

### What are bacteriocins?

- ~700,000 people worldwide die each year from drug-resistant diseases: Antibiotics are no longer enough
- **Bacteriocin**: a peptide produced by gram-positive bacteria that inhibits growth of closely-related bacterial species
- Unlike antibiotics, produced by bacteria *themselves* as a defense mechanism
  - As their targets develop resistance, they in turn have the capability to evolve to produce bacteriocins to overcome this resistance.
- Nisin has been used as a food preservative for decades (so we know its safe and has low cytotoxicity)
- Nisin also shows promising killing activity; being both potent and broad range in its inhibition ability

**Question:** To what extent can bacteria evolve resistance to bacteriocins? How does the rate of development of resistance compare between bacteriocins and antibiotics?

**Hypothesis:** Bacteria will likely exhibit a slower rate of resistance against nisin compared to antibiotics.

### Proposed Methods

- Competition assays to compare the *rate of development of resistance* of different pathogenic bacterial species chronically exposed to different concentrations of *antibiotics* or *nisin*
- Generate growth curves based on optical density measurements of each sample in order to quantify possible recovery and growth of bacteria post-treatment
  - Also requires understanding of concentrations in which bacteriocins are lethal to bacteria

### Various Outcomes are Expected

- Some antibiotics more lethal to bacteria compared to other antibiotics
- Some types of nisin more effective at inhibiting growth than other types of nisin.
- Differences in the lethality between nisin and antibiotic on a given bacterial strain.
- Development of bacterial resistance in samples treated with nisin may be slower than those treated with antibiotic (or vice versa)

### Conclusions/Future Directions

- Bacteriocins may be a strong alternative to fight off infectious disease and mitigate the negative consequences of antibiotic overuse
- Utilize molecular biology techniques to reveal the mechanism in which bacteria might develop resistance to bacteriocins (if at all)
- Overall goal - clinical applications to fight off infectious diseases without consequences of resistance development?

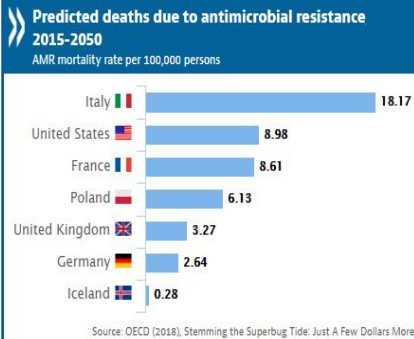


Figure 1: Expected deaths due to antibiotic resistance in seven developed countries

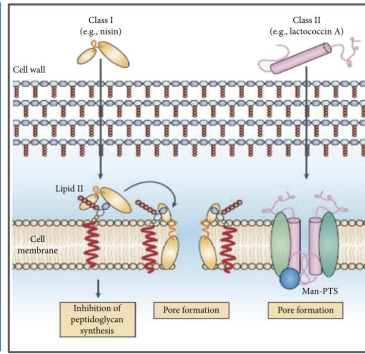


Figure 2: Mechanism by which Class I and Class II bacteriocins attack bacteria.