

Antimicrobial peptides – design and application in biomedicine

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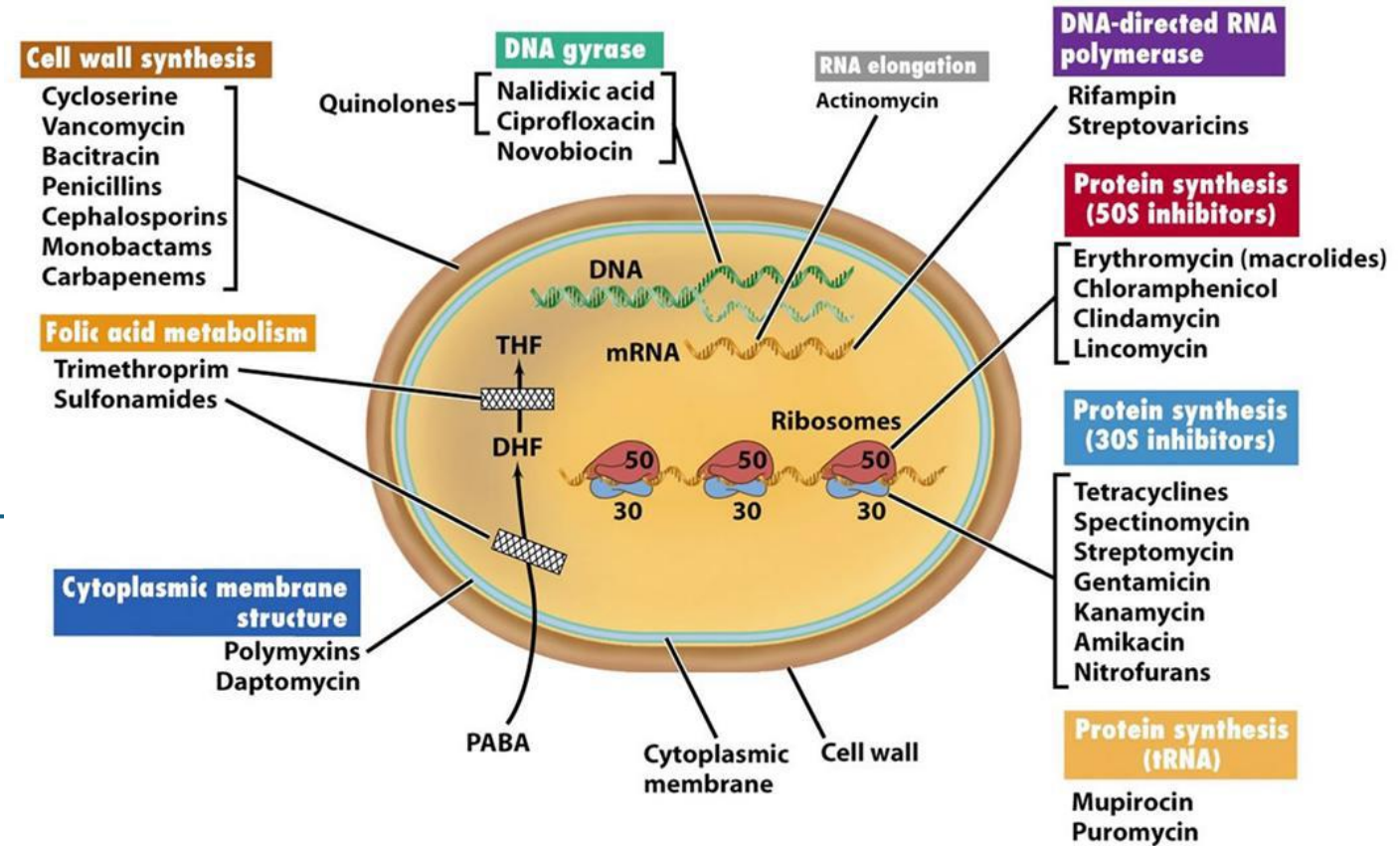
Based on C. Zhong, Y. He, J. Zou, et al. An antimicrobial peptide as a potential therapy for bacterial pneumonia that alleviates antimicrobial resistance. *Nature Communications* 2025 16:1 **2025**, 16 (1), 10488-.

Introduction

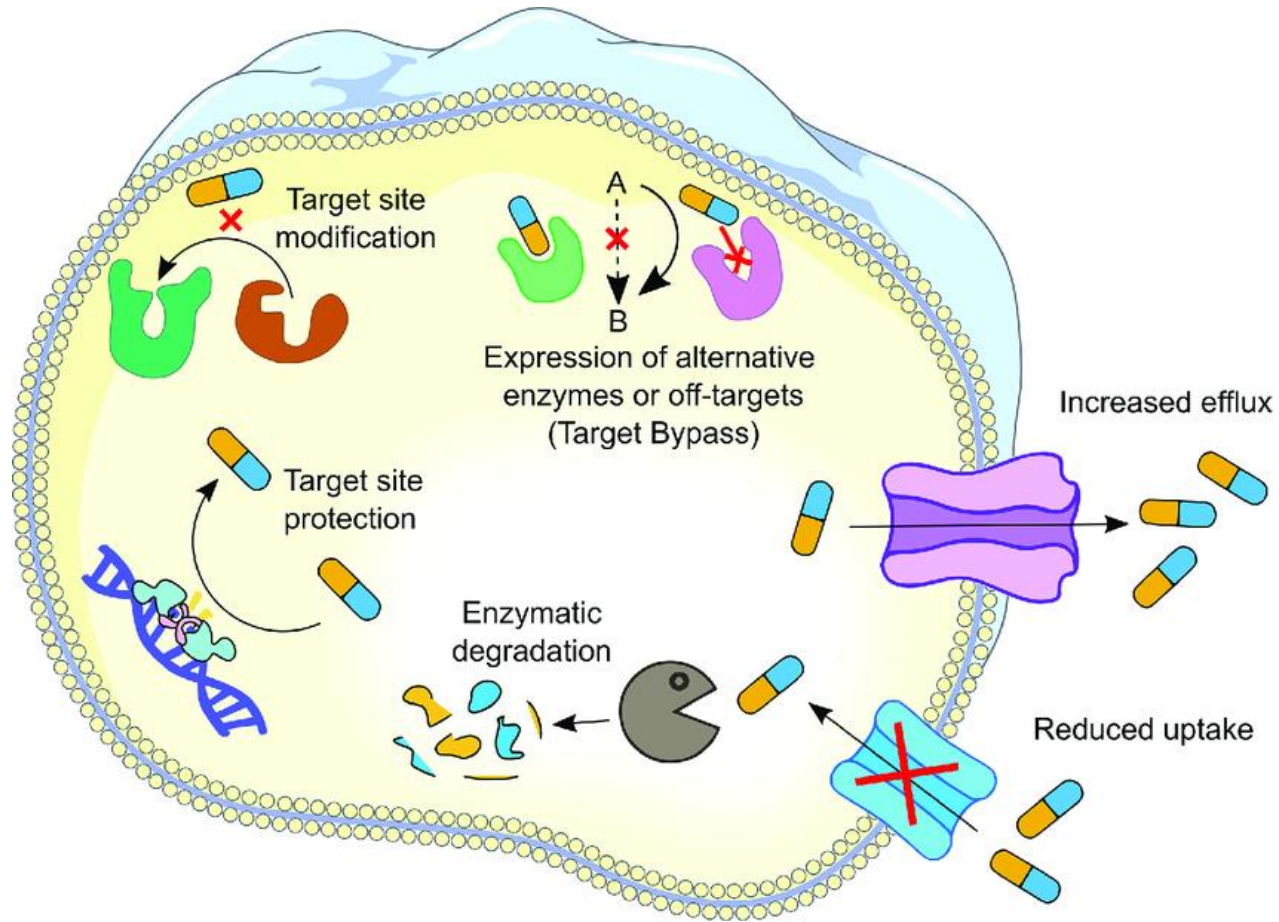
Fight against bacteria

Antibiotics

- Cell wall inhibitors
- Protein synthesis inhibitors
- Nucleic acid & metabolic inhibitors



Introduction

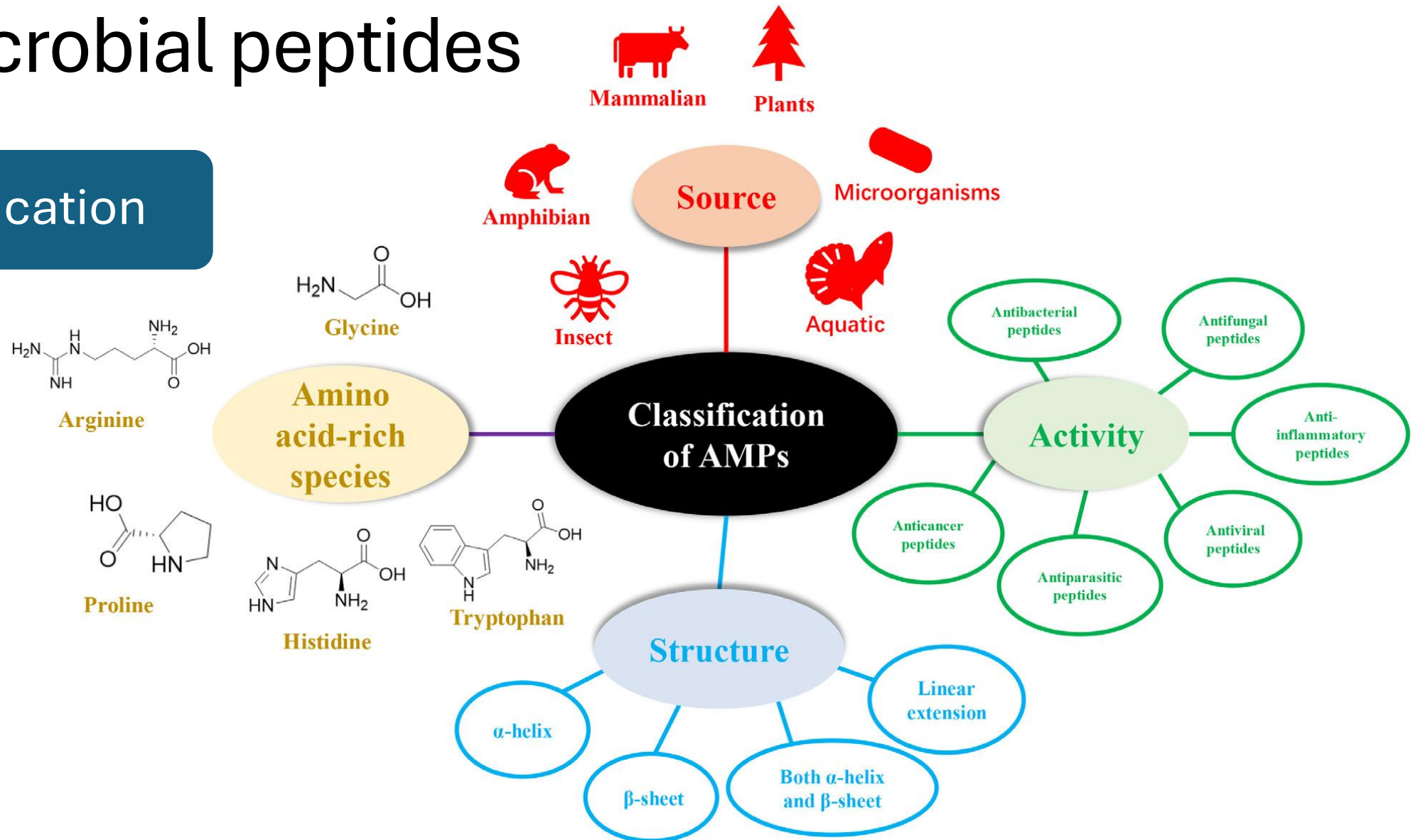


Antibiotic resistance

- Superbugs
- Mechanisms
- Solutions

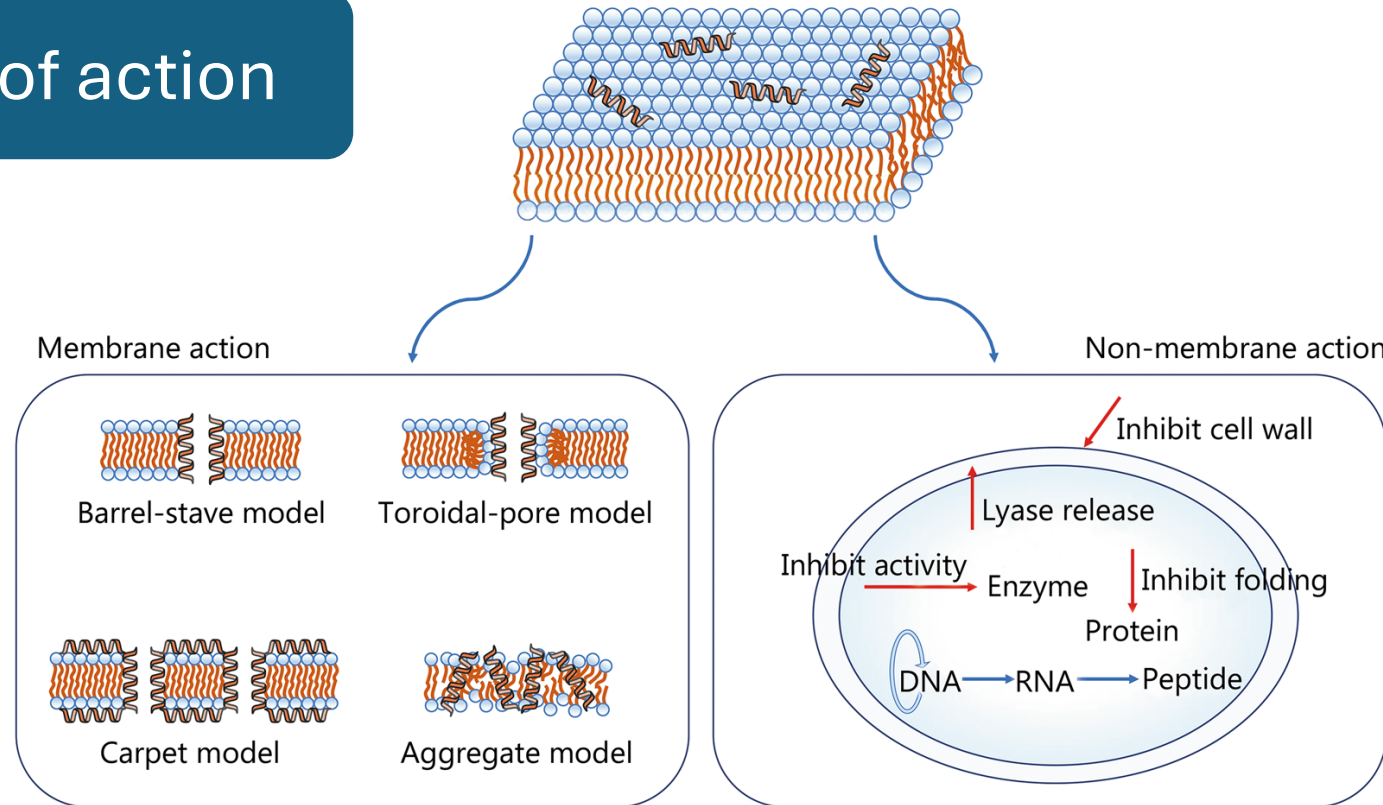
Antimicrobial peptides

Classification



Antimicrobial peptides

Mechanism of action



Antimicrobial peptides

Clinical application

- antimicrobials or templates for peptidomimetic drug design
- treating MDR bacteria
- synergistic effect

In use:

- polymyxins (e.g. colistin)
- daptomycin
- gramicidin
- food preservation
- animal husbandry

Antimicrobial peptides

Pharmacological challenges

- physiological factors
- cytotoxicity
- pharmacokinetics

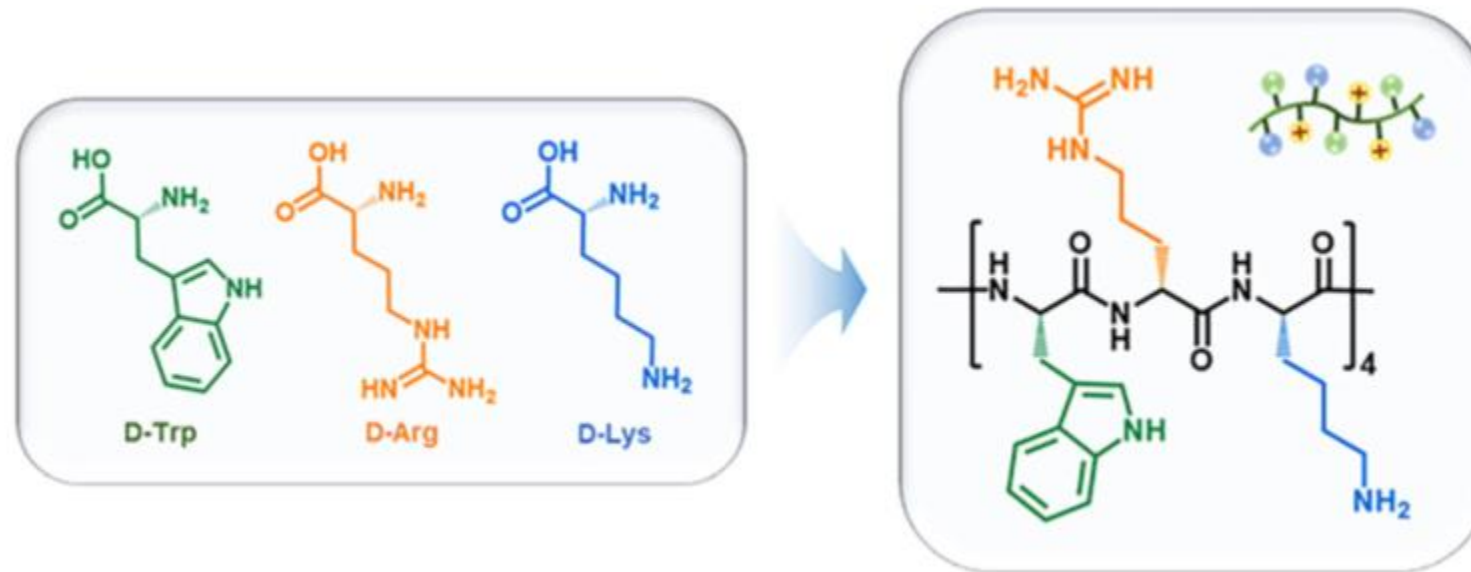
Strategies of design for better AMPs

- rational design
- chemical modifications
- synthetic mimetics and nanocarriers
- computational tools and AI

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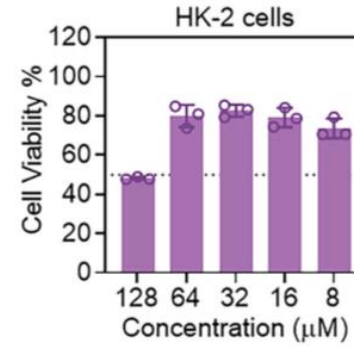
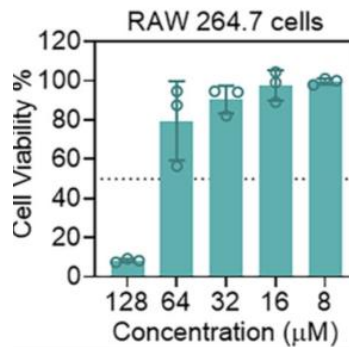
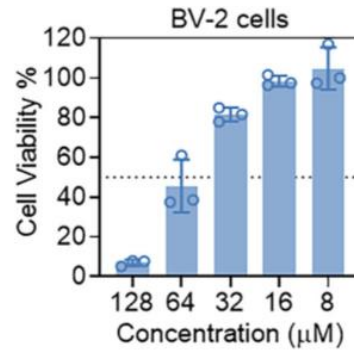
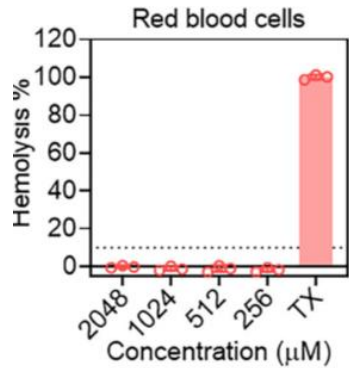
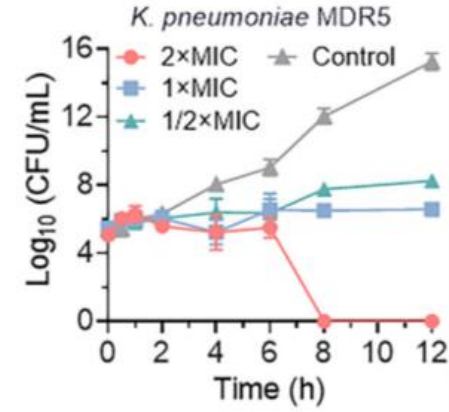
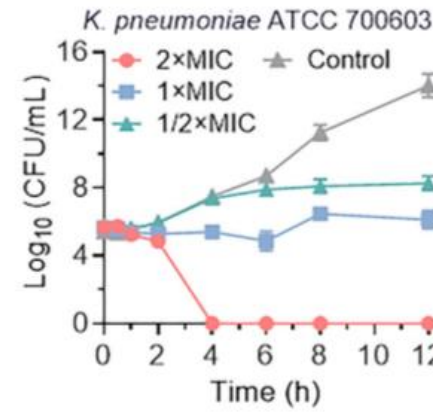
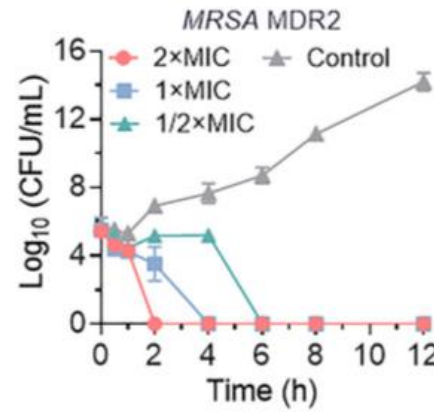
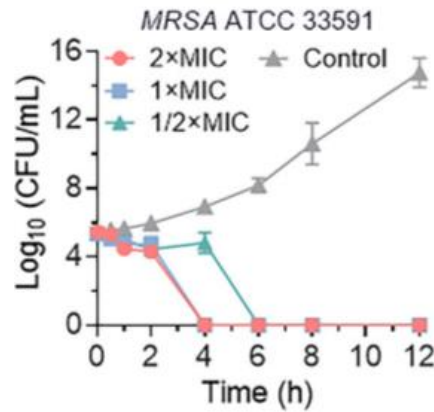
Design and characterization

- Chemical structure
- Antimicrobial activity



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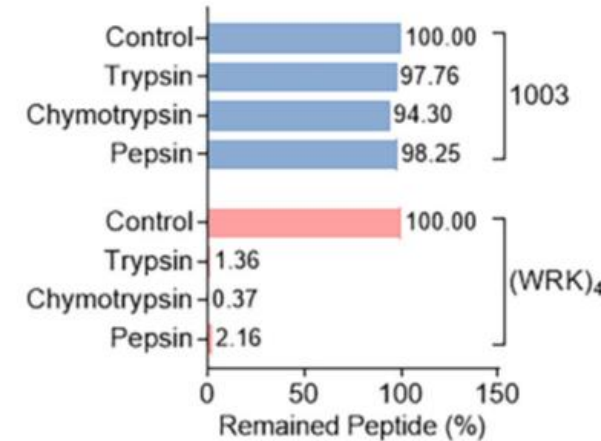
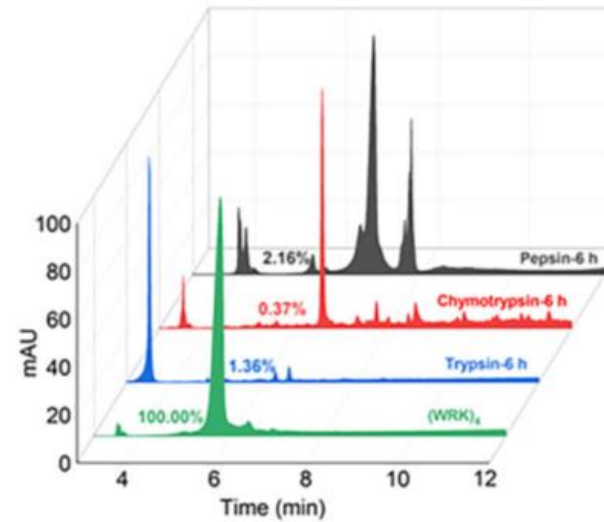
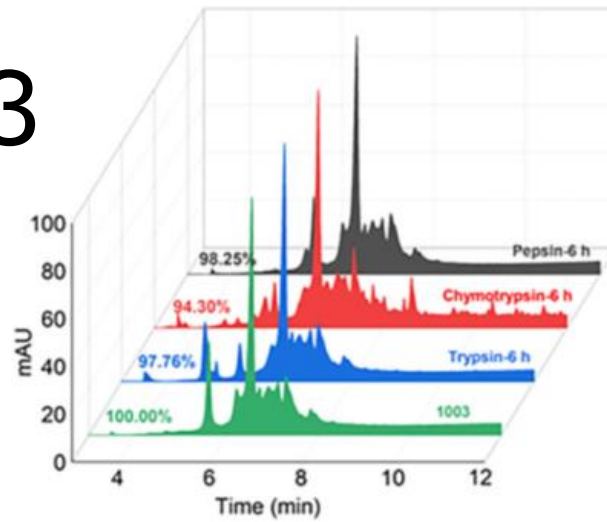
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Characterization

- Bacterial killing kinetics
- Hemolysis
- Cytotoxicity

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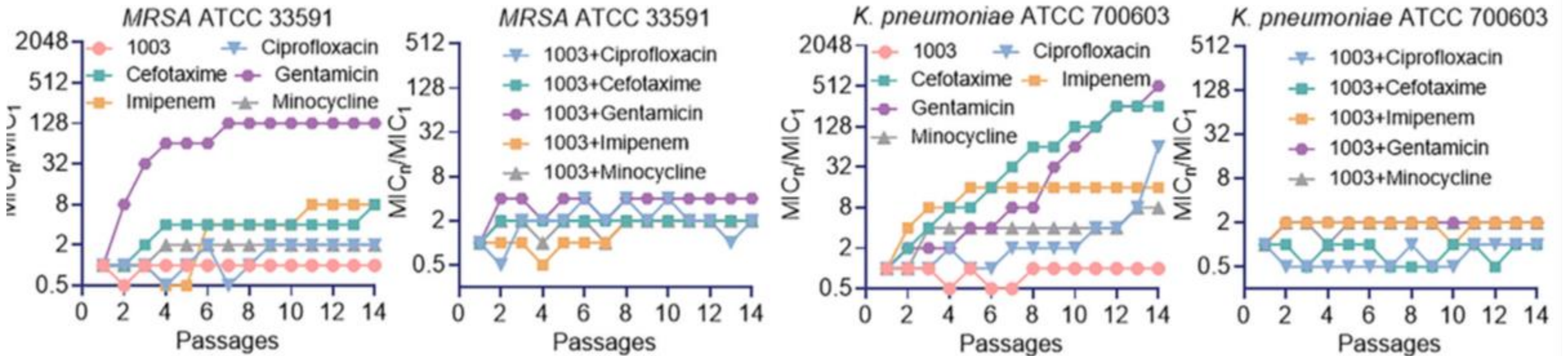
Antimicrobial activity and stability

- Enzymatic degradation
- MICs -> digestive enzymes, ions, serum

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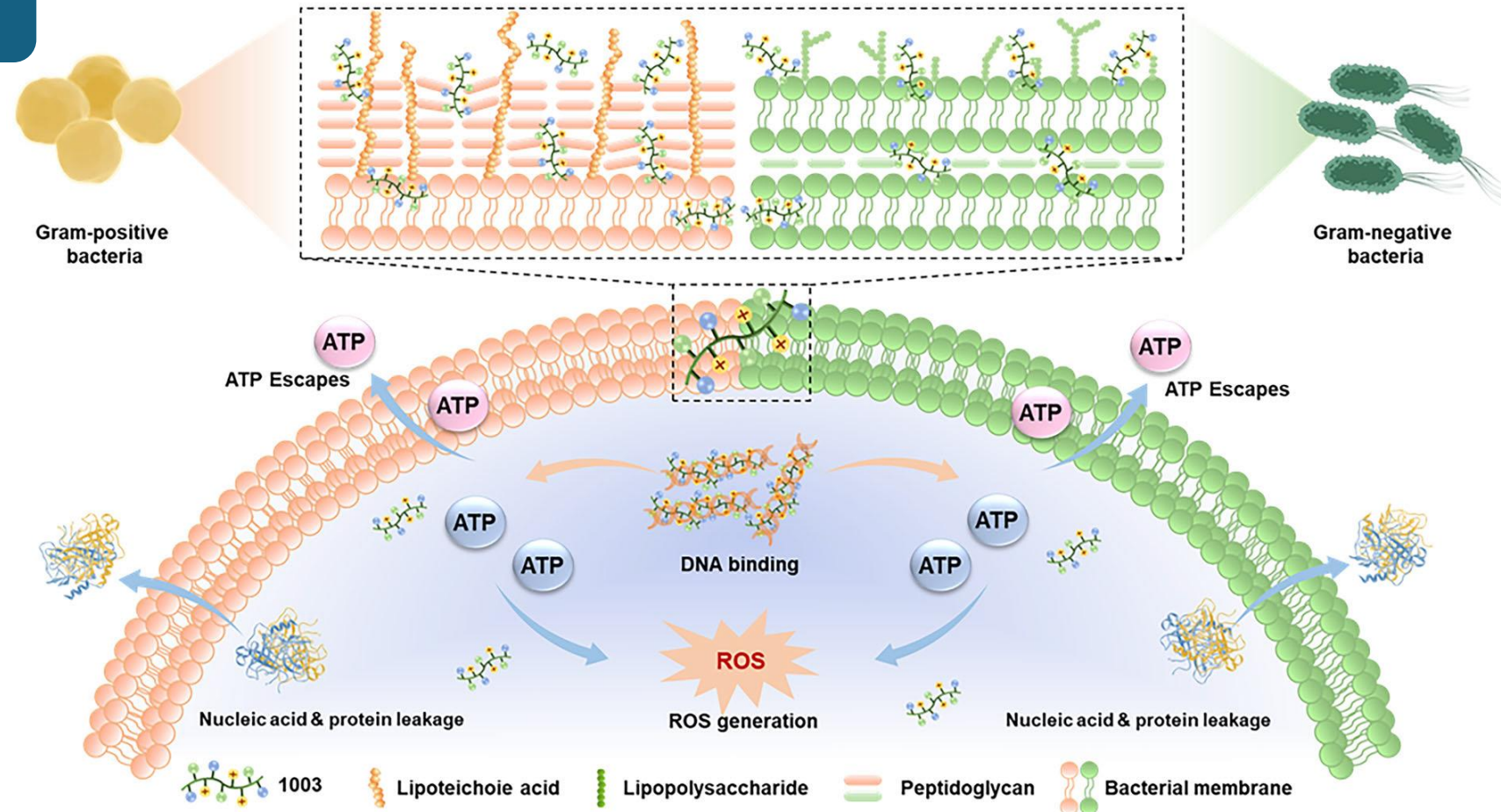
Alleviates antimicrobial resistance

- Resistance development
- Killing kinetics -> persister cells



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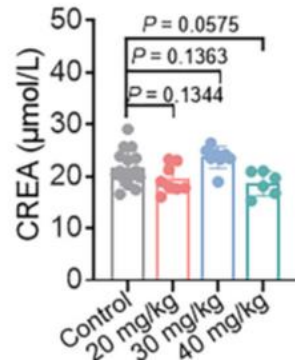
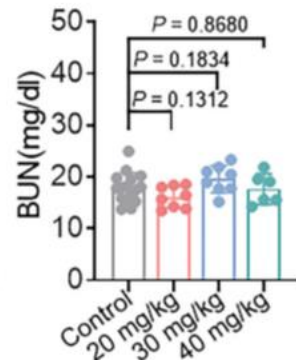
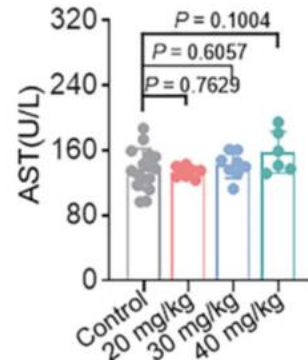
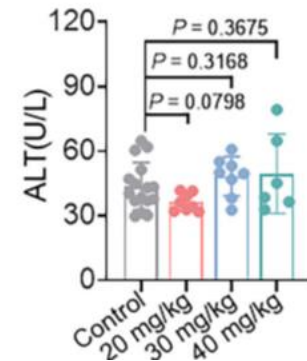
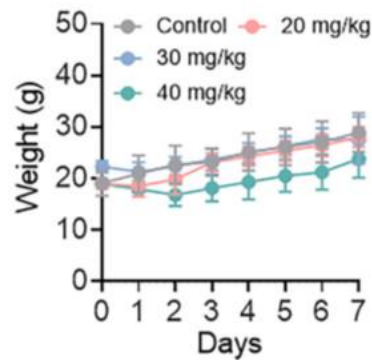
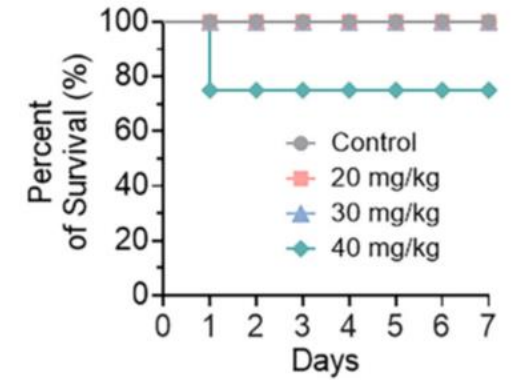
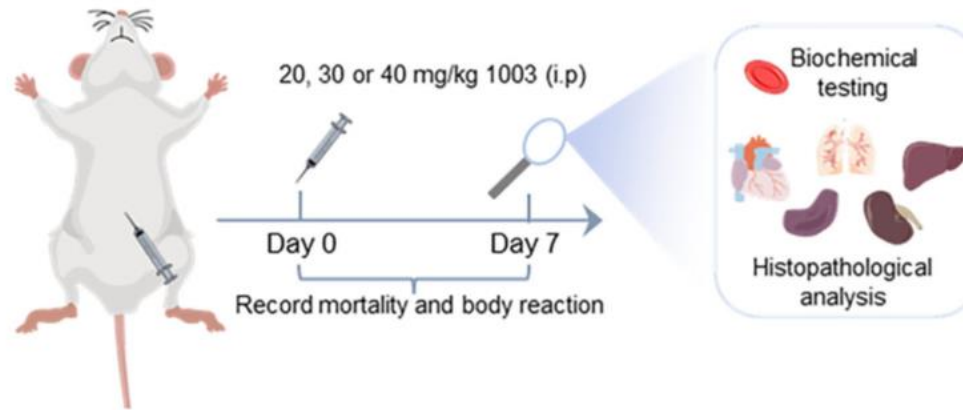
Mechanism of action



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Safety profile *in vivo*

- mouse pneumonia models
- anti-inflammatory activity
- survival curves
- blood biochemical analysis



Conclusion

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- multiple mechanisms of action
- boosts antibiotics
- *in vivo* success

Next steps

- chronic infections
- organ-compromised patients
- long-term safety

Thank you for your attention!