



Myungjin Kim, PhD

Principal Investigator

EMOTION, COGNITION & BEHAVIOR GROUP
Korea Brain Research Institute (KBRI)

Office : 4-3

Lab : wet lab 3-1

Tel : +82-53-980-8370

Fax : +82-53-980-8339

E-mail : myungjin@kbri.re.kr

http://www.kbri.re.kr/new/pages_lab/sub/page.html?mc=3136

Molecular mechanisms of neuronal cell fate determination in neural development and brain disorders

From genes to proteins, all are dynamically modified to respond to internal and external stress. Especially, when neurons are exposed to various stimuli, they need to quickly decide how to cope with such signals and maintain cellular homeostasis. The MKLNB (MK Lab of Neurobiochemistry) group at KBRI actively investigates to gain a better understanding of the molecular mechanisms underlying neuronal cell fate determination during cellular stress response, from normal neuronal development to senescence and neuronal death. We also focus on the whole and single-cell multiomics approaches for brain connectome project.

Aim

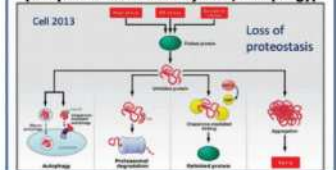
Elucidating the underlying molecular mechanisms for development and brain disorders by investigating the neuro-epigenome and eproteome dynamics(Need)

Tool

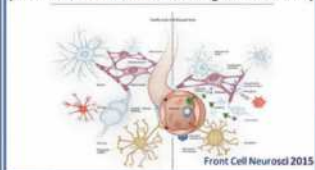
Biochemistry & Molecular Biology for Protein Modification / Degradation(UPS) & DNA Methylation analyses

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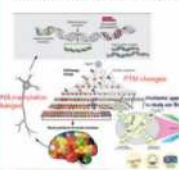
**Protein metabolism to maintain neuronal health
(Ubiquitin-Proteasome System, Autophagy)**



**Molecular understanding of Emotion
(Neuroinflammation in neuro-glial activation)**



Neuronal activity & Disease-specific changes



Curriculum Vitae

2017~Present : Principal Investigator, KBRI
 2008~2017 : BK professor, Research Assistant Professor,
 Research Associate Professor, School of Biological
 Sciences, IMBG, RIBS, Seoul National University, Korea
 2006~2007 : Postdoctoral Research Associate., USC/ Norris Cancer
 Center, USC Epigenome Center, University of Southern California, USA

Academic Credential

2006 : Ph.D., Biochemistry and Molecular Biology, University
 of Southern California, USA
 1998 : M.S., Molecular Biology, Seoul National University
 1995 : B.S., Biological Sciences, Ewha Womans University

Grants/Awards/Memberships

2019~2022 : Mid-career Research Grant, NRF, Ministry of Science, ICT
 2018~Present : Member, Society for Neuroscience
 2015~2018 : Basic Research Grant, NRF, Ministry of Education
 2017~Present : Member, The Korean Society for Brain and Neural Sciences
 2016 : IASSF Best Young Scientist group membership, KAST.
 Qualified candidate for Young Academy, KAST.
 2013~2016 : Basic Research Grant for Female Scientist, NRF, Ministry of
 Science, ICT and Future Planning
 2009~2012 : Basic Research Grant for Female Scientist, NRF, MEST
 2008~2009 : Prospective Female Scientist Grant, Korea Research Foundation, MST
 2004 : The Best Poster Presentation Award. USC Annual Biochemistry Retreat
 2003 : The Outstanding Oral Presentation Award. USC Graduate Student Seminar Series

Research keywords

Neuronal cell fate determination, Post-translational modifications, Cellular stress response, Epigenetics.

Key techniques

- Molecular approaches for epigenome and epiproteome dynamics : protein modification (ubiquitylation, SUMOylation, phosphorylation, acetylation, O-GlcNAcylation, etc.), Analyses for gene expression, DNA methylation, histone modification, chromatin accessibility.
- Monitoring neuronal health: neuronal senescence and apoptosis assays.

Research Interests/Topics

- Molecular biology of protein metabolism in neuronal health.
- Development of single cell-based multiomic analyses for neuro-glial activation during neuroinflammation.
- Molecular understanding of neuronal activity and disease-specific changes in development and brain disorders through NEED. (Neuro-Epigenome and Epiproteome Dynamics)

Research Publications (selected since 2015)

- Lee J, Ko YU, Chung Y, Yun N, **Kim M**, Kim K, Oh YJ. The acetylation of cyclin-dependent kinase 5 at lysine 33 regulates kinase activity and neurite length in hippocampal neurons. *Sci Rep.*, 8(1):13676, 2018.
- Lee KA, Cho KC, Kim B, Jang IH, Nam K, Kwon YE, **Kim M**, Hyeon DY, Hwang D, Seol JH, Lee WJ. Inflammation-Modulated Metabolic Reprogramming Is Required for DUOX-Dependent Gut Immunity in *Drosophila*. *Cell Host Microbe.*, 23(3):338-352.e5, 2018.
- **Kim M**, Kwon YE, Song JO, Bae SJ, Seol JH. CHFR negatively regulates SIRT1 activity upon oxidative stress. *Sci Rep.*, 6,37578, 2016.
- Joo JH*, Oh H*, **Kim M**, An EJ, Kim RK, Lee SY, Kang DH, Kang SW, Park CK, Kim, Lee SJ, Lee D, Seol JH, Bae YS. NADPH Oxidase 1 Activity and ROS Generation Are Regulated by Grb2/Cbl-Mediated Proteasomal Degradation of NoxO1 in Colon Cancer Cells. *Cancer Res.*, 76(4):855-65, 2016.
- Bae SJ*, **Kim M***, Kim SH, Kwon YE, Lee JH, Kim J, Chung CH, Lee WJ, Seol JH. NEDD4 controls intestinal stem cell homeostasis by regulating the Hippo signalling pathway. *Nat Commun.*, 6:6314, 2015. (*co-first author)