

**Foods
2022**

**The 3rd International Electronic Conference
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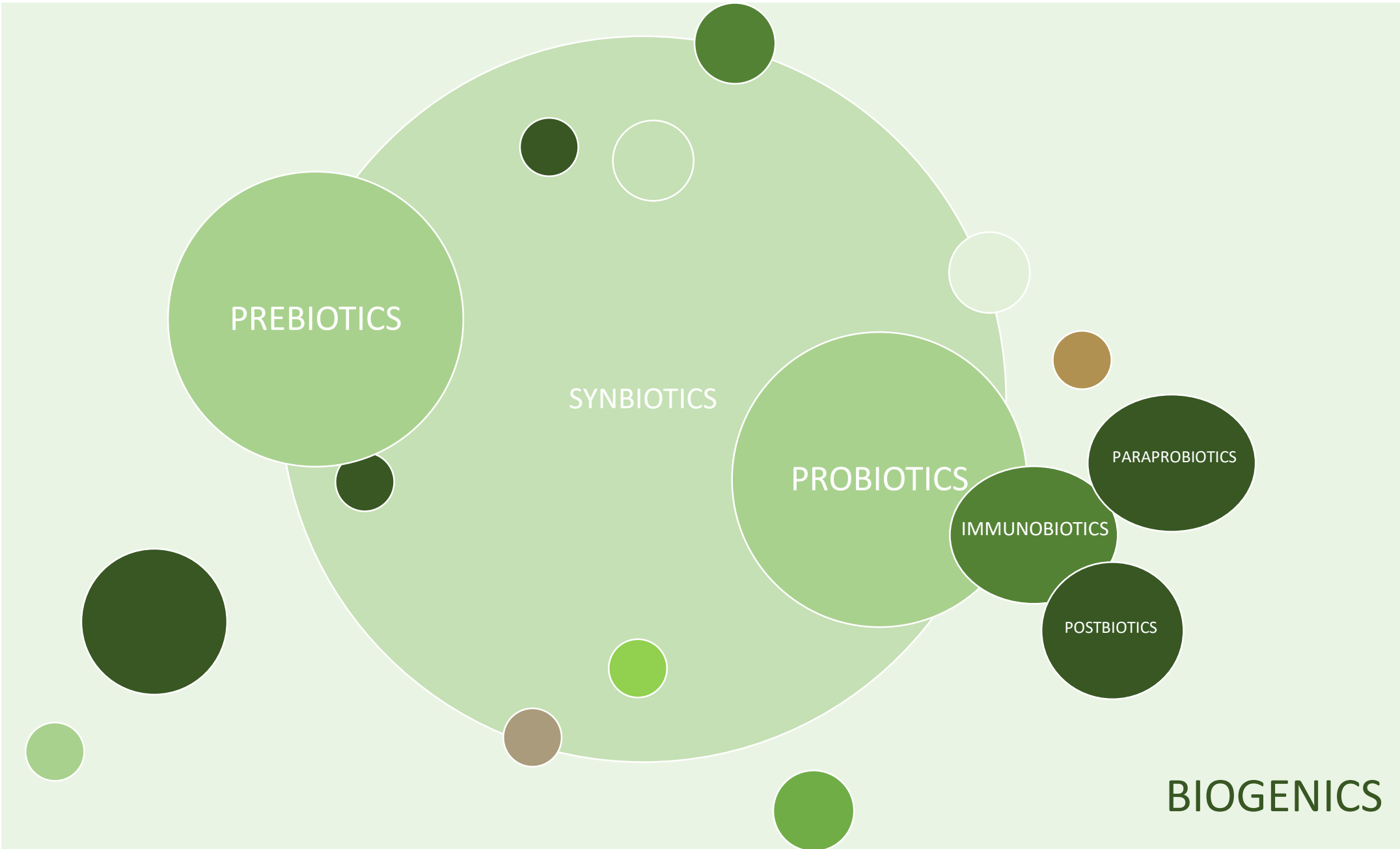


General Perspective and Assessment of the Potential of Utilizing Paraprobiotics in Food Products

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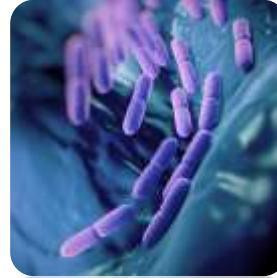
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(Cutting, 2011; Oelschlaeger, 2010)

“Probiotics, live microorganisms which, when administered in adequate amounts confer a health benefit on the host”

PROBIOTICS



FOOD



HEALTH BENEFITS



MICROBIOTA



Probiotics will be affected by;



The food's composition;
Water activity
Antibiotic content



Processing conditions;
Temperature
Time
pH



Storage conditions;
Oxygen content
Packaging materials

Problem;

- Adding probiotics during food processing
- Survival of microorganisms
- Shelf-life stability
- Proper delivery to the gut microbiota



**PROBIOTICS
(LIVE)**



(INACTIVATED)



**PARAPROBIOTICS
(DEAD, NON-VIABLE)**

“Paraprobiotics are non-viable microbial cells that, when administered in adequate amounts, confer some health benefits to the consumer”



METABOLITES AND EFFECTS



PHARMACEUTICALS

Advantages of paraprobiotics:

- Stability over a wide pH and temperature range
- No interaction with other components in the food matrix
- Easy food processing, industrial usage, commercialization
- Extending the shelf life of food



HEALTH BENEFITS



FOOD

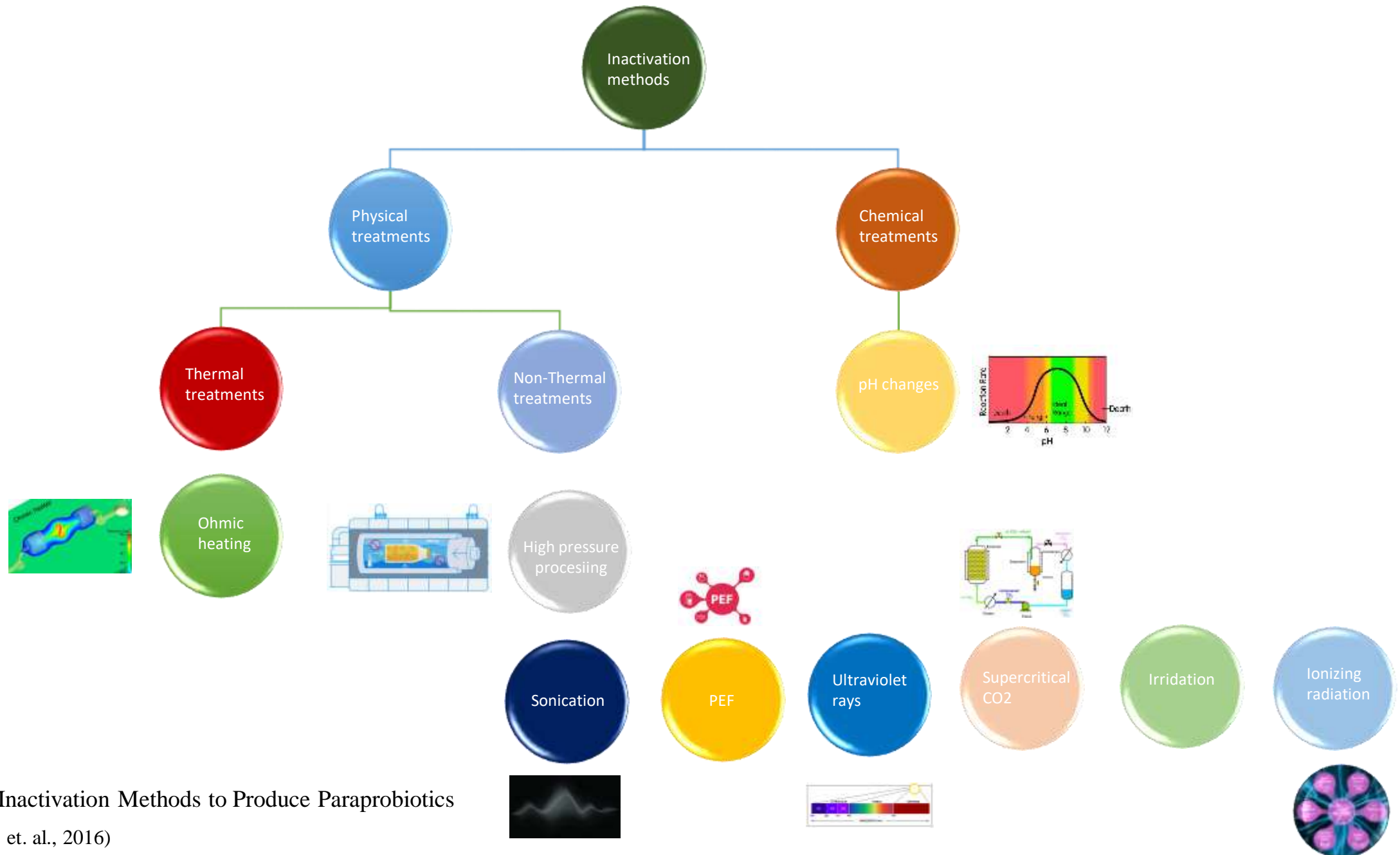


Figure 1. Inactivation Methods to Produce Paraprobiotics
(de Almada et. al., 2016)

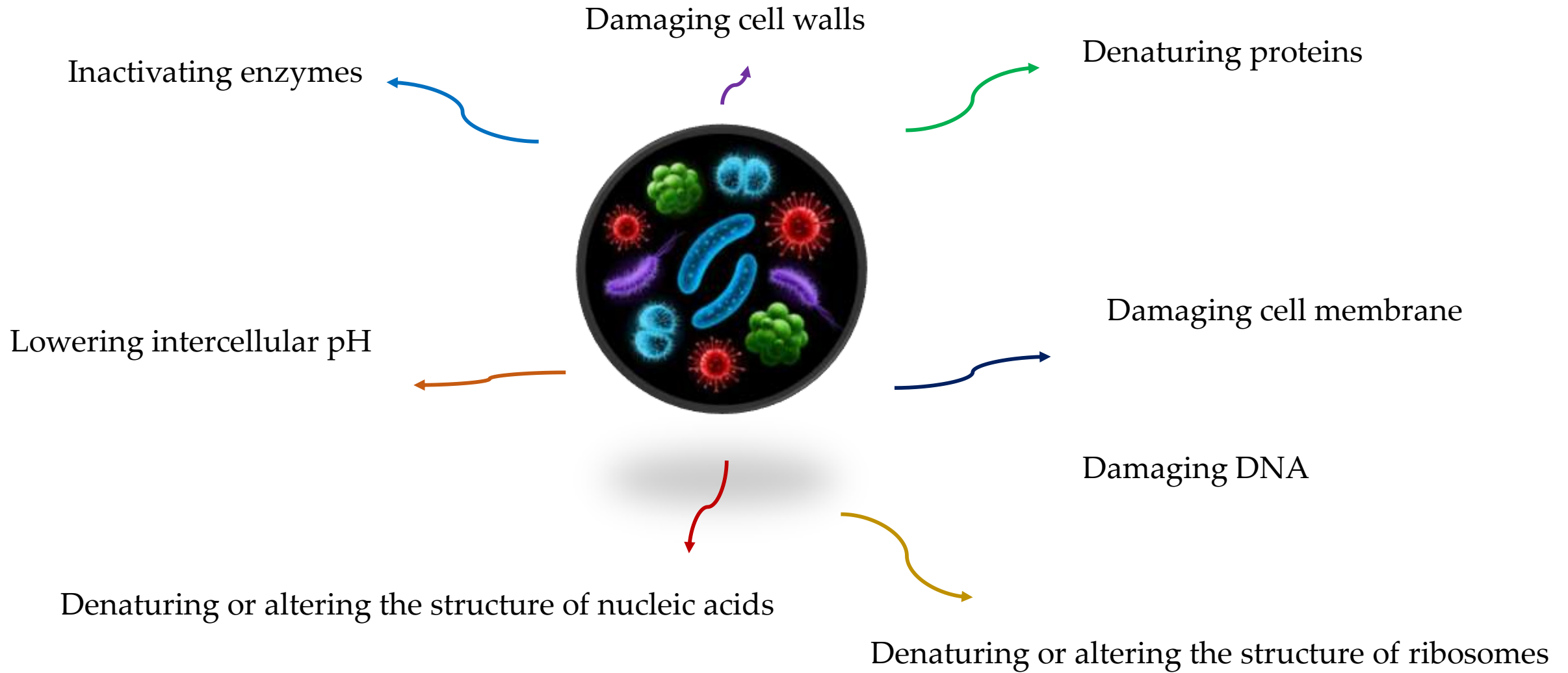
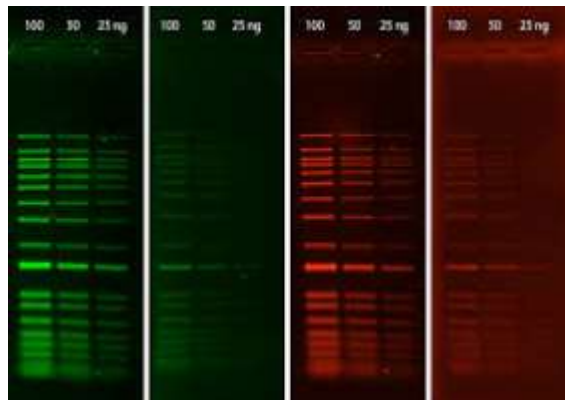
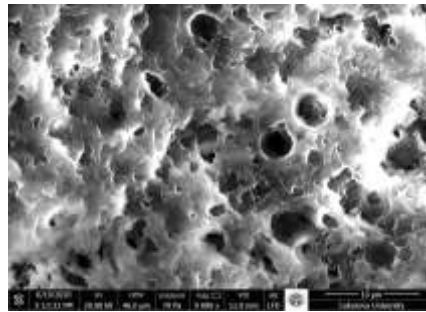


Figure 2. Changes in bacterial cell during inactivation of probiotics

SEM



PCR

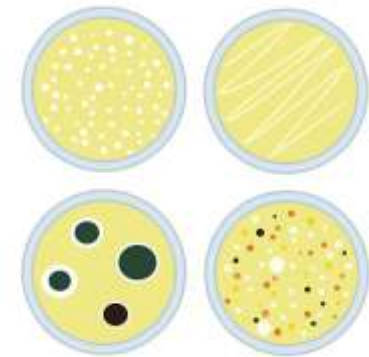
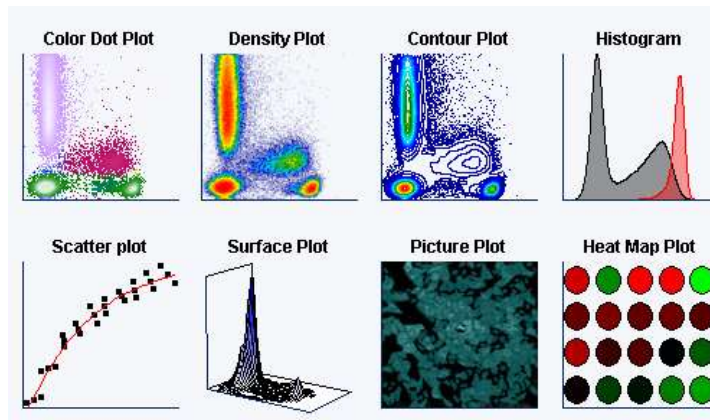


Plate Counting



Flow Cytometry

Figure 3. Paraprobiotic Assessment Methods

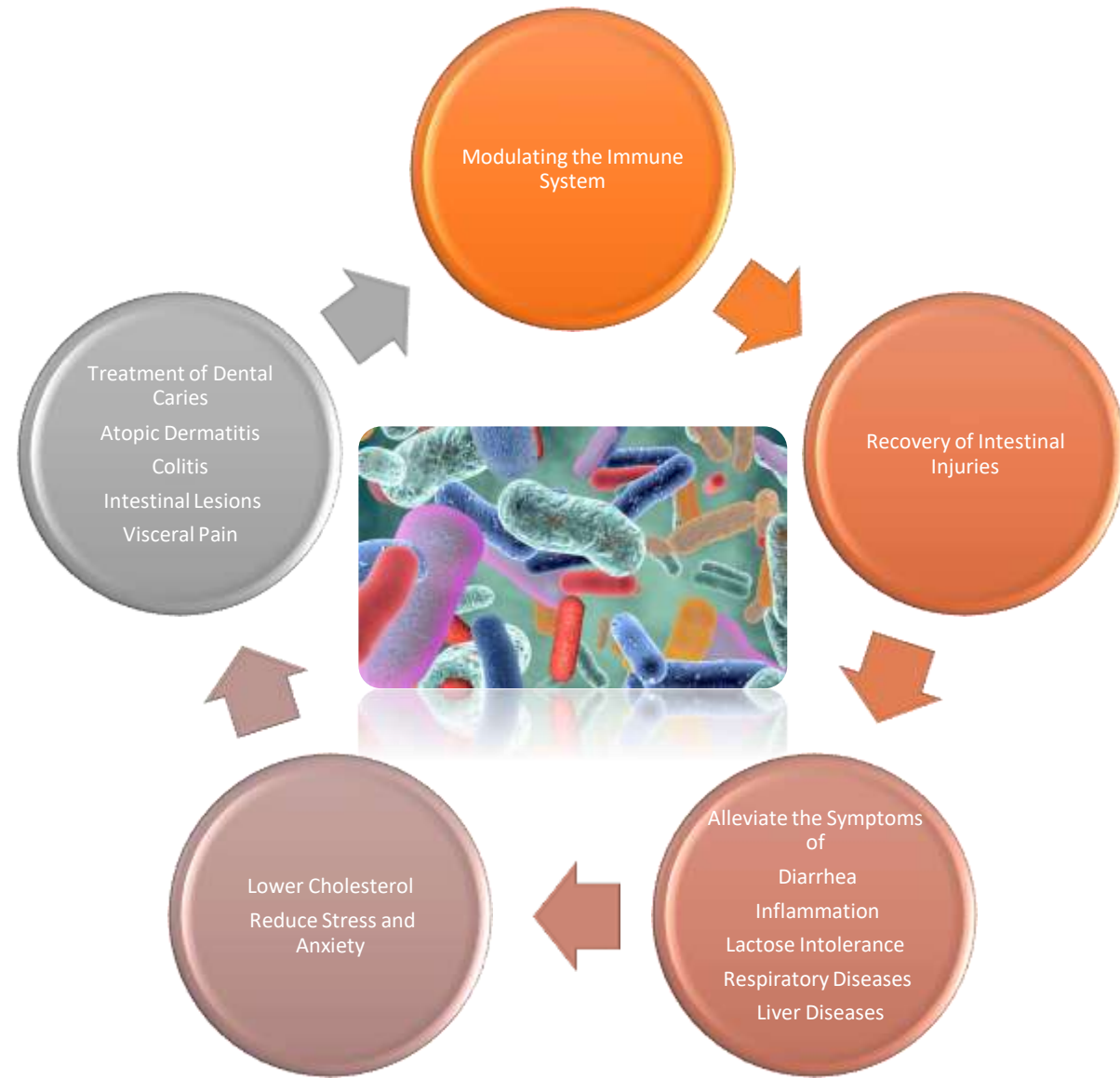


Figure 4. Health Benefits of Paraprobiotics

(de Almada et. al., 2016; Grześkowiak et. al., 2014; Shin et. al., 2010)

Table 1. Applications of paraprobiotics in foods

Probiotic strain	Food matrix	Inactivation method	Results	References
<i>L. acidophilus</i> and <i>B. lactis</i>	Yogurt	Heat treatment (121°C, 15 min)	Viscosity↑ WHC↑ Syneresis↓ Storage modulus↓ Loss modulus↓ Stress crossover point↓ Loss tangent↓ Sensory properties↑ L*↔ a*↔ b*↔ pH↓ Acidity↑ Redox potential↑	Molae Parvareei et. al., 2021a, 2021b, 2021c
<i>L. casei</i> subsp. <i>paracasei</i> 01	Whey-grape juice	Ohmic heating (8V/cm, 95°C/7min, 60 Hz)	Glucose rate↑ Maximum glucose value↔ Glucose incremental percentage↔ Peak blood glucose time↔, Glycemic responses (AUC, AIg, PGV, HP, GB)↔ Glucose postprandial level↓	Barros et. al., 2021

CONCLUSION

- The paraprobiotic term has been evolving and gaining attention in recent years.
- Clinical studies demonstrated that paraprobiotics have health benefits for the consumers like probiotics. Therefore, paraprobiotics can be an alternative to probiotics for people with a sensitive immune system or who are immunocompromised/immunodeficient and avoid probiotic consumption.
- Also, paraprobiotics can be used when the use of probiotics is a technological challenge. In the case of processing and shelf-life conditions, not convenient probiotics survive.
- However, there isn't enough information and research in the literature about paraprobiotics just yet.
- The mechanism of action of paraprobiotics is not fully understood and requires further investigation.
- In this regard, the following studies should focus on determining valid conditions for emerging inactivation methods, the biological activities and stability of paraprobiotics in vitro and in vivo, and the terms for wide application and easy commercialization of paraprobiotics.
- Furthermore, it's critical to establish a precise definition by subject-matter experts and prevent the misuse of paraprobiotics.

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