Association of Korean Neuroscientists (AKN) eTalk Series (2022-2023)

Committee Members

Doo-Sup Choi (Mayo Clinic), Chair
Mi-Hyeon Jang (Rutgers), Co-Chair
Byoung-Il Bae (U. Conneticut)
Byungkook Lim (UCSD)
Eunhee Kim (U. Texas Health Science Center)
Gabsang Lee (Johns Hopkins)
Hoonkyo Suh (Cleveland Clinic)
Jae-Kyung Lee (U. Georgia)
Jun-Ho La (U. Texas Medical Branch)
Sung Han (Salk Institute)

2022-2023 AKN eTalk Plan			
Date	**Presenter**	**Affiliation**	**Area**
6/1/2022	**Bae, Byoung-il**	Univ of Conneticut	Cerebral cortical development
6/15/2022	**Woo, Alex**	Case Western	Alzheimer's disease
7/6/2022	No Meeting		
7/20/2022	**Lee, Gabsang**	Johns Hopkins	Muscular dystrophy; pain; peripheral nerve disorders
8/3/2022	**Kang, Seungwoo**	Med Coll of Georgia	Social interaction and addiction-circuits and electrophysiology
8/17/2022	**Choi, Seungwon**	UT Southwestern	Ascending somatosensory circuitry in pain
9/7/2022	**Choi, Se Hoon**	Harvard Univ	Alzheimer's disease
9/21/2022	**Suh, Hoonkyo**	Cleveland Clinic	Neurogenesis, neural circuits, cognition and mental disorders
10/5/2022	**Special Session: Postdoc, Park, Soo-Hyun (NIH)-Lee Gabsang, Kim, Jae-Kyung (UCSF)-Choi Doo-Sup**		
10/19/2022	**Special Session: Postdoc, Kim, Tae-Wan (Sloan-Kettering)-Lee Gabsang, Yi, Minhee (Mayo)-La, Jun-Ho**		
11/2/2022	**Lee, Hey-Kyoung**	Johns Hopkins	Cross-modal synaptic plasticity and relations to brain disease
11/16/2022	SFN (No Meeting)		
11/23/2022	**Kim, Changyoun**	NIH/NIA	Parkinson's disease
12/7/2022	**Lee, Hyun-Kyoung**	Baylor College of Med	Glial cell mechanism in CNS pathophysiology
12/21/2022	**Lee, Jae-Kyung**	Univ Georgia	Inflammation in neurodegenerative diseases
1/4/2023	**Kim, Euiseok**	UC Santa Cruz	Cortical circuits and development
1/18/2023	**Kim, Yongsoo**	Penn State Univ	Brain mapping
2/1/2023	**Kim, Eunhee**	UT Health Houston	Stroke and brain arteriovenous malformation
2/15/2023	**Kwon, Hyungbae**	Johns Hopkins	Neural circutis, Ensembles and connectome
3/1/2023	**La, Jun-Ho**	UT Med Branch	Chronic pain and therapy
3/15/2023	**Kwon, Jaerock**	University of Michigan	Artificial intelligence, machine learning, optimization, and intelligent systems, neuroscience, and robotics
4/5/2023	**Chung, Man-Kyo**	Univ of Maryland	Neural and pain science
4/19/2023	**Lee, Jean-Pyo**	Tulane Univ	Stem cell therapies
5/3/2023	**Kim, Yu-Shin**	UTH San Antonio	Peripheral sensory system (pain, itch, etc.)
5/17/2023	**Lee, Juneyoung**	UT Health Houston	Microbiome in stroke
6/7/2023	**Jo, Young-Hwan**	Albert Einstein	Obesity. Electrophysiology of hypothalamus
6/21/2023	**Lee, Hye Young**	UTH San Antonio	Fragile X syndrome

Association of Korean Neuroscientists (AKN) eTalk

June 1, 2022

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Ferreting out how a big and convoluted brain is made: molecular and cellular mechanisms underlying gyrencephalic cortical development

Byoung-Il Bae, PhD, Assistant Professor of Neuroscience at the University of Connecticut School of Medicine (moderator: Mi-Hyeon Jang, PhD, Associate Professor at Rutgers Med School)

발표자 약력 및 실험실 소개

배병일 박사는 서울대학교 분자생물학과에서 학사(1994-1998)를 받고, 존스홉킨스대학교에서 신경퇴행성질환 헌팅턴병(role of p53 in Huntington's disease)을 주제로 박사(1999-2006)를 받았다. 포닥(2006-2015) 시절 보스턴어린이병원/하버드의대에서 신경발달질환인 다소뇌회증(polymicrogyria) 원인유전자 *GPR56*, 소두증 (microcephaly) 원인유전자 *ASPM*과 *WDR62*, 자폐증(autism) 관련 인간특이적 유전체 부위(human accelerated region) 등을 연구하였다. 수련 기간 내내 인간의 신경질환이 생쥐에서 지극히 불완전하게 재현되는 한계를 답답해하다가, 유전자 편집 기술을 이용해 *Aspm* knockout (KO) 페렛/족제비를 만들어 인간 소두증 형질이 생쥐에 비해 훨씬 강력하게 재현된다는 사실을 밝혔다. 이후 예일대학교 신경외과 연구교수(2015-2018)를 거쳐, 2019년부터 코네티컷주립대 의대 신경과학과에서 조교수로 지내고 있으며, 현재는 (1) 생쥐에 비해 인간/페렛에서 소두증 형질이 더 강하게 나타나는 분자적 기작과 이 과정에서 대뇌의 주름이 어떻게 단순화되는지, (2) 일부 자폐증 환자에서 나타나는 대두증(macrocephaly)이 사회인지기능을 어떻게 방해하는지 연구하고 있다. https://www.baelab.org/

발표 내용 요약

The cerebral cortex is the largest part of the human brain that is highly convoluted (gyrencephalic) with 86 billion neurons and a similar number of non-neuronal cells. It mediates numerous cognitive functions including language and abstract thinking, and its abnormal development leads to neuropsychiatric disorders, such as autism spectrum disorder, attention-deficit/hyperactivity disorder, and schizophrenia. However, there are significant phenotypic discrepancies between human patients and mouse models with the same genetic mutations. This suggests that, unlike the small and smooth-surfaced mouse cortex, the human cortex requires developmental mechanisms that are specific to gyrencephalic mammals, primates, or only humans. Thus, we generated germline KO ferrets lacking *Aspm* (*abnormal spindle-like microcephaly-associated*), the most frequent causative gene for microcephaly in humans encoding a centrosomal protein. Ferrets have a moderate-sized gyrencephalic cortex with similar progenitor diversity and gene expression patterns to the human cortex. We found that, unlike mice, *Aspm* KO ferrets demonstrate severe microcephaly with simplified gyri. Intriguingly, *Aspm* KO ferrets, but not mice, manifest premature delamination and programmed cell death of cortical progenitors. Therefore, we aim to mechanistically understand how loss of *Aspm* causes those gyrencephalic mammal-specific cellular phenotypes. To this end, we are identifying ASPM-interacting proteins that are specific to humans and ferrets vs. mice. Our research has broad implications for other brain disorders that are severe in humans but mild in mice, such as autism and schizophrenia.

발표자 관련 논문

1. Johnson, M. B., Sun, X., Kodani, A., …, Walsh, C. A., Bae, B.-I. (2018). *Aspm* Knockout Ferret Reveals an Evolutionary Mechanism Governing Cerebral Cortical Size. *Nature*, *556*(7701), 370–375.
2. Jayaraman, D., …, Bae, B.-I., Walsh, C. A. (2016). Microcephaly Proteins Wdr62 and Aspm Define a Mother Centriole Complex Regulating Centriole Biogenesis, Apical Complex, and Cell Fate. *Neuron*, *92*(4), 813–828.

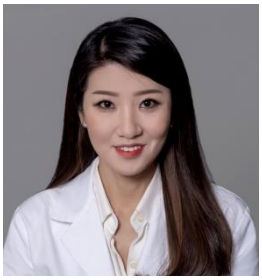
Association of Korean Neuroscientists (AKN) eTalk

June 15, 2022

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



Targeting β-arrestins to arrest Alzheimer's disease pathogenesis

Alexa Woo, PhD, Assistant Professor
Dept of Pathology, Case Western Reserve University School of Medicine
(Moderator: Jae-Kyung Lee, PhD, Assistant Professor at University of Georgia)

발표자 약력 및 실험실 소개

Dr. Alexa Woo received her bachelor's degree in Life Science at Handong Global University and completed her master's degree at Seoul National University in South Korea. Dr. Woo received her Ph.D. in Neuroscience from the University of South Florida and completed her postdoctoral training with Dr. Stephen Liggett, Vice Dean and Associate Vice President for Research at USF Health, for two years. In his lab, she studied G-protein coupled receptor (GPCR) and β-arrestin signaling in different human diseases. She received her first NIH R01 in 2019 which allowed her lab to study the role of β-arrestin signaling in tau pathology. In 2021, Dr. Woo joined the Case Western Reserve University, Dept of Pathology as an Assistant Professor. Dr. Woo's research focuses on the GPCR and β-arrestin signaling in neurodegenerative disease, including AD, FTD, PD, and ALS. Her lab also works on the mitochondrial protein CHCHD2 in PD and Lewy body disorders.

발표 내용 요약

Molecular mechanism of β-arrestin-mediated neurotoxicity and neurodegeneration: G protein coupled receptors (GPCR) are one of the largest, most diverse protein families in human genome, and a third to half of FDA-approved drugs target GPCRs. Multiple studies have shown that GPCRs are implicated in Alzheimer's disease and related dementias (ADRD). However, whether and/or how these heterologous GPCRs impinge on AD pathogenesis was unclear. While several groups have shown β-arrestins promote amyloid pathology and are increased in the brains of AD patients, it was not known if β-arrestins pathogenically impinge on tauopathy and neurodegeneration in AD/FTLD. We first found that β-arrestins are increased in brains of FTLD-tau patients, and both β-arrestin1 and β-arrestin2 share common mechanisms of exacerbating tauopathy through two mechanisms, 1) impairing the SQSTM1/p62-based autophagy machinery and 2) disrupting microtubule stability. We further showed that genetic reduction of β-arrestin2 or β-arrestin1 mitigates tau pathology and that β-arrestin oligomers but not monomers drive tauopathy in vivo.

Mitochondrial protein CHCHD2 in Lewy body disorders: Coiled-coil helix coiled-coil helix domain containing 2 (CHCHD2) is a mitochondrial protein localized to the intermembrane space (IMS). Multiple mutations in CHCHD2 are associated with Lewy body disorders (LBDs), with the CHCHD2-T61I mutation being the most widely studied. We generated the first transgenic mouse model expressing the human PD-linked CHCHD2-T61I mutation and found that CHCHD2-T61I Tg mice exhibit pathological and motor changes associated with LBDs, indicating that this model successfully captures phenotypes seen in human LBD patients with CHCHD2 mutation.

발표자 관련 논문

1) **Woo JA***, Liu T, Fang CC, Castaño MA, Kee T, Yrigoin K, Yan Y, Cazzaro S, Matlack J, Wang X, Zhao X, Kang DE, Liggett SB. β-Arrestin2 oligomers impair the clearance of pathological tau and increase tau aggregates. Proc Natl Acad Sci U S A. 2020 Mar 3;117(9):5006-5015. doi: 10.1073/pnas.1917194117. Epub 2020 Feb 18. Selected as 'In this issue' *Corresponding

2) **Woo JA***, Yan Y, Kee TR, Cazzaro S, McGill Percy K, Wang X, Liu T, Liggett SB, Kang DE (2021). β-arrestin1 promotes tauopathy by transducing GPCR signaling, disrupting microtubule and autophagy. Life Sci Alliance. 2021 Dec 3;5(3):e202101183. doi: 10.26508/lsa.202101183.*Corresponding

3) Kee TR, Wehinger JL, Gonzalez PE, Nguyen E, McGill Percy K, Khan S, Chaput D, Wang X, Liu T, Kang DE, **Woo JA*** (2022). Pathological characterization of a novel mouse model expressing the PD-linked CHCHD2-T61I mutation. *In press* Human Molecular Genetics

Association of Korean Neuroscientists (AKN) eTalk

July 20, 2022

10am PST, 12pm CST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Human pluripotent stem cell-based modeling neural and skeletal diseases toward therapy development

Gabsang Lee, DVM, PhD, Professor
Department of Neurology and Neuroscience, Institute for Cell Engineering at the Johns Hopkins University School of Medicine

(Moderator: Jun-Ho La, DVM, PhD, Assistant Professor at the University of Texas Medical Branch)

발표자 약력 및 실험실 소개

Gabsang obtained his B.S., D.V.M., Ph.D. degrees in Veterinary Medicine at the Seoul National University, South Korea (1993-2004). After his post-doctoral training at Sloan Kettering Institute (New York,) he joined the faculty of Johns Hopkins as Assistant Professor (2011). Now Dr. Lee is a Professor in the Department of Neurology/Neuroscience and Institute for Cell Engineering (ICE) at the Johns Hopkins University School of Medicine. Dr. Lee is one of the first researchers who utilized induced pluripotent stem cells (iPSCs) for disease modelling and drug discovery/validation. The international scientific community recognizes and values Dr. Lee's knowledge, and this is exemplified by many awards he received including the Druckenmiller Postdoctoral Fellowship and the Robertson Investigator Award from the New York Stem Cell Foundation. His lab is continuing the human iPSC-based research focusing on neural and skeletal muscle disorders toward developing new therapeutic options for patients. https://sites.google.com/site/gabsanglee/Home

발표 내용 요약

Human pluripotent stem cells (PSCs) can provide a large quantity of the specific cell populations that are otherwise extremely challenging to obtain, which enabled us to study human diseases. In this talk, we will discuss our recent efforts to develop potential therapeutic options for amyotrophic lateral sclerosis (ALS) and muscular dystrophies. In ALS patients, the ocular motor neurons (oMNs) are largely spared, whereas spinal motor neurons (sMNs) are damaged. We generated and compared the oMNs and sMNs from ALS PSCs, to understand the cell type-specific susceptibility, led us to identify aberrant lipid metabolism in 17 different ALS sMNs. Then we found that pharmacological reduction of arachidonic acid levels was sufficient to reverse ALS-related phenotypes in both human sMNs and *in vivo* in Drosophila and $SOD1^{G93A}$ mouse models. Muscle wasting, which is caused by aging, genetic mutations, radiation, or traumatic injury, can result in significant functional impairment and currently there is no cure. Human iPSCs can provide strategic opportunities for muscle wasting condition, but it is unknown if the iPSC-derived skeletal muscle cells can be functionally engrafted in vivo. We demonstrate that human PSC-derived PAX7::GFP+ satellite cells engraft within the niche, adopt a quiescent state, exhibit adult satellite cell molecular profiles, and contribute to regeneration upon reinjury and in mdx mouse (a rodent model of Duchenne muscular dystrophy). Our studies present a proof of principle for human PSC-based drug development and cell therapy for neural and muscle disorders.

발표자 관련 논문

1. Lee H, Lee JJ, Park NY, Dubey SK, Kim T, Ruan K, Lim SB, Park S-H, Ha S, Kovlyagina I, Kim K-T, Kim S, Oh Y, Kim H, Kang S-U, Song M-R, Lloyd TE, Maragakis NJ, Hong YB, Eoh H, Lee G. Multi-omic analysis of selectively vulnerable motor neuron subtypes implicates altered lipid metabolism in ALS. Nature Neuroscience 2021 Dec 21. PMID: 34782793.
2. Sun C, Kannan S, Choi IY, Lim HT, Zhang H, Chen GS, Zhang N, Park S-H, Serra C, I SR, Lloyd TE, Kwon C, Lovering RM, Lim SB, Andersen P, Wagner KR, Lee G. Human pluripotent stem cell-derived myogenic progenitor cells engraft to become quiescent functional satellite cells in vivo. Cell Stem Cell 2022 Apr 7;29(4):610-619.PMID: 35395188.

Association of Korean Neuroscientists (AKN) eTalk

August 3, 2022

10am PST, 12pm CST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Communication of Astrocyte-Neuron in Motivated Behaviors and Alcohol Use Disorder

Seungwoo Kang, PhD, Assistant Professor of Pharmacology at Augusta University Medical College of Georgia
(moderator: Mi-Hyeon Jang, PhD, Associate Professor at Rutgers Med School)

발표자 약력 및 실험실 소개

Dr. Kang has built a research background on the cellular and molecular mechanisms controlling physiological and pathophysiological brain activities in psychiatric disorders since he earned his B.S. in Life Sciences and M.S. in Neurobiology at Korea University. After he received Ph.D. in Pharmacology at University of California, Irvine (PI: Naoto Hoshi, M.D., Ph.D.), he extended his research experience at Rutgers New Jersey Medical School as a Postdoctoral Fellow (PI: Jiang-Hong Ye, M.D., M.Sc.) and Mayo Clinic College of Medicine as a Research Associate/Research Scientist/Assistant Professor of Pharmacology (PI: Doo-Sup Choi, Ph.D.). In 2021, he joined the Dept. of Pharmacology & Toxicology in the Medical College of Georgia at Augusta University as an Assistant Professor and is now leading research programs mainly focusing on how the interaction of neurons and astrocytes modulate spatiotemporal brain activities in the local tripartite synapses and long-range circuits to resolve motivated behaviors and alcohol use disorder. The research applies multi-layered combination of biochemical, opto-/chemo-genetic, electrophysiological, and behavioral assays with a real-time behavior-synchronized brain recording and computational analysis.

발표 내용 요약

Alcohol use disorder has been characterized by an entangled framework that comprises three stages; binge/intoxication, withdrawal/negative affect, and preoccupation/anticipation that plausibly correspond with enhanced incentive salience/pathological habits, negative emotional states, and executive function deficits, respectively. To fill the substantial gap in our knowledge of the fundamental biological mechanisms underlying those complex alcohol-related behaviors, we have been focusing on the context dependent communication, specially between neurons and one of the non-neuronal glial cells, astrocytes, in brain. In addition to the traditional well-known neuro-supportive roles, astrocytes are emerging as a key determinant of neuronal synaptic function and consequent behavioral changes through bi-directional modulation including the temporal releasing of various gliotransmitters and scavenging of overflowed neurotransmitters.

Recently, we showed chemo-genetic activation of the astrocytes in the Dorsal Striatum (DS), one of the main brain regions for shaping reward-seeking and coordinating movement, induces the various changes in adjacent neuronal synaptic transmission in a cell-type specific manner, leading a shift in reward-seeking behavioral patterns. We also found that the coordinated activities in the medial and lateral parts of DS have distinguishable signatures for an environmental context dependent locomotion and alcohol-withdrawal disrupts these coordinated cellular activities. Our study provides new insights into the importance of context dependent coordination of neuronal and astrocytic activities to understand the diverse behaviors in alcohol use disorder and its comorbid psychiatric disorders.

발표자 관련 논문

1. Kang S, Hong SI, ..., Choi DS. Activation of Astrocytes in the Dorsomedial Striatum Facilitates Transition From Habitual to Goal-Directed Reward-Seeking Behavior. Biol Psychiatry. 2020 Nov 15;88(10):797-808.
2. Kang S, Li J, Bekker A, Ye JH. Rescue of glutamate transport in the lateral habenula alleviates depression- and anxiety-like behaviors in ethanol-withdrawn rats. Neuropharm. 2018 Feb;129:47-56.
3. Kang S, Li J, ..., Ye JH. Ethanol Withdrawal Drives Anxiety-Related Behaviors by Reducing M-type Potassium Channel Activity in the Lateral Habenula. Neuropsychopharm. 2017 Aug;42(9):1813-1824.

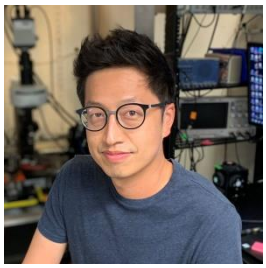
Association of Korean Neuroscientists (AKN) eTalk

August 17, 2022

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



Ascending somatosensory circuitry that shapes the perception of touch and pain

Seungwon (Sebastian) Choi, Ph.D., Assistant Professor in the Department of Psychiatry at UT Southwestern Medical Center (moderator: Sung Han, Ph.D., Assistant Professor at Salk Institute for Biological Studies)

발표자 약력 및 실험실 소개

Dr. Choi was born and raised in South Korea and received his B.S. and M.S. from the Korea Advanced Institute of Science and Technology (KAIST), where he studied molecular mechanisms underlying dendritic spine formation. He obtained his Ph.D. at Harvard University, where he studied behavioral arousal and quiescence in C. elegans. As a postdoctoral fellow at Harvard Medical School, Dr. Choi studied ascending spinal pathways that convey touch and pain signals to the brain. Dr. Choi joined the Department of Psychiatry at UT Southwestern Medical Center as an Assistant Professor in July 2022.

발표 내용 요약

Each day we experience myriad somatosensory stimuli: hugs from loved ones, warm showers, a mosquito bite, sore muscles after a workout. These tactile, thermal, itch, and nociceptive signals are detected by peripheral sensory neuron terminals and end organs distributed throughout our body, propagated into the spinal cord where they are processed, and transmitted to the brain via ascending spinal projection pathways. Primary sensory neurons that innervate the skin and detect a wide range of somatosensory stimuli have been identified and characterized. In contrast, very little is known about how peripheral signals are integrated and processed within the spinal cord and how these signals are conveyed to the brain by spinal projection neurons to generate somatosensory perception and behavioral responses. Importantly, touch and pain are subjective experiences that are greatly modulated by internal states as well as pathological conditions: wounded soldiers in the battlefield often do not experience significant pain, and a gentle touch can be perceived as painful or disturbing in patients with neuropathic pain or autism spectrum disorders. How do we perceive a similar sensory stimulus differently, in a context-dependent manner? What are the key nodes of convergence of top-down and bottom-up neural signals within the somatosensory system that provide such computational flexibility? My lab aims to define the functional organization of ascending somatosensory circuitry and to use this knowledge to reveal how internal states and disorders of the nervous system shape our sense of touch and pain. My lab will explore these exciting areas using new mouse genetic tools in conjunction with advanced molecular, anatomical, physiological, and behavioral approaches.

발표자 관련 논문

Choi S, Hachisuka J, Brett MA, Magee AR, Omori Y, Iqbal N, Zhang D, DeLisle MM, Wolfson RL, Bai L, Santiago C, Gong S, Goulding M, Heintz N, Koerber HR, Ross SE, Ginty DD (2020). Parallel ascending spinal pathways for affective touch and pain. Nature. 587(7833). DOI: 10.1038/s41586-020-2860-1 PMID: 33116307

Association of Korean Neuroscientists (AKN) eTalk

September 7, 2022

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Pro-neurogenic and anti-amyloid effects of exercise in Alzheimer's disease

Se Hoon Choi, PhD, Assistant Professor of Neurology at Massachusetts General Hospital and Harvard Medical School (moderator: Jae-Kyung 'Jamise' Lee, PhD, Associate Professor at University of Georgia College of Veterinary Medicine)

발표자 약력 및 실험실 소개

최세훈 박사는 성균관대학교 생물학과에서 학사를 받고, 서울의대 약리학 교실에서 알츠하이머 (Alzheimer's disease)에 관한 주제로 서유헌 교수님 실험실에서 석사를 받았다. 시카고 대학 (University of Chicago)의 Sangram Sisodia 실험실에서 박사를 받았고 박사 과정에서 알츠하이머와 관련된 Presenilin 1 mutations이 어떻게Adult neurogenesis를 조절하는지에 대한 연구를 하였다. 포닥시절 Massachusetts General Hospital (MGH)/하버드의대의 Rudolph Tanzi 실험실에서 Adult neurogenesis 의 감소와 증가가 Alzheimer's disease의 진행과정에 어떤 영향을 미치는지에 관한 연구를 마우스 모델에서 진행하였고, 알츠하이머 연구를 위한 three-dimensional (3D) human cell culture system 개발에 참여하였다. 현재 MGH/하버드 의대에서 조교수로 연구를 하고 있으며, 알츠하이머에 관련한 Adult neurogenesis에 관한 연구, 운동이 알츠하이머 병변에 어떤 영향을 주는지, Blood-brain barrier을 포함한 3D cell culture model 개발과 알츠하이머 약 개발 등을 진행하고 있다.

발표 내용 요약

Alzheimer's disease (AD) is the most common form of age-related dementia, characterized by cognitive impairment, neurodegeneration, and β-amyloid (Aβ) deposition. Presently available treatments work to slow memory loss, but there is no known cure. Various lines of evidence suggest that exercise reduces the risk of AD. However, the mechanisms underlying this association are unclear. Exercise increases adult hippocampal neurogenesis (AHN) and decreases Aβ burden in animal studies. AHN is a process that generates new functional neurons in the hippocampus throughout life. But AHN begins to be impaired during early stages of AD pathology. Although adult-generated neurons play critical roles in learning and memory under physiological conditions, their functions under pathological conditions, such as those of AD, have remained elusive. In this talk, I will present data showing that suppressing AHN worsened cognitive dysfunction in AD mice and that inducing AHN genetically and pharmacologically in combination with elevating brain-derived neurotrophic factor (BDNF) levels is sufficient to mimic the beneficial effects of exercise on AD mice. These findings are opening possibilities that promoting AHN and BDNF could be disease-modifying or a preventative strategy against AD. Furthermore, the underlying mechanisms by which exercise decreases Aβ burden have not been fully elucidated. I will present and discuss data showing that an exercise hormone reduces Aβ pathology, in a three-dimensional (3D) cell culture model of AD, by increasing release of Aβ-degrading enzyme neprilysin.

발표자 관련 논문

1. Choi SH, Kim YH, Hebisch M, …. Tanzi RE, Kim DY (2014). A three-dimensional human neural cell culture model of Alzheimer's disease. *Nature*, *515*(7526), 274–278.
2. Choi SH, Bylykbashi E, Chatila ZK, … Gage FH, Tanzi RE (2018). Combined adult neurogenesis and BDNF mimic exercise effects on cognition in an Alzheimer's mouse model. *Science*, *361*(6406), 813–828.

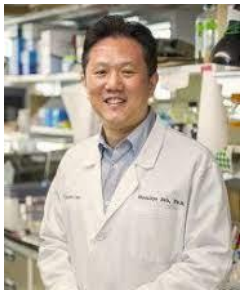
Association of Korean Neuroscientists (AKN) eTalk

September 21, 2022

10am PST, 11 am MST, 12 pm CST and 1 pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



A role of hippocampal neurogenesis in a "Gate" function and its implication in epileptogenesis

Hoonkyo Suh, PhD, Associate Professor in the Department of Neurosciences at the Cleveland Clinic Medicine

(moderator: Mi-Hyeon Jang, PhD, Associate Professor at Rutgers Med School)

발표자 약력 및 실험실 소개

서훈교 박사는 연세 대학교 생화학과에서 학사 학위를 받고 (1994), 미시간 주립대학교에서 뇌하수체 호르몬을 분비하는 세포의 (pituitary-hormone producing cells) 분화과정을 주제로 박사 학위를 받았습니다 (2002). 박사후 (postdoctoral) 과정동안, 해마 (hippocampus)에서 일어나고 있는 성체 신경세포 발생 (neurogenesis)과 그 역할에 대한 연구를 솔크 연구소 (Salk Institute, San Diego) 에서 하였습니다. 2009년에 클리브랜드 클리닉에 조교수로 부임하여 2016년부터 부교수로 재직중에 있으며, 해마에서 일어나고 있는 신경발생이 신경질환에 미치는 영향에 대한 연구를 하고 있습니다. 특히,새로 만들어진 신경세포가 "excitatory and inhibitory (E/I) signal balance" 를 유지하는 데 어떻게 관여하는 지를, 그리고 신경세포의 발생과 연결이 비정상적으로 이루어질 경우 어떻게 발작(seizure) 혹은 간질 (epilepsy)를 유발하는지를 현재 연구 하고 있습니다. 유전자 조작으로, 약물 중독 이후에 금단증상으로, 혹은 약물로 유도되는 발작이나 간질을 실험모델로 하고 있습니다.

발표 내용 요약

New neurons are continuously generated and incorporated into the preexisting neural circuits in the adult hippocampus. This process termed as neurogenesis is critical to provide plasticity that underlies multiple hippocampus-dependent functions such as learning and memory, emotional stability, addiction, and social behaviors. In addition, hippocampal newborn neurons play an important role in the maintenance of excitatory and inhibitory (E/I) signal balance. We tested the hypothesis that disrupted "gate" function of newborn neurons that limits the flow of excitatory signals to the hippocampus and prevent hyperactivation of the hippocampus may lead to seizure or epilepsy. Using a rabies virus as a neural circuit tracer and DREDD method to control neuronal activity, we discovered that abnormal development and connection of hippocampal newborn neurons generate pro-epileptic neural circuits that allow the entrance, amplification, and transmission of excessive excitatory signals. We also showed that the activity of hippocampal newborn neurons is necessary and sufficient for the expressions of seizures. Thus, our study revealed how aberrant neural circuit formation caused by abnormal neurogenesis underlies epileptogenesis. We are currently investigating molecular and neural circuitry mechanisms by which changes in activity of hippocampal newborn neurons lead to epilepsy.

발표자 관련 논문

1. Zhou, Q.G., Nemes, A.D., Lee, D., Ro, E.J., Zhang, J., Nowacki, A.S., Dymecki, S.M., Najm, I.M., and **Suh, H**. (2019). Chemogenetic silencing of hippocampal neurons suppresses epileptic neural circuits. ***J Clin Invest*** *129*, 310-323.
2. Lee D, Krishnan B, Zhang H, Park HR, Ro EJ, Jung YN, **Suh H**. Activity of hippocampal adult-born neurons regulates alcohol withdrawal seizures. ***JCI Insight***. Oct 3 2019;4(19).

Association of Korean Neuroscientists (AKN) eTalk

October 5, 2022

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Studying social vision in nonhuman primates : new insights from a naturalistic vision paradigm

Soo Hyun Park, PhD, Research Fellow at the National Institute of Mental Health
(moderator: Gabsang Lee, DVM, PhD, Professor at Johns Hopkins University, School of Medicine)

발표자 약력 및 실험실 소개

박수현 박사는 서울대학교 심리학과에서 학사(2003-2007)를 받고, 이후 서울대학교 뇌과학 협동과정 석박사 통합과정에 진학, 뇌인지과학과 이상훈 교수의 지도 아래 우리의 시지각과 초기 시각 피질의 반응이 주변의 맥락에 의해 어떻게 변화하는지를 연구하였다. 정신물리학적 방법론 (psychophysics)과 fMRI를 이용한 연구로 2013년 박사를 받은 후, 신경 세포 수준의 연구를 하기 위해 원숭이 모델에서 시각을 연구하는 미국 국립 보건원의 Dr. David Leopold의 연구실에서 박사후 연구원 생활을 시작하였다. 현재까지 마카크 원숭이 및 마모셋 원숭이 모델에서 신경생리학, fMRI, calcium imaging 등의 다양한 방법론을 익히면서 여러 수준에서 연구를 진행하였다. 특히 마카크 원숭이의 측두엽 (inferotemporal cortex)에 위치한 얼굴 지각 관련 영역들의 세포들이 원숭이들이 비디오를 볼 때 어떤 식으로 반응하며, 다른 뇌 영역과 어떤 식으로 상호작용하는지에 대하여 논문으로 발표하였다. 일련의 연구를 진행하면서, 우리가 일상에서 다른 사람의 행동과 감정을 이해하기 위해 사용하는 시각 정보, 그리고 그러한 정보들이 뇌에서 어떤 식으로 처리되는지에 관심을 가지게 되었고, 앞으로 독립연구자로서 마모셋 원숭이 모델에서 이를 연구하고자 한다.

발표 내용 요약

In visual neuroscience, neurons or areas are characterized by their visual feature selectivity. This captures only a fraction of how the visual system works because a given neuron or area is always part of a larger network. In our everyday vision, the whole visual system continuously engages as we actively interact with the world. In this talk, I will present my recent studies that focus on the local and global functional networks during dynamic visual experience by utilizing a movie-watching paradigm in macaques and marmosets. In a series of work looking at the face-processing system in the macaque inferotemporal cortex, I developed a novel single-unit fMRI mapping approach that offers a unique way of studying individual visual neurons in relation to their whole-brain functional networks, instead of namable visual features of the stimulus. Using this approach, I revealed that a local face-selective region contains a mixture of functional subpopulations of cells characterized with distinct whole-brain networks. These subpopulations were shared across spatially separated face-selective regions, suggesting parallel subnetworks distributed within the face-processing system. In an ongoing study in marmoset monkeys, using calcium imaging with a head-mounted miniscope, I am asking how the interactions between neurons within a local circuitry unfold at multiple spatiotemporal scales during free viewing of videos. In the future, I plan to continue to probe the primate social visual system in marmoset monkeys during more natural modes of vision to advance our understanding of how the visual system processes dynamic, continuous visual inputs in real-time to interact with the world.

발표자 관련 논문

1. S. H. Park et al., Parallel functional subnetworks embedded in the macaque face patch system. *Sci Adv* **8**, eabm2054 (2022).
2. S. H. Park et al., Functional Subpopulations of Neurons in a Macaque Face Patch Revealed by Single-Unit fMRI Mapping. *Neuron* **95**, 971-981 e975 (2017).

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October 5, 2022

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발표 제목과 발표자

Roles of sleep oscillations in motor memory consolidation

Jaekyung Kim, PhD, Postdoctoral Fellow of Department of Neurology at University of California-San Francisco, and Neurology and Rehabilitation Service at San Francisco Veterans Affairs Medical Center (moderator: Doo-Sup Choi, PhD, Professor at Mayo Clinic)

발표자 약력 및 실험실 소개

김재경 박사는 한양대학교 생체공학과에서 학사(2006-2010)를 받고, 한국과학기술원(KAIST)에서 시냅스 자극과 억제의 균형이론(Theory of homeostatic balance between synaptic excitation and inhibition)을 주제로 박사(2010-2017)를 받았다. 현재 포닥(2017-현재)으로 UCSF, Karunesh Ganguly 연구실에서 운동학습원리와 특히 수면동안의 운동기억형성(motor memory consolidation) 원리에 대해 연구하고 있다. Ganguly 연구실은 설치류-영장류-인간에 걸쳐 운동학습과 뇌기계인터페이스(brain-machine interface)를 주제로 신경생리학 및 계산신경과학을 통해 연구를 하고 있다. 김재경 박사는 또한 NIH K99/R00 과제를 통해 수면동안의 기억형성 원리가 뇌졸중(stroke) 발병 이후 회복에 하는 역할에 대해서도 연구를 진행하고 있다. 2017년 부터의 포닥과정 동안 대표적으로 세가지 연구를 발표 하였다. 1. 비렘수면동안 발생하는 기억공고화와 기억망각의 상반된 기능이 각각 느린진동(slow-oscillations)과 델타파형(δ-waves)에 의해 매개됨. 2. 느린진동-델타파형의 원리에 기반하여 뇌졸중 발병 후 회복과정을 촉진시킬 수 있는 치료적 접근법을 발견. 3. 가장 최근 대뇌(cortex)와 해마체(hippocampus)의 연결성에 근거한 운동기억의 두 단계적 형성 원리를 밝힘.

발표 내용 요약

Sleep has been known to contribute to brain plasticity and consolidation of both declarative and nondeclarative/motor memories. Declarative memory is defined as our capacity to acquire and recollect facts and events, while motor memory is described as our ability to acquire a variety of skills, including motor skills such as shoe lacing or playing a musical instrument. A large body of studies has proposed the roles of sleep oscillations for declarative memories. Yet, direct evidence for the neural basis is lacking for motor memory systems. My recent studies have focused on *motor memory processing* to understand a sleep-dependent mechanism using multi-scale in vivo electrophysiology as well as state-of-the-art techniques such as brain-machine interface and reach-to-grasp tasks developed by our lab at UCSF. My presentation will introduce important discoveries for intra-cortical, inter-cortical, and subcortical-cortical memory processing during sleep as well as foresight and directions for my future research. There will be three parts about the ground findings during my post-doc research. 1. Sleep slow-oscillations (SO) and delta-waves (δ-waves) have dissociable and competing roles in memory "consolidation" versus "forgetting" during NREM sleep (Kim et al., *Cell*, 2019). 2. Applications of the novel SO-δ distinction for the recovery processing after brain injury, i.e., stroke (Kim et al., *Cell Rep.*, 2022). 3. Two-stage role of hippocampal sharp-wave ripples in motor memory consolidation and cortical manifold learning (Kim et al., under revision).

발표자 관련 논문

1. **Kim, J.**, Gulati, T., Ganguly, K. (2019) Competing roles of slow oscillations and delta waves on memory consolidation versus forgetting. *Cell*, 179(2), 514-526. (Cover article)
2. **Kim, J.**, Guo, L., …, Ganguly, K. (2022) Recovery of consolidation after sleep following stroke – interaction of slow waves, spindles and GABA. *Cell Reports*, 38, 110426

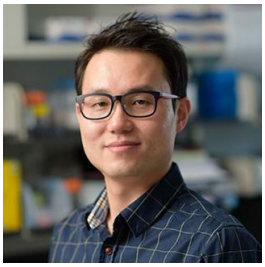
Association of Korean Neuroscientists (AKN) eTalk

Oct 19, 2022

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



Human Pluripotent Stem Cell Engineering to Study and Treat Parkinson's Disease

Tae Wan Kim, PhD, Senior Research Scientist of the Center for Stem Cell Biology at the Memorial Sloan Kettering Cancer Center (moderator: Gabsang Lee, PhD, Professor at Johns Hopkins Med School)

발표자 약력 및 실험실 소개

김태완 박사는 아주대학교 생물공학과에서 학사(1998-2004)를 받고, 서울대학교에서 후성 유전학에 의한 줄기세포와 역분화 조절 (role of O-Glycosylation, Ctbp2, and AuroraB/protein phosphatase1 in embryonic stem cell pluripotency and reprogramming)을 주제로 박사(2009-2014)를 받았다. 포닥(2015-현재) 시절 메모리얼 슬로안 케더링 켄서센터에서 줄기세포를 이용하여 도파민 뉴론을 만들어 파킨슨 질병을 모델링 하였고, 특히 농약성분인 Propargite의 의한 선택적인 도파민 뉴론 괴사와 파킨슨병의 원인 유전자 (SATB1)이 도파민 뉴론의 노화를 조절함을 보였다. 또한, 줄기세포로부터 실제로 환자에 사용될수 있는 도파민 세포생성 기술을 개발하였고, 이 방법을 이용하여, 실제적으로 환자에 사용될수 있는 도파민 세포가 만들어졌으며, 실제 미국에서 12명의 환자에게 줄기세포치료를 하는 임상실험을 하였다. 현제는 줄기세포를 이용한 제2세대 파킨슨병 모델링과 치료를 위하여 1) 더욱 안전하고 효율을 높일수 있는 방법을 High-Throughput marker and in vivo CRISPR/Cas9 스크린 방법을 이용하여 연구하고 있고, 2) 줄기세포로부터 좀더 실제 in vivo 도파민 뉴론과 서브타입이 만들어질수 있는 프로토콜을 2D와 3D 방법을 이용하여 연구하고 있다.

발표 내용 요약

The pathological hallmark of Parkinson's disease (PD) is the progressive loss of selective midbrain dopamine (mDA) neurons leading to well-known motor symptoms. Derivation of mDA neurons from human pluripotent stem cells (hPSCs) show considerable promise for applications not only to develop novel cell replacement therapy, but also to model human PD in a dish. Protocols have been developed to derive mDA neurons from hPSC capable of reversing dopamine-related deficits in PD animal models. However, the generation of mDA neurons at clinical scale suitable for human application remains an important challenge. Here, we present an mDA neuron derivation protocol from hPSC in a clinically relevant condition based on two-step WNT signaling activation strategy that improves expression of midbrain markers including Engrailed-1, while minimizing expression of contaminating markers. The resulting neurons exhibit molecular, biochemical, and electrophysiological properties of mDA neurons. Cryopreserved mDA neuron precursors can be successfully transplanted into 6OHDA lesioned PD rat models to induce recovery of PD behavior. Importantly, this protocol is the basis for large scale production of cryopreserved clinical grade mDA progenitor and preclinical safety and efficacy studies. Currently, we have obtained FDA clearance, and which is being used in a first-in-human clinical trial for mDA neuron replacement therapy in 12 PD patients in USA. In parallel, I developed precise, hPSC-based disease models to determine the role of PD-related genes in the pathogenesis of PD. In particular, we demonstrate the identification of SATB1 as a cell-type specific neuroprotective modifier in mDA neurons which acts by repressing an mDA neuron senescence program. These studies take advantage of generating mDA neuron products in a clinically relevant culture system to develop cell-based therapy to PD patients as well as to better understand molecular characteristics of selective vulnerability of mDA neurons.

발표자 관련 논문 *Co-First Author

1. Kim TW*, Piao J*, Koo SY, ..., Studer L. (2021). Biphasic Activation of WNT Signaling Facilitates the Derivation of Midbrain Dopamine Neuron from Human ESC for Translational Use . *Cell Stem Cell*, PMID: 33545081.
2. Riessland M*, Kolisnyk B*, Kim TW*,..., Studer L. (2019). Loss of SATB1 Induces p21 Dependent Cellular Senescence in Post-mitotic Dopaminergic neuron. *Cell Stem Cell*, PMID: 33545081.

Association of Korean Neuroscientists (AKN) eTalk

October 19, 2022

10am PST, 12pm EST and 1pm EST

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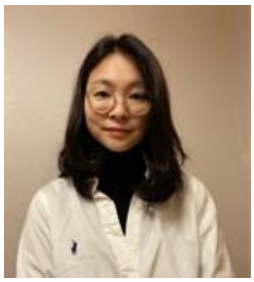
발표 제목과 발표자



What is the function of microglia in chronic pain? : Chemogenetic and optogenetic manipulations of microglia in chronic pain

Min-Hee Yi, PhD, Senior Research Fellow
Department of Neurology at Mayo Clinic

(Moderator: Jun-Ho La, DVM, PhD, Associate Professor at the University of Texas Medical Branch)

발표자 약력 및 실험실 소개

이민희 박사는 학부(05-09)와 석사(09-11)를 전북대학교 자연과학부 분자생물학과에서 졸업하고, 16년 충남대학교 의과대학 해부학 교실에서 박사학위를 취득하였다. 박사과정에서는 Kainic acid에 의해 유도된 Status Epilepticus 모델을 이용하여 Neuron-Glia immune interaction에 관하여 연구하였으며, 박사학위 과정 중 15년 12월부터 17년 10월까지 University of Texas Medical Branch (UTMB), Neuroscience and Cell biology부서의 Dr. Yu Shin Kim실험실의 Visiting Scientist로 Dorsal root ganglion (DRG)와 Trigeminal ganglion (TG)의 Primary sensory neuron에서 Ca^{2+} in vivo imaging을 pain model에서 수행하였다. 17년 10월부터 미네소타주의 로체스터에 위치한 Mayo Clinic, Neurology 부서의 Dr. Long-Jun Wu 실험실의 Research Fellow로 합류하여, 21년부터 현재 Senior Research Fellow로 Pain에서 microglia의 기능과 조절에 중점을 두고 연구하고 있으며, chemogenetics, optogenetics, spinal cord stimulation (SCS) 그리고 in vivo 2P imaging을 포함한 최첨단 기술을 사용하여 Microglia-Neuron immune interaction에 관한 연구를 수행하고 있다.

발표 내용 요약

Chronic pain relief remains an unmet medical need. Current research points to a substantial contribution of glial-neuron interaction in its pathogenesis. Particularly, microglia play a crucial role in the development of chronic pain. To better understand the microglial contribution to chronic pain, specific regional and temporal microglial manipulations are necessary. Recently, two new approaches have emerged that meet these demands. Chemogenetic tools allow the expression of designer receptors exclusively activated by designer drugs (DREADDs) specifically in microglia. Similarly, optogenetic tools allow for microglial manipulation via the activation of artificially expressed, light-sensitive proteins. Chemo- and optogenetic manipulations of microglia in vivo are powerful in interrogating microglial function in chronic pain. Our recent findings suggest that Gi DREADD manipulation in microglia attenuates chronic pain by inhibiting microglia proliferation, neuroinflammation, and synaptic potentiation. In addition, optogenetic stimulation of spinal microglia triggers IL-1β release, which increases neuronal activity underlying chronic pain behaviors suggesting the intriguing possibility of “microgliogenic” pain that originates from microglial activation in the CNS.

Keywords: chronic pain, microglia, optogenetics, chemogenetics, DREADD

발표자 관련 논문

1. Yi MH, Liu YU, Liu K, Chen T, Bosco DB, Zheng J, Xie M, Zhou L, Qu W, Wu LJ. Chemogenetic manipulation of microglia inhibits neuroinflammation and neuropathic pain in mice. Brain Behav Immun. 2020 Nov 20:S0889-1591(20)32406-5.
2. Yi MH, Liu YU, Umpierre AD, Chen T, Ying Y, Zheng J, Dheer A, Bosco DB, Dong H, Wu LJ. Optogenetic activation of spinal microglia triggers chronic pain in mice. PLoS Biol. 2021 Mar 19;19(3):e3001154. Selected as a Research highlights in Nature Neurology Review, 2021 May;17(5):262 PMID:33828292
3. Peng J*, Yi MH*, Jeong H, McEwan P, Zheng J, Wu G, Ganatra S, Ren Y, Richardson J, Oh SB, Wu LJ. The voltage-gated proton channel Hv1 promotes microglia-astrocyte communication and neuropathic pain after peripheral nerve injury. Mol Brain 2021 Jun 28;14(1):99.

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발표 제목과 발표자

Cross-modal synaptic plasticity: How the brain adapts to sensory loss

Hey-Kyoung Lee, PhD, Professor of Neuroscience at the Johns Hopkins University (moderator: Jae-Kyung Lee, PhD, Associate Professor at University of Georgia)

발표자 약력 및 실험실 소개

Dr. Hey-Kyoung Lee is a Professor of Neuroscience at the Johns Hopkins University School of Medicine. Her research focuses on the cellular and molecular changes that happen at synapses to allow memory storage and experience-dependent plasticity. Her research interests include elucidating the mechanisms underlying cross-modal synaptic plasticity and exposing the events that occur in diseased brains.
Dr. Lee received her B.S. degree in Biology from Yonsei University (Seoul, Korea). She earned her Ph.D. in Neuroscience from Brown University and completed postdoctoral training in Neuroscience at the Johns Hopkins School of Medicine. Dr. Lee joined the Johns Hopkins faculty in 2011. Prior to joining Johns Hopkins, Dr. Lee was an Associate Professor of Biology at the University of Maryland (College Park). She was awarded the Sloan Research Fellowship in 2004 and was nominated as one of the Yonsei 100 Women Leaders in 2006. She was also a recipient of the the Junior Faculty Award in 2009 (College of Chemical and Life Sciences, University of Maryland) and the Discovery Award in 2021 (Johns Hopkins University). She is currently serving as the Chair of the Undergraduate Neuroscience Program.

발표 내용 요약

Cross-modal plasticity refers to the adaptation of the brain after losing a sensory modality, which enables the organism to navigate the world with the remaining senses. One such example seen in blind subjects is the activation of the visual cortex by Braille or speech. Such cross-modal recruitment is thought to be beneficial as it allows the spared sensory information to be processed by a larger cortical area. In addition, there is enhancement and refinement of the remaining senses via compensatory plasticity of the spared sensory cortices. We found that a short duration of vision loss triggers large-scale circuit plasticity across the primary sensory cortices even in adults. Such cross-modal plasticity is robust and manifests differently in the deprived visual cortex (V1) and the spared auditory cortex (A1). Plasticity in V1 mainly involves potentiation of intracortical excitatory synapses, while in A1 it expresses as potentiation of the feedforward pathways at the expense of intracortical inputs. Mechanistically, plasticity observed in both V1 and A1 conforms to Hebbian plasticity coupled to the sliding threshold (Bienenstock-Cooper-Monreo, BCM) model of metaplasticity. I will discuss the functional consequences of the circuit level cortical plasticity, and present data that cross-modal plasticity is observed even earlier in the sensory processing at the level of thalamic gating.

발표자 관련 논문

1. Chokshi V, Gao M, Grier B, Owens A, Wang H, Worley PF, and Lee H-K. (2019) Input-specific metaplasticity in the visual cortex requires Homer1a mediated mGluR5 signaling. *Neuron* 104: 736-748.
2. Petrus E*, Isaiah A*, Jones AP, Li D, Wang H, Lee H-K, and Kanold PO. (2014) Cross-modal induction of thalamocortical potentiation leads to enhanced information processing in the auditory cortex. *Neuron* 81: 664-673.

Association of Korean Neuroscientists (AKN) eTalk

November 23, 2022

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Discovering new pathogenic mechanisms for synucleinopathies; Identifying and evaluating new therapeutic targets

Changyoun Kim, PhD, Staff Scientist of Laboratory of Neurogenetics at National Institute on Aging (moderator: Mi-Hyeon Jang, PhD, Associate Professor at Rutgers Med School)

발표자 약력 및 실험실 소개

김창연 박사는 서울 건국대학교 생명과학과에서 학사(1999-2006)를 받고, 동 대학 의생명과학과에서 소포체 스트레스(Unfolded Protein Responses)를 주제로 석사학위(2006-2008)를, 퇴행성 뇌질환인 파킨슨병(Mechanism of neuronal a-synuclein-induced microglia activation)을 주제로 박사학위(2008-2012)를 받았으며, 톨유사 수용체 2(TLR2)가 파킨슨병의 병리현상에 중요한 매개체라는 사실을 최초로 밝혔다. 박사 후 연수 시절(2013-2016) 샌디에고 캘리포니아 주립대 의대(University of California, San Diego, School of medicine)에서 시뉴클리노병증 (Synucleinopathies; 파킨슨병, Dementia with Lewy bodies, Alzheimer's disease, Multiple system atrophy)에서의 뇌염증 반응, a-synuclein 단백질의 비정상적 응집 및 병리적 전파 메커니즘, Immunotherapy, Drug repurposing 등에 관한 연구를 다양한 동물모델과 환자샘플 등을 이용하여 수행하였다. 이후, National Institute on Aging에서 Scientist(2017-2019)를 거쳐, 현재 Staff Scientist(2020-)로 근무하고 있으며, 현재 (1) 시뉴클리노병증의 뇌염증 반응에서의 파킨슨병 연관 유전자의 역할 연구, (2) 발굴한 새로운 질병 타겟들을 이용한 치료방법 개발 및 검증 연구, (3) 시뉴클리노병증에서의 후천면역의 역할 연구, 및 (4) 시뉴클리노병증과 SARS-CoV-2의 연관성 연구 등을 수행하고 있다.

발표 내용 요약

Synucleinopathies such as Parkinson's disease (PD) and dementia with Lewy bodies (DLB) are age-related neurological disorders. Pathological hallmarks of the diseases are abnormal deposition of a-synuclein (a-syn) and neuroinflammation, which are both strongly associated with disease onset and progression. Although synucleinopathies affect over 10 million people worldwide, we still do not have any effective treatments, perhaps due in part to a lack of a mechanistic understanding of the diseases. So far, deposition of a-syn has been regarded as the most potent pathogenic mechanism for these diseases. However, the failures of recent clinical trials targeting a-syn aggregates support the necessity of reinforcement of existing hypotheses or discovering new pathogenic mechanisms. Therefore, for decades, we have been attempting to gain a comprehensive understanding of the pathogenic mechanisms for these diseases. As a result of these studies, we have demonstrated the pathogenic interaction of a-syn depositions and neuroinflammation in PD/DLB models, and identified four potential new drug targets for synucleinopathies, including Toll-like receptor 2 (TLR2), beta1-integrin, p38gamma, and Nuclear factor of activated T cell 1 (NFAT1). In this presentation, we will summarize and discuss the findings and clinical applications of recently identified new targets for synucleinopathies.

발표자 관련 논문

1. **Kim C**, … Lee SJ. Neuron-released oligomeric α-synuclein is an endogenous agonist of TLR2 for paracrine activation of microglia. (2013) **Nat Commun**. 4. 1562.
2. **Kim C**, … Masliah E. Immunotherapy targeting toll-like receptor 2 alleviates neurodegeneration in models of synucleinopathy by modulating α-synuclein transmission and neuroinflammation. (2018) **Mol Neurodegener**. 13. 43.
3. **Kim C***, … Masliah E*. LRRK2 mediates microglial neurotoxicity via NFATc2 in rodent models of synucleinopathies. (2020) **Sci Transl Med**. 12. aay0399.
4. Szabo M, … **Kim C***. Does SARS-CoV-2 affect neurodegenerative disorders? TLR2, a potential receptor for SARS-CoV-2 in the CNS. (2022) **Exp Mol Med.** 54. 447.

Association of Korean Neuroscientists (AKN) eTalk

Dec 7, 2022

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Role for Glia in Brain Function and Injury Response

Hyun Kyoung Lee, MS, Ph.D., Associate Professor of Pediatrics and Neuroscience at Baylor College of Medicine, Duncan Neurological Research Institute at Texas Children's Hospital (Moderator: Eunhee Kim, Ph.D., Assistant Professor at UT Health Science Center at Houston)

발표자 약력 및 실험실 소개

이현경 박사는 동아대학교 생명공학 학사(1999-2004)를 받고, 동대학교 의과대학 생리학교실에서 동물 모델을 이용한 말초신경관련 퇴행성질환을 주제로 석, 박사(2004-2009)를 받았다. 포닥(2009-2015) 시절 Baylor College of Medicine 에서는 신경발달초기 신경교세포 분화에 중요한 유전자들을 밝히는 연구를 하였으면 그에 관련된 충추신경계 발달질환, 퇴행성 질환을 연구하였다. 2016년 부터 Texas Children's Hospital Neurological Research Institute 에서 조교수로 독립적인 연구를 시작하였고 현재는 부교수로 재직중이다. 주요 연구분야로는 신경교세포의 발생과 관련된 1) myelin development and regeneration, 2) astrocyte development and reactivegliosis, 3) CNS diseases and injuries including white matter injury, ischemic stroke, brain cancer 등의 연구를 진행 하고 있다. https://www.hkleelab.org

발표 내용 요약

PART-I: Regeneration after injury and disease remains a foremost challenge in neurobiology. Myelin plays crucial roles in electrical signaling and trophic support in the nervous system, and damage to myelin can lead to long-term axonal injury and degeneration. Whereas the peripheral nervous system (PNS) can regenerate effectively, the central nervous system (CNS) displays a low capacity for regeneration after axonal damage. In this presentation, Dr. Lee will describe recent advances in understanding the underlying signaling pathways in the specification and differentiation of oligodendrocytes during development and under pathological conditions.

PART-II: The extraordinary morphological and functional complexity of astrocytes supports their diverse and critical roles in synaptogenesis, neurotransmission, blood-brain barrier formation, and brain circuit development. Dysregulation of astrocyte functions leads to substantial morphological changes and contributes to the pathology of numerous neurological disorders and malignancies, yet the molecular and cellular mechanisms that link astrocyte morphology to neuronal and circuit activity remain largely undiscovered. Dr. Lee will present new mechanisms regulating astrocyte morphology, via formin protein Daam2, can differentially influence circuit function through molecular, cellular, and physiological approaches.

발표자 관련 논문

1. Lee HK, Chaboub L, Zhu W, Zollinger D, Rasband M, Fancy S, and Deneen B. *Neuron*. Mar 18:85 (6):1227-43 (2015) PMCID:PMC4402944 ("F1000 must read").
2. Ding X, Jo J, Cristobal DC, Zuo Z, Wang CY, Wirianto M, ..., Kawabe H, Jung SY, Bellen H, Yoo, SH, Lee H K. *Genes and Development*. Sep 1;34(17):1177-1189 (2020) PMCID:PMC7462057 (Featured in Cover).
3. Jo J, Woo JS, Cristobal CD, Wang C, Ye Q, Smith JA, Ung K, Liu G, Arenkiel BR, Lee HK. *EMBO Reports*. Oct 11;e53200 (2021) PMCID:PMC7462057 (Featured in Cover).

Association of Korean Neuroscientists (AKN) eTalk

Dec, 21st, 2022

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Understanding immune responses in Synucleinopathy

Jae-Kyung 'Jamise' Lee, PhD, Associate Professor of Physiology and Pharmacology at the University of Georgia College of Veterinary Medicine (moderator: Byoung-il Bae, PhD, Assistant Professor at the U of Connecticut)

발표자 약력 및 실험실 소개

이재경 박사는 경북대학교 생물학과에서 학사와 석사 학위를 (1993-1999)를 받고, University of North Texas Health Science Center at Fort Worth 에서 인간 면역세포, 특히 B와 NK 림프세포에 관한 암연구를 주제로 박사(2000-2006)를 받았다. 포닥(2006-2008)과 Instructor (2008-2010)는 UT Southwestern Medical Center at Dallas 에서 수련하였고 이 기간 동안 면역학 연구경험을 바탕으로 퇴행성뇌질환과정에서의 면역반응 연구로 연구주제를 전환하여 주로 노화 관련 Neuroinflammation 및 Microglia biology 의 역할과 파킨슨병과의 관계에 관한 연구과제를 수행하였다. 이후 Emory 의과 대학교 연구교수 (2010-2015) 를 거쳐, 2015년부터는 University of Georgia 수의대학에서 조교수로 독립 연구를 수행하게 되었고, 현재는 부교수로 재직하고 있으며, 진행중인 연구과제는 다음과 같다. (1) Synucleinopathies가 진행 되는 과정에서 뇌에서 일어나는 면역반응 및 몸 전체의 면역반응이 어떻게 진행 되는 지, (2) 그 중에서 NK 림프구 세포가 병 진행 과정에서 어떤 역할을 담당하는지, 그리고 (3) microglia phenotype 을 조절하는 기작이 무엇이고, 그를 이용해서 가능한 Synucleinopathies 치료 개발 연구를 진행하고 있다. (Lee Lab Website: https://jamlee7.wixsite.com/mysite)

발표 내용 요약

My lab focuses on understanding the role of innate immune cells, especially microglia and natural killer cells in the progression of Lewy body diseases including Parkinson's disease (PD). We utilize a combination of *in vivo* and *in vitro* models of Lewy body diseases to uncover the mechanism of innate immune cells in neurodegenerative diseases.

Project I. To investigate the role of innate immune cells in Lewy body diseases. I have established the relevant *in vitro* and *in vivo* model of PD using preformed fibril (PFF) alpha-synuclein (α-syn). This preclinical mouse model of PD exhibits many clinically relevant hallmarks of PD including dopaminergic cell loss, behavior deficits, and synucleinopathies. By utilizing this mouse model, we characterize immune cell composition during a prodromal stage of the disease to determine whether CNS-initiated α-synucleinopathies alter immune cell profiles in the CNS and the periphery.

***Project II. To investigate the* role of NK cells in Lewy body diseases utilizing a preclinical mouse model of PD.** Our recent studies demonstrated that *in vivo* depletion of NK cells in a preclinical mouse PD model resulted in exacerbated motor deficits and increased in phosphorylated α-syn deposits implicating neuroprotective role of NK cells. Collectively, we hope to develop a novel therapeutic for PD and other synucleinopathies.

***Project III. To elucidate* the role of microglial homeostatic protein** called RGS10 and generate nanoparticles specifically targeting microglia as a therapeutic target for amyloid fibril-associated neurodegenerative diseases.

발표자 관련 논문

1. Earls RH, Menees KB, Chung J, Barber J, Gutekunst CA, Hazim MG, **Lee JK*** (2019) Intracerebral injection of pre-formed alpha-synuclein fibrils alters central and peripheral immune cell profiles in mice**.** ***Journal of Neuroinflammation.*** 2019 Dec 3;16(1):250. doi: 10.1186/s12974-019-1636-8.
2. Earls RH#, Menees KB#, Chung J#, Gutekunst CA, Lee HJ, Hazim MG, Rada B, Wood LB, **Lee JK*** (2020) NK cells clear α-synuclein and the depletion of NK cells exacerbates synuclein pathology in a mouse model of α-synucleinopathy. ***Proc Natl Acad Sci U S A.*** 2020 Jan 21;117(3):1762-1771. doi: 10.1073/pnas.1909110117. Epub 2020 Jan 3.

Association of Korean Neuroscientists (AKN) eTalk

January 4, 2023

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Neural Circuit Connectivity and Its Development for Higher Brain Functions

Euiseok Kim, PhD, Assistant Professor of Molecular, Cell, and Developmental Biology at the University of California, Santa Cruz
(moderator: Hoonkyo Suh, PhD, Associate Professor at Cleveland Clinic)

발표자 약력 및 실험실 소개

김의석 박사는 연세대학교 생화학과에서 학사(1998-2002)를 받고, University of Texas, Southwestern Medical Center at Dallas 에서 Neurogenesis and Gliogenesis of Ascl1 expressing progenitors을 주제로 박사(2003-2010)를 받았다. 포닥(2006-2015) 시절 UCSD와 The Salk Institute에서 mammalian cortical neuronal cell type connectivity and function, next-generation trans-synaptic viral tracer development 등을 연구하였다. 현재는 2019년 부터 University of California, Santa Cruz에서 조교수로 재직중이며, how specific long-distance neural circuits are organized and develop into specific connectivity patterns at the single cell level for proper functions. In the mature brain, what are the connectivity and functional bases of cortical hierarchy for higher brain functions? In the developing brain, what are the mechanisms that match gene expression to long-range neuronal connectivity? 등의 질문에 답을 하기위한 연구를 하고 있다. http://www.ejkimlab.com/

발표 내용 요약

The brain is composed of millions of diverse neurons that differ systematically in the genes that they express. Cell types can be most accurately characterized through multi-modal analysis; however, it is still an open question as to how many features are needed to identify cell types. The recent explosion of genomic technologies has advanced our ability to characterize cell types based on gene expression at the single cell level, whereby unsupervised clustering methods identify putative cell types based on discretization. Are distinct gene expression profiles sufficient to identify neuronal cell types? Can neuron types from within a single genetic cluster be further extracted based on connectional properties, and if so, do they differ systematically in the genes that they express? We addressed these questions by combining retrograde labeling, single cell gene expression, and rabies-based analyses of connectivity to assess cortico-cortical projection neurons in the mouse primary visual cortex. We find that pyramidal neurons projecting to different cortical targets differ systematically in their gene expression and connectivity despite forming only a single genetic cluster with continuous variability. These observations demonstrate that single-cell gene expression analysis in isolation is insufficient to identify neuron types. Connectivity is an important feature for cell type identification and that gene expression alone cannot be used to fully annotate cell types. We are currently investigating whether gene expression defines connectivity or whether connectivity, and perhaps the inherent similarity in activity found between neurons of similar circuitry, underlies differences in gene expression.

발표자 관련 논문

1. **Kim EJ**, Zhang Z, Huang L, Ito-Cole T, Jacobs MW, Juavinett AL, Senturk G, Hu M, Ku M, Ecker JR, Callaway EM. Extraction of distinct neuronal cell types from within a genetically continuous population. Neuron. 107(2):274-282.
2. **Kim EJ**, Jacobs MW, Ito-Cole T, Callaway EM. Improved Monosynaptic Neural Circuit Tracing Using Engineered Rabies Virus Glycoproteins. Cell Rep. S2211-1247(16)30356-4.

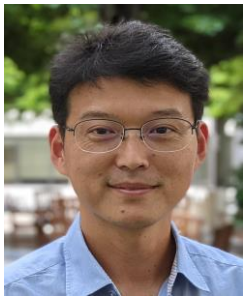
Association of Korean Neuroscientists (AKN) eTalk

Jan 18, 2023

10am PST, 12pm CST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



High resolution cell type mapping in the whole mouse brain and 3D atlases

Yongsoo Kim, PhD, Associate Professor, Department of Neural and Behavioral Sciences, College of Medicine, Penn State University.
(Moderator: Han Sung, PhD, Assistant Professor at Salk Institute)

발표자 약력 및 실험실 소개

김용수 박사는 서울대학교 약대에서 학사 (1996-2000)를 받고, 시카고 노스웨스턴 대학교에서 adult neurogenesis을 주제로 박사 (2004-2010)를 받았습니다. 포닥 (2010-2015) 시절 Cold Spring Harbor Lab에서 Serial two-photon tomography를 이용한 고해상 brain mapping 기술을 개발한 후 쥐의 사회성 자극에 반응하는 신경 회로를 매핑하였습니다. 또한 cell type specific transgenic report mouse lines을 이용해서 뇌에서 GABAergic cell types이 어떻게 다르게 분포하고 있고 이것이 뇌 정보 처리에 다르게 기여하고 있는지에 대한 연구를 하였습니다. 펜스테이트 대학에 2015년 조교수로 부임하여 현재 부교수로 재직하고 있습니다. 다양한 고해상도 brain mapping 기술들을 사용하고 그에 관련된 분석 기술을 개발 함으로써 뇌의 각 다른 부분들이 어떤 다른 cell type으로 구성되어 있는 지, 그리고 cell types이 뇌 형성 과정 그리고 뇌 퇴화 과정에서 어떻게 변하는지를 중점 연구하고 있습니다. 특히 Oxytocin neuron관련 된 neural circuits, GABA cell type during developing and degenerating brain등을 관심있게 보고 있습니다. 또한 최근에는 뇌 혈관들이 어떻게 구성되고 치매를 비롯한 각종 뇌 질병에 어떻게 연관 되어 있는지를 연구 하고 있습니다. 이와 더불어 디지털 뇌 지도를 그리며 뇌의 구조가 발달 과정에서 어떻게 변하는지를 관찰하고 있습니다. . https://kimlab.io/

발표 내용 요약

The brain contains multiple neuronal and non-neuronal cell types with distinct spatial relationship that serve as a basic building block in the brain. I previously developed high resolution mapping methods to visualize and to quantify these individual brain cell types across the entire mouse brain using 3D reference atlases. In this talk, I will present my lab's effort to understand spatial arrangement of several major cell types including GABAergic neuronal cell types and oxytocin neurons. Moreover, I will discuss our new methods to trace the complete network of cerebrovasculature and to quantify perivascular pericytes across the mouse brain. In all my works, 3D reference brains play critical role to integrate individual mapping data into the standard anatomical framework. My lab established a new online anatomical atlas for the adult mouse brain that combines the segmentation of the Allen Mouse Brian Atlas and Paxinos Mouse Brain Atlas. We also developed 3D atlas frameworks for early postnatal brains. Furthermore, my lab is developing multimodal common coordinate frameworks from embryonic and early postnatal mouse brains. Using these resources, my lab is finely mapping spatiotemporal trajectories for GABAergic neurons in developing mouse brains. In summary, high resolution anatomical mapping with 3D atlases helps to unveil overall anatomical organizational plans of cell types across different brain areas.

발표자 관련 논문

1. Yuan-ting Wu, Hannah C. Bennett, ..., Yongsoo Kim. Quantitative relationship between cerebrovascular network and neuronal cell types in mice, *Cell Reports*, (2022), https://doi.org/10.1016/j.celrep.2022.110978
2. Kim Y, Yang GR, ..., Osten P. Whole Brain Maps Uncover Cell Type-based Cortical Architecture and Sexual Dimorphism (2017). *Cell*. https://www.ncbi.nlm.nih.gov/pubmed/28985566

Association of Korean Neuroscientists (AKN) eTalk

February 1, 2023

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Cellular and molecular mechanisms underlying cerebrovascular diseases: Stroke and brain arteriovenous malformations

Eunhee Kim, PhD, Assistant Professor of Neurosurgery Department at the University of Texas Health Science Center (UTHealth) at Houston
(moderator: Jae-Kyung Lee, PhD, Associate Professor at the University of Georgia College of Veterinary Medicine)

발표자 약력 및 실험실 소개

김은희 박사는 동국대학교 응용생물학과에서 학사 (1996-2000)와 석사 (2001-2003)를 받고, 경희대학교에서 rat 모델을 이용한 성장호르몬 관련 시상하부 (hypothalamus) 와 뇌하수체 (pituitary) 물질에 대한 스트레스 호르몬의 역할 (role of glucocorticoids in growth hormone axis)을 주제로 박사 (2003-2006)를 받았다. 뉴욕의 Burke/Cornelle Medical Research Institute 에서 Postdoc (2006-2013)과 Instructor (2013-2017) (Mentor: Dr. Sunghee Cho, Ph.D) 로서, mouse 모델을 이용한 허혈성 뇌졸중 (ischemic stroke) 에 의한 뇌손상 (infarction) 과 부종 (edema), 그리고 염증반응 (inflammation)에 대한 CD36, peripheral macrophages, 그리고 VEGF signaling 의 역할 등을 연구 하였다. 2017년 10월 부터 휴스턴에 위치한 UTHealth 에서 조교수로 독립적인 연구를 시작하였다. 현재 1) KRAS mutation 에 의해서 유발된 뇌동정맥 기형 (brain arteriovenous malformations, bAVMs)이 어떤 기작에 의해 병변이 진행이 되는지와, 2) trametinib의 bAVM 치료 효과, 그리고 3) 허혈성 뇌졸중에 hypothalamic-pituitary-adrenal axis (HPA) axis를 통한 스트레스 반응이 어떤 영향을 주는지 등의 연구를 진행하고 있다.

발표 내용 요약

Dr. Kim's research focuses on evaluating molecular and cellular mechanisms underlying stroke and brain arteriovenous malformation (bAVM). The ultimate research goal is to translate the findings into novel therapeutic strategies for the patients.

Pathomechanisms underlying brain arteriovenous malformations (bAVM). Brain arteriovenous malformation (bAVM) is a tangle of blood vessels with aberrant connections between arteries and veins. bAVM patients are at high risk (~34%) of a life-threatening intracerebral hemorrhage (ICH); however, pathophysiologic mechanisms are poorly understood. Recent clinical studies found a high frequency of activating KRAS mutations (~76.2%) in the endothelium of sporadic bAVMs. Using a virus system called AAV-BR1 in a mouse model, Dr. Kim's lab confirmed that KRAS mutation is sufficient to cause bAVMs. In the presentation, Dr. Kim will discuss her findings in projects, 1) the characterization of mutant KRAS-induced bAVMs, 2) the efficacy of trametinib on $KRAS^{G12V}$-induced bAVMs in mice, and 3) the role of endothelial-to-mesenchymal transition in bAVM pathology.

The role of hypothalamic-pituitary-adrenal axis (HPA) axis in diabetic mice following stroke. Although stroke severity is increased in patients with diabetes, the underlying mechanism(s) of the worse outcomes is not clear. Evidence shows that the HPA axis is dysregulated, and cortisol levels are increased in diabetes. However, it is not clear how the diabetes-dysregulated stress response affects stroke outcomes. In the presentation, Dr. Kim will describe how HPA axis is regulated in diabetic mice and how the dysregulated stress response impacts inflammation and stroke injury in diabetic mice.

발표자 관련 논문

1. Park ES, Kim S, Huang S, Yoo JY, Korbelin J, Lee TJ, Kaur B, Dash PK, Chen PR*, and **Kim E*** (2021) Selective endothelial hyperactivation of oncogenic KRAS induces bAVMs in mice. *Annals of Neurology*, 2021 May; 89(5)926-941. Doi: 10.1002/ana.26059 (Featured in Cover*)
2. Kim S, Park ES, Chen PR, and **Kim E*** (2022) Dysregulated hypothalamic-pituitary-adrenal axis is associated with increased inflammation and worse outcomes after ischemic stroke in diabetic mice. *Frontiers in Immunology*. 2022 Jun 16;13:864858. doi: 10.3389/fimmu.2022.864858. eCollection 2022.

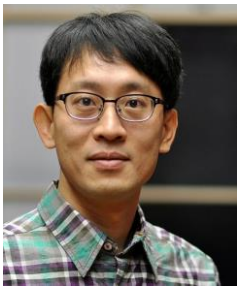
Association of Korean Neuroscientists (AKN) eTalk

February 15, 2023

10am PST, 12pm EST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자



Tagging and Controlling Active Neurons

Hyungbae Kwon, PhD, Associate Professor of The Solomon H Snyder Department of Neuroscience, Johns Hopkins University School of Medicine

(moderator: Byungkook Lim, PhD, Associate Professor at University of California, San Diego)

발표자 약력 및 실험실 소개

권형배 박사는 고려대학교 응용동물학과 에서 학사 (1992-1997), 생화학과에서 석사 (1997-1999)를 받고, 미국 알버트 아인슈타인 의과대학에서 Glutamate receptor들의 short-term and long-term plasticity에 대한 역할에 대한 주제로 박사(2002-2008)를 받았다. 이후 하버드 대학의 Bernardo Sabatini 랩에서 포닥 연구생활을 하는 동안 Synaptogenesis와 plasticity에 대한 중요한 연구들을 발표하였다. 포닥 연구생활 후 막스 플랑크 연구소에서의 교수 생활을 거쳐 현재는 존스홉킨스 의과대학 신경과학부 부교수로 지내고 있다. 현재 (1) Synapse 형성에 중요한 Cellular 기작, (2) 인지적 유연성에 관련한 신경회로를 Two-photon 이미징들 최신 기술로 연구하고 있으며, (3) 행동 변화에 대한 신경회로를 연구하고 위한 분자적 도구들은 개발하고 있다. https://sites.google.com/view/kwon-lab

발표 내용 요약

A central question in neuroscience is how neural activity is linked to complex behaviors. However, monitoring activity patterns in the mammalian brain has been particularly challenging because of its complexity and the limited availability of tools with high spatiotemporal precision. Recent developments in electrophysiological and imaging techniques such as multiunit recordings and genetically encoded calcium indicators have significantly improved our understanding of the circuit mechanisms underlying sensory perception and behavior. However, a critical need exists to develop new methods that can convert neural activity to an effector system that directly demonstrates a circuit-behavior relationship. I will present recently developed optogenetic methods that label active neuronal ensemble and neuromodulation-sensitive populations and further discuss how we apply these techniques for neuroscience research.

발표자 관련 논문

Hyun JH, Nagahama K, Namkung H, Mignocchi N, Hannan P, Krüssel S, Kwak C, McElroy A, Liu B, Cui M, Lee S, Lee D, Huganir RL, Sawa A, Kwon HB., (2021) Tagging active neurons by soma-targeted Cal-Light. doi: https://doi.org/10.1101/2021.10.13.464095 **BioRxiv**

Lee D*, Hyun JH*, Jung K, Hannan P, Kwon HB., (2017) A calcium- and light-gated switch to induce gene expression in activated neurons. **Nature Biotechnology** Sep; 35(9): 858-863 **equal contribution*

Lee D*, Creed M*, Jung K*, Stefanelli T, Wendler DJ, Oh WC, Mignocchi NL, Luscher C, Kwon HB., (2017) Temporally precise labeling and control of neuromodulatory circuits in mammalian brain. **Nature Methods** 14(5): 495-503 **equal contribution*

Association of Korean Neuroscientists (AKN) eTalk

March 1, 2023

10am PST, 12pm CST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Sex differences in pain chronification

Jun-Ho La, DVM, PhD, Associate Professor
Department of Neurobiology at the University of Texas Medical Branch

(Moderator: Byoung-Il Bae, PhD, Assistant Professor at the University of Connecticut School of Medicine)

발표자 약력 및 실험실 소개

나준호 박사는 서울대학교 수의과대학에서 학사 (1992-96), nitric oxide의 위장관 평활근 조절 연구로 수의생리학 석사 (1996-98), 과민성대장증후군 동물모델을 이용한 장관운동 이상과 내장통증 기전 연구로 수의생리학 박사 (1998-2004)를 받았다. 박사후 연수과정으로 경상의대 생리학 교실에서 dorsal root ganglion (DRG) 신경세포의 K2P channel을 연구하였고 (2004-06), 이후 University of Pittsburgh에서 박사후 연구원, 연구조교수로 근무하며 내장통증 동물모델 개발과 DRG 신경세포 기능 변화를 연구하였다 (2006-2015). 현재 UTMB에 재직하며, 말초, 척수, 뇌에 이르는 통증신경회로의 변화가 통증의 만성화를 유발하는 기전을 탐구하고, 그 기전을 바탕으로 만성 통증을 제어하는 치료법을 개발하고 있다.
https://www.utmb.edu/ncba/faculty/bios/jun-ho-la-phd-dvm

발표 내용 요약

Acute injury-induced pain can transition to chronic nociplastic pain (pain chronification) which predominantly affects women. We investigated how the transition occurs, whether females are more susceptible to the transition, and how the nociplastic pain state is maintained despite the resolution of the inciting acute injury. Using a mouse model in which postinjury stimulation of an acute injury area triggers pain chronification, we found that females have a greater sensitivity and a wider timeframe for postinjury stimulation to trigger pain chronification. The nociplastic pain state was maintained by ongoing nerve activity at the inciting injury area in females but by reactive spinal microglia in males. In the absence of estrogen, females develop nociplastic pain that is maintained by none of the two mechanisms. In males, spinal GABAergic disinhibition is critical for normally innocuous peripheral stimulation to activate spinal microglia and consequently trigger pain chronification. When GABAB (but not GABAA)-mediated spinal inhibition is impaired, females also develop pain chronification upon normally innocuous peripheral stimulation despite lacking a tissue injury. However, unlike in males, this pain state is not mediated by spinal microglia. These results demonstrate sex differences in pain chronification mechanisms. However, there is a complex interplay between multiple factors including sex, sex hormones, and GABA receptor subtypes.

발표자 관련 논문

1. Hankerd K, McDonough KE, Koo H, Wang J, Pariyar R, Tang SJ, Chung JM, La JH. Gonadal hormone-dependent nociceptor sensitization maintains nociplastic pain state in female mice. Pain. 2023. 164(2):402-412. PMID: 35975896.
2. McDonough KE, Hammond R, Wang J, Tierney J, Hankerd K, Chung JM, La JH. Spinal GABAergic disinhibition allows microglial activation mediating the development of nociplastic pain in male mice. Brain Behav Immun. 2023. 107:215-224. PMID: 36273650
3. Hankerd K, McDonough KE, Wang J, Tang SJ, Chung JM, La JH. Postinjury stimulation triggers a transition to nociplastic pain in mice. Pain. 2022. 163(3): 461-473. PMID: 34285154.

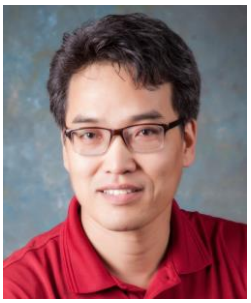
Association of Korean Neuroscientists (AKN) eTalk

March 15, 2023

10am PST, 12pm CST and 1pm EST

Zoom: https://us02web.zoom.us/j/8796243387

발표 제목과 발표자



EAO-Net: *Everything All at Once* Network; toward eXplainable AI-based Controller using Sensory Motor Contingency Theory for Highly Automated Mobility

Jaerock Kwon, PhD, Assistant Professor of Electrical and Computer Engineering at the University of Michigan-Dearborn (moderator: Mi-Hyeon Jang.

발표자 약력 및 실험실 소개

Dr. Jaerock Kwon received his B.S. (1988-1992) from Hanyang University, Department of Electronics and Telecommunications, and his M.S. (1992-1994) from the same university, with the topic "*The Design and Implementation of a Korean Sentence Generator using Feature Structures*." From 1994 to 2004, he worked as a software engineer at LG Electronics, SK Telecom, and Qualcomm before receiving his Ph.D. in computer science from Texas A&M University (2004-2009) on "*Acquisition and Mining of the Whole Mouse Brain Microstructure*." He was an Assistant/Associate Professor in the Department of Electrical and Computer Engineering at Kettering University (2010-2019) and has been an Assistant Professor of Robotics in the Department of Electrical and Computer Engineering at the University of Michigan-Dearborn since 2020. His current research interests include eXplainable AI (XAI), Sensorimotor Contingency Theory (SMC), and Delay Compensation using Internal Simulation inspired by Forward/Inverse Models in the Cerebellum.
http://jrkwon.com

발표 내용 요약

Most controllers based on Deep Neural Networks (DNNs) are more of a black box model. The outputs of the controllers are assumed to be accurate because the DNNs have been trained to have small prediction errors. However, it is virtually impossible to include all edge cases in the training process so the outputs of DNNs cannot be close to perfection. This raises the question of how much we can trust the output of the controllers. In safety-critical systems such as highly automated mobility, including air and ground vehicles, this question is particularly important. Having a certain level of transparency in how and why the controllers predict actuation signals will significantly improve the reliability of the system. To mitigate the above problems and provide a new learning method, we propose the Everything All at Once Network (EAO-Net), which utilizes the simulation theory (simulation of actions, simulation of perceptions, and anticipations) of cognitive brain function. The simulation theory is largely based on the Sensory Motor Contingency (SMC) theory, which considers perception a form of embodied know-how constituted by lawful regularities in the sensorimotor flow in an active and situated agent. EAO-Net, inspired by forward and inverse models of the cerebellum, generates an appropriate sequence of motor actions to achieve a desired state through a pseudo-inverse model. A forward model, trained in the form of the Variational Auto-Encoder (VAE), infers future states caused by the motor actions. EAO-Net is capable of showing how and why a certain sequence of actions must be applied to a certain task, which means that the decision-making process is transparent as it retains highly adaptive and robust DNN-based methods. The proposed EAO-Net has been tested and validated in a realistic simulated environment with an automated vehicle.

발표자 관련 논문

1. Jaerock Kwon, Aws Khalil, Donghyun Kim, Haewoon Nam, “Incremental End-to-End Learning for Lateral Control in Autonomous Driving,” IEEE Access, 2022
2. Subhadip Ghosh, Aydin Zaboli, Junho Hong, Jaerock Kwon, “An Integrated Approach of Threat Analysis for Autonomous Vehicles Perception System, ” IEEE Access, 2023

Association of Korean Neuroscientists (AKN) eTalk

April 5, 2023

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Fight Fire with Fire: Neurobiology of Capsaicin-Induced Analgesia

Man-Kyo Chung, DMD, PhD, Professor
Department of Neural and Pain Sciences, School of Dentistry, Center to Advance Chronic Pain Research, University of Maryland Baltimore

(Moderator: Jun-Ho La, DVM, PhD, Associate Professor at the University of Texas Medical Branch)

발표자 약력 및 실험실 소개

Dr. Chung is a professor, interim assistant dean of research in the School of Dentistry, and a co-director of UM Center to Advance Chronic Pain research at the University of Maryland Baltimore. He received DMD PhD from Kyung Hee University, Seoul, Korea and received his postdoctoral training in Dr. Michael Caterina lab at Johns Hopkins University. As a dentist scientist, he devoted his career to study pain mechanisms focused on the roles of nociceptive sensory afferents and temperature-gated transient receptor potential (TRP) channels. Dr. Chung has been interested in electrophysiological and biophysical properties of TRP channel activation and desensitization. He is also interested in how capsaicin receptor TRPV1 and TRPV1-expressing afferents lead to different craniofacial pain conditions, such as neuropathic pain and temporomandibular joint pain. Recently, his lab investigates the mechanisms whereby TRPV1-expressing afferents regulate host responses and bone remodeling in periodontitis.

발표 내용 요약

Capsaicin, the pungent ingredient in chili peppers, produces intense burning pain in humans. Capsaicin selectively activates TRPV1, which is enriched in nociceptive primary afferents, and underpins the mechanism for capsaicin-induced burning pain. Paradoxically, capsaicin has long been used as an analgesic. The development of topical patches and injectable formulations containing capsaicin has led to application in clinical settings to treat chronic pain conditions, such as neuropathic pain and the potential to treat osteoarthritis. More detailed determination of the neurobiological mechanisms of capsaicin-induced analgesia should provide the logical rationale for capsaicin therapy and help to overcome the treatment's limitations, which include individual differences in treatment outcome and procedural discomfort. High concentrations of capsaicin lead to long-term defunctionalization mediated by the ablation of TRPV1-expressing afferent terminals, resulting in long-lasting analgesia persisting for several months. We have shown that capsaicin-induced Ca^{2+}/calpain/microtubule depolymerization-mediated ablation of axonal terminals is necessary to produce long-lasting analgesia in a mouse model of neuropathic pain. Such ablation leads to the attenuate maladaptive brain connectivity following neuropathic injury. Further determination of the neurobiological mechanisms of capsaicin-induced analgesia should lead to more efficacious non-opioidergic analgesic options with fewer adverse side effects.

발표자 관련 논문

Wang S., Wang S., Asgar J., Joseph J., Ro J.Y., Wei F., Campbell J.N., Chung M.K.: Ca^{2+} and calpain mediate capsaicin-induced ablation of axonal terminals expressing transient receptor potential vanilloid 1. J Biol Chem, 292:8291-8303, 2017.

Wang S., Yang J., Bian C., Gao Y., Wei F., Chung M.K.: A single injection of capsaicin induces long lasting analgesia for trigeminal neuropathic pain in mice. eNeuro, 7(3). doi: 10.1523/ENEURO.0118-20.2020.

Arora V., Campbell J.N., Chung M.K.: Fight fire with fire: Neurobiology of capsaicin-induced analgesia for chronic pain. Pharmacology and Therapeutics, 107743. doi: 10.1016/j.pharmthera.2020.107743, 2020.

Arora V., Li T., Kumari S., Wang S., Asgar J., Chung M.K.: Capsaicin-induced depolymerization of axonal microtubules mediates analgesia for trigeminal neuropathic pain. Pain 2021 Oct 28;10.1097/j.pain.0000000000002529.

Association of Korean Neuroscientists (AKN) eTalk

April 19, 2023

10 am PST, 11 am MST, 12 pm CST and 1 pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Novel Strategies for Curtailing Inflammation in Neurovascular Diseases

Jean-Pyo Lee, PhD, Assistant Professor in the Department of Physiology at Tulane University School of Medicine

(Moderator: Hoonkyo Suh, PhD, Associate Professor in the Department of Neurosciences at the Cleveland Clinic Medicine)

발표자 약력 및 실험실 소개

Dr. Jean-Pyo Lee is an Assistant Professor in the Department of Physiology at Tulane University. Dr. Lee received her B.S. from Seoul National University and Ph.D. from the University of Chicago and completed postdoctoral training at Harvard University. Before joining Tulane University, Dr. Lee was a Staff Scientist at Sanford Burnham Prebys Medical Discovery Institute (SBP), San Diego and concurrently an Assistant Adjunct Professor in the Department of Pediatrics at the University of California, San Diego (UCSD). It is gaining a lot of attention that blood-brain barrier permeability increases significantly with the inflammatory cascades of several neurovascular diseases. Using cellular and pharmacological approaches, Dr. Lee's laboratory focuses on reducing inflammation and curtailing neurovascular injury during the disease's initial stage, thus mitigating further vascular and brain tissue damage. Further, using genetic approaches, Dr. Lee's laboratory focuses on identifying new drug targets against neurovascular diseases. Dr. Lee is on the editorial boards of Experimental Neurology and the American Journal of Physiology (AJP)-Heart and Circulatory Physiology. Further, Dr. Lee has been serving as a Moderator at the International Stroke Conference (ISC) Meetings.

발표 내용 요약

Stroke is a world-wide leading cause of death and disability. Clinically, extensive injury from ischemic stroke results from ischemic-reperfusion (IR), causing long-term neurological disability and death. IR is accompanied by inflammation, blood-brain barrier damage, neural cell death and extensive tissue loss. Cell-based therapies involve stem cell transplantation and migration toward injury sites in the brain. To gain insight into the multiple mechanisms by which transplantation of neural stem cells (NSCs) improves ischemic stroke outcomes, we evaluated global gene expression profiles from RNA-seq analysis following human neural stem cell (hNSC) transplantation in an aged mouse model of ischemic stroke. By defining the differentially expressed genes in the brains of mice that received the hNSCs and mapping these genes to signal transduction pathways, many molecular pathways along with specific encoded proteins were identified that either increased or decreased in the treated brains. These details provide key insights into the mechanisms by which hNSCs mediate beneficial effects, along with identifying multiple additional targets for therapeutic exploration and development of new therapies that minimize early-stage damage and subsequent injury from stroke.

발표자 관련 논문

1. **Lee J-P** *, ¶, Zhang R *, Yan M-C, Duggineni S, Wakeman DR, Niles WL, Feng Y, Chen J, Hamblin MH, Han EB, Gonzalez R, Fang X, Zhu Y, Wang J, Xu Y, Wenger DA, Seyfried T, An J, Sidman RL¶, Huang Z¶, Snyder EY¶. Chemical mutagenesis of a GPCR ligand: Detoxifying "inflammo-attraction" to direct therapeutic stem cell migration. **Proc. Natl. Acad. Sci., 2020.** Dec 8;117(49):31177-31188. (First * and Co-corresponding author¶).

2. Hamblin MH¶, Murad R, Yin J, Vallim G, **Lee J-P¶**. Modulation of gene expression on a transcriptome-wide level following human neural stem cell transplantation in aged mouse stroke brains. **Experimental Neurology**, 347:113913. 2021.

Association of Korean Neuroscientists (AKN) eTalk

May 3, 2023

10am PST, 12pm CST and 1pm EST

***Zoom:* https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Deciphering Peripheral Molecular and Cellular Mechanisms of Pain and Itch using *in vivo* cellular Calcium and Voltage imaging

Yu Shin Kim, PhD, Associate Professor
Department of Oral Maxillofacial Surgery, School of Dentistry, University of Texas Health Science Center at San Antonio
(Moderator: Jun-Ho La, DVM, PhD, Associate Professor at University of Texas Medical Branch)

발표자 약력 및 실험실 소개

Dr. Kim is an Associate professor, at the University of Texas Health at San Antonio. He received PhD from Johns Hopkins University School of Medicine and received his postdoctoral training in Dr. Xinzhong Dong lab at Johns Hopkins University SoM. His lab is studying pain & itch mechanisms focused on the roles of nociceptive sensory neurons and afferents, and various modulators. His Ph.D. research was focusing cerebellar learning and memory mechanism with cellular substrates & intrinsic excitability studies. During his postdoctoral fellow, He developed primary sensory neuron-specific, Pirt promoter driven genetically-encoded calcium indicator, GCaMP *in vivo* imaging for pain & itch & somatosensation mechanisms in dorsal root ganglia (DRG). He got his first faculty job at UTMB and moved to UTHSA until now. His main research areas are including chronic pain, itch, aging, alcohol & substance addiction mechanism, migraine/headache mechanism, peripheral inflammation-mediated Alzheimer's disease or dementia mechanism, discovery of small molecule therapeutics to inhibit chronic pain & itch conditions.

발표 내용 요약

Detection of somatosensory inputs requires conversion of external stimuli into internal electrical signals by activation of primary sensory neurons. The mechanisms by which heterogeneous primary sensory neurons encode different somatosensory inputs remains unclear. *In vivo* intact dorsal root ganglia (DRG) imaging using genetically-encoded Ca^{2+} indicators (GECIs) stands out among the available methodologic advances providing an unprecedented spatial and populational resolution with simultaneous imaging of >1800 neurons/DRG & >2800 neurons/TG in live mice. However, these approaches are limited by the fact that Ca^{2+} is a second messenger and by its inherently slow kinetics. In contrast, genetically-encoded voltage indicators (GEVIs) that reveal subthreshold electrical activity and resolve fast spike timing with subcellular resolution offer numerous advantages during *in vivo* voltage imaging with high temporal resolution. We use soma-targeted ASAP4 & Pirt-Marina, novel GEVIs, to dissect the temporal dynamics of noxious and non-noxious neuronal signals during mechanical, thermal, or chemical stimulation in DRG of live mice. The ASAP4 or Pirt-Marina is sufficiently bright and fast enough to optically characterize individual neuron coding dynamics. Notably, we uncovered cell-to-cell electrical synchronization between adjacent DRG neurons and robust dynamic transformations in sensory coding following tissue injury. Finally, we found that a combination of GEVI and GECI imaging empowered *in vivo* optical studies of sensory signal processing and integration mechanisms with optimal spatiotemporal analysis.

발표자 관련 논문

1. Shannonhouse J, Bernabucci M, Gomez R, Son H, Zhang Y, Ai CH, Ishida H, and Kim YS*(2022) Meclizine and metabotropic glutamate receptor agonists attenuate severe pain and Ca2+ activity of primary sensory neurons in chemotherapy-induced peripheral neuropathy. **J. Neurosci** 2022; 10.1523/JNEUROSCI.1064-21.2022
2. Ishida H, Zhang Y, Gomez R, Shannonhouse J, Son H, and Kim YS*(2021) *In vivo* calcium imaging visualizes incision-induced primary afferent sensitization and its amelioration by capsaicin pretreatment. **J. Neurosci**, **41(41)**, pp. 8494-8507
3. Son H, Zhang Y, Shannonhouse J, Ishida H, Gomez R, Akopian A, and Kim YS*(2022) Mast cell-specific receptor/corticotropin-releasing factor axis mediates alcohol withdrawal-associated headache. Revision in ***Neuron***
4. Zhang Y, Shannonhouse J, Gomez R, Son H, Ishida H, Lin M, and Kim YS* (2022) Imaging sensory transmission and neuronal plasticity in primary sensory neurons with a positively tuned voltage indicators. ***Nature Communications*** *in press*

Association of Korean Neuroscientists (AKN) eTalk

May 17, 2023

10am PST, 12pm EST and 1pm EST

Zoom: **https://us02web.zoom.us/j/8796243387**

발표 제목과 발표자

Microbiota-immune-brain axis: a novel therapeutic target for age-related neurological diseases

Juneyoung Lee, PhD, Assistant Professor
Department of Neurology, McGovern Medical School, The University of Texas Health Science Center at Houston (UTHealth)
(Moderator: Eunhee Kim, PhD, Assistant Professor at the UTHealth)

발표자 약력 및 실험실 소개

이준영 박사는 경북대학교 생명공학부에서 학사학위(2004-2008)를 받고, 동 대학원의 이동건 교수님 연구실에서 항균 펩타이드(antimicrobial peptide)의 발굴 및 작용기작에 대한 연구로 석사학위(2008-2010)를 받았다. 일본 동경대학교(The University of Tokyo) Hiroshi Kiyono 교수님의 점막면역학(mucosal immunology)연구실에서 mouse 모델을 이용한 inflammatory bowel disease에서의 장 상피세포, 면역세포, 장내미생물 및 microRNA의 상호작용에 대한 연구로 박사학위(2013-2016)를 받았다.
2016년 12월 미국 휴스턴 Texas Medical Center에 위치한 UTHealth의 Louise McCullough 교수님 연구실에 postdoctoral research fellow로 합류하여 aging 및 stroke에서의 microbiota-gut-brain axis의 역할 등을 연구하였다. 2021년 10월 UTHealth에서 Assistant Professor로 임용되어 "Neuro-Mucosal Immunology"의 관점에서 노화 및 노화 관련 뇌질환의 해석에 대한 독립적인 연구를 시작하였다. 현재 노화 및 뇌질환에서의 1) neuro-immune interactions, 2) host-microbe interactions, 3) inter-organ communication 및 4) host metabolism에 대한 연구를 진행하고 있다.

발표 내용 요약

Stroke is a leading cause of mortality and long-term disability, especially in the elderly population. There are very limited acute management options such as intravenous thrombolytics and endovascular thrombectomy, however the development of new treatment options is urgently needed for long-term recovery of the patients. Along with the brain damage, multiple systemic complications encompassing inflammation and infection are one of the key contributors for stroke pathophysiology. Importantly, recent advances in metagenomic and metabolomic analyses have revealed that (1) stroke significantly induces gut dysbiosis (imbalance of gut microbiota compositions) and (2) this gut dysbiosis exacerbates neuroinflammation in the brain and delays post-stroke recovery in aged mice compared with younger counterparts. Using a mouse model of ischemic stroke and aged mice, Dr. Lee and colleagues demonstrated that targeted bacteriotherapy using short-chain fatty acid (SCFA)-producing bacteria predominantly found in a youthful gut ecosystem improves post-stroke recovery by enhancing gut barrier integrity and ameliorating T cell-mediated inflammation in both the gut and the brain. In a separate study using germ-free (GF) mice and fecal microbiota transplantation method, Dr. Lee and colleagues further found that aged microbiome alone can reduce SCFA levels and induce the impairment of cognition and memory functions in young GF mice.
Currently, Dr. Lee's Laboratory of Neuro-Mucosal Immunology studies (1) neuro-immune interactions, (2) host-microbe interactions, (3) inter-organ communication and (4) host metabolism in aging, age-related cerebrovascular (e.g., stroke) and neurodegenerative diseases (e.g., cerebral amyloid angiopathy and Alzheimer's disease) and psychosocial stress (e.g., loneliness) using multiomics, flow cytometry, organoid and single-cell RNA sequencing.

발표자 관련 논문

1. **Lee J**, d'Aigle J, Atadja L, Quaicoe V, Honarpisheh P, Ganesh BP, Hassan A, Graf J, Petrosino J, Putluri N, Zhu L, Durgan DJ, Bryan RM Jr, McCullough LD, Venna VR. (2020) Gut Microbiota-Derived Short-Chain Fatty Acids Promote Poststroke Recovery in Aged Mice. ***Circulation Research.*** 2020 Jul 31;127(4):453-465. (Featured Article)
2. **Lee J**, Venna VR, Durgan DJ, Shi H, Hudobenko J, Putluri N, Petrosino J, McCullough LD, Bryan RM. (2020) Young versus aged microbiota transplants to germ-free mice: increased short-chain fatty acids and improved cognitive performance. ***Gut Microbes.*** 2020 Nov 9;12(1):1-14.

Association of Korean Neuroscientists (AKN) eTalk

June 7, 2023

10am PST, 12pm EST and 1pm EST

Zoom: https://us02web.zoom.us/j/8796243387

발표 제목과 발표자

Can the liver regulate emotions?

Young-Hwan Jo, Ph.D., Associate Professor
The Fleischer Institute for Diabetes and Metabolism, Division of Endocrinology, Department of Medicine and Department of Molecular Pharmacology,
Albert Einstein College of Medicine, NY

(Moderator: Doo-Sup Choi, PhD, Professor, Mayo Clinic School of Medicine and Science)

발표자 약력 및 실험실 소개

Dr. Jo received his PhD in Neuroscience from the University of Louis Pasteur in France in 1998 and did his postdoctoral training in Neuroscience at Columbia University (1991-2005). Following his postdoctoral training, he joined the Albert Einstein College of Medicine as Assistant Professor in 2006 and will get promoted to full Professor in 2023. First, my ongoing research examines whether liver-derived interoceptive signals can influence emotions (R01AT011653). Second, I seek to define the role of the parasympathetic nervous system of the liver in controlling energy metabolism (R01DK134333) using a unique, coordinated, and multidisciplinary combination of state-of-the-art techniques, including viral tracing, virus-mediated gene delivery, *in vivo* fiber photometry, and functional readouts of liver function in lean and obese mice. Lastly, my study aims to assess the role of central melanocortin tone in the function of hypothalamic pro-opiomelanocortin (POMC) neurons projecting to the medial amygdala and the dorsal motor nucleus of the vagus in mice (R01DK092246).
https://www.einsteinmed.edu/faculty/10070/young-hwan-jo/

발표 내용 요약

Proper integration and transportation of interoceptive signals from organs to the brain via vagal sensory neurons appear to be critical for psychological experiences ranging from various feelings and emotions to motivations and adaptive behaviors. Optimal sensing and integration of internal body signals are crucial for many essential physiological functions. I specifically seek to determine if there is a specialized anatomical organization of liver-innervating vagal sensory neurons and determine the roles of liver-projecting vagal sensory neurons in controlling energy homeostasis and emotions.

Parasympathetic cholinergic efferent neurons innervating the liver are located in the dorsal motor nucleus of the vagus (DMV). Prior studies with retrograde neuronal tracers such as cholera toxin B, pseudorabies virus, and AAV encoding a Cre-inducible reporter protein demonstrate that the mouse liver receives DMV cholinergic innervation. Furthermore, we recently showed that hepatocytes receive direct DMV cholinergic input and express muscarinic acetylcholine receptors (mAChRs). Importantly, a short-term change in DMV cholinergic neuron activity regulates hepatic glucose output in lean mice. Despite these previous studies strongly support that the hepatic cholinergic system contributes to proper liver metabolism, recent 3D imaging analysis of cleared liver tissues shows a lack of the parasympathetic cholinergic innervation of the mouse liver. Hence, we re-evaluate the cholinergic system in the liver to understand better how the autonomic nervous system controls hepatic metabolism.

발표자 관련 논문

1. Lee, D.K., Jeong, J.H., Chun, S.-K., Chua, S.C. Jr. and **Jo, Y.H.** (2015) Interplay between glucose and leptin signaling determines the strength of GABAergic synapses at POMC neurons. ***Nature Commun*.** 26; 6:6618. doi: 10.1038/ncomms7618
2. Jeong JH, Lee DK, Liu S-M, Chua SC Jr., Schwartz GJ, and **Jo YH**. (2018) Activation of Temperature-sensitive TRPV1-like receptors in ARC POMC neurons reduces food intake. ***PLOS Biology***, 16 (4):e2004399 **(**Research highlight in ***Nature*,** Top 10% cited article in ***PLOS biology*** in 2018-2019**)**
3. Kwon, E., Joung, H.-Y., Liu, S. M., Chua, S. C., Jr., Schwartz, G. J., and **Jo, YH**. (2020) Optogenetic stimulation of the liver-projecting melanocortinergic pathway promotes hepatic glucose production. ***Nature Commun.*** December; 11(1):6295. 10.1038/s41467-020-20160-w

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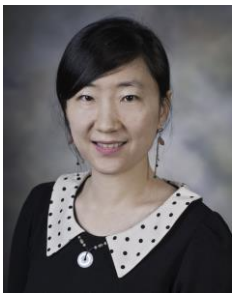
발표 제목과 발표자



Cellular mechanisms and therapeutic strategies for fragile X syndrome

Hye Young Lee, PhD, Assistant Professor
Department of Cellular and Integrative Physiology at the University of Texas, Health Science Center at San Antonio

(Moderator: Doo-Sup Choi, PhD, Professor, Mayo Clinic School of Medicine and Science)

발표자 약력 및 실험실 소개

이혜영 박사는 이화여대 학사, 포항공대 박사를 마치고, University of California, San Francisco (UCSF), Lily Jan Group에서 박사후 연수과정에서 neurodevelopmental disorders 의 하나인 fragile X syndrome (FXS) 연구를 시작했습니다. 2016년부터 University of Texas, Health Science Center at San Antonio에 재직을 하면서 연구실에서 현재 FXS 연구를 네가지 분야에 집중하여 진행하고 있습니다: (1) Microglia contribution to FXS, (2) Primary cilia contribution to FXS, (3) Imitative deficits in FXS, (4) Nonviral delivery tool for gene therapy in FXS and beyond. 이번 발표는 그동안의 연구 뿐만이 아니라, 정년 심사과정과 부교수로의 전환, 연구비 신청 과정 경험을 소개/공유하고, 디스커션 하는 시간도 갖도록 하겠습니다.

발표 내용 요약

Lee Lab focuses on (1) identifying the molecular and cellular mechanisms responsible for the pathophysiology of fragile X syndrome (FXS), as well as (2) developing nonviral gene delivery tools for genetic brain disorders. The presentation will focus on the current understanding about microglia in FXS with aspects of their altered characteristics as well as their contributions to FXS phenotypes. Specifically, the Lee lab demonstrates that ablating FMRP in microglia induces their proinflammatory responses and phagocytic activities. Moreover, ablating FMRP in microglia recapitulates spine abnormalities (increase immature spines) seen in FXS patients and *Fmr1* KO mice. Therefore, the Lee lab concludes that microglia not only response abnormally to the inflammatory stimuli, but also is dysfunction to prune neurons. Lastly, the presentation will introduce the novel nonviral gene delivery approaches which hold great therapeutic potential for FXS and beyond.

https://lsom.uthscsa.edu/physiology/team-member/hye-young-lee-ph-d/

발표자 관련 논문

1. Lee, B., Lee, K., Panda, S., Rojas-Gonzales, R., Chong, A., Bugay, V., Park, H. M., Brenner, R., Murthy, N., **Lee, H. Y.** (2018) Nanoparticle delivery of CRISPR into the brain rescues increased repetitive behaviors in the mouse model of fragile X syndrome. *Nature Biomedical Engineering* 2: 497-507. PMID: 30948824.
2. Li, J., Tuma, J., Han, H., Kim, H., Wilson, R., **Lee, H. Y*.**, Murthy, N*. (2022) The coiled-coil forming peptide $(KVSALKE)_5$ is a cell penetrating peptide that enhances the intracellular delivery of proteins. *Advanced Healthcare Material* 11: 2102118-2102129. PMID: 34861744. (***Co-corresponding authors**)
3. Parrott, J., Oster, T., **Lee, H. Y.** (2021) Altered inflammatory response in FMRP-deficient microglia. *iScience* 24: 103293-103301. PMID: 34820601.

https://www.ncbi.nlm.nih.gov/myncbi/hye%20young.lee.1/bibliography/public/