세미나 초록

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발표 주제	Cross-Modal Diagnostic Platform for Disease Analysis Based on Exosome SERS and Deep Learning
발표 내용	Disease diagnosis relies on both molecular-level information and medical imaging, yet technologies that directly bridge these two modalities remain limited. Here, we present a research framework that leverages surface-enhanced Raman scattering (SERS) spectra of exosomes isolated from body fluids as a molecular information source, combining them with AI for disease diagnosis and clinical image generation. A high-sensitivity SERS substrate was fabricated using DNA-templated plasmonic nanostructure synthesis. Synovial fluid exosome spectra were analyzed with a deep neural network, achieving over 95% accuracy in classifying osteoarthritis severity (K-L grades 2–4), with SHAP-based explainable AI used to interpret the key molecular contributors. We further propose a cross-modal AI model that generates X-ray images directly from Raman spectra using a masked autoencoder architecture with cross-modal alignment loss. This study thus establishes a novel diagnostic concept linking molecular information and clinical imaging through AI, with potential for expansion into a precision medicine platform.