
novozymes
CHR HANSEN
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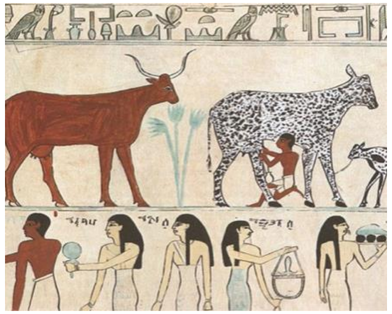
The Power of good Bacteria

Dirk Hoffmann
Senior Account Manager Meat & Prepared Food

Food and bacteria

- Old and traditional food processing technology
- Originally an empiric process induced by endogenous bacteria to help protect food
- Today = industrial processes require the use of food culture for
  - Safety/traceability
  - Controlled process (less variability, less waste, more safety)
  - Cost effectiveness (faster process, energy saving…)

Ancient time: Intuitive use
Fermented milk, wine, bread, beer etc.



Early science, building knowledge

Today, applied knowledge

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The unseen magic performed by good bacteria!

Food cultures contribute in many ways to characteristic features of fermented meat

LACTIC ACID BACTERIA

ACTIVITIES DURING RIPENING

- Formation of lactic acid
- Formation of aroma compounds
- Nutrient competition and competitive flora

STAPHYLOCOCCI

ACTIVITIES DURING RIPENING

- Formation of proteases and lipases
- Formation of nitrate reductase
- Formation of catalase
- Oxygen consumption

YEASTS

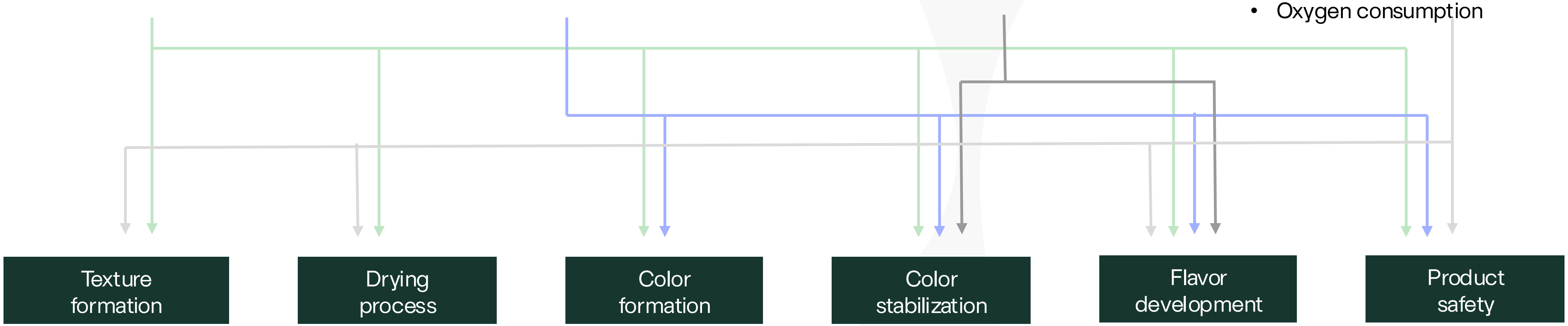
ACTIVITIES DURING RIPENING

- Formation of proteases and lipases
- Formation of catalase
- Oxygen consumption

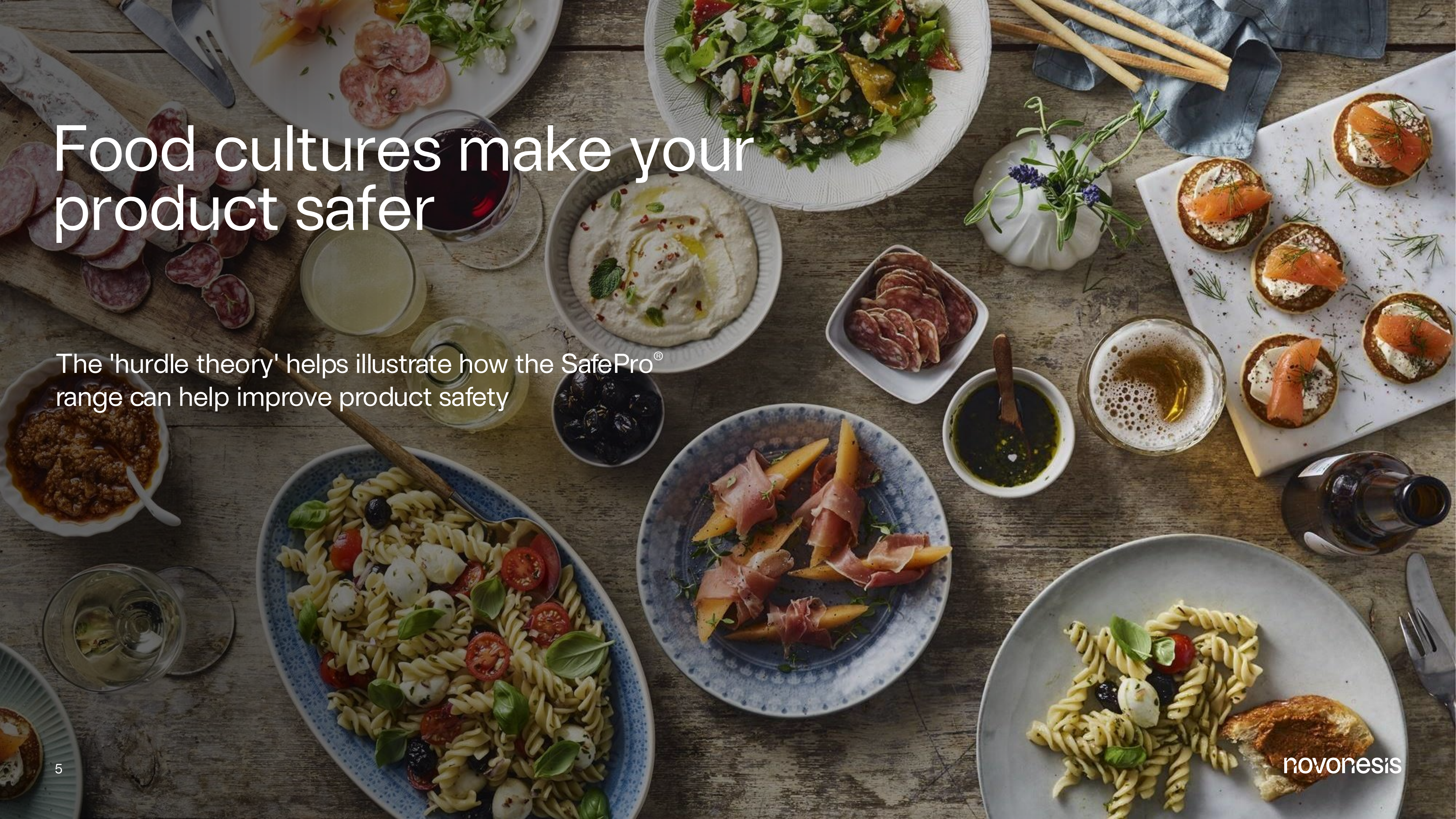
EDIBLE MOULD

ACTIVITIES DURING RIPENING

- Formation of typical white mycelium covering product surface
- Protective function
- Formation of proteases and lipases
- Oxygen consumption



See also: ERKES - Cultures optimize raw cured products - FleischWirtschaft International 3/2011; ERKES - Cultures assure ripening and protection – FleischWirtschaft International 3/2014; ERKES – Ars vivendi needs culture! – FleischWirtschaft International 3/2016; MARGERIN – Cultures in salami and raw cured muscles applications – DLG-expert report 3/2018



Food cultures make your product safer

The 'hurdle theory' helps illustrate how the SafePro® range can help improve product safety

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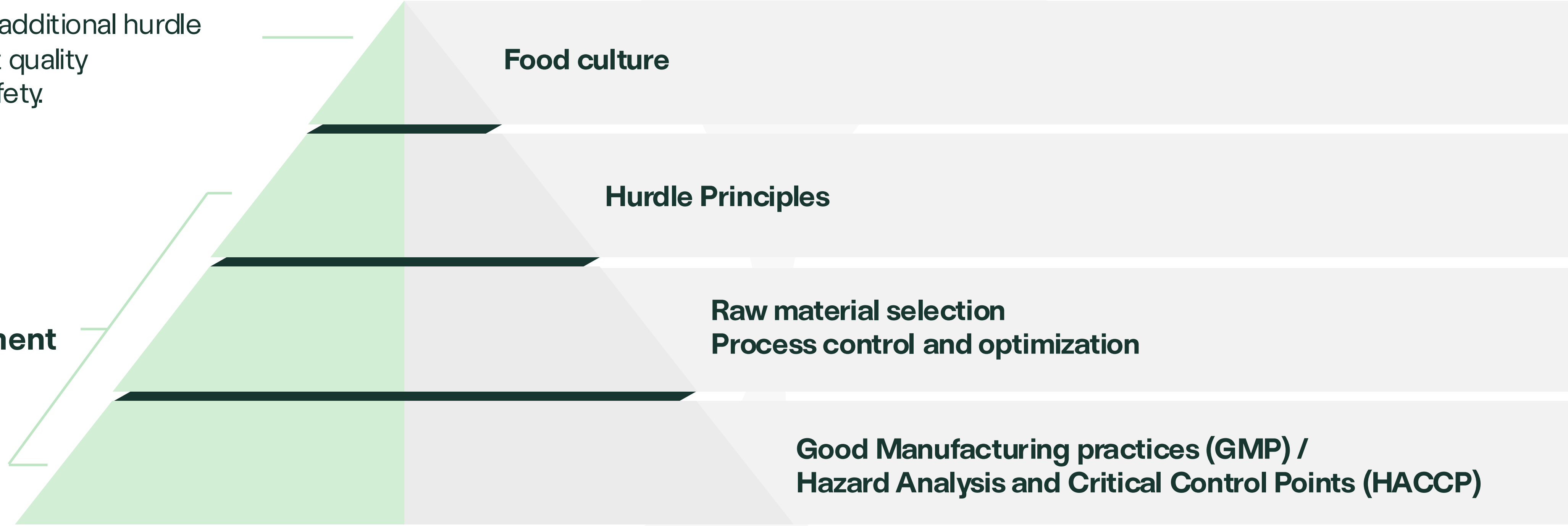
Food cultures can be used as an additional building block for the food safety and quality concept

Food cultures can help control the growth of unwanted microorganisms, like spoilage organisms and pathogens, e.g. *Listeria monocytogenes.*

Additional Hurdle
A food culture can be an additional hurdle to support stable product quality and improved product safety.

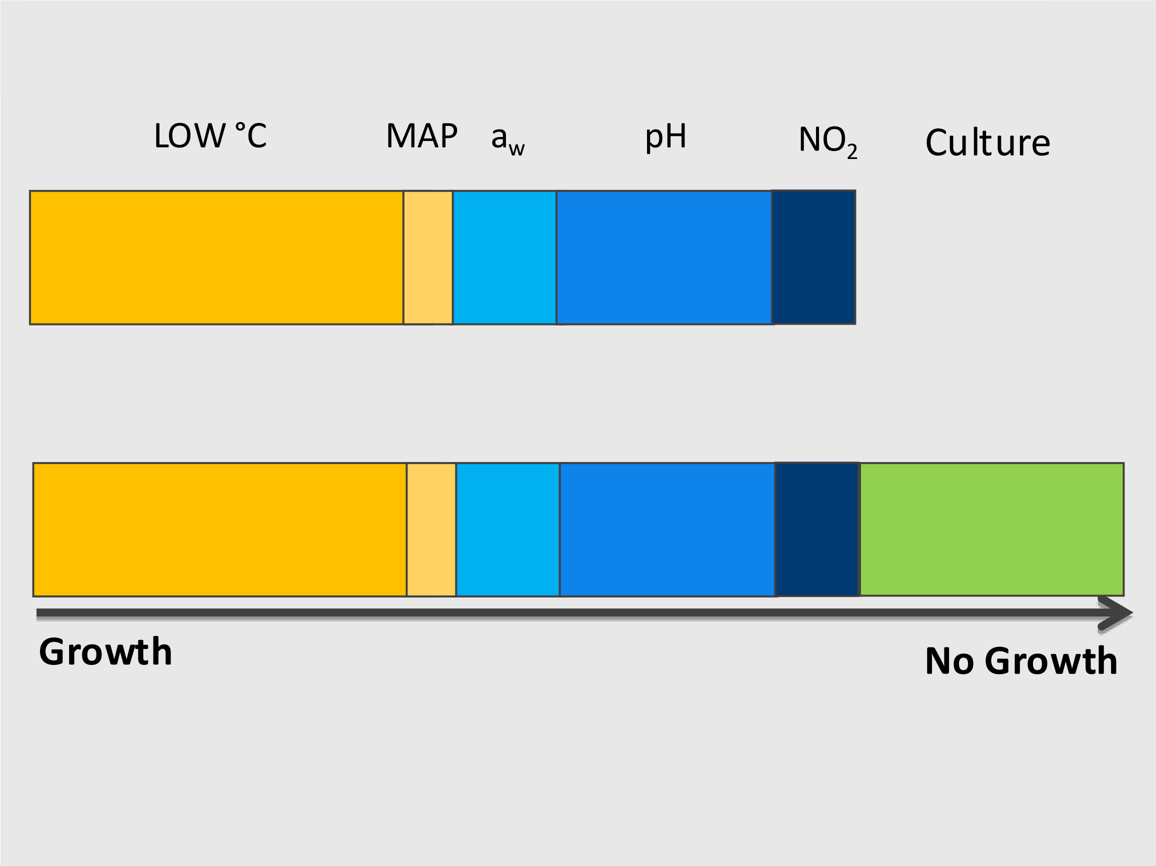
Food safety and quality management



The hurdle theory to maintain quality and safety of food

- The microbial stability and safety of the most foods is based on a combination of several factors (called hurdles) that microorganisms are unable to overcome (*Leistner, 1978*)

- Examples of hurdles
  - Extrinsic parameters
    - CO_2 presence (MAP packaging)
    - Temperature
  - Intrinsic parameters
    - Recipe: nitrite / organic acid / inhibitors / salt / food culture
    - Endogenous flora



Adam Harris
Owner and CEO, Harris Smokehouse Australia

“The simplest way to put it: You are fighting the bad guys with good guys.”

QR-Link to Video with Adam Harris

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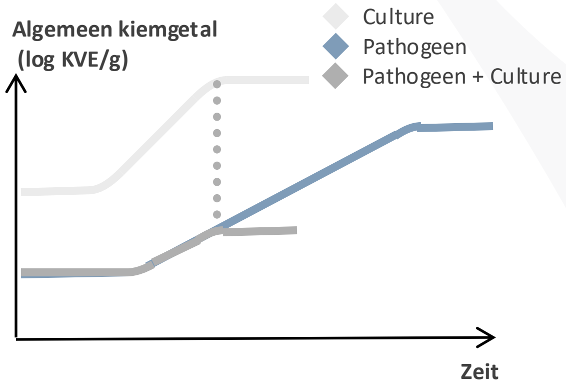
Protective effects come from the multiple functions of fermentation with food cultures

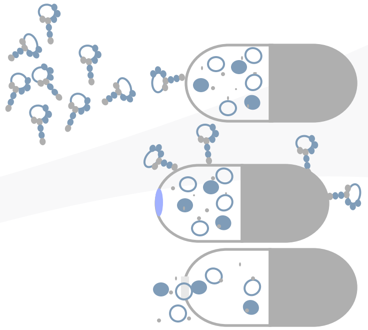
JAMESON EFFECT: COMPETITION FOR SPACE

> 5x10^6 KVE/g



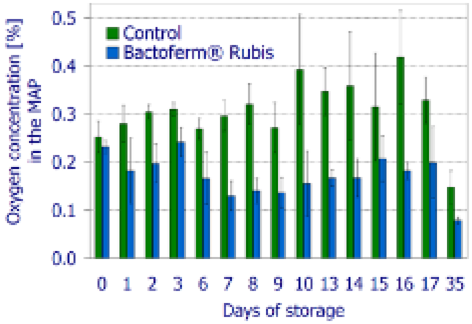
PRODUCTION OF METABOLITES

Like organic acid, volatile compounds, Peptides, …



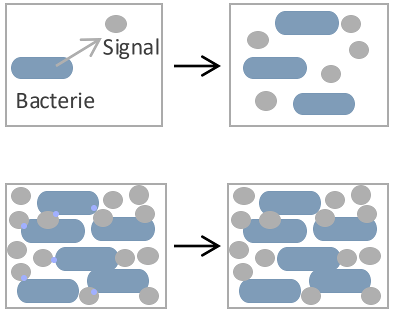
COMPETITION FOR NUTRIENTS

Like Oxygen, Carbohydrates, spore elements, …



CEL-CEL COMMUNICATION

Quorum sensing



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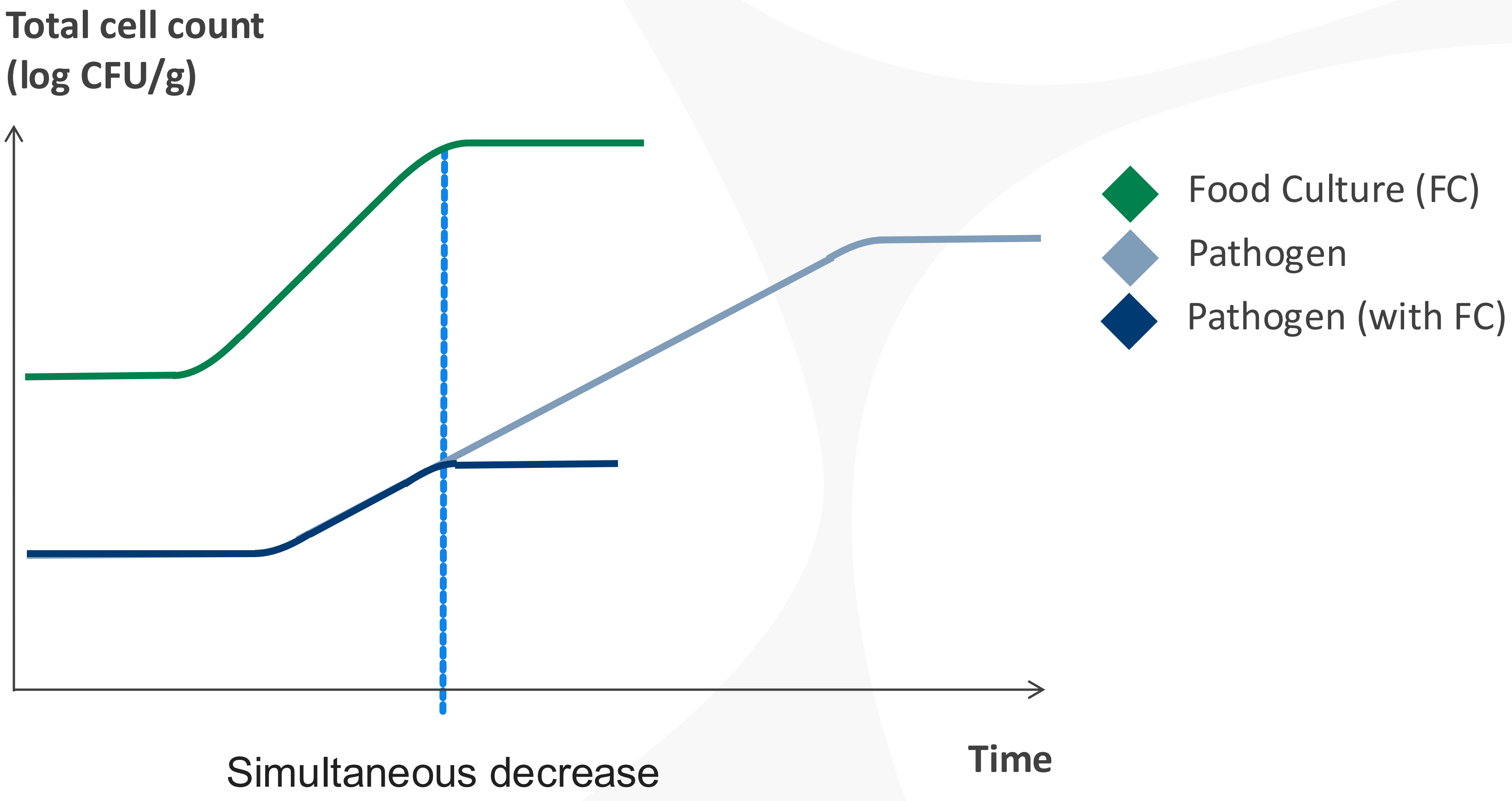
Competition for space / Jameson effect



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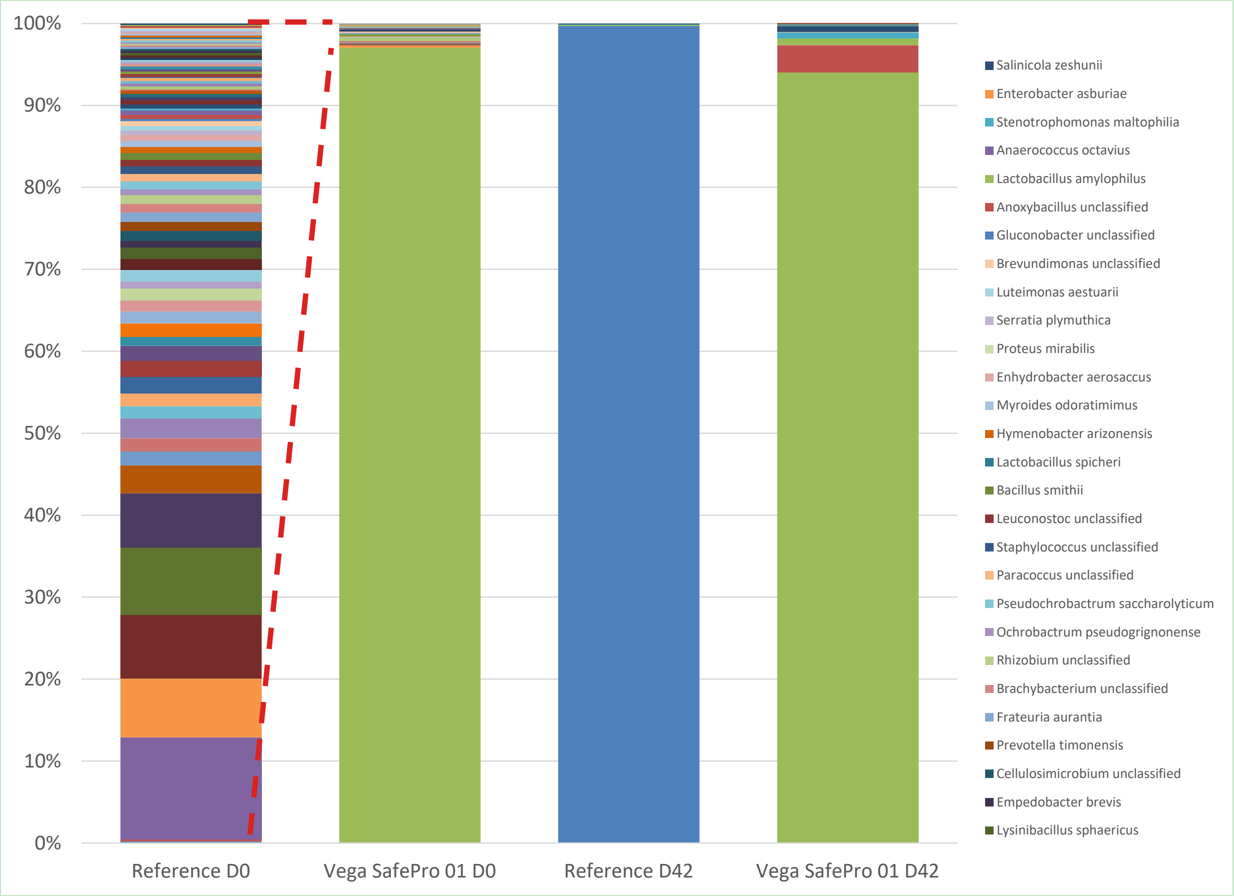
Adding SafePro® 01 culture mimics the natural process of “bacterial selection” and can help increase shelf life

METAGENOMIC ANALYSIS OF ENTIRE MICROBIAL ECOSYSTEM IN THE PRODUCT STORED AT 8 °C

Percentage of bacteria



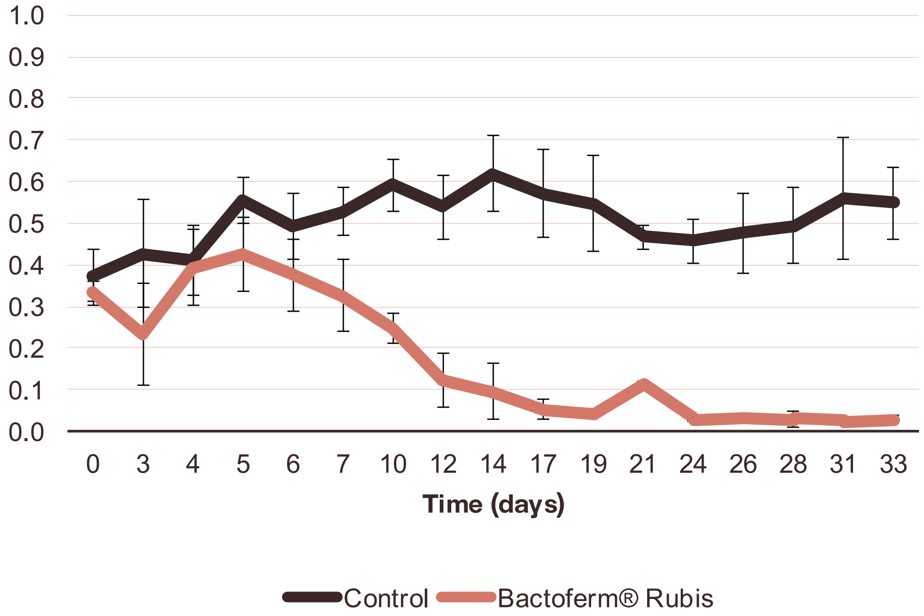
SOY-BASED CHICKEN STRIPS

Product packed in MAP with 70% N2/30%CO2

Competition for nutrients

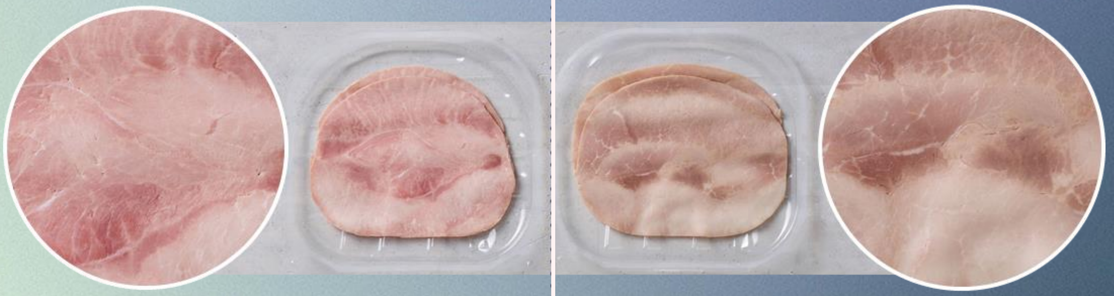
Residual oxygen (O_2) in packages

O_2 concentration (%) in modified atmosphere packed cooked ham.*



Color comparison of cooked ham

Cooked ham packaged under modified atmosphere and stored at 7°C for 7 days – 3 days in the dark and 4 days under light.



With Bactoferm® Rubis

Without Bactoferm® Rubis

* (50% CO_2 /50% N_2) mean and standard deviation, n=5.

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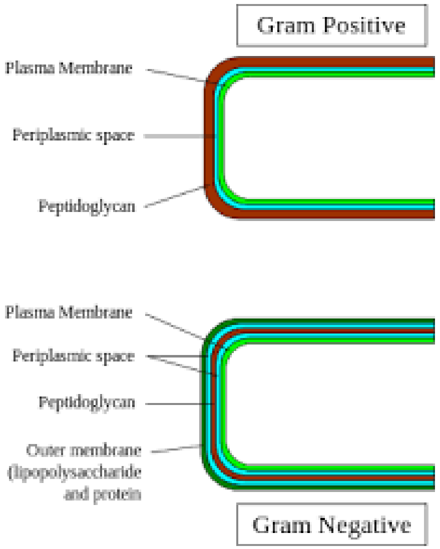
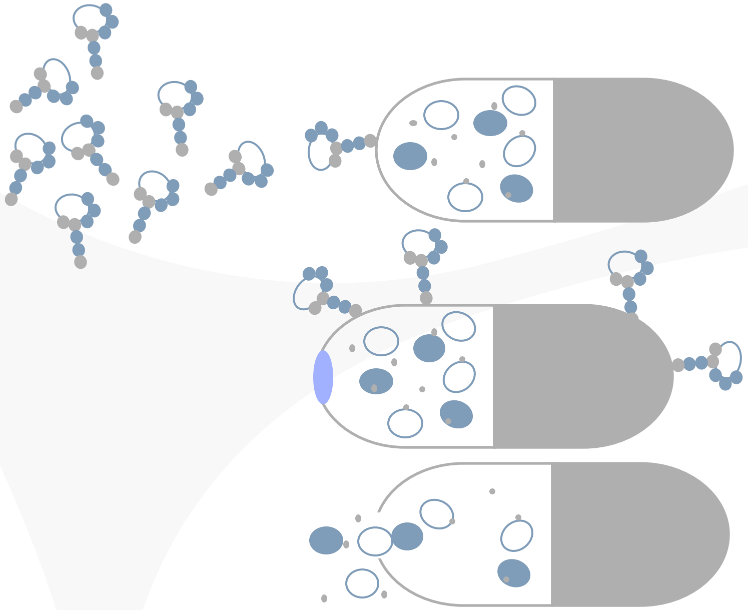
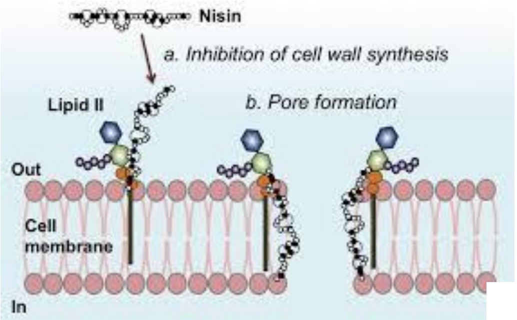
Production of inhibitory molecules

- Inhibitory molecules
  - Small antimicrobial peptides
  - Pore formation (breaking cell membrane)
  - Only Gramm positive
- Inhibits Listeria monocytogenes

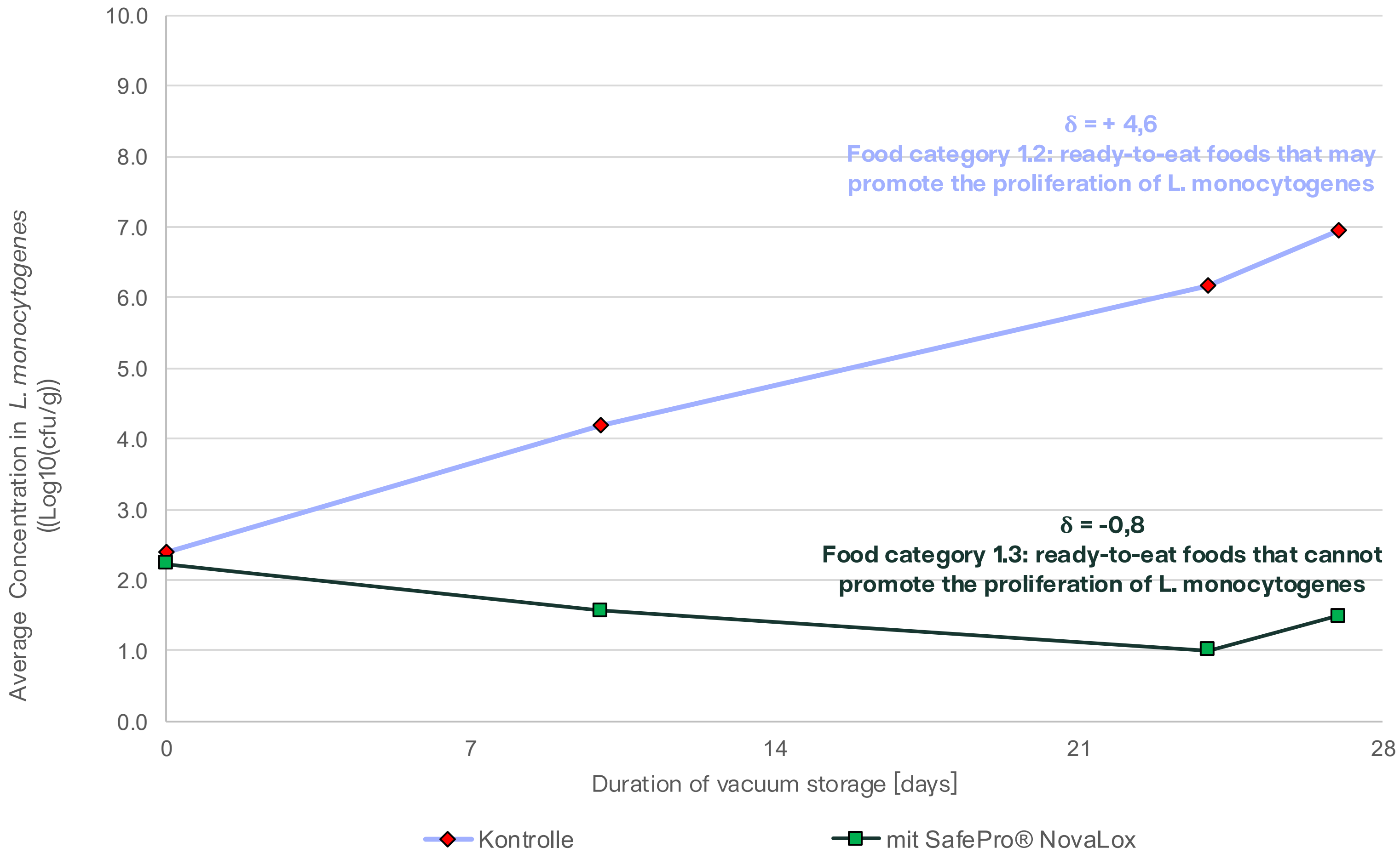






- **Other metabolites: organic acids, Diacetyl, Peptides …**

Smoked salmon hand-salted SafePro®NovaLox spray application on the slicer



Challengetest gemäß "EURL Lm TECHNICAL GUIDANCE DOCUMENT for conducting shelf-life studies on Listeria monocytogenes in ready-to-eat foods"
(version 3 of June 6, 2014; Amendment 1 of February 21, 2019)
Zusatz SafePro®NovaLox über Sprühanwendung während des Slicens; Vakuumlagerung über 27 Tage bei +8°C

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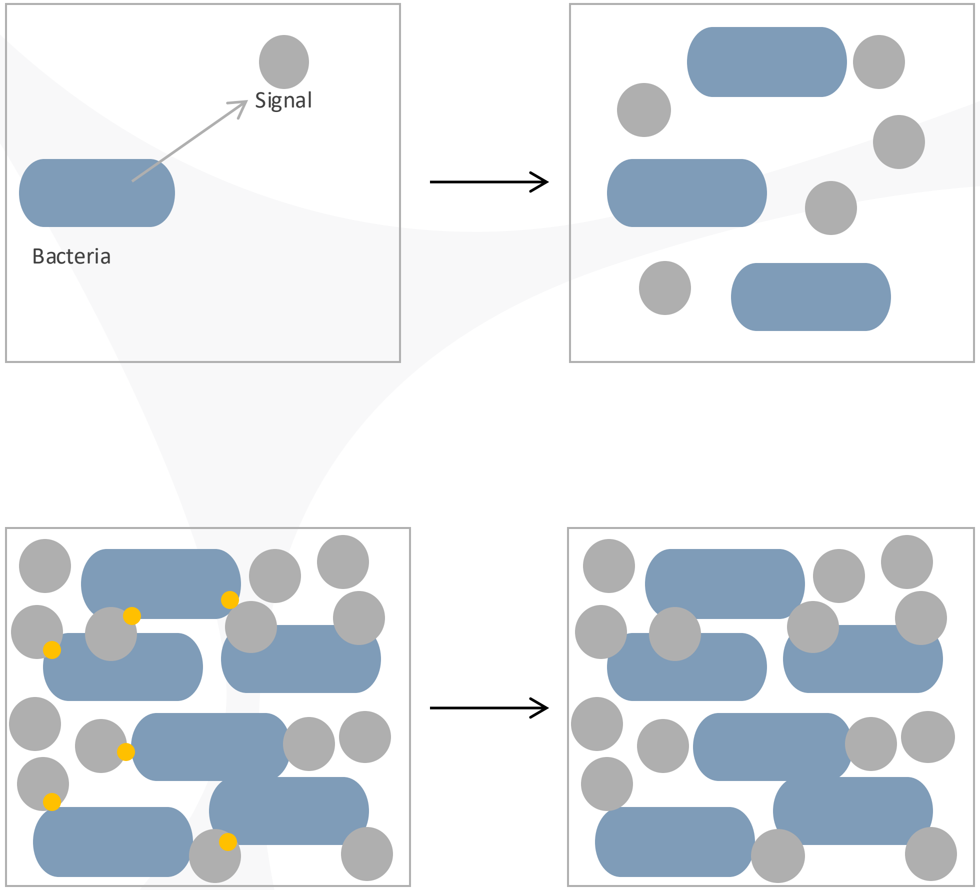
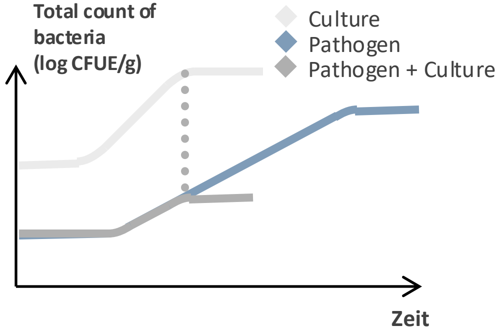
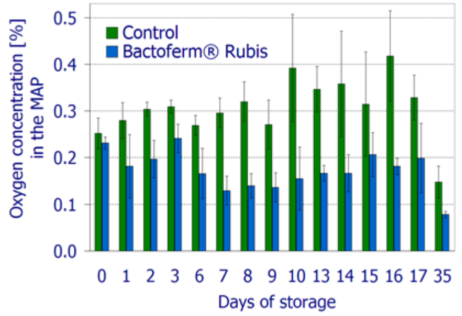
Quorum sensing – Cell to Cell comunication

- Quorum Sensing
  - Synthesis : Mediator-molecules were produced
  - Activates production of specifical genes
    - Positive effect on the growth of bacteria
  - Sustainable formation of biofilm (optimization of house flora)



Four Mechanism are of relevance





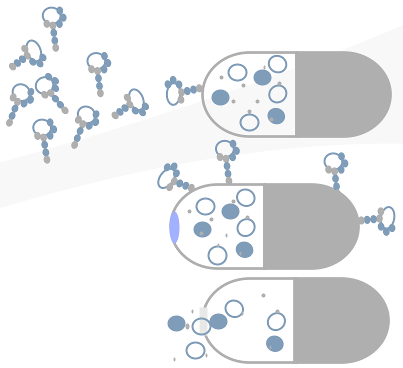
Competitive exclusion
Dominant culture taking space

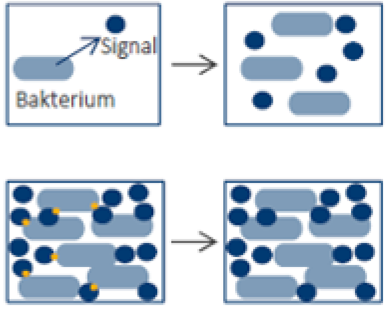
Nutrient
Culture consumes e.g. carbohydrates, minerals, oxygen etc.

Food Protection

Metabolism
e.g. organic acids, peptides etc.

Quorum sensing
cell-to-cell communication





CULTURE INSIDE!

Transparent labelling - examples from European retail

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Dirk Hoffmann

Senior Account Manager
Meat & Prepared Food

PHONE
+49 170 371 77 46

E-MAIL
diho@novonesis.com

WWW
www.novonesis.com