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## **Professor Jiwon Seo's joint research team develops antimicrobial peptoids for catching super-strong bacteria and identifies its antibacterial mechanism**

□ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Department of Chemistry Professor Jiwon Seo and Chosun University Song Yub Shin developed a peptoid\*-based antibiotic and investigated its mechanism of antibacterial activity.

- The results of this research are expected to provide possibilities of developing new antibiotics using peptoids that structurally mimic the antimicrobial peptide, an innate immunity\*\* molecule in living organisms.

\* peptoid: a new material developed to artificially simulate the function of a biological protein and is a biopolymer peptide derivative

\*\* innate immunity: The immune system as the primary defense that is immediately utilized for defense without remembering a specific pathogen. Unlike acquired immunity, pathogens are treated in a comprehensive way.

□ With drug companies turning a blind eye to the development of new antibiotics over the past 30 years along with the misuse of conventional antibiotics, bacteria have established a resistance mechanism to conventional antibiotics. Multi-drug resistant bacteria\* to various antibiotics are now a threat to human health worldwide.

\* multi-drug resistant bacteria: bacteria that have acquired resistance to multiple antibiotics simultaneously through natural selection or mutation

- Accordingly, the study of antibacterial peptide and its derivatives optimized by long-term evolution in nature has been actively conducted around the world. In particular, peptoids, which are artificial structural mimetics of peptides, have high resistance to peptide-degrading enzymes and high in vivo stability, unlike natural peptides, and thus are attracting much attention as new antibiotics.

- The antimicrobial peptoids developed by the research team improved the selectivity\* for bacteria through the control of the helix structure and showed activity against a wide range of gram-positive bacteria\*\* and gram-negative bacteria\*\*\*, including multi-drug resistant bacteria. In addition, unlike natural peptides, it exhibits high stability against metabolic enzymes in the body, and it is expected to contribute to the future development of new research on treatments for multi-drug resistant bacteria

\* selectivity: It is expressed as a contrast value for antimicrobial activity and mammalian cytotoxicity. Higher values means lower toxicity.

\*\* gram-positive bacteria: Gram-positive bacteria are bacteria that give a positive result in the Gram stain test such as tuberculosis bacteria, diphtheria bacteria, antiseptic bacteria, tetanus bacteria, pneumonia bacteria, and staphylococcus and are resistant to gastric fluid or digestive enzymes and is sensitive to penicillin

\*\*\* gram-negative bacteria: Gram-negative bacteria do not retain the crystal violet stain used in the Gram stain test and include include Escherichia coli, Shigella, gonorrhea, lactic acid bacteria, cholera, and plague bacteria, and are weak against digestive enzymes and are not affected by penicillin.

- The research team found that peptoid No. 17 through a circular dichroic spectroscopy\* experiment increased the selectivity of peptoid 17 as the helix structure became stronger in the bacterial biological membrane. In addition, by observing the change of the surface of E. coli by the antibacterial peptoid through confocal laser microscope and atomic microscope, the principle of antibacterial activity using cell membrane destruction was confirmed.

\* circular dichroic spectroscopy: a spectroscopic equipment used to investigate the secondary structure of biomolecules such as proteins, peptides, and nucleic acids

- In addition, it was confirmed that peptoid No. 17 has a wide range of activities against various multi-drug resistant bacteria such as Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, and pneumococci.

- GIST Department of Chemistry Professor Jiwon Seo said, "This study suggested the principles of drug design to improve bacterial selectivity of existing antibacterial peptoids. We will continue research and development so that antibacterial peptoids can become an important chemical weapon in the war between humans and microorganisms."
  
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