Bacteriocins as a Novel Natural Food Preservatives

Desalegn Amenu (PhD Candidate)
in Food Microbiology Jimma University

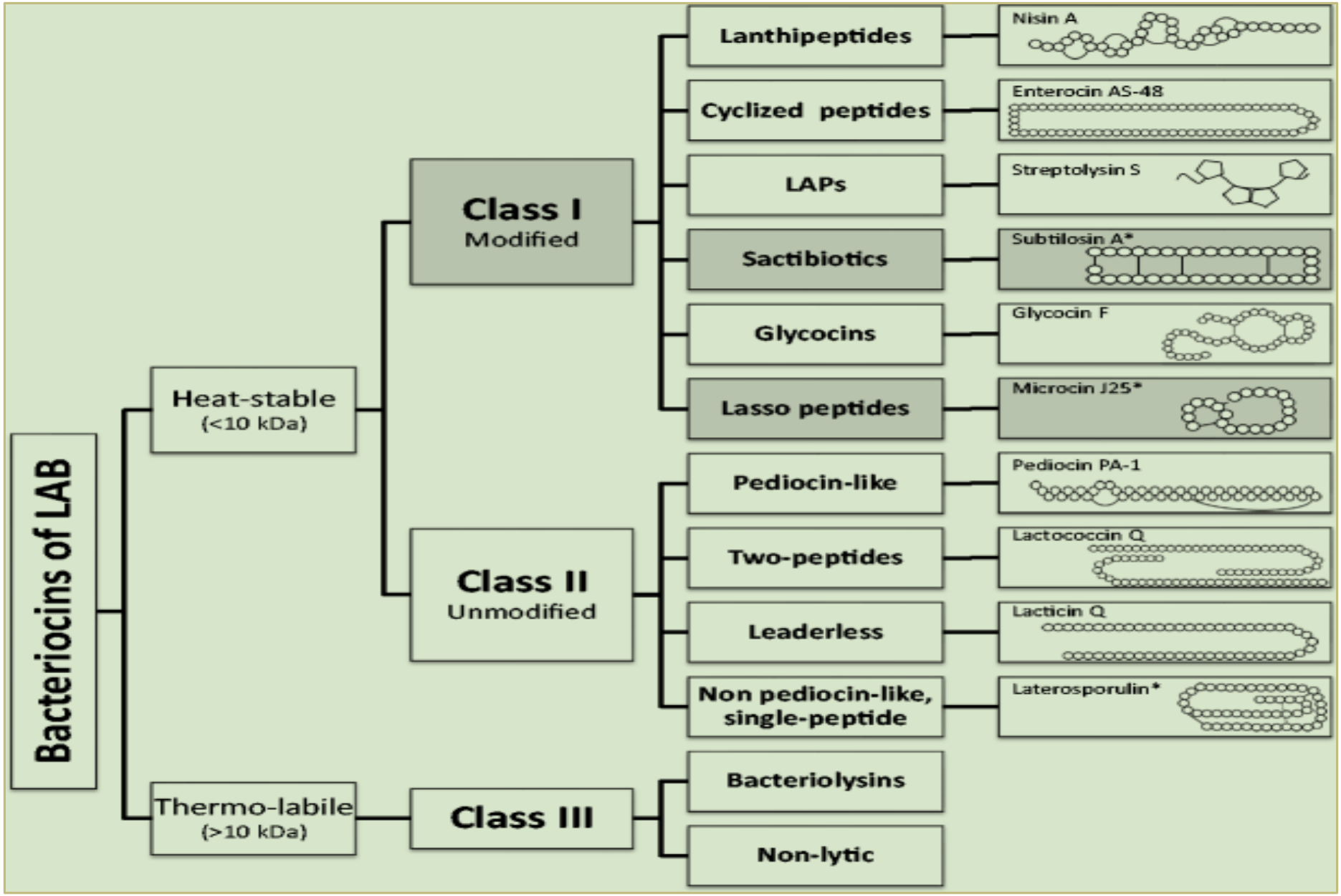
Introduction

- ✓**Bacteriocins** are generally defined as ribosomally synthesized peptides produced by bacteria that have bacteriostatic or bactericidal activity against other related and unrelated microorganisms.

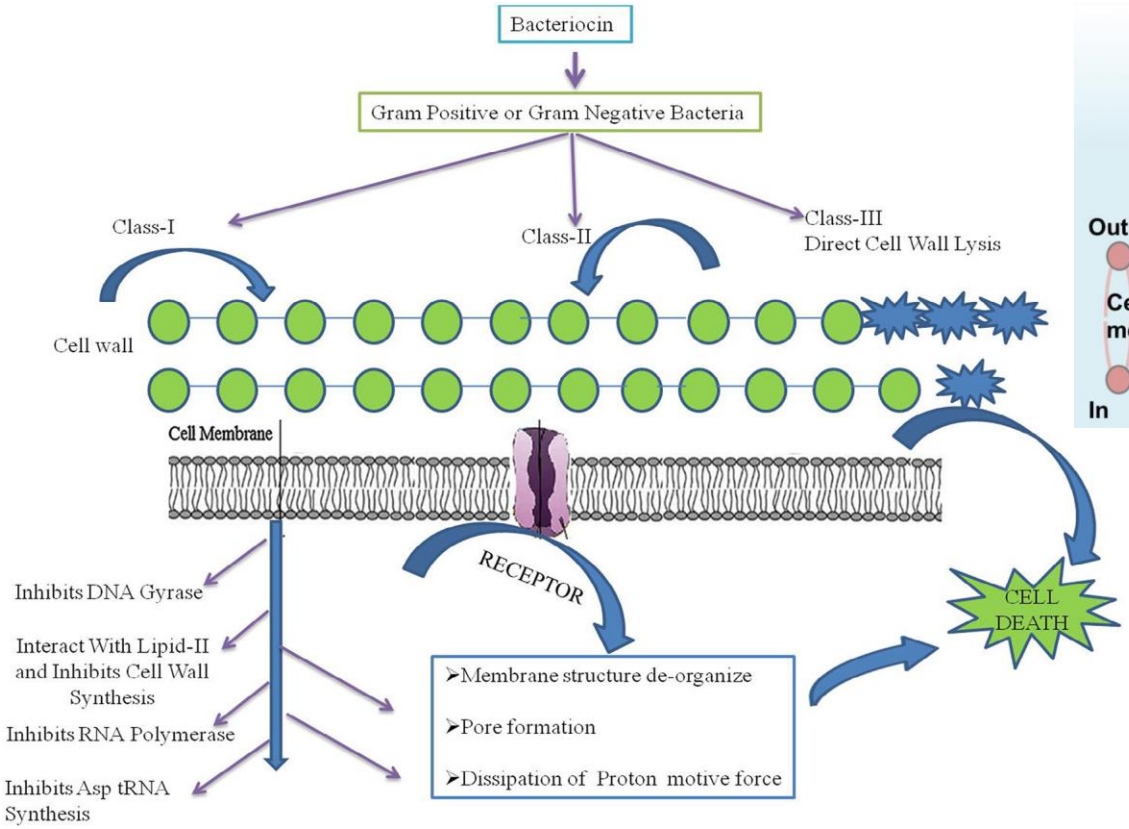
- ✓"Colicin" the first bacteriocin, *Escherichia coli*

- ✓ Application bactericins natural food preservatives
  - ✓ consumers are aware of the health concerns regarding food additives
  - ✓ strict government requirements to guarantee food safety
  - ✓ side effects of chemical food preservatives
  - ✓ food producers have faced conflicting challenges

Figure 1. Bacteriocins Classification (Alvarez sieiro *et al.*, 2016).



Bacteriocin Mode of Action



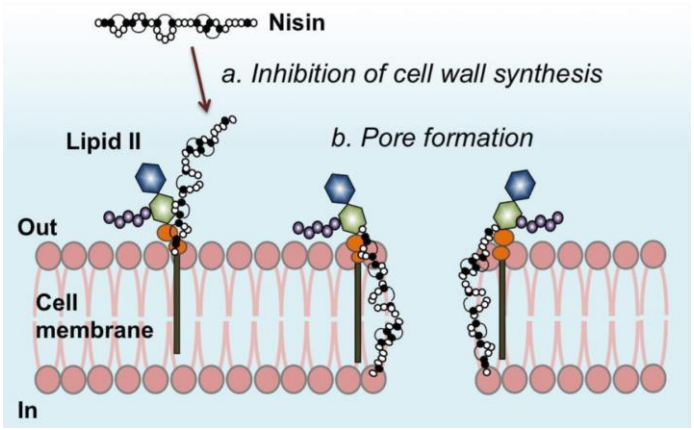


Figure 2. Mechanism of Action of Classes I, II and III Bacteriocins ((Alvarez-Sieiro *et al.*, 2016)

Molecular technique to detect bacteriocins

PCR

- ✓ Amplification of specific gene responsible for bacteriocin,
- ✓ Differentiation of closely related bacteria in mixed populations.

DNA technology

- ✓ Expression of bacteriocin genes
- ✓ Environmental influence of bacteriocin genes

Fluorescence technology

- ✓ Distribution of bacterioigenic strain in the food metrics
- ✓ Heterogeneous response of bacterial populations to bacteriocins

Purification techniques	Descriptions
1) **Ammonium sulphate precipitation**	✓ It is used to precipitate, bacteriocin, partial purification of peptides
1) **Ion exchange chromatography**	✓ used to purify bacteriocin based cationic/ anionic property, high strength exchanger is required for large scale purification
1) **Affinity chromatography**	✓ Used to determine bacteriocin based on ionic attraction and ligands are used
1) **Size exclusion chromatography**	✓ Determine bacteriocins based on molecular weight ✓ Generally used after the ammonium salt precipitation
1) **HPLC and Reverse phase HPLC**	✓ Best method, b/s complete purification bacteriocin ✓ It is highly recommended method of purification of bacteriocin
1) **Polyacrylamide gel electrophoresis (PAGE)**	✓ Uses stacking gel and resolving gel. ✓ It is used for determining the purity and the molecular weight of the bacteriocins
1) **UV–Visible spectrophotometry (UV–Vis spectroscopy)**	✓ Qualitative purification, spectra of crude extract is compared with the standard curve of bacteriocins

New development of bacteriocin application

- ✓ Conjugation of multiple **bacteriocinogenic plasmids.**
- ✓ **Genes** involved in **bacteriocin biosynthesis**
  - ✓ **genetic engineering,**

Bacteriocin as promising natural food preservative

Why??????????????

- It GRAS
- It is not poisonous to eukaryotic cells.
- It possesses broad-spectrum activity against foods spoiling microorganisms.
- It is pH and heat resistant.
- It shows minimum inactivation when exposed to the protease enzymes.

Bacteriocins as Novel Natural Food Preservation

Application of LAB bacteriocins …… **how/when (Criteria)**

- ✓GRAS property
- ✓non-toxic on eukaryotic cells
- ✓inactivated by digestive proteases
- ✓No damage to normal gut microflora
- ✓ they are usually thermostable and pH-tolerant
- ✓wide antimicrobial spectrum
- ✓industrial use
- ✓satisfy the increasing consumers'
- ✓**Reduced risks**

Why LAB Bacteriocins are safe to use as natural preservative

- ✓GRAS property
- ✓non-toxic on Eukaryotic cells
- ✓inactivated by proteases
- ✓No damage to normal gut microflora
- ✓ they are usually thermostable and pH-tolerant
- ✓wide antimicrobial spectrum

Application methods

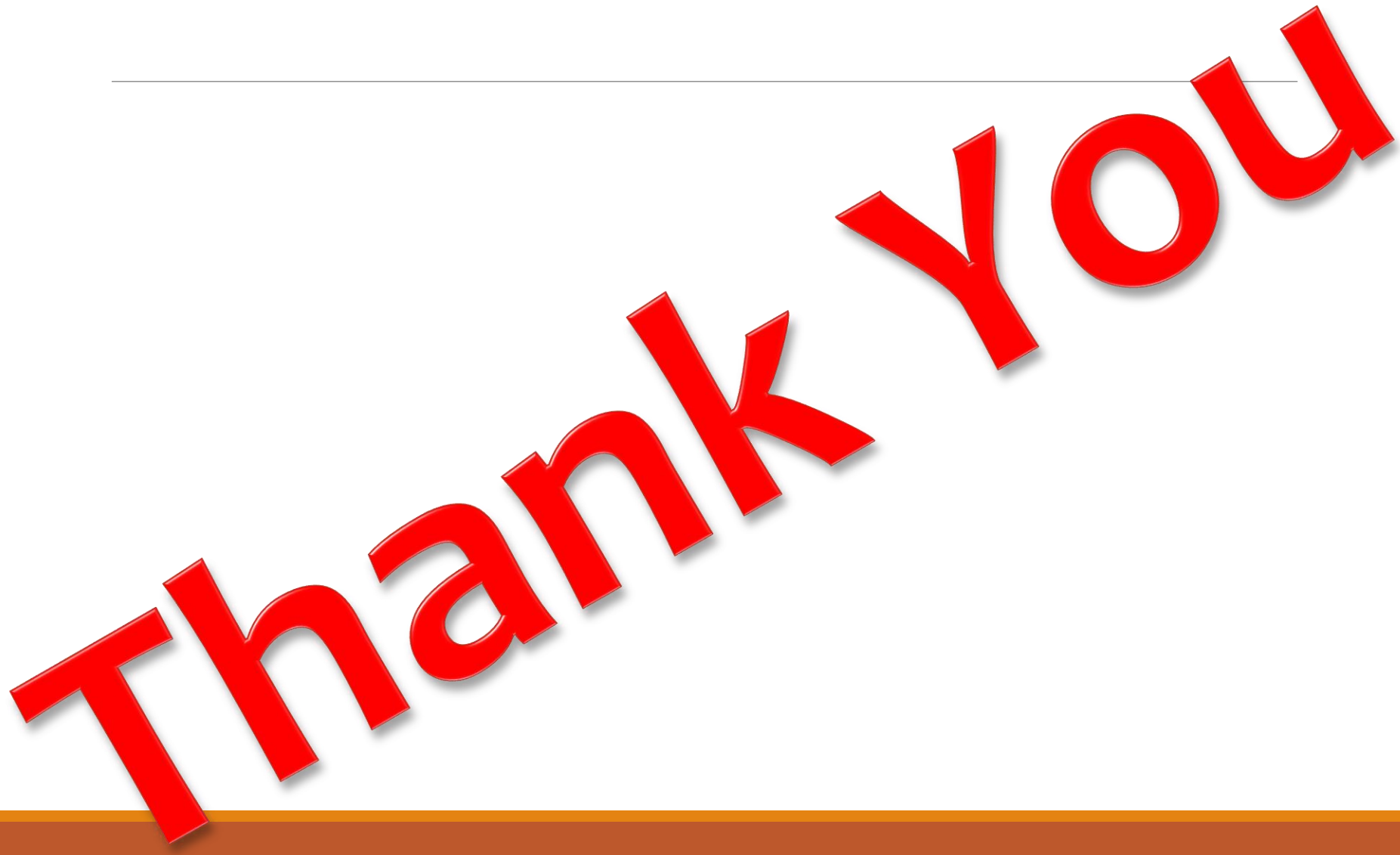
1) Inculcation of bacteriogenics strains

2) Direct inoculation of Bacteriocins

3) Use previous fermented foods

Benefits' of Bacteriocin as food preservative

- ✓ decreases contamination
- ✓ extends the shelf life of food
- ✓ decreases economic losses
- ✓ Reduce thermal effect of chemical preservatives
- ✓ provides alternative preservation barriers for "novel" foods less acidic,


Thank You