CNU Create New University

CNU 70th ANNIVERSARY

2022 충남대학교 소재화학연구소 국내심포지엄

2022
과학자를 위한 미생물의 의미 및
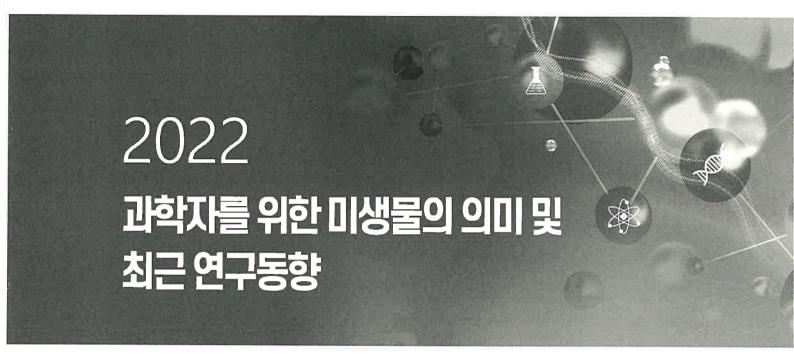최근 연구동향

2022년 5월 26일(목)
충남대학교 자연과학대학 4호관 109호

| 주관 | 충남대학교 소재화학연구소
Research Institute of Materials Chemistry, Chungnam National University

| 후원 | 충남대 화학물질특성분석 핵심연구지원센터
CNU Chemistry Core Facility

충남대학교 기초과학연구원
CNU Research Institute of Basic Sciences

⟨ Program ⟩

15:00 ~ 15:30　등록

15:30 ~ 15:40　축사 및 개회사
　　　　　　　최 성 희 교수 *(충남대학교 자연과학대학장)*
　　　　　　　김 정 권 교수 *(충남대학교 소재화학연구소장)*

좌 장 : 명 창 우 교수 *(충남대학교 화학과)*

15:40 ~ 16:10　이 철 호 박사 *(한국생명공학연구원)*
　　　　　　　" Role of Gut Microbiota, *Akkermansia muciniphilla*, in Healthy Aging "

16:10 ~ 16:40　유 희 민 박사 *(한국표준과학연구원)*
　　　　　　　" The microbiome and recent probiotics research "

16:40 ~ 17:10　강 덕 진 박사 *(한국표준과학연구원)*
　　　　　　　" Quantitative proteomic analysis of gut microbiome for discovery of pharmabiotics "

17:10 ~ 17:20　사진 촬영

17:20 ~ 17:30　마무리

17:30 ~ 　　　 만찬

Brief C.V.

General information

Name : Chul-Ho Lee
Affiliation : Korea Research Institute of Bioscience and Biotechnology (KRIBB)
E-mail : chullee@kribb.re.kr

Education

- 1990.03 ~ 1997.08 : Ph.D., Department of Veterinary Medicine,
  Chungnam National University, Daejeon, Korea
- 1988.03 ~ 1990.08 : M.S., Department of Veterinary Medicine,
  Chungnam National University, Daejeon, Korea
- 1984.03 ~ 1988.02 : B.S., Department of Veterinary Medicine,
  Chungnam National University, Daejeon, Korea

Experience

- 2006.03 ~ present : Principal Researcher, Korea Research Institute of Bioscience
  and Biotechnology (KRIBB), Daejeon, Korea
- 2005.03 ~ present : Professor, Korea Research Institute of Bioscience and
  Biotechnology (KRIBB), Daejeon, Korea
- 2002.09 ~ 2004.09 : Visiting Investigator, The Jackson Laboratory (TJL), Bar
  Harbor, ME, USA
- 2006.03 ~ 2006.02 : Researcher/Senior Researcher, Korea Research Institute of
  Bioscience and Biotechnology (KRIBB), Daejeon, Korea

Representative publications

1. Ageing and rejuvenation models reveal changes in key microbial communities associated with healthy ageing (2021). *Microbiome, 9: 240.*
2. Orphan nuclear receptor ERR-γ regulates hepatic FGF23 production in acute kidney injury (2021). *PNAS, 128: e2022841118.*
3. Human gut microbiota *Agathobaculum butyriciproducens* improves cognitive impairment in LPS-induced and APP/PS1 mouse models of Alzheimer's disease (2021). *Nutr Res, 86: 96-108.*
4. Small heterodimer partner controls the virus-mediated antiviral immune response by targeting CREB-binding protein in the nucleus (2019). *Cell Reports, 27: 2105-2118.*
5. Metformin ameliorates acetaminophen hepatotoxicity via Gadd45β-dependent regulation of JNK signaling in mice (2015). *Journal of Hepatology, 63: 75-82.*
6. Estrogen-related receptor gamma controls hepatic CB1 receptor-mediated CYP2E1 expression and oxidative liver injury by alcohol (2013). *Gut, 62: 1044-1054.*
7. Metformin inhibits growth hormone-mediated hepatic PDK4 gene expression through induction of orphan nuclear receptor small heterodimer partner (2012). *Diabetes, 61: 2484-2494.*

Role of Gut Microbiota, *Akkermansia muciniphilla*, in Healthy Aging

Chul-Ho Lee

Korea Research Institute of Bioscience & Biotechnology (KRIBB)

Healthy life span has been known to be determined by the interactions between genetic and environmental factors. As aging progresses, both humans and laboratory animal models considerably alter the composition of intestinal bacteria, which changes affect the health and longevity. Therefore, it is important to understand our microbiome, related to maintenance of the healthy function of body. Because the microbiome contains 5~8 millions of microbial genes compared to just 25,000 human genes, it enables human to defend against disease and to adapt to new environments providing us capabilities that are not encoded within our own genome. To figure out correlation between microbiome pattern and aging process, the ideas such as probiotic administration and fecal microbiota transplantation, have been applied to alter the gut microbiome and promote healthy aging. Nevertheless, prolongation of the healthy span of aged mice by remodeling the gut microbiome remains challenging. To investigate the changes in gut microbial communities, their functions and healthy life span during aging, we recently have applied three procedures including co-housing, serum-injection, and parabiosis in young and aged mice. Through these procedures, we were able to observe that the microbial community of aged mice were changed to those of young mice. Also, the experimental results showed that the compositional structure and gene abundance of the intestinal microbiota were dynamically changed during the aging process. Especially, the metagenomic data analysis underscores the importance of the high abundance of *Akkermansia muciniphilla* and the butyrate biosynthesis pathway in aged mice showing young mice microbial community. Furthermore, oral administration of *Akkermansia muciniphilla* sufficiently ameliorated the senescence-related phenotype and extended the healthy life span, as evidenced by the frailty index and restoration of muscle atrophy. These results provided a significant insight for developing microbiome-based therapeutic implications to achieve healthy aging.

Brief C.V.

General information

Name: **Hee Min Yoo** (Ph.D.)
E-mail: hmy@kriss.re.kr
Homepage: https://sites.google.com/view/kriss-heeminyoo/home
google scholar ID: https://scholar.google.com/citations?user=QvxaMzkAAAAJ&hl=en
ORCID iD: https://orcid.org/0000-0002-5951-2137

Education

- 2009.03 ~ 2014.02	Seoul National University, School of Biological Sciences, Korea Ph.D., in Protein Biochemistry
- 2007.03 ~ 2009.02	Seoul National University, School of Biological Sciences, Korea M.S., in Protein Biochemistry
- 2003.03 ~ 2007.02	Chungnam National University, College of Biological Science, Korea B.S. in Microbiology and Molecular Biology

Experience

- 2017 ~ present	Senior Research Scientist (Team Leader) Korea Research Institute of Standards and Science (KRISS), Biometrology Group, Microbiological Analysis Team, Republic of Korea.
- 2021 ~ present	Associated Professor Department of Bio-Analytical Science, University of Science & Technology (UST), Republic of Korea.
- 2015 ~ 2017	Postdoctoral fellow (Mentors: Louis M. Staudt, M.D., Ph.D.) National Institutes of Health (NIH), National Cancer Institute (NCI), Center for Cancer Research, USA
- 2014 ~ 2015	Postdoctoral fellow (Mentors: Chin Ha Chung, Ph.D.) Seoul National University (SNU), School of Biological Sciences, Republic of Korea.

Representative publications

1. **Yoo HM***, Park JH, Kim JY, Chung CH*. Modification of ERα by UFM1 Increases Its Stability and Transactivity for Breast Cancer Development. *Molecules and Cells*. 2022. In press (Cover article).
2. Pham CH, Lee JE, Yu J, Lee SH, Yu KR, Hong J, Cho N, Kim S, Kang D, Lee S, **Yoo HM***. Anticancer Effects of Propionic Acid Inducing Cell Death in Cervical Cancer Cells. *Molecules*. 2021 August 16;26(16) 4951.
3. **Yoo HM***, Kim IH*, Kim S. Nucleic Acid Testing of SARS-CoV-2. *International Journal of Molecular Sciences*. 2021 Jun 7;22(11):6150. [IF= 5.923]
4. Lee J, Lee JE, Kim S, Kang D, **Yoo HM***. Evaluating Cell Death Using Cell-Free Supernatant of Probiotics in Three-Dimensional Spheroid Cultures of Colorectal Cancer Cells. *Journal of Visualized Experiments*. 2020 Jun 13;(160).
5. Lee JE, Lee J, Kim JH, Cho N, Lee SH, Park SB, Koh B, Kang D, Kim S, **Yoo HM***. Characterization of the Anti-Cancer Activity of the Probiotic Bacterium Lactobacillus fermentum Using 2D vs. 3D Culture in Colorectal Cancer Cells. *Biomolecules*. 2019. 9(10). pii: E557.

The microbiome and recent probiotics research
(마이크로바이옴과 차세대 프로바이오틱스 연구)

Hee Min Yoo

Korea Research Institute of Standards and Science (KRISS)

Probiotics are known for their ability to improve the health of the host. Many studies are being conducted to elucidate the importance of probiotic bacteria and to investigate how commensal bacterial flora colonization influences the body's health or pathologic conditions (such as cancer).

Probiotics like *Lactobacillus* have been demonstrated to exhibit tumor-suppressive effects in colorectal cancer cell lines and in mouse tumor models. Most probiotic testing studies were previously conducted using two-dimensional (2D) systems. However, 2D cultures cannot fully replicate the three-dimensional (3D) interactions of cells and the extracellular matrix (ECM) within tissues. In contrast to 2D cultures, which consist of monolayers on plastic, 3D cell cultures are better suited to restore intrinsic properties and mimic in vivo behavior. Recently, we investigated the potential anti-cancer effects of probiotic cell-free supernatant (CFS) treatments that involve the use of *Lactobacillus fermentum* for colorectal cancer (CRC) in 3D culture systems.

Additionally, short-chain fatty acids (SCFAs), which are produced by bacterial fermentation in the gastrointestinal tract, have been found to have oncoprotective effects against cervical cancer. The most well-known SCFAs are acetic acid, butyric acid, and propionic acid, the latter of which has been shown to induce apoptosis in cervical cancer cells. However, the mechanism by which SCFAs suppress cervical cancer cell viability is still unknown. Our research aims to provide a more in-depth look into the mechanism of propionic acid (PA) in cervical cancer cells. Flow cytometry analysis revealed that PA causes reactive oxygen species (ROS) to be generated, which in turn causes mitochondrial membrane dysfunction. Furthermore, PA inhibits the NF-κB and AKT/mTOR signaling pathways while also increasing LC3B protein levels, which results in autophagy.

Neurodegenerative diseases, which are caused by the dysfunction and death of neuron cells and the central nervous system (CNS), include some of the most common diseases in the world, such as Alzheimer's disease (AD), Parkinson's disease (PD), and Huntington's disease (HD). In fact, neurodegenerative diseases are the second leading cause of death after cancer. The effects of gut microbiota on our brain and behavior have been well documented in recent decades. Notably, intestinal microflora participates in mechanisms of bidirectional communication between the gastrointestinal tract and the central nervous system. Furthermore, several animal studies have shown that probiotics and lactobacillus treatment can reduce anxiety and depression-like behavior. Probiotics may also be beneficial by improving the intestinal barrier and immune responses.

Brief C.V.

General information

Dukjin Kang, Ph.D.
Principal Researcher,
Group for Bioanalysis,
Division of Chemical and Biological Metrology
Korea Research Institute of Standard and Science
267 Gajeong-ro, Yuseong-gu, Daejon, Korea 34113
EMAIL: djkang@kriss.re.kr
Phone: 82-42-868-5700

Education

- 2004.03 ~ 2008.02　　Ph.D. in Chemistry, Yonsei University Seoul, Korea
- 1999.09 ~ 2001.08　　M.S. in Chemistry, Pusan National University Busan, Korea
- 1993.03 ~ 1999.02　　B.S. in Chemistry, Gangnung National University
　　　　　　　　　　　　Gangnung, Korea

Experience

- 2021.01 ~ Present　　Board Member, Analytical Chemistry,
　　　　　　　　　　　　Korean Chemical Society (KCS)
- 2018.01 ~ 2020.12　　Secretary, The Korean Society of Mass Spectrometry
　　　　　　　　　　　　(KSMS)
- 2018.01 ~ Present　　Board Member, The Korean Society of Mass Spectrometry
　　　　　　　　　　　　(KSMS)
- 2017.01 ~ Present　　Evaluation Committee, National Research Facilities &
　　　　　　　　　　　　Equipment Center (NFEC)

Representative publications

1. Y.E. Kim, E.-K. Kim, M.-J. Song, T.-Y. Kim, H.H. Jang, D. Kang, SILAC-Based Quantitative Proteomic Analysis of Oxaliplatin-Resistant Pancreatic Cancer Cells., Cancers, 2021, 13(4), 724
2. Y.E. Kim, K. Kim, H.B. Oh, S.K. Lee, D. Kang, Quantitative Proteomic Profiling of Cervicovaginal Fluid from Pregnant Women with Term and Preterm Birth., Proteome Science, 2021, 19, 3
3. S. Y. Lee, S. B. Park, Y. E. Kim, H. M. Yoo, J. Hong, K.-J. Choi, K. Y. Kim, D. Kang, iTRAQ-Based Quantitative Proteomic Comparison of 2D and 3D Adipocyte Cell Models Co-cultured with Macrophages Using Online 2D-nanoLC-ESI-MS/MS., Scientific Reports, 2019, 9(1), 16746
4. Y. E. Kim, H. J. Jeon, D. Kim, S. Y. Lee, K. Y. Kim, J. Hong, P. J. Maeng, K. R. Kim, D. Kang, Quantitative Proteomic Analysis of 2D and 3D Cultured Colorectal Cancer Cells: Profiling of Tankyrase Inhibitor XAV939-Induced Proteome., Scientific Reports, 2018, 8, 13255

Quantitative proteomic analysis of gut microbiome for discovery of pharmabiotics

Dukjin Kang

Korea Research Institute of Standards and Science

Very recently, the beneficial effects of microbes on human health are enough to whip up interest in investigating the biological functions of gut microbiome and its curative effects of human diseases. In general, trillions of microbes exist mainly inside human intestines while interacting with each other in a symbiotic way. Because of a large portion of microbes inside intestines that may weigh as much as 1~2 kg (approximately similar to the brain), it goes to show that gut microbes play crucial roles in metabolic regulations (*e.g.*, digestion of foods, immune system, central nervous system, and so on). In addition, it is reported that the occurrence of inflammatory bowel disease (IBD), heart diseases, type 1 and 2 diabetes is also caused by the interaction between gut microbiome and intestines. In this regard, there's mightily important to perform grafting advanced proteomic strategies onto the discovery of pharmabiotics whereby it is effective for improving diverse human diseases. In this respect, we performed quantitative proteomic analysis of *Akkermansia muciniphila* (AK) cells and their culture medium (CM) at different culture conditions. AK is a Gram-negative, anaerobic, oval-shaped bacterium and well-known that AK has health-promoting effects in animal models, for instacne, reducing cardiovascular risks and obesity, glucose intolerance, insulin resistance (*Nature Medicine*, doi:10.1038/s41591-019-0495-2). In this presentation, we introduce an automated shotgun proteomics to identify AK proteome using online two-dimensional liquid chromatography-electrospray ionization-tandem mass spectrometer(2D-nLC-ESI-MS/MS). Secondly, coupling of 2D-nLC-ESI-MS/MS with isobaric labeling for quantitative profiling of AK cellular and CM proteome will present in order to find out protein-based pharmabiotic candidates. As a result, we found new Amuc_#1 protein that might be useful to provide health-promoting effect in inflammatory bowel disease (IBD).