DAESOO KIM

PLENARY TALK 1

Shining Lights on Parkinson's Disease

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Abstract

Parkinson's disease (PD) is a condition where specific brain cells, called dopaminergic neurons, gradually die, leading to difficulties with movement and other symptoms. Scientists have long believed that motor issues in PD result from reduced signals sent from a brain region called the thalamus to the motor cortex, which controls movement. However, our study challenges this idea. Using advanced optogenetics techniques, we directly inhibited specific neurons in the thalamus of mice to observe their response. Surprisingly, instead of staying inactive, these neurons became more active—a phenomenon known as "rebound excitation." This abnormal activity caused symptoms in the mice, such as muscle stiffness and tremors, which resemble those seen in PD patients. When we blocked this rebound firing, the mice's motor symptoms disappeared, showing that this mechanism is likely responsible for the movement problems in PD. This finding reshapes our understanding of PD symptoms and offers new insights into how the brain controls movement. Furthermore, we are exploring a novel approach to treating PD by targeting a specific type of calcium channel, CaV3.1, in the thalamus. Our research focuses on developing antisense-oligonucleotide (ASO) drugs that could prevent PD symptoms and protect brain cells from dying. These promising therapies could represent a new generation of treatments for Parkinson's disease and related disorders.

Keywords: Parkinson's disease, Optogenetics, Thalamus, Gene therapy

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Education History

[Doctorate]	1995-1998	Genetics and Neuroscience, Pohang University of Science & Technology (POSTECH)
[Master]	1993-1995	Genetics and Neuroscience, Pohang University of Science & Technology (POSTECH)
[Bachelor]	1989-1993	Biology, Sogang University

Professional Background

2023-Present	Dean The College of Life Sciences & Bioengineering, KAIST
2021-Present	CEO, NeuroTobe Pharmaceuticals
2021-Present	Director, KAIST-Wonjin Cell Therapy Center, KAIST
2019-2022	Director, The Biocore Center, KAIST
2019-2021	Head, Dept. of Biological Sciences, KAIST

Selected Awards and Honors

1. 2022 The Social DNA Award (As Actnova founder), *the iFORUM 2022*
2. 2017 The Samil Prize of Science, *The Samil Foundation*
3. 2016 The 10 Outstanding Research 2016, *KAIST*
4. 2003 Young Scientist Award 2003 ,*The Behavioral and Neural Genetics Society (IBANGS), USA*
5. 2001 Outstanding Research Award 2001,*Association of Korean Neuroscientists (AKN), San Diego, USA*
6. 1998 The Best Thesis of 1998 in Korea,*Korea Society of Molecular Biology (KSMB)*

Selected Publications

1. Cerebellar 5HT-2A receptor mediates stress-induced onset of dystonia *Science Advances (2021)*
2. Medial preoptic circuit induces hunting-like actions to target objects and prey. *Nature Neuroscience (2018)*
3. Inhibitory basal ganglia inputs induce excitatory motor signals in the thalamus. *Neuron (2017)*
4. Optogenetic mapping of functional connectivity in freely moving mice via insertable wrapping electrode array beneath the skull. *ACS Nano (2016)*
5. CaV3.1 is a tremor rhythm pacemaker in the inferior olive. *PNAS (2010)*