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Can antimicrobial peptides be an antibiotic alternative? - fundamental studies and tool development -

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Antibiotic resistance is among the most critical challenges in medicine in 21st century. Antimicrobial peptide (AMP) is among the top candidates as an antibiotic alternative, thanks to its production method that is relatively compatible to scaling up and because bacteria cannot easily mutate against it due to its complicated mechanism of action. Currently, a major bottleneck for their broader applications is their unpredictable side effects. Therefore, lowering the dosage and clarifying the role of these peptides against our human bodies are the top priorities for enabling their major impact on the infection treatments. In 2000, Nagaoka and coworkers have reported that *Escherichia coli* and *Staphylococcus aureus* were killed much more efficiently when two types of peptides are mixed (positive synergy). In addition, last year my group has discovered that the cytotoxicity of these individual peptides is reduced when they are combined (negative synergy). These discoveries suggest that we can "double-benefit" from the synergies for improving the antimicrobial efficiency and reducing the side effects by mixing the right couple of antimicrobial peptides at the right ratio, opening a new horizon in the antimicrobial peptide research. However, the underlying mechanism of these synergies is completely left unexplored due to the limited available characterization tools that provide the information on the peptide-lipid interactions. In my group, we have been developing cell membrane characterization tools for studying its electrical and mechanical properties. Our research goal is to clarify the mechanism of the antimicrobial peptide synergy at the molecular level by employing these developed methods. Understanding the mechanism of the synergy will be a breakthrough for developing the peptide-based infection treatment and potentially be one of the solutions for the current crisis of resistance.