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국문 강연제목: 정밀 뇌수술을 위한 고해상도 뉴럴 인터페이스 소자 기술
영문 강연제목: Neural Interface Technologies for High Precision Intraoperative Brain Mapping

Abstract
Electrophysiological devices are critical for mapping eloquent and diseased brain regions and therapeutic neuromodulation in clinical settings and are extensively utilized for research in brain-machine interfaces. However, the existing devices are often limited in either spatial resolution or cortical coverage. Here, we developed scalable manufacturing processes and dense connectorization to achieve reconfigurable thin-film, multi-thousand channel neurophysiological recording grids using low impedance platinum-nanorods (PtNRGrids).
In the clinical setting, PtNRGrids resolved fine, complex temporal dynamics from the cortical surface in an awake human patient performing grasping tasks. High gamma activities (HGAs) showed distinctive neural correlates of hand movements when compared to baseline. We also recorded phase reversal boundaries during motor mapping to precisely localize the central sulcus in mm scale resolution. Additionally, the PtNRGrids identified the spatial spread and dynamics of epileptic discharges in a patient undergoing epilepsy surgery, including activity induced by direct electrical stimulation.
Furthermore, to provide automated and real-time feedback directly from the cortical surface for efficacious and high-precision neurosurgery, we integrated a flexible micro-LED display with PtNRGrids. This system recorded the cortical activities, processed the data in real time, and displayed brain mapping information on the cortical surface. On top of the pig's brain, the LED+ECoG grid displayed the cortical functional boundary, HGAs, and the propagation of interictal discharges. By visualizing the cortical functional boundaries to the neurosurgeon, this technology has the potential to significantly shorten surgical time and enhance the precision of resective neurosurgery.

Brief Biosketch
Youngbin Tchoe is an assistant professor in the Department of Biomedical Engineering at Ulsan National Institute of Science and Technology (UNIST), Republic of Korea. He received his PhD degree in physics from Seoul National University, Republic of Korea, in 2018. From 2018 to 2023, he was a postdoctoral researcher at the Integrated Electronics and Biointerfaces Laboratory at the University of California, San Diego, spearheading the development of ultrahigh channel, ultrahigh-density brain interface devices using novel materials and fabrication techniques.