In recent years, the KBCH has held regular information sharing meetings with Japans and is now exploring possibility of similar cooperation with China and India.

Biosafety Protocol Article 20 (Information Sharing and the BCH)

- A Biosafety Clearing House is hereby established as part of the clearing house mechanism under Article 18, paragraph 3, of the Convention

LMO Law. Article 32 (Korea Biosafety Clearing House)

- The head of the competent national authority may designate the Korea Biosafety Clearing House which professionally carries out the matters concerning the management and exchange of the information on LMOS.

International Cooperation

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Beyond borders toward the Leading Bio Institute for the Humankind

KRIBB conducted an External Review from October 19 through 21, 2009 for the first time to assess research capacity and management capability and to identify its strengths and weaknesses so as to take KRIBB to a new level. The Committee of External Review said that "It is brilliant, and no doubt that KRIBB is compatible with any American or European institutions ..... "

There is still a long way to go but we have unfolded international cooperation and joint research activities to take a step closer to the vision of becoming the "Global Research Institute Leading Bio Innovation for the Humankind" in the year of 2009.

International partnerships are considered a high priority and the KRIBB has executed MOUs with 108 institutions and companies from 28 countries so far. In the year of 2009, we have signed 7 organizations from 5 countries such as the German Collection of Microorganisms and Cell Cultures, BiotechCorp, Malaysia for establishing and maintaining a profile of an international network.

KRIBB has made every effort to become an internationally renowned research institute in the field of biotechnology by cooperating with major R&D organizations and global pharmaceutical companies. In addition there is a broad biodiversity sample collection and distribution partnership with countries in Asia, South America, and Africa to establish a worldwide network for the utilization of biological resources.

KRIBB continues to establish global networking with renowned organizations from basic to applied research and a new stage of collaborative works are under way.

Launch of the WCI (World Class Institute) Program

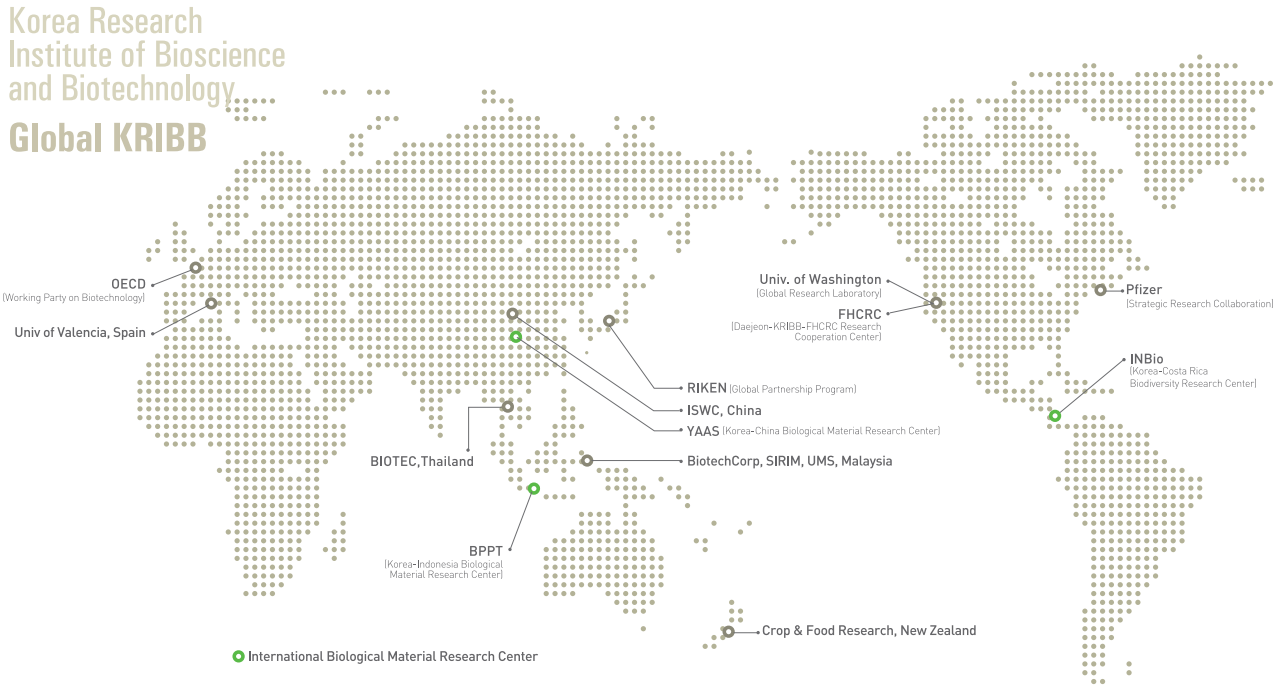
KRIBB launched the World Class Institute (WCI) Program with the aim of discovering a kinomics-based, cancer-causing, target protein and new drug candidates. The government-invested program is designed to enhance our global competitiveness by inviting outstanding researchers from home and abroad to conduct joint research. Under a program it will run for five years from December 2009 to November 2014. With the launch of this program, KRIBB will be better poised to create an international joint research network in close collaboration with major global research institutions such as Harvard University, the Max Planck Institute, and the NIH.

▸ Promotion of International Repute

We are carrying out 18 international joint research projects with 11 countries and are publishing at a high rate, with several publications in the highest ranking international journals such as Genome Evolution and Adaptation in a Long-term Experiment with Escherichia Coli (*Nature,* Oct. 2009), Elucidation of Multifaceted Evolutionary Processes of Microorganisms by Comparative Genome-based Analysis (*Journal of Microbiology and Biotechnology*, Nov. 2009 Cover Story), and Mapping Human Genetic Diversity in Asia (*Science,* Dec. 2009). These achievements, in particular, stand out as high impact journals with high scientific standards, wide readerships and span a broad swath of biological and technological research areas, thus reflecting the varied activities and a high standard for publication at KRIBB.

▸ Strengthening Our Strategic Alliance with Pfizer, the World's No. 1 Pharmaceutical Company

In June 2007 KRIBB became the only research institute in Korea to have formed a strategic alliance with Pfizer. Under this alliance, KRIBB and Pfizer agreed to undertake joint research projects aimed at screening chemical compounds with the potential to control the NK cell, an immune cell, in 2008, and identifying a suitable target for the development of liver and stomach cancer drugs, in 2009. Under the 2009 joint research project, KRIBB is expected to acquire the drug development know-how of the global pharmaceutical company and thereby significantly improve its own research capability.



▸ Opening of Korea-Indonesia Biological Material Research Center

KRIBB is working to establish biological material centers in four major areas at the earliest possible date and to help neighboring countries enrich their biodiversity. As part of such efforts, KRIBB opened the Korea Indonesia Biodiversity Research Center in March 2009.

The Korea-China Biological Material Research Center, opened in April 2007, and the Korea Costa-Rica Biological Material Research Center, February 2008 are playing a central role in effectively conducting joint research with 12 other countries. These centers have provided Korean researchers in academia, industry and research with over 28,700 useful biomaterials.

Global Network for global issue resolution

KRIBB has developed the drought-tolerant plants using the bioengineering technology through China-Japan-Korea cooperation from 2004 and named the top authorities in environmental plant stress, Dr. Ray Bressan (Purdue University) and Hans Bohnert (University of Illinois), as research fellows and carried out joint research projects for the development of environment-friendly plants.

▸ Operation of cooperation center with Fred Hutchinson Cancer Research Center (FHCRC)

To acquire the advanced bioengineering technology to become the leading cancer research center in Northeast Asia, Daejeon-KRIBB-FHCRC Research Cooperation Center has been operating since 2005. We have published some 20 SCI research papers, submitted 10 cases for patent registration and made efforts to promote the diagnostic products using the nano technology applied to the antibody and protein chip.

KRIBB President Invited to Be a Member of BIO-IAP, Malaysia

KRIBB president Young-Hoon PARK was invited as a member of BIO-IAP(International Advisory Panel), an international advisory body under direct control of the Malaysian Prime Minister.

Malaysia bestowed with rich bioresources, identified bioindustry as one of the new growth engines and has been implementing a 3-phase national biotechnology policy project. The project was launched in 2005 and is scheduled to be completed by 2020. President PARK offered a briefing on how far Korea's bioindustry and biotechnology have come and assured continued cooperation with Malaysian research institutes and corporations. 2010 marks the 50th anniversary of opening Korea-Malaysia diplomatic relations and a variety of cooperation programs is being planned in celebration of the anniversary.

Technology Transfer Office (TTO)

Bridging the Gap between the Bioscience Innovation and the Real World Applications

The business development based on the technologies of KRIBB has been doing by the Department of Intellectual Property Management which is playing a role as a technology transfer office(TTO). The idea or know-how as well as the technologies developed from the R&D centers are detected by the Technology Evaluation Committee of KRIBB run by the TTO of KRIBB, and their market and business values for creating new bioindustry are also assessed. The selected technologies are actively licensed out to market leaders including domestic and global companies. Nurturing and incubating start-ups are another important function of the TTO of KRIBB. The joint venture with established partner company could be created by providing with highly valued technology.

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Main Functions

Knowledge (Intellectual) Property Management : Making a "strong" patent

- Consulting of intellectual property filling/office action/maintenance
- Screening of excellent idea/know-how/technology
- Scientific affairs to internal and/or external collaboration

Technology Transfer

- Technology valuation/marketing/negotiation for transfer
- Technology licensing-out

Business Incubation

- Creating new startups/joint ventures ("Institute Enterprise")
- Arranging fund investment for spin-off KRIBB companies
- Incubating biotech. start-ups at BioVenture Center (BVC)

Technology Licensing-out

Name of Technology	Director	Company	Date	Contract Payment
Technology to develop Body-friendly Sunblocks & Nanocosmetics by Nanotech.	**Dr. Bong Hyun Chung**	Bioprogen Co.	Jun 30	100 million won
Technology to develop subminiature SPR protein chip analysis system	**Dr. Bong Hyun Chung**	KoMiCo Co.	Jul 07	3 billion won
Method for preparing Biofertilizer using Palm Oil Mill Wastage	**Dr. Jae Jun Song**	Ultimate Biotech Sdn. Bhd.	Jul 07	60 million won
Technology to product Novel Phytase & utilized Additives	**Dr. Taek Kwang Oh**	Esseltech Co.	Jul 17	63 million won
Technology to develop Preventive Materials for Influenza Virus	**Dr. Woo Song Lee**	Koreastevia Co.	Oct 08	30 billion won
Technology to product Disease Model Mouse of Changing Genetic Trait	**Dr. Dae-Yeul Yu**	Labanimal Co.	Oct 20	58 million won

Creating the Joint-Venture, MiCoBioMed, Inc. (2nd "Institute Enterprise")

- Company type : The Joint Venture ("Institute Enterprise")
- Partner Company : KoMiCo, Inc. (KOSDAQ company)
- Technology base : Biochip and Bionano-sensor technology from Bionanotechnology Research Center (Dr. Bong Hyun Chung)
- Market area : Biosensor market, Diagnostic Market

Support for Technology Information

Information Collection and Current Status

The KRIBB Digital Library(http://library.kribb.re.kr) has made it a priority to collect electronic materials such as electronic journals, electronic books, and web databases for providing information more rapidly and improving users' convenience. The library has been subscribing to electronic journals since 1998 and participating in the KESLI consortium. At the moment, the number of electronic journals to which the library subscribes is 5,300 titles, which is much higher than their 47 printed journals. More than 370,000 articles are downloaded in PDF and HTML format each year.

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Information		No. of Material	Major Sources
Journals	Printed journals	469	Currently 47 journals are subscribed to and 16,412 volumes are bound
	Electronic journals	5,300	17 publishers including ACS, Elsevier, Nature, Oup, Springer, Wiley
Books	Printed books	13,310	Research books or reference materials
	Electronic books	10,520	Elsevier, netLibrary, Springer, Wiley
Research reports		6,273	KRIBB and other institutes
Market trend reports		730	Datamonitor, Frost & Sullivan
Video materials		200	KBS Media
Web databases		8	Delphion, JCR, SciFinder, Scopus, Springer Protocol. TradiMed
SW		3	ChemBioOffice, Endnote, ezPDF

Research Results and Information Databases

The library has databased KRIBB's research results on the web with 6,361 papers, 1,549 patents, 1,453 research reports, and 420 presentations (Total: 9,783) for web users. By using the iLIPS program, users can search and gain access to all data including printed books, electronic journals, and electronic books within the library.

Document Delivery Service (DDS)

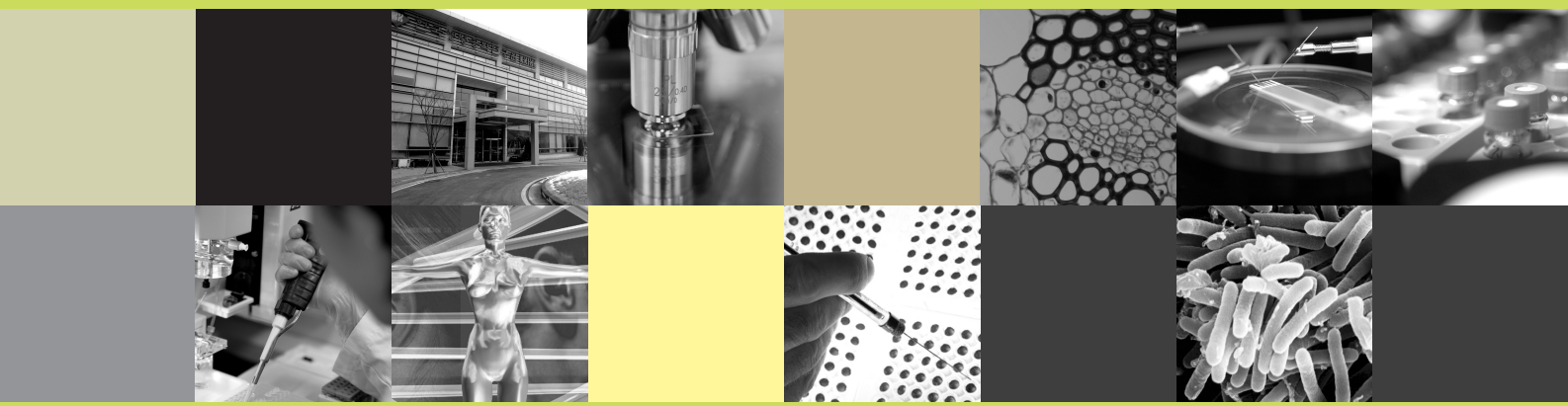
To solve the problems of the increasing amount of information and the lack of collections in the library, the library has made agreements with the Korean Medical Library Association (KMLA), National Digital Science Library (NDSL), Korea Institute of Science and Technology Information (KISTI), and Korea Education and Research Information Service (KERIS) so that researchers can obtain copies of original materials. The library has provided more materials (1,965 items) than it has received requests for original copies (1,623 items), which means that it has contributed to promoting document delivery among domestic libraries.

Management of Papers and Laboratory Notebooks

In deciding on promotions and assessing personal performance, every paper published by researchers has been managed with a special program (MIS) according to the criteria for paper assessment. The program is used for registering and inputting papers, building a full-text database, checking SCI and IF, issuing statistical data, reporting the results in and out of the KRIBB, providing a service for web users, and publishing references(SCI reference materials, vol. 7, in Sep.).

We manage the whole process related to laboratory notebooks-from requests and issuance to taking over-by implementing the management program (740 notebooks were issued in 2009). We promote laboratory notebook recording, and assist in establishing a proper research culture by running educational courses regularly. In line with this policy, we developed the Electronic Laboratory Notebook (ELN) system this year.

SCIENCE FOR THE HUMAN BEING



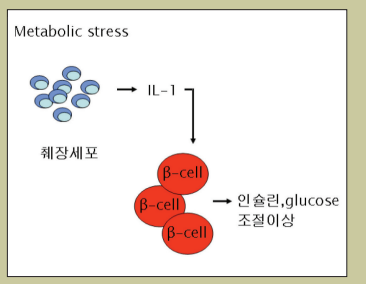
Korea Research Institute of Bioscience and Biotechnology

APPENDICES





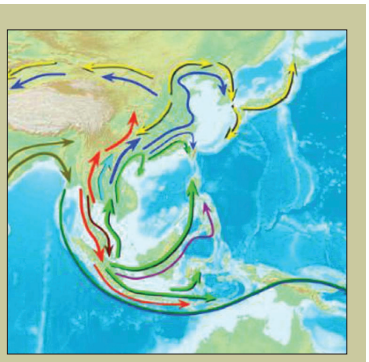
Outstanding Research Achievements



The Correlation between an Infection-Controlling Gene and Diabetes Has Been Defined

Researcher **Dr. Inpyo Choi** December 2009

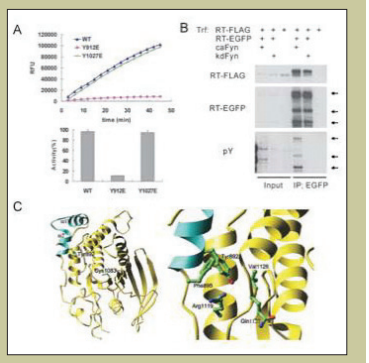
The research team led by Dr. Choi discovered two genes with a dual function on inflammation and diabetes, and identified their roles. The team discovered that these two genes make a complex in the cell to control inflammation, and the function of beta-cell producing insulin. They discovered a new gene called TXNIP (VDUP1), which makes up the infection-controlling complex. They also found that VDUP1 combines with NLRP3 and that these two proteins play a critical role in the secretion of IL-1. These findings suggest that a lack of either of these two proteins may result in problems with IL-1 secretion and inflammatory reaction. The results of this study were published in the December 21st edition of *Nature Immunology.*



International Joint Research Has Uncovered the Origin and Genetic Polymorphism of Asians

Researcher **Dr. Hyang-Sook Yoo** December 2009

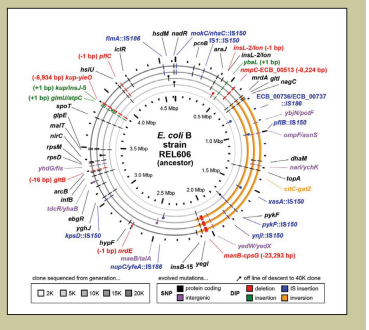
Members of HUGO Pan-Asian SNP Consortium started a comparative genomic analysis project using information obtained from 73 ethnic groups in South and North Asia in 2004, and have identified specifically where single nucleotide polymorphism, or SNP, occurs and how the spot varies depending on different ethnic groups. The findings released by the team in the December 11th edition of *Science* Magazine showed the migratory routes and genetic traits of Asians. According to the findings, Asians can be classified into different genetic groups along linguistic and geographic lines, with Southeast Asians exhibiting more genetic diversity than Northeast Asians.



The Activation Mechanism for the Nerve Cell Responsible for Memory and Learning Has Been Identified.

Researcher **Dr. Jae-Ran Lee** November 2009

The team led by Dr. Lee discovered that PTPR - a tyrosine phosphatase, located in a rat's hippocampal cell- plays an important role in the development of neuronal cells and signal transduction by controlling the formation of synapses. If a certain tyrosine gets phosphorylated and their combination thereby becomes stronger, PTPRT becomes less active and consequently cannot nurture the formation of synapses. The presence of phosphorylation on certain tyrosine residues of PTPRT, which results in stronger interaction between the molecules, may lead to a decrease in the functional activity that promotes the formation of neuronal synapses. In addition, PTPRT interacts with nerve cell adhesion molecules, which implies their possible involvement in neurological psychiatric disorders such as autism and low intelligence. The results of the research have been published in the *EMBO Journal* in November.



Discovery of the Genome Evolution Path Marks a New Epoch in Life Evolution Research

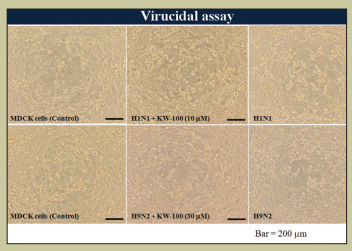
Researcher **Dr. Jihyun F. Kim** October 2009

Research jointly conducted by Professor Richard E. Lenski of Michigan State University in the U.S. and Professor Dominique Schneider of Joseph Fourier University in France has opened up a new chapter in the history of life evolution research, by unveiling the path of life evolution via comparative analyses of the genome sequence of a life that has been evolved in the laboratory over 40,000 generations and by establishing the correlation between evolution and the level of adaptation to the environment. With this research, the genome sequence of a living organism undergoing evolution has been decoded with higher precision, and the mutations of the genome have been followed up for tens of thousands of generations over some twenty years, something which has never been attempted before. The results were published as an article in *Nature* on October 18, 2009.

An Influenza Virus-Preventing Bio Material Has Been Developed

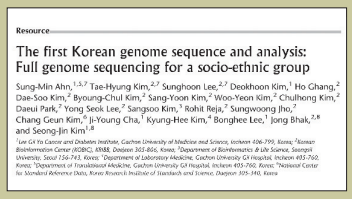
Researcher **Dr. Woo-Song Lee** October 2009

The team led by Dr. YI has developed KW-100, a bio-material capable of preventing the influenza virus, from herb extracts and fractions, and other compounds separated from them. KW-100 is capable of suppressing the activation of neuraminidase, an enzyme involved in the propagation of viruses, and can effectively prevent viruses borne by avian and Spanish influenza. Further research will be carried out to evaluate the effects of KW-100 in dealing with the H1N1 virus - which the WHO has officially declared as a pandemic, following the rapid rise in the number of cases of infection around the world, in order to develop these newly found materials into a new infection-preventing product.



The Korea Genome Project Has Been Completed
Korean Bioinformation Center June 2009

Korean Bioinformation Center of KRIBB and Gachon University of Medicine and Science jointly analyzed the genomic sequence of Koreans and discovered 3.43 million individual genetic variations out of a total of 3 billion DNA sequences. Of those variations, 420,000 have never been reported so far, and approximately 6% of the genome of Koreans was found to have new DNA sequences. Based solely on the diversity of genetic variation, the genome of Koreans was found to be around 48% different from that of Westerners, and around 40% different from that of the Chinese. The findings were released in Genome Research, a globally-recognized scientific journal on May 26, 2009. Korean Bioinformation Center, designated as an official institute by the Ministry of Education, Science and Technology, offers specialized genomic analysis services to support biological research.


Resource

The first Korean genome sequence and analysis: Full genome sequencing for a socio-ethnic group

Sung-Min Ahn,[1,5,7] Tae-Hyung Kim,[2,7] Sunghoon Lee,[2,7] Deokhoon Kim,[1] Ho Ghang,[2] Dae-Soo Kim,[2] Byoung-Chul Kim,[2] Sang-Yoon Kim,[2] Woo-Yeon Kim,[2] Chulhong Kim,[2] Daeui Park,[2] Yong Seok Lee,[2] Sangsoo Kim,[3] Rohit Reja,[3] Sungwoong Jho,[3] Chang Geun Kim,[4] Ji-Young Cha,[1] Kyung-Hee Kim,[4] Bonghee Lee,[1] Jong Bhak,[2,8] and Seong-Jin Kim[1,8]

[1] Lee Gil Ya Cancer and Diabetes Institute, Gachon University of Medicine and Science, Incheon 406-799, Korea; [2] Korean Bioinformation Center (KOBIC), KRIBB, Daejeon 305-806, Korea; [3] Department of Bioinformatics & Life Science, Soongsil University, Seoul 156-743, Korea; [4] Department of Laboratory Medicine, Gachon University Gil Hospital, Incheon 405-760, Korea; [5] Department of Translational Medicine, Gachon University Gil Hospital, Incheon 405-760, Korea; [6] National Center for Standard Reference Data, Korea Research Institute of Standards and Science, Daejeon 305-340, Korea

KRIBB Will Work Closely with Pfizer to Develop New Bio-Drugs

May 2009

KRIBB and Pfizer agreed to work closely to indentify therapeutic targets for the development of liver and stomach cancer drugs and develop potential candidates that will meet future demand for new drugs in Asian markets by screening the compounds and antibodies that Pfizer has already developed. If the genome data relating to stomach and liver cancers and the application expertise that KRIBB has accumulated over the years is merged with Pfizer's new drug development know-how, it will expedite the development of stomach and liver cancer drugs and KRIBB will be able to create a new model for global new drug development in Korea.

KRIBB Launches Its Second R&D Enterprise, Miko Bio-Med

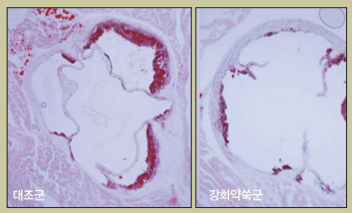
Researcher **Dr. Bong Hyun Chung** May 2009

KRIBB has launched its second R&D enterprise, Miko Bio-Med, which will produce a blood sugar sensor using a nano cap sensor and a glucose oxidase modulator developed by Dr. Chung and his team at the Bio Nanotechnology Research Center. The blood sugar sensor is made as a strip and portable device that uses a stable blood sugar-measuring enzyme. The sensor is so sensitive that just a drop of blood or urine is enough to obtain data on a person's overall health profile, including diseases, etc. Miko Bio-Med will serve as a key channel through which KRIBB will commercialize its bio-sensor technology for diagnosis and measurement.

Wormwood Grown on Ganghwado Island Found to Prevent Obesity and Improve Blood Circulation

Researcher **Dr. Tae Sook Jeong** April 2009

The team led by Dr. Jeong administered Ganghwa wormwood spirit extract to laboratory mice with a high-fat diet for 8 weeks. The results showed that their total blood-cholesterol level decreased by 7.1% and triglycerides dropped by 22.5%, compared to the obese control group, which was not given the wormwood extract. The team proved that wormwood spirit extract suppresses the generation of inflammation-stimulating materials that can be activated under various circumstances, as well as the activation and transmission of arteriosclerosis-triggering signals, thereby preventing arteriosclerosis and obesity.

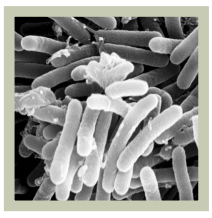


List of Patents Registered Overseas

Title of Patent	Inventors	Date	Country
Method of diagnosing of cancers by measuring the changes glycosylation of proteins related to tumorigenesis and metastasis and kit for diagnosis of cancers using the same	**Dr. Jeong Heon Ko** et al.	Jan 04	China
Fungicide compositions comprising extract of Chloranthus henryi and a novel sesquiterpene compound isolated from them	**Dr. Sung Uk Kim** et al.	Feb 17	U.S.A
A use of nover 2-oxo-heerocyclic compounds and the pharmaceutical compositions comprising the same	**Dr. Hwan Mook Kim** et al.	Mar 11	China
Fluorescent indicator proteins with increased signal intensity to concentration of sugars and use thereof	**Dr. Seung Goo Lee** et al.	Mar 25	U.K
Differentiation regulating agent containing a gene which regulates differentiation from stem cell to natural killer cell effective ingredient	**Dr. In Pyo Choi** et al.	Mar 26	Austrailia
Differentiation regulating agent containing gene which regulating differentiation from stem cell to natural killer cell effective ingradient	**Dr. In Pyo Choi** et al.	Mar 27	Russia
Nover abiet ane diterpenoid compound, and composition comprising extract of torreya nucifera, or abiet ane diterpenoid compounds or terpenoid compounds isolated from them for the prevention and treatment of cardiovascular disease	**Dr. Tae Sook Jeong** et al.	Apr 14	U.S.A
A peroxidase genomic gene derived from ipomoea batatas and a promoter thereof	**Dr. Sang Soo Kwak** et al.	Apr 21	Canada
Rapid method of screening translational fusion partners for producing recombinant proteins and translational fusion partners screened from them	**Dr. Jung Hoon Sohn** et al.	Apr 29	India
A protease, a gene derived from it and the use thereof	**Dr. Ho Yong Park** et al.	May 13	Europe
Agastache rugosa extract and composition containing tilianin isolated and purified from said extract having anti-inflammatory and anti-atherogenic activity	**Dr. Hyeong Kyu Lee** et al.	May 19	U.S.A
Prodigiosin composition for the treatment of rheumatoid arthritis	**Dr. Hwan Mook Kim** et al.	Jul 03	Japan
Multiple stress-inducible peroxidase promoter derived form ipomoea batatas	**Dr. Sang Soo Kwak** et al.	Jul 08	China
A protease, a gene therefor and the use thereof	**Dr. Ho Yong Park** et al.	Jul 21	U.S.A
Method of Diagnosing Liver Diseases	**Dr. Eun Young Song** et al.	Aug 18	U.S.A
Antibiotics-indepentdent vector for constant high-expression and method of gene expression using the same	**Dr. Moon Hee Sung** et al.	Aug 21	Japan
Novel 2-oxo-heterocyclic compounds and pharmaceutical compositions comprising the same	**Dr. Hwan Mook Kim** et al.	Sep 02	China
A protease, a gene therefor and the use thereof	**Dr. Ho Yong Park** et al.	Sep 02	India

List of Technology Transfers

Name of Technology	Date	Director	Company
Technology for bio-compatible sunscreen and anti-oxidant containing nano-cosmetics using nano-technology	Jun 30	**Dr. Bong Hyun Chung**	Bioprogen Co.
Bio-fertilizer and its manufacturing technology using waste made during the palm-oil extracting process	Jul 07	**Dr. Jae Jun Song**	Ultimate Biotech Sdn. Bhd.
Compact-type SPR biosensor system and manufacturing technology for the biosensor and its compatible chip	Jul 07	**Dr. Bong Hyun Chung**	Komico. Co.
Technologies for manufacturing novel phytase and its utilization as additives	Jul 17	**Dr. Tae Kwang Oh**	Esseltech Co.
Technology for compounds including turmeric extract that can be used for preventive and therapeutic purposes against influenza virus infection	Oct 08	**Dr. Woo-Song Lee**	Koreastevia. Co.
Transgenic mouse for disease model	Oct 20	**Dr. Dae-yeol YU**	Central Lab. Animals Inc.



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2009
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List of Research Projects

MEST	Ministry of Education, Science and Technology	**RDA**	Rural Development Administration
MKE	Ministry of Knowledge Economy	**KRCF**	Korea Research Council of Fundamental Science & Technology
MIFAFF	Ministry for Food, Agriculture, Forestry and Fisheries	**KEMCO**	Korea Energy Management Corporation
MIHWAF	Minister for Health, Welfare and Family Affairs	**KFS**	Korea Forest Service
ME	Ministry of Environmemt	**CBTP**	ChungBuk Techno Park
MLTM	Minister of Land, Transport and Maritime Affairs	**GATC**	Ganghwa Agricultural Technology Service Center

Project Title	Manager	Fund	Period
Studies on the molecular markers of cancer metastasis using quantitative proteomics and immuno-proteomics	**Dr. Sunghyun Kang**	MEST	05.01.2009-04.30.2010
Development of a dedifferentiation-accelerating technology using epigenetic system-modifying proteins	**Dr. Yong-Kook Kang**	MEST	08.01.2009-07.31.2010
Development of fully human monoclonal antibodies against a novel target for cancer therapeutics	**Dr. Sangseok Koh**	MEST	04.01.2009-03.31.2010
Mechanistic studies and antibody therapeutic application of CTHRC1, a novel factor expressed in cancer cells	**Dr. Sangseok Koh**	MEST	11.15.2009-10.31.2010
Mechanistic studies and therapeutic applications of a new apoptosis-inducing biofactor	**Dr. Sangseok Koh**	MEST	07.16.2009-07.15.2010
Development of hepatoma biomarker(s) using glycomic approach	**Dr. Jung Hun Koh**	MEST	04.01.2009-03.31.2010
Institutional cooperation for cancer biomarker developemnt	**Dr. Jung Hun Koh**	MEST	07.01.2009-06.30.2010
Development and application of the drought tolerant plants for combating desertification	**Dr. Sang-Soo Kwak**	MEST	12.28.2009-12.27.2010
Operation of the for Korea-China Biothchnology Collaboratioon Research Center on Combating Desertification	**Dr. Sang-Soo Kwak**	MEST	12.28.2009-12.27.2010
Spatio-temporal Bio-imaging of calcium signaling system	**Dr. Ki-Sun Kwon**	MEST	04.01.2009-03.31.2010
Study on the redox-mediated cell shgnaling network	**Dr. Ki-Sun Kwon**	MEST	08.01.2009-07.31.2010
Development of Nutraceuticals and Viologically Active Compounds for Cancer Therapy	**Dr. Byoung-Mog Kwon**	MEST	04.01.2009-03.31.2010
Mode of actions of candidates in biological systems with genomic and proteomic tools	**Dr. Byoung-Mog Kwon**	MEST	04.01.2009-03.31.2010
Development of metagenome expression and genetic enzyme screening system	**Dr. Ohsuk Kwon**	MEST	08.01.2009-07.31.2010
Development of molecular biological tools for the strain improvement of succinic acid producing Mannheimia succiniciproducens	**Dr. Ohsuk Kwon**	MEST	04.01.2009-03.31.2010
Study of two-component signal transduction system of the methylotrophic yeast Hansenula polymorpha	**Dr. Ohsuk Kwon**	MEST	05.01.2009-04.30.2010
Development of functional genome resources of gastric and liver cancers and Construction of their database combined with function information	**Dr. Nam Soon Kim**	MEST	04.01.2009-03.31.2010
Development of targets and preclinical drugs for the tailored therapy of gastric cancer	**Dr. Nam Soon Kim**	MEST	07.16.2009-07.15.2010
Planning for Structural Proteomics Program in Korea	**Dr. Myung Hee Kim**	MEST	07.15.2009-2009.10.14
Proteome Bank	**Dr. Myung Hee Kim**	MEST	04.01.2009-03.31.2010
Development of a Cancer-Diagnosis Biosensor Targeting Post-Modified Proteins	**Dr. Min-Gon Kim**	MEST	07.01.2009-06.30.2010
Development of microreactor-type optical biosenser for diagnosis and monitoring	**Dr. Min-Gon Kim**	MEST	07.10.2009-06.30.2010
Discovery and functional analysis of new anti-cancer target genes using DNA methyltransferase inhibitors	**Dr. Bo-Yeon Kim**	MEST	07.16.2009-07.15.2010
Global Research Center for Discovery of Cancer Targets and Chemotherapeutics Based on Kinomics	**Dr. Bo-Yeon Kim**	MEST	12.01.2009-11.30.2010
Identifaction funcional exploitation of genes regulating ingibition of ionizing radiation-induced ER-stress	**Dr. Bo-Yeon Kim**	MEST	04.01.2009-03.31.2010

Project Title	Manager	Fund	Period
Development of antibodies recognizing cancer-specific glycosylation and their application to cancer diagnosis	**Dr. Sang Jick Kim**	MEST	05.01.2009-04.30.2010
Epithelial-mesenchymal transition(EMT) induction and regulation of cancer metastasis and progression by a noval serine protease TMPRSS4	**Dr. Semi Kim**	MEST	09.01.2009-08.31.2010
Regulation of cancer metastasis and progression by deltaEF1 family: Identification and validation of novel cancer metastasis promoters	**Dr. Semi Kim**	MEST	05.01.2009-04.30.2010
Development of natural drugs for hyperlipidemia.	**Dr. Young-Kook Kim**	MEST	04.01.2009-03.31.2010
Monitoring and in-depth analysis of aberrant glycoproteins as cancer biomarkers using mass spectrometry	**Dr. Yong Sung Kim**	MEST	07.10.2009-06.30.2010
Early detection of gastric cancer using DNA biomarker	**Dr. Yong Sung Kim**	MEST	04.01.2009-03.31.2010
Integrative Epigenome Profiling of Human Embryonic Stem Cells	**Dr. Yong Sung Kim**	MEST	09.01.2009-07.31.2010
Development of new antibacterial compounds using microbial genomics	**Dr. Won-Gon Kim**	MEST	04.01.2009-03.31.2010
Study on Inhibitors of New Anti-mycobacterial Target, Enoyl-ACP Reductase	**Dr. Won-Gon Kim**	MEST	05.01.2009-04.30.2010
An Integrated Information Bank for Microbial Genome Research	**Dr. Jihyun F. Kim**	MEST	04.01.2009-03.31.2010
Human and Environmental Risk assessment of transgenic crops	**Dr. Chang-Gi Kim**	MEST	04.01.2009-03.31.2010
Exploitation of microbial diversity under extreme and rhizosphere environment	**Dr. Chang jin Kim**	MEST	04.01.2009-03.31.2010
Functional analysis of 3-hydroxypropionic acid synthesis enzyme derived from Lactobacillus sp	**Dr. Chul Ho Kim**	MEST	05.01.2009-04.30.2010
Development of plant-derived vaccine for Alzheimer's disease	**Dr. Hyun Soon Kim**	MEST	04.01.2009-03.31.2010
Construction of Biosafety Management System for R&D LMO	**Dr. Hwan Mook Kim**	MEST	07.01.2009-03.31.2010
Evaluation of efficacy and pharmacokinetics of molecular target specific anticancer drug candidates and validation of molecular targets	**Dr. Hwan Mook Kim**	MEST	11.15.2009-11.14.2010
Development of Disease animal models using proton beam	**Dr. Ki-Hoan Nam**	MEST	04.01.2009-03.31.2010
Study of virus infection-inflammation regulatory bio-material based on cell adhesionmolecule and cytokine	**Dr. Mun-Chual Rho**	MEST	05.01.2009-03.31.2010
Understanding signaling transduction/ production technique of bacterial secondary metabolite	**Dr. Choong-Min Ryu**	MEST	04.01.2009-03.31.2010
Quantitative and PTM analysis of Mitochondrial Proteome in diabetes model and clinical samples	**Dr. Jeong Hee Moo**	MEST	04.01.2009-03.31.2010
Functional analysis of the pathogen-associated molecular patterns and effector of Burkholderia glumae causing bacterial grain rot in rice and the development of the disease control methods by the surveillance mechanism of rice to the pathogen	**Dr. Jae Sun Moon**	MEST	04.01.2009-03.31.2010
Study of co-regulation of disease specific metabolome with proteome and genome	**Dr. Sung Goo Park**	MEST	2009.04.01-03.31.2010
Evaluation of anticancer activity, pharmacokinetics, and preliminaty toxicity of anticancer drug candidates targeting RhoB	**Dr. Song-Kyu Park**	MEST	04.01.2009-03.31.2010
Development of bio-contents and on-chip kits for MS-based diagnosis	**Dr. Sung Sup Park**	MEST	07.10.2009-06.30.2010
Construction of fully human monoclonal antibody for the treatment of Lung cancer	**Dr. Youngwoo Park**	MEST	07.31.2009-05.31.2010
Development of fully human antibodies and Receptor fusion proteins for Rheumatoid Arthritis	**Dr. Youngwoo Park**	MEST	11.15.2009-11.14.2010
Epigenetic control of plant defense responses against viral pathogens	**Dr. Jeong Mee Park**	MEST	09.01.2009-08.31.2010
Development of high active xylanase from insect microbes	**Dr. Ho-Yong Park**	MEST	04.01.2009-03.31.2010
System development for application of genomic sequence information	**Dr. Hong-Seog Park**	MEST	09.01.2009-07.31.2010
Robustness engineering of Escherichia coli : discovery and application of new targets	**Dr.Jae Gu Pan**	MEST	04.01.2009-03.31.2010

Project Title	Manager	Fund	Period
Development of cellulolytic yeast complex for consolidated bioprocess	**Dr. Jung Hoon Sohn**	MEST	03.01.2009-02.28.2010
Development of detection system for HCC marker	**Dr. Eun Young Song**	MEST	04.01.2009-03.31.2010
Development of High-Throughput Screening Technology for Enzyme Mining on the Basis of HTS Robot System	**Dr. Jae Jun Song**	MEST	08.01.2009-07.31.2010
Characterization of nanoimprint technology based on nano-phtoelectronic devices	**Dr. Yong Beom Shin**	MEST	04.01.2009-03.31.2010
Development of Sweetpotato with High Levels of Antioxidants for Marginal Land	**Dr. Young Ock Ahn**	MEST	07.01.2009-06.30.2010
Bioactive Metabolite Research Center	**Dr. Jong-Seog Ahn**	MEST	10.01.2009-09.30.2010
Construction of Polyketide Biosynthetic Diversity and Screening of Bioactive Microbial Metabolite.	**Dr. Jong-Seog Ahn**	MEST	04.01.2009-03.31.2010
Identification of molecular targets for the targeted therapy of hepatocellular carcinoma and their application for therapeutics development	**Dr. Young Il Yeom**	MEST	04.01.2009-03.31.2010
Modelling the genetic network of calcium metabolism by DNA microarray-based gene expression analysis	**Dr. Young Il Yeom**	MEST	04.01.2009-03.31.2010
Development of Molecular Imaging Technology for Glycan Marker	**Dr. Doo-Byoung Oh**	MEST	05.01.2009-04.30.2010
Development of large-scale CO2 fixation and biodiesel production technology using improved microalgae.	**Dr. Hee-Mock Oh**	MEST	04.01.2009-03.31.2010
Determination of SMART antibody mechanism and Structure-Based Antibody Design for Nano-Diagnostics	**Dr. Eui-Jeon Woo**	MEST	09.01.2009-06.30.2010
Developing protein biosensor by engineering of hormone nuclear receptors	**Dr. Eui-Jeon Woo**	MEST	07.16.2009-07.15.2010
Structural and functional studies on the mechanism of DNA degradation in caspase-independent apoptosis	**Dr. Eui-Jeon Woo**	MEST	09.01.2009-08.31.2010
A study on mode of action of RoB-modulating anti-cancer drug	**Dr. Mi Sun Won**	MEST	04.01.2009-03.31.2010
Control of insulin signaling by the neuropept ide and ER stress	**Dr. Kweon Yu**	MEST	09.01.2009-08.31.2010
Functional analysis of the short neuropeptide F signaling for regulating metabolic syndrome	**Dr. Kweon Yu**	MEST	05.01.2009-02.28.2010
Establishment of lung cancer model mice vulnerable to oxidative stress and elucidation of the related mechanisms	**Dr. Dae-Yeul Yu**	MEST	07.16.2009-07.15.2010
Generaion of ENU mutant mice and studies on in vivo function of the mice	**Dr. Dae-Yeul Yu**	MEST	03.01.2009-02.28.2010
Target mining and clinical validation for liver cancer using hepatitis virus transgenic mice	**Dr. Dae-Yeul Yu**	MEST	04.01.2009-03.31.2010
Enhancement of plant comoplex resistance and growth rate by manipulating membrane signal transduction	**Dr. Beung Tae Ryu**	MEST	04.01.2009-03.31.2010
Development of Cyanocrop by utilizing photosynthetic Syanobacterial genes	**Dr. Stephen Beungtae Ryu**	MEST	04.01.2009-03.31.2010
Discovery and development of domestic novel and useful biological resources	**Dr. Jung Hoon Yoon**	MEST	04.01.2009-03.31.2010
Microbial Resources Bank-Metagenome Bang	**Dr. Jong Hoon Yoon**	MEST	04.01.2009-03.31.2010
Crystallization of macromolecules for neutron Bio-diffractometer	**Dr. Tae-Sung Yoon**	MEST	07.01.2009-06.30.2010
Development of selective small-molecule inhibitors of tumor hypoxia	**Dr. Kyeong Lee**	MEST	03.01.2009-11.30.2009
The functions of Drosophila insulin-like peptides in growth and metabolism	**Dr. Kyu-Sun Lee**	MEST	05.01.2009-04.30.2010
Pulmonary/Intravenous siRNA Delivery System for Lung Cancer Therapy	**Dr. Myung Kyu Lee**	MEST	07.10.2009-06.30.2010
Integration System on National Biological Resource and Genome Information	**Dr. Byung Wook Lee**	MEST	04.01.2009-03.31.2010
Differentiation control of human mesenchymal stem cell via targeting on the regulation network of Protein tyrosine phosphatases	**Dr. Sang Chul Lee**	MEST	08.01.2009-07.31.2010
The study and operation of the ombudsman system on the institutional research ethics	**Dr. Sang Chul Lee**	MEST	07.01.2009-06.30.2010

List of Research Projects

Project Title	Manager	Fund	Period
High-throughput Affinity Screening Technology	**Dr. Seung Goo Lee**	MEST	03.01.2009-02.28.2010
System development for single-cell assay and molecular evolution of functional biocatalysts	**Dr. Seung Goo Lee**	MEST	07.16.2009-07.15.2010
Complex natural plants therapeutics for the treatment of hepatitis	**Dr. Young Ik Lee**	MEST	04.01.2009-03.31.2010
Development of biomaterial for virus infection control	**Dr. Woo Song Lee**	MEST	05.01.2009-03.31.2010
Development of integrated bioprocess for biopharmaceutical proteins using quality-by-design technology	**Dr. Eun-Gyo Lee**	MEST	07.10.2009-06.30.2010
Quantitative analysisof tyrosine phosphorylation in the synapse formation	**Dr. Jae-Ran Lee**	MEST	09.01.2009-08.31.2010
Management for the Application of Bio R&D Products (Bioresources)	**Dr. Jung-Sook Lee**	MEST	04.01.2009-03.31.2010
Development of cell line with multiple transgenes for xenotransplantation	**Dr. Jeong-Woong Lee**	MEST	07.31.2009-05.31.2010
Mechanical studies of embryogenesis/ovary disease by protein aggregates	**Dr. Jeong-Woong Lee**	MEST	05.01.2009-04.30.2010
Development of nutraceuticals to improve erectile dysfunction, protecting liver function from indigenous Ogalpi	**Dr. Jung Joon Lee**	MEST	04.01.2009-03.31.2010
Studies on the molecular function of ZFP91 and validation as a molecular target for cancer therapy	**Dr. Jung Joon Lee**	MEST	04.01.2009-03.31.2010
Seed bank establishment of rare and endangered plant species in Korea	**Dr. Joongku Lee**	MEST	04.01.2009-03.31.2010
Infra-establisment and Support of Metabolic Syndrome Animal Models for Mitochondrial Function-regulation Researches	**Dr. chul ho Lee**	MEST	09.01.2009-07.31.2010
Establishment of Plant extract bank	**Dr. Hyeong-Kyu Lee**	MEST	04.01.2009-03.31.2010
Developement of a diagnostic tool for gastric cancer using protein biomarker	**Dr. Hee Gu Lee**	MEST	04.01.2009-03.31.2010
Development of biological products for monitoring bio-medical function using high sensitive biosystems	**Dr. Hee Gu Lee**	MEST	04.01.2009-03.31.2010
Near-infrared Molecular Imaging Platform for Tracking of Immunotherapeutic Cells	**Dr. Yong Taik Lim**	MEST	03.01.2009-08.31.2009
Development of somatic cell clone monkey	**Dr. Kyu-Tae Chang**	MEST	04.01.2009-03.31.2010
Establishment of neuroprotective strategies in the primate model	**Dr. Kyu-Tae Chang**	MEST	05.01.2009-04.30.2010
Study of epigenetic genes related to radiational-induced genome instability and sensitivity	**Dr. Kyung-Sook Chung**	MEST	03.01.2009-02.28.2010
Elucidation of activation mechanism of MAP kinase and development for structure-based drugs by structural studies of MAP kinase phosphatase1	**Dr. Dae Gwin Jeong**	MEST	05.01.2009-04.30.2010
Design, purification and production of highly sensitive and stable L-Glutamate oxidase	**Dr. Bong Hyun Chung**	MEST	07.10.2009-06.30.2010
Development of Novel Switch Molecules for Molecular Diagnosis and Imaging	**Dr. Bong Hyun Chung**	MEST	03.01.2009-02.28.2010
Development of protein chip-based bioassay system and biological contents for protein chip applicaion	**Dr. Bong Hyun Chung**	MEST	07.31.2009-05.31.2010
Planning and management of protein chip technology research project	**Dr. Bong Hyun Chung**	MEST	07.31.2009-05.31.2010
Development of Bio-system for Optimization of Label Free Molecular Imaging Technology	**Dr. Sang Jeon Chung**	MEST	08.01.2009-07.31.2010
Production and application of biomolecules for bio-electronical devices	**Dr. Yongwon Jung**	MEST	04.01.2009-03.31.2010
The application of novel genes associated with tumor growth and metastasis for the treatment of liver cancer	**Dr. Cho-Rok Jung**	MEST	04.01.2009-03.31.2010
Development of new therapeutics on atherosclerosis via the combination of ACAT inhibitors and modulators of bile acid synthesis	**Dr. Tae-Sook Jeong**	MEST	03.01.2009-02.28.2010
Research on the mechanism of proton beam-induced mutagenesis and prospects of its applications	**Dr. Haeyoung Jeong**	MEST	04.01.2009-03.31.2010
The establishment and management of foreign biological resources center	**Dr. Hyouk Joung**	MEST	11.01.2009-09.30.2010

Project Title	Manager	Fund	Period
Development of cancer diagnostics using tumor-associated autoantibodies	**Dr. Eun Wie Cho**	MEST	09.01.2009-08.31.2010
Study of cellular signaling networks regulation stem cell function	**Dr. Yee Sook Cho**	MEST	08.01.2009-07.31.2010
Development of Bcl-2 family inhibiting anti-cancer therapeutics based on a novel apoptsis pathway.	**Dr. Seung-Wook Chi**	MEST	09.01.2009-08.31.2010
Identification of a novel Bcl-2 family-binding protein and structure-based interaction site mapping	**Dr. Seung-Wook Chi**	MEST	05.01.2009-04.30.2010
Development of Bacillus expression system using mRNA stabilizer	**Dr. Soo-Keun Choi**	MEST	04.01.2009-03.31.2010
Synthetic biology for the biological production of hydrocarbon biofuel	**Dr. Eui Sung Choi**	MEST	04.01.2009-03.31.2010
Development of platform technology for cancer immunotherapy	**Dr. Inpyo Choi**	MEST	04.01.2009-03.31.2010
Funtional analysis of VDUP1 as a drug target	**Dr. Inpyo Choi**	MEST	07.16.2009-07.15.2010
Development of Industrial Host-Vector System based on metagenomic Resources	**Dr. Jong Hyun Choi**	MEST	05.01.2009-04.30.2010
Development of database and bioinformatics tool of microarray gene expression profile data	**Dr. In-Sun Chu**	MEST	07.16.2009-07.15.2010
Development of zero-reference nanostructure for one-tip multicomponent nano-inking system in the dip-pen nanolithography	**Dr. Tai Hwan Ha**	MEST	05.01.2009-04.30.2010
Target identification and characterization of molecular mechanism for biologically active chemicals	**Dr. Dong Cho Han**	MEST	04.01.2009-03.31.2010
Strategy for the participation of global epigenomics consortium	**Dr. Kwang-Lae Hoe**	MEST	05.01.2009-11.30.2009
Development of Deposit and Application Systems for Biological Data	**Dr. Bo Kyeng Hou**	MEST	04.01.2009-03.31.2010
Construction and Utilization of plant EST DB	**Dr. Cheol Goo Hur**	MEST	04.01.2009-03.31.2010
Development of a interpretation system for gene-regulatory networks in plant pathogens	**Dr. Cheol Goo Hur**	MEST	04.01.2009-03.31.2010
The international tomato chromasome 2 sequencing project and functional analysis for solanaceae genomes	**Dr. Cheol Goo Hur**	MEST	04.01.2009-03.31.2010
A Study on the OECD WPB-related Activities	**Dr. Hyeon Byung Hwan**	MEST	02.10.2009-02.09.2010
Supporting Program for Policy & Information of Biotechnology	**Dr. Hyeon Byung Hwan**	MEST	07.01.2009-06.30.2010
Technologies of a reconstruction of biosynthetic pathway for modification of benwoquinone ring of geldanamycin	**Dr. Young-Soo Hong**	MEST	04.01.2009-03.31.2010
Anti-metastasis therapeutic antibody development	**Dr. Hyo Jeong Hong**	MEST	07.31.2009-05.31.2010
Production of tag-t2 humanized antibody	**Dr. Hyo Jeong Hong**	MEST	03.01.2009-02.28.2010
Development of PAR-2 antagonist for treatment of inflammatory skin diseases	**Dr. Jong Soon Kang**	MKE	10.01.2009-09.30.2010
Efficacy evaluation of pinitol in animal model of osteoporosis	**Dr. Jong Soon Kang**	MKE	10.01.2009-04.30.2010
In vitro activity of a Remicade biosimilar	**Dr. Sang Seok Koh**	MKE	10.01.2009-04.30.2010
Studies on the biological activity of materials for periodontal tissue regeneration using collagen barriers	**Dr. Ki-Sun Kwon**	MKE	10.01.2009-04.30.2010
Development of glycan control and analysis system of glyco-medicine	**Dr. Ohsuk Kwon**	MKE	07.01.2009-06.30.2010
Development of detection system(kit) for new Influenza A (H1N1) mutant and Tamiflu-resistant virus	**Dr. Dong-Uk Kim**	MKE	10.01.2009-04.30.2010
The analysis of CXCL-10 antibody in CIA animal model	**Dr. Seon-Young Kim**	MKE	10.01.2009-09.30.2010
Development of analysis method for standard gene and antigen in malaria infection-diagonostics	**Dr. Won-Gon Kim**	MKE	08.01.2009-07.31.2010
Study on effects of blood in antigen-antibody reaction	**Dr. Won-Gon Kim**	MKE	04.11.2009-12.31.2009

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Development of functional food to improve adult disease using soybean fermented by Monascus	**Dr. Chul Ho Kim**	MKE	04.01.2009-06.05.2009
Development of functional food to improve metabolic syndrome using the medicinal plants	**Dr. Chul Ho Kim**	MKE	10.01.2009-09.30.2010
Bridging project of formulation material bank	**Dr. Hwan Mook Kim**	MKE	12.01.2009-04.30.2010
Clinical studies and global commercialization of a leading antidiabetic drug	**Dr. Byoung Chul Park**	MKE	10.01.2009-04.30.2010
Develpoment of prodrugs for insoluble drugs	**Dr. Byoung Chul Park**	MKE	10.01.2009-09.30.2010
High resolution impurity profiling for preclinical study	**Dr. Byoung Chul Park**	MKE	10.01.2009-09.30.2010
Development of anti-cancer antibody specific for HER2	**Dr. Youngwoo Park**	MKE	10.01.2009-09.30.2010
Platform engineering center for industrial utilization of protein resources	**Dr. Jae Gu Pan**	MKE	08.01.2009-07.31.2010
Selection of phytase clone displaying improved thermostability and activity	**Dr. Jae Gu Pan**	MKE	11.01.2009-01.31.2010
Production of recombinant anti-obesity vaccine using yeast	**Dr. Jung Hoon Sohn**	MKE	06.01.2009-05.31.2010
Development of combined subuni antigens against Erysipelothrix rhusiopathiae Clostridium perfringens	**Dr. Jung-Oh Ahn**	MKE	10.01.2009-09.30.2010
Development of the next-generation super-biosimilar diabetes therapeutics	**Dr. Doo-Byoung Oh**	MKE	10.01.2009-09.30.2010
Commercialization of novel bio-molecule that has a compex of resistances against pathogens	**Dr. Beung Tae Ryu**	MKE	08.01.2009-11.30.2009
In vitro and in vivo efficacy evaluation in support of the development of glycosylation-based prodrugs of poorly soluble drugs	**Dr. Kiho Lee**	MKE	10.01.2009-09.30.2010
Engineering human growth hormone for innovative non-parenteral protein drug	**Dr. Seung Goo Lee**	MKE	10.01.2009-09.30.2010
Production of 2-pyrrolidone through industrial biotechnology	**Dr. Eun-Gyo Lee**	MKE	06.01.2009-05.31.2010
Specialized cluster for therapeutic antibody business	**Dr. Eun-Gyo Lee**	MKE	04.01.2009-03.31.2010
Development of porcine circovirus associated disease combined vaccine and diagnostic kit	**Dr. Hong-Weon Lee**	MKE	10.01.2009-09.30.2010
Development of Purification Process for Leukotuximab Commercialization	**Dr. Hong-Weon Lee**	MKE	12.01.2009-04.30.2010
A Project on the Establishment of Biosafety Information Infrastructure for a Focal Point of BCH	**Dr. Ho-Min Jang**	MKE	01.01.2009-12.31.2009
Development of materialls for one-spot multiple bioanalysis	**Dr. Bong Hyun Chung**	MKE	07.01.2009-06.30.2010
Commercialization of multi-channel surface plasmon resonance ellipsometer	**Dr. Sang Jeon Chung**	MKE	04.01.2009-05.31.2010
Development of biointerfacing technology for multi-functional nanocomplex	**Dr. Yongwon Jung**	MKE	06.01.2009-05.31.2010
Discovery of anticancer drug candidate modulating endoplasmic reticulum stress	**Dr. Bo-Yeon Kim**	MIHWAF	06.01.2009-05.31.2010
Development of radio-immunotherapeutic agent with VEGFR-2 neutralizing antibody	**Dr. Semi Kim**	MIHWAF	05.25.2009-05.24.2010
Identification of in vivo target molecules of tumor metastasis inducer TMPRSS4 and its application to colorectal cancer therapy	**Dr. Semi Kim**	MIHWAF	04.01.2009-03.31.2010
Development of Inhibitors of New Anti-mycobacterial Target InhA	**Dr. Won Gon Kim**	MIHWAF	05.01.2009-03.31.2010
Functional study of Intrinsic factors associated with malignant colon cancer	**Dr. Jae Wha Kim**	MIHWAF	05.01.2009-03.31.2010
Target validation of novel HIF modulators as drugable targets for HCC and study of a basic technology for drug development	**Dr. Kyung Chan Park**	MIHWAF	05.25.2009-05.24.2010
Molecular mechanism study of biomarker for metastasis of colon cancer	**Dr. Byoung Chul Park**	MIHWAF	04.01.2009-03.31.2010
Target validation and therapeutic antibody development using the cancer genomic databases	**Dr. Young Woo Park**	MIHWAF	04.01.2009-03.31.2010
National Cosmeceutical Research Center	**Dr. Ick Dong Yoo**	MIHWAF	04.01.2009-03.31.2010

Project Title	Manager	Fund	Period
The novel molecular mechanism for Non Alcoholic fatty liver disease and Hepatocellular carcinoma	**Dr. Cho Rok Jung**	MIHWAF	05.01.2009-04.30.2010
Elucidation of structural basis for neutralization mechanism by hepatitis B virus and structure-based design of hepatitis B therapeutic antibody	**Dr. Seung Wook Chi**	MIHWAF	04.01.2009-03.31.2010
Molecular recognition mechanism of p53 in cancer protein network	**Dr. Seung Wook Chi**	MIHWAF	05.25.2009-05.24.2010
Structural basis for p53 rescue from mdm2 by SUSP4	**Dr. Kyon Hoon Han**	MIHWAF	05.01.2009-04.30.2010
Therapeutic Antibody Center	**Dr. Hong Hyo Jeong**	MIHWAF	04.01.2009-03.31.2010
Production of goat cloned embryos for TPO manufacturing	**Dr. Yong Kook kang**	MIFAFF	06.25.2009-06.24.2010
Development of an Integrated Portable DNA Analysis Microsystem for On-site Verification of Korean Cow Originality	**Dr. Min-Gon Kim**	MIFAFF	04.10.2009-04.09.2010
Development of high-intensity sweetener using citrus peel wastes	**Dr. Min Soo Kim**	MIFAFF	05.30.2009-05.29.2010
Development of high potency ginseng products for prevention of metabolic diseases	**Dr. Bo-Yeon Kim**	MIFAFF	06.25.2009-06.24.2010
Search for Novel Insecticides to Inhibit Sterol Acyl Transferase and Mechanism study	**Dr. Young-Kook Kim**	MIFAFF	05.30.2009-05.29.2010
Development of monitoring method for GM oilseed rape and bentgrass	**Dr. Chang-Gi Kim**	MIFAFF	04.10.2009-04.09.2010
Studies on bacterial quorum sensing system for the development of biocontrol agent	**Dr. Chang Jin Kim**	MIFAFF	06.25.2009-06.24.2010
Cultivar registration of transgenic elite lines expressing TGEV and HBV antigen and development as edible vaccine	**Dr. Hyun Soon Kim**	MIFAFF	04.10.2009-04.09.2010
Management of plant diseases by induced systemic resistance	**Dr. Choong-Min Ryu**	MIFAFF	04.25.2009-04.24.2010
Development of defense triggers derived from natural product and metagenome against biotic and abiotic stresses	**Dr. Choong-Min Ryu**	MIFAFF	04.10.2009-04.09.2010
The development of the certification technique for the crop breeding resistant to viral diseases	**Dr. Jae Sun Moon**	MIFAFF	04.10.2009-04.09.2010
Microbial display: Development of platform host displaying biomass-degrading enzymes	**Dr. Jae Gu Pan**	MIFAFF	04.10.2009-04.09.2010
Development of cost-effective production system for recombinant cellulase	**Dr. Jung Hoon Sohn**	MIFAFF	06.25.2009-06.24.2010
Development of dandelion as an industrial crop producing natural rubber	**Dr. Beung Tae Ryu**	MIFAFF	04.10.2009-04.09.2010
Development of bioactive material for the preventive feed additive and treatment of avian influenza	**Dr. Woo Song Lee**	MIFAFF	12.20.2009-12.19.2010
SPF induction of miniature-pig and improvement of reproductivity of miniature-pig in the SPF facilities	**Dr. Kyu-Tae Chang**	MIFAFF	04.10.2009-04.09.2010
Improvement of insecticidal activity of bioinsecticide by using customized enzyme	**Dr. Soo-Keun Choi**	MIFAFF	04.10.2009-04.09.2010
Development of analytical technology of low-molecular toxic materials using a surface enhanced Raman scattering combined with bioreceptors	**Dr. Min-Gon Kim**	ME	04.01.2009-03.31.2010
Development of technology for propanediol production from crude-glycerol by strain engineering and scale-up process	**Dr. Chul Ho Kim**	ME	06.01.2009-05.31.2010
Development of DNA chip for assessment of aquatic hazard, using cyanobacterial genome	**Dr. Chi-Yong Ahn**	ME	03.01.2009-02.28.2010
Development of practical techniques for measuring aquatic toxicity using biomarkers	**Dr. Hee-Mock Oh**	ME	06.01.2009-05.31.2010
Improvement of developmental potential of cloned pig embryos through modifying epigenetic states of specific genome targets	**Dr. Yong-Kook Kang**	RDA	01.01.2009-12.31.2009
Development of transgenic potato/sweetpotato and forage crops with enhanced tolerance to multiple environmental stress	**Dr. Sang Soo Kwak**	RDA	01.01.2009-12.31.2009
Detection of developmental abnormality in cloned gnotobiotic pig fetus during gestation	**Dr. Deong Bon Koo**	RDA	01.01.2009-02.28.2009
Analysis of transcriptome in rose	**Dr. Suk Yoon Kwon**	RDA	01.01.2009-12.31.2009

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Project Title	Project Manager	Fund	Period
Development of marker-free transgenic crops	**Dr. Suk Yoon Kwon**	RDA	01.01.2009-12.31.2009
Development of commercial rose cell lines and establishment of transformation system using useful small RNAs	**Dr. Suk Weon Kim**	RDA	01.01.2009-12.31.2009
Acquisition, isolation and mass production of inhibitors for type III secretion system of phytopathogenic bacteria	**Dr. Sung Uk Kim**	RDA	01.01.2009-12.31.2009
Development of environmental risk assessment technology for genetically modified agricultural microorganisms	**Dr. Sung Uk Kim**	RDA	01.01.2009-12.31.2009
Development of biocontrol agent from bioactive compounds of microbial origin	**Dr. Chang Jin Kim**	RDA	01.01.2009-12.31.2009
Practical use of induced resistance compounds derived from endophytic and soil microorganisms	**Dr. Choong-Min Ryu**	RDA	01.01.2009-12.31.2009
Development of inhibitors for type III secretion systems of phytopathogenic bacteria	**Dr. Jae Sun Moon**	RDA	01.01.2009-12.31.2009
The broad application of newly invented chip technology and the national database of oligo-nucleotide chip for the diagnosis of plant viruses	**Dr. Jae Sun Moon**	RDA	01.01.2009-12.31.2009
Molecular Breeding of Fusaricidin Overproducing Microorganism and its application	**Dr. Seung-Hwan Park**	RDA	01.01.2009-12.31.2009
Development of bioinformatics tools for Isolation of useful promoter from Solanaceae genome information	**Dr. Jeong Mee Park**	RDA	01.01.2009-12.31.2009
Glycan analysis for the recombinant vaccines and therapeutic proteins expressed in plants	**Dr. Doo Byoung Oh**	RDA	01.01.2009-12.31.2009
Isolation of cancer-preventing substances for bones from peach skin extract	**Dr. Sei-Ryang Oh**	RDA	01.01.2009-12.31.2009
Efficacy test of the medical protein (EPO) produced from transgenic pig	**Dr. Sang-Rae Lee**	RDA	01.01.2009-12.31.2009
Development of bioactive substances for lipotoxicity suppression using optimized metabolic disease animal models from agricultural	**Dr. Chul ho Lee**	RDA	01.01.2009-04.24.2009
Hypolipidemic and Anti-atherogenic Efficacy Test of Agricultural Muschroom	**Dr. Chul ho Lee**	RDA	01.01.2009-12.31.2009
Development of nutraceuticals improving dyslipidemia and respiratory inflammation using old Platycodi radix	**Dr. Hyun Sun Lee**	RDA	01.01.2009-12.31.2009
Development and distribution to growers of soybean cultivars containing resistance genes to SMV and bacterial pustule diseases	**Dr. Soon-Chun Jeong**	RDA	01.01.2009-12.31.2009
Development of transgene silencing free plant for stable expression of foreign gene	**Dr. Won Joong Jeong**	RDA	01.01.2009-12.31.2009
Development of functional materials for prevention and treatment of metabolic syndrome from agricultural resources	**Dr. Tae-Sook Jeong**	RDA	01.01.2009-12.31.2009
Development of salt tolerant bioenergy crops by utilizing salt-inducible genes from marine cyanobacteria	**Dr. Stephen Beungtae Ryu**	MLTM	01.01.2009-12.31.2009
Fusion technology to control aging for the extended healthy life	**Dr. Ki-Sun Kwon**	KRCF	07.01.2009-06.30.2010
Bioinformatics Analysis of Gene Expression Data	**Dr. Seon-Young Kim**	KRCF	07.01.2009-06.30.2010
Development of cell control technology for the regeneration of aged tissues	**Dr. Doo Byoung Oh**	KRCF	07.01.2009-06.30.2010
Development of asthma-related biomarkers based on the technic of functional genomics and proteomics	**Dr. Hyeong-Kyu Lee**	KRCF	07.01.2009-06.30.2010
Development of novel technology that controls stem cell pluripotency to advance development of stem cell-based therapies of presently incurable diseases	**Dr. Yee Sook Cho**	KRCF	10.01.2009-08.31.2010
Enzyme platform for the production of cellulosic bioethanol	**Dr. Jung Hoon Sohn**	KFS	05.16.2009-05.15.2010
Production of recombinant enzymes for the deconstruction of red algae biomass	**Dr. Jung Hoon Sohn**	KEMCO	08.01.2009-07.31.2010
Development of functional food materials for prevention of hyperlipidemia and obesity from the active fractions of Gangwha mugwort and turnip	**Dr. Tae Sook Jeong**	GATC	02.16.2009-12.31.2009
Development of an anti-inflammatory drug candidate using Curcuma wenyujin	**Dr. Hwan Mook Kim**	CBTP	12.01.2009-11.30.2010

March 2009

April 2009

May 2009

Korea Research
Institute of Bioscience
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Events

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2009

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❶ Mar 03, 2009 Opening of Korea-Indonesia Biological Material Research Center

❷ Apr 2009 Signing of a three-party MOU with Samsung SDS and Gachon University of Medicine and Science

❸ Apr 2009 Visit from André Syrota, the CEO of Inserm

❹ Apr 2009 Ceremony for the Completion of the Biomedical Drug Research Building

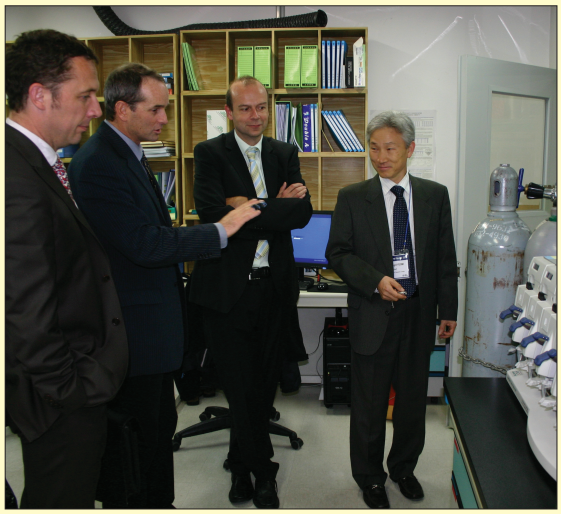
❺ May 18, 2009 Signing of a R&D MOU with Pfizer

❻ May 26, 2009 Participating in the Bio 2009, Atlanta

June 2009

Korea Research Institute of Bioscience and Biotechnology

October 2009



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September 2009

November2009

1. Jun 10, 2009 The Second Joint-Venture Company, MiCoBiomed's Founding Anniversary
2. Jul 07, 2009 Signing of MOUs with BiotechCorp and SIRIM, Malaysia
3. Sep 24, 2009 KRIBB Earns the 2009 Forbes Korea Excellence Award in Creative Management
4. Oct 18, 2009 Signing Ceremony for Technology Transfer, Hitting a hostoric high of 30 billion won
5. Oct 19, 2009 KRIBB External Review - On-site Evaluation
6. Oct 23, 2009 Signing of a MOU with Thailand's ARDA (Agricultural Research Development Agency)
7. Nov 16, 2009 Dr. Park, President attending the BIO-IAP(International Advisory Panel)

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Korea Research Institute of Bioscience and Biotechnology

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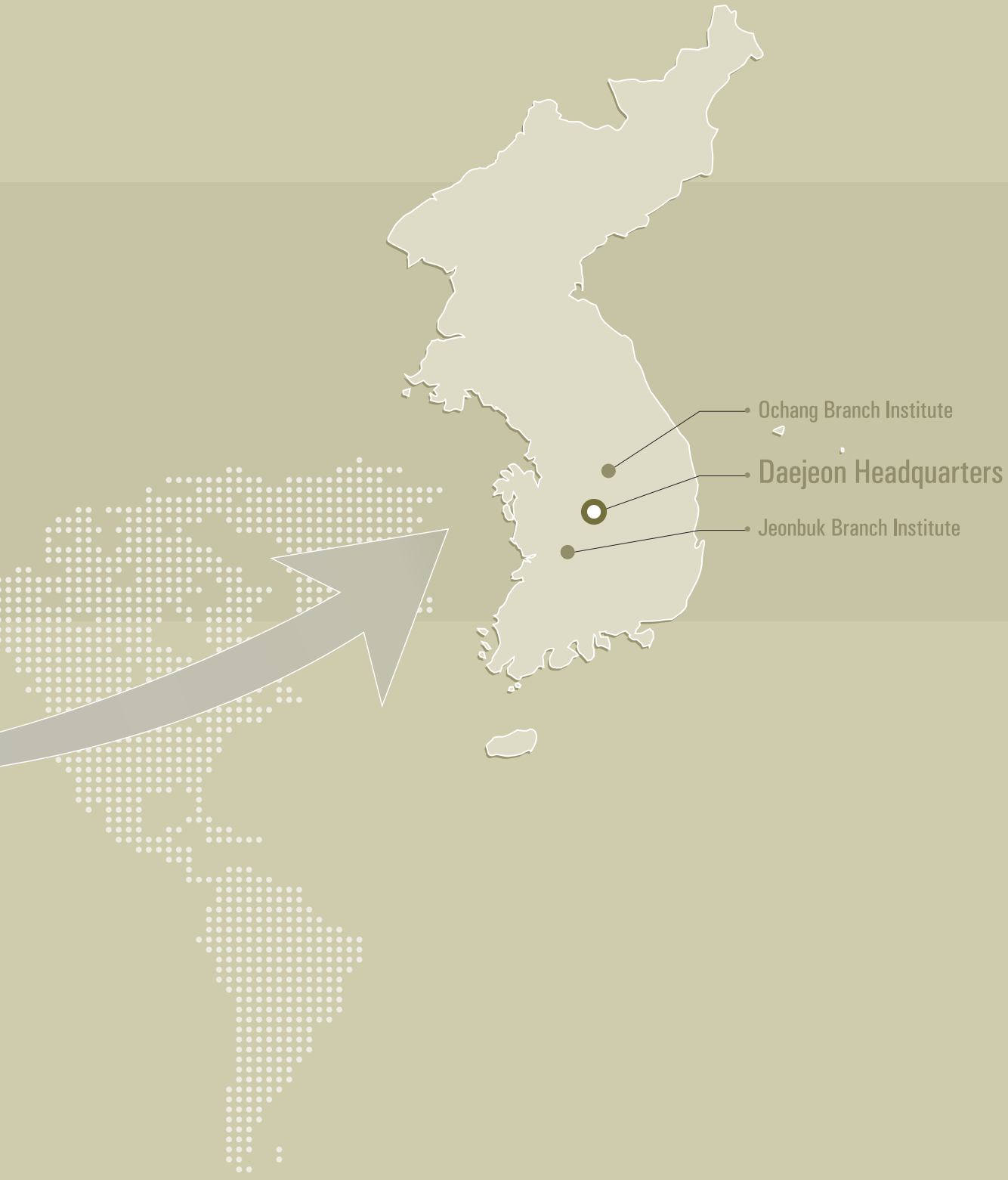
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RESEARCH ENHANCING COMPETITIVENESS WORLD STAGE

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High-level research in such fields as bioconvergence, biopharmaceuticals and biomaterials, conducted at KRIBB, has resulted in numerous technological breakthroughs, earning Korea a place among global biotech innovation leaders in the process.

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Korea Research Institute of Bioscience and Biotechnology

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