Julius-Maximilians-
UNIVERSITÄT WÜRZBURG

DIE GANZE WELT DER ORTHOPÄDIE
Orthopädische Klinik König-Ludwig-Haus

BEWEGUNG IST LEBEN
Bernhard-Heine-Centrum für Bewegungsforschung

GUEST SEMINAR SERIES

Department of Musculoskeletal Tissue Regeneration

Date Wednesday 22nd July 2026 at 10:00-11:00 o'clock

Location Seminar room of Department of Musculoskeletal Regeneration, König-Ludwig-Haus Orthopaedic Hospital IGZ ◦ Friederich-Berguis-Ring 15, Entry D: Ground floor ◦ 97076 Würzburg

Guest-Speaker **Prof. Fumiko Yano, D.D.S., Ph.D.**
Associate Professor, Showa Medical University, Tokyo, Japan

Lecture "Molecular Mechanisms and Pathological Landscapes of Joint Diseases via Supersulfide Mass Spectrometry and Spatial Transcriptomics."

For seminar abstract and presenter's biosketch, please refer to next page

Seminar abstract

Supersulfides have emerged as key regulators of cellular redox homeostasis. Among the enzymes involved in their biosynthesis, mitochondrial cysteinyl-tRNA synthetase 2 (CARS2) has been identified as the central enzyme responsible for endogenous supersulfide production. We have investigated the roles of supersulfides in joint homeostasis and bone regeneration by combining genetically engineered mouse models with mass spectrometry-based analyses. In a mouse model of osteoarthritis (OA), administration of glutathione trisulfide (GSSSG) significantly attenuated cartilage degeneration. Furthermore, mass spectrometric analysis using stable isotope-labeled GSSSG directly demonstrated the intracellular uptake of exogenously administered GSSSG. Mass spectrometry-based metabolic profiling of murine joint tissues further revealed the metabolic landscape of supersulfides in articular cartilage and suggested that supersulfide metabolism suppresses OA progression through the inhibition of inflammation and lipid peroxidation. To investigate the molecular pathology of temporomandibular joint osteoarthritis (TMJ-OA), we employed two complementary mouse models: a mechanical loading model and a disc displacement model. By integrating single-cell RNA sequencing with high-resolution spatial transcriptomics (Xenium), we characterized gene expression changes while preserving the spatial organization of joint tissues, including the synovium. This integrative analysis identified enhanced adipogenic differentiation, fibrosis, macrophage activation, and cell type-specific catabolic responses in the posterior synovium, providing new insights into the mechanisms underlying TMJ-OA pathogenesis. Together, these findings demonstrate that mass spectrometry enables the direct characterization of the in vivo dynamics and metabolic regulation of supersulfides, establishing it as a powerful platform for elucidating disease mechanisms and facilitating therapeutic discovery in joint diseases. In parallel, spatial transcriptomics provides unprecedented insights into tissue- and cell type-specific pathological alterations in TMJ-OA, offering complementary insights into the spatial and molecular mechanisms underlying joint degeneration.

Biosketch

Prof. Yano is a dentist and oral and maxillofacial surgeon, currently serving as an Associate Professor at Showa Medical University, Japan. Her research focuses on the molecular mechanisms of musculoskeletal diseases, particularly osteoarthritis, using genetically engineered mouse models together with advanced mass spectrometry and multi-omics technologies. She has investigated the protective roles of supersulfides in joint homeostasis using mass spectrometry, primarily in mouse models of knee osteoarthritis. More recently, she has extended these research approaches to temporomandibular joint osteoarthritis (TMJ-OA) through establishing mouse models and applying single-cell RNA sequencing and spatial transcriptomics to characterize tissue- and cell type-specific pathological changes. Her research aims to elucidate the molecular mechanisms underlying musculoskeletal diseases, including disorders of the joints, tendons, and ligaments, and to develop novel regenerative therapies. She hopes that these approaches will foster new opportunities for interdisciplinary collaboration in musculoskeletal research.