Bacterial infection in the outer eye is a major cause of ocular diseases. The commonly used antibiotics to treat ocular infections penetrate poorly into the eye and are required to be administered in high-doses and the increased drug resistance of bacteria can cause ineffectiveness of antibiotics [1]. Unlike common antibiotics, naturally occurring antimicrobial peptides (AMPs) can disrupt the bacterial cell membrane by electrostatic attachment and insertion, and this non-specific interaction can thus reduce the development of drug-resistance [2].

Herein, two types of self-assembling amphiphilic peptides, liquid extracellular matrix-like (LEM) nanofibers and amphiphilic Cardin antimicrobial (ACA) nanorods [3], were rationally designed and tested for eye infections. These amphiphilic peptides contained the same hydrophobic domain and ?-sheet forming domain, but differed in the outer hydrophillic peptide sequence. The (Gly-Pro-Hyp)₆ repeating sequences on the LEM nanofiber outer surface mimic the triple helical structure of collagen proteins, whereas the ACA nanorods contained the Cardin antimicrobial peptides (Ala-Lys-Lys-Arg-Ala)₂ on the outer surface of the nanorods to exert antibacterial activities. To stabilize the antibacterial nanofibers and minimize the toxicity to host cells, the LEM nanofibers and ACA nanorods were non-covalently combined by ?-sheet stacking to form hybrid nanofibers. Transmission electron microscope (TEM) characterization observed that both of the LEM nanofibers and ACA nanorods could assemble into cylindrical structures with about 10 nm in diameter, and combining equimolars of these two self-assembling peptides could form hybrid nanofiber networks. Also, a Gram-positive bacteria Staphylococcus aureus (S. aureus) was incubated with different concentrations of these hybrid nanofibers (40 to 80 µM), and a 24 h growth curve was monitored by measuring the optical density at 562 nm (Figure 1). The results showed that these hybrid nanofibers could inhibit Staphylococcus aureus (S. aureus) growth. Such results show great promise for the use of these novel self-assembled nanofibers for treating numerous infections.

![Figure 1: Inhibition of the hybrid nanofibers on the growth of S. aureus. The antimicrobial nanofibers delayed the exponential growth of the bacteria. N=2.](image)

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References:


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