

ME Spring Seminar 06

Biofilm-activated catalytic materials for targeted diagnostics and therapeutics



Prof. Dongyeop Kim

School of Dentistry
Jeonbuk National University



The oral microbiome is a dynamic ecosystem in which bacteria interact with each other, host factors, and microbially derived metabolites. Within this extended microbiome, functional outcomes, such as cariogenic microbial dysbiosis, emerge from complex microbe-microbe and host-microbe interactions rather than from the presence of individual pathogens alone. This highlights the need for microbiome-responsive strategies that enable targeted diagnostics and therapeutics within pathogenic biofilms.

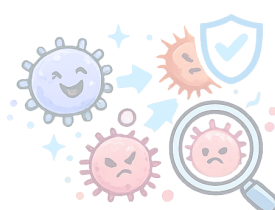
In this lecture, I will introduce microbiome-responsive catalysts with intrinsic enzyme-like activity. As an example, SnF₂ catalyzed hydrogen peroxide (H₂O₂)-dependent oxidation reactions with enzyme-like kinetics. In a multispecies biofilm model, H₂O₂ produced by commensal *Streptococcus oralis* antagonized *Streptococcus mutans*, and this interaction was markedly enhanced by SnF₂. Brief SnF₂ exposure selectively amplified reactive oxygen species (ROS) generation within cariogenic biofilm microenvironments, leading to targeted suppression of *S. mutans* while preserving *S. oralis*. Confocal imaging further confirmed spatially localized ROS production in situ.

Conceptually, these catalytic materials respond to microbiome-derived metabolites as functional cues, enabling selective activity within diseased niches. This paradigm extends beyond specific agents to include nanozymes (e.g., iron oxide nanoparticles) and biomolecule-inspired systems such as lectins, which exhibit selective interactions with carbohydrate structures. This paradigm supports the development of biofilm-responsive diagnostics and therapeutics that translate and potentiate endogenous microbial interactions for precision oral healthcare.

Bldg.110 #N105

16:00 - 17:15

Wednesday, April 29



Host:

Prof. Kang Soo Lee (kangsoolee@unist.ac.kr)