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강연제목: 플라즈모닉 금나노입자를 활용한 비침습적, 고해상도 광인공시각장치

(Non-invasive, High-resolution Photonic Retinal Prosthesis using Plasmonic Gold Nanoparticles)

Abstract:

Retinitis pigmentosa, age-related macular degeneration, and Stargardt disease are the most common incurable eye diseases associated with outer retinal degeneration leading to blindness. Among the various current trials to cure those diseases including optogenetic stimulation and stem cell therapy, only electrical retinal prosthetics has validated clinical promise. Since most retinal ganglion cells (RGCs) in those diseases remain intact, the cells can convey visual signals to the brain when properly stimulated as in the electrical retinal prosthetics. Yet, the electrical prosthetics still suffers from fundamental limitations such as the invasive nature of the device and both the limited number and fixed location of stimulation sites. Here, this study establishes the feasibility of novel, minimally-invasive, high-resolution retinal prosthetics in animal models, based on an emerging neuromodulation approach, nanoparticle-enhanced near-infrared neural stimulation. When a neuron is attached with gold nanorods (AuNRs), near-infrared (NIR) light illumination with a wavelength matching to the nanorod's resonant wavelength was shown to activate the neuron via photothermal effects. In this talk, novel optical tool development and its theoretical background will be presented. Delivery of gold nanoparticles into the retinal tissue will be presented. Ex vivo and in vivo validation of minimally-invasive retinal prosthesis will be demonstrated.

Brief Biosketch

Dr. Kyungsik Eom is currently an assistant professor at the department of electronics engineering at Pusan National University since 2019. He is also an adjunct professor of school of medicine at Pusan National University. Dr. Eom received his B.S. from KAIST majored in electrical and electronics engineering in 2010. He got his M.S. and Ph.D. from Seoul National University from electrical and computer engineering in 2012 and 2016, respectively. Since then, he moved to Providence, RI and had a postdoc train at the Brown University where he focused on building photonic retinal prosthesis using plasmonic gold nanoparticles. His currently research topic include neuromodulation techniques especially using magnetics (transcranial magnetic stimulation) and optics, and developing retinal prosthesis using optics.