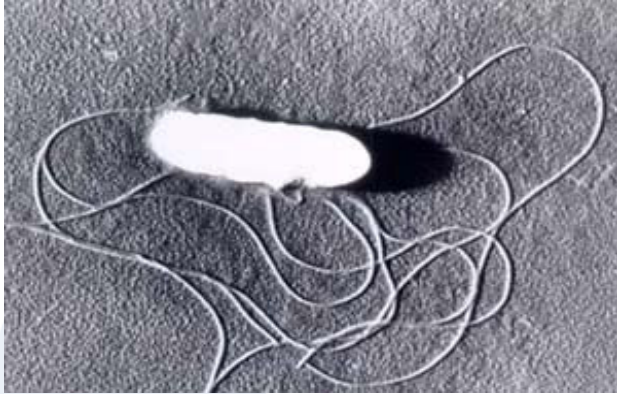


# Controlling *Listeria Monocytogenes* in Canadian Meats



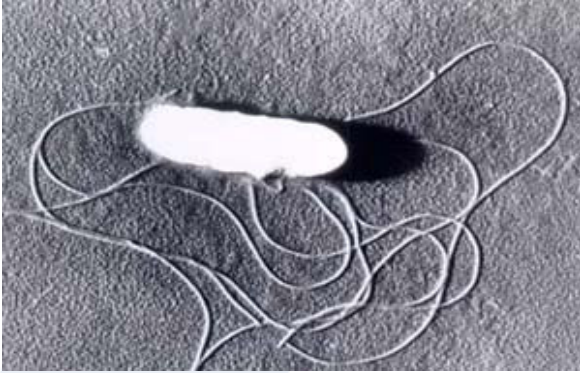
Lee Galligan

# *Listeria monocytogenes*



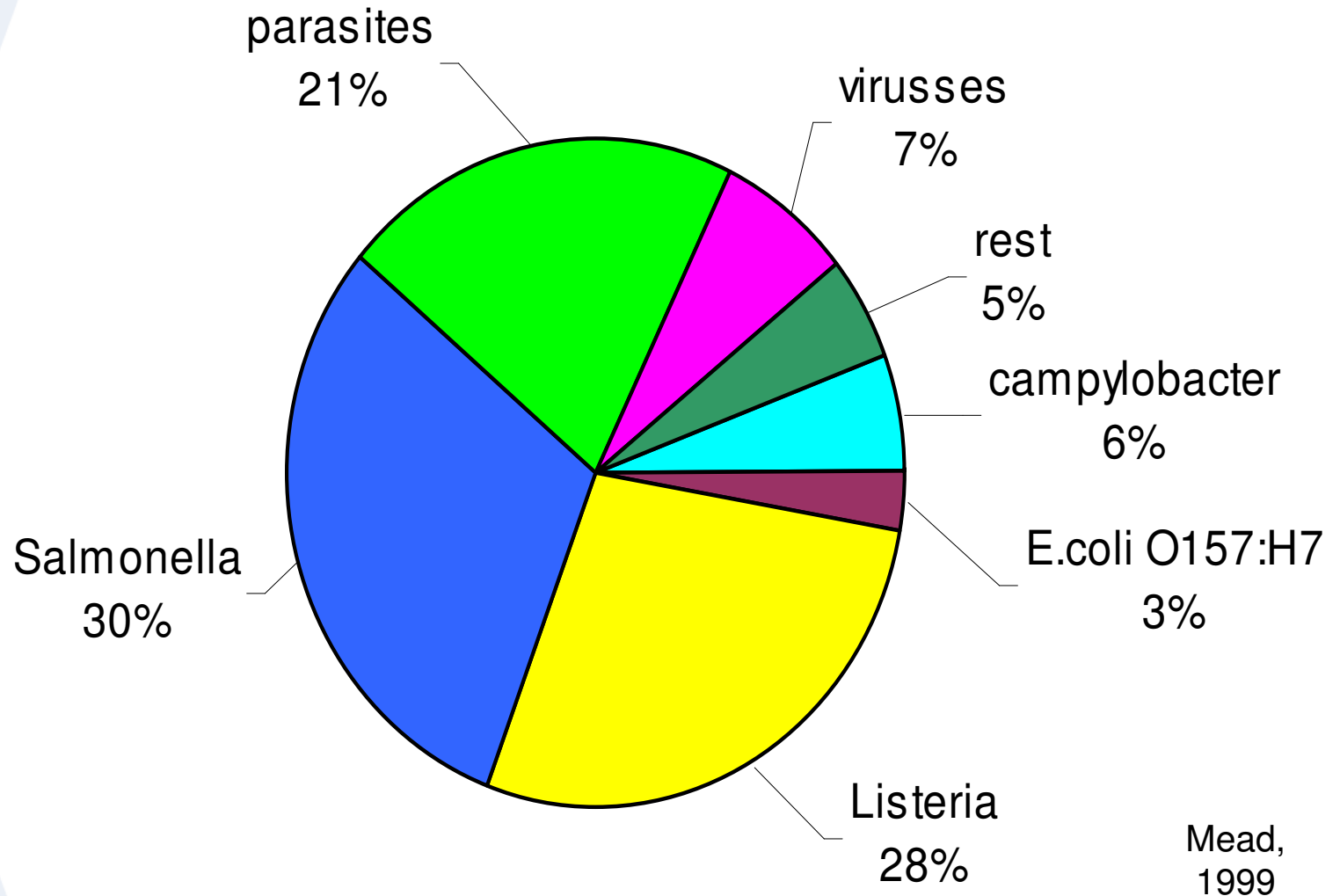
- Facultative anaerobic, Gram+ bacterium
- Many different L.m. serotypes and some are pathogenic
- Ubiquitous to nature (soil, water, vegetation, animal feed, food contact surfaces, slaughterhouse wastes, raw salmon, etc)

# *Listeria monocytogenes*



- It grows in refrigerated temperatures as low as 0°C and up to 13% NaCl
- Mortality rate is high in infections of the invasive form. People at risk are pregnant women, AIDS, transplant and cancer patients, young children, fetuses and the elderly.
- Listeriosis requires infection by a large number of organisms.

# Deaths caused by food-borne pathogens



**Listeria: Low incidence rate → high fatality rate**

## So what can we do?

- *Listeria m.* is everywhere
- Listeriosis has a high mortality rate
- *Listeria m.* can grow in high salt conditions and at refrigerated temperatures down to 32 F

**Go with what works!**

**Go with interventions that have been well documented for efficacy.**

**There is very good news to report!**

**On Saturday September 20<sup>th</sup>**

**Sodium diacetate**

**will be published in the gazette and  
therefore approved for use in cooked  
meat and poultry products.**

# *Opti*.Form

- **Optimum Formulation of**
  - Natural sodium or potassium lactate and
  - Sodium diacetate
- **Unique balance of flavor and effectiveness**
- **Neutral pH**
- **Bacteriostatic properties**  
**(ongoing suppression of pathogen growth)**
- **Available as a Liquid or Powder**

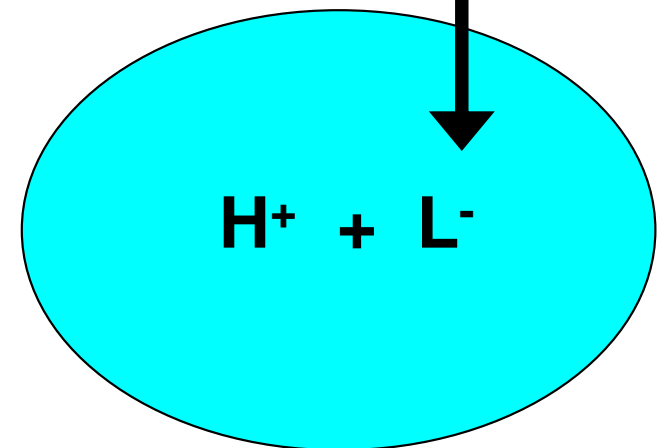
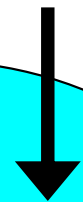
# The Antimicrobial Effects of *Opti-Form*



# *Opti-Form* MODE OF ACTION

## Internal Cell Acidification

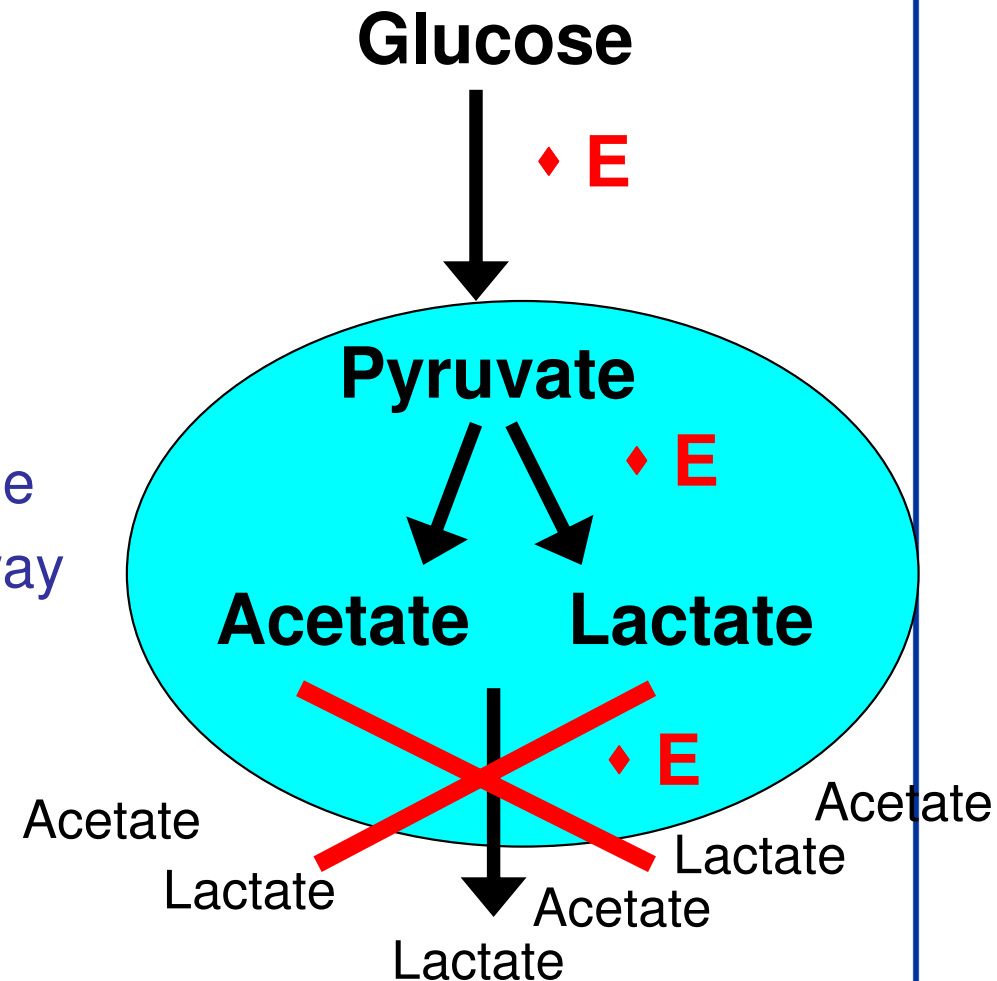
- Lactate and sodium diacetate is in equilibrium with Lactic Acid and acetic acid
- Undissociated lactic acid and acetic acid penetrate into organism
- Acids dissociate, resulting in a lower internal pH of the cell
- Cell needs energy to raise the pH
- Cell stops growing and multiplying



# *Opti-Form* MODE OF ACTION

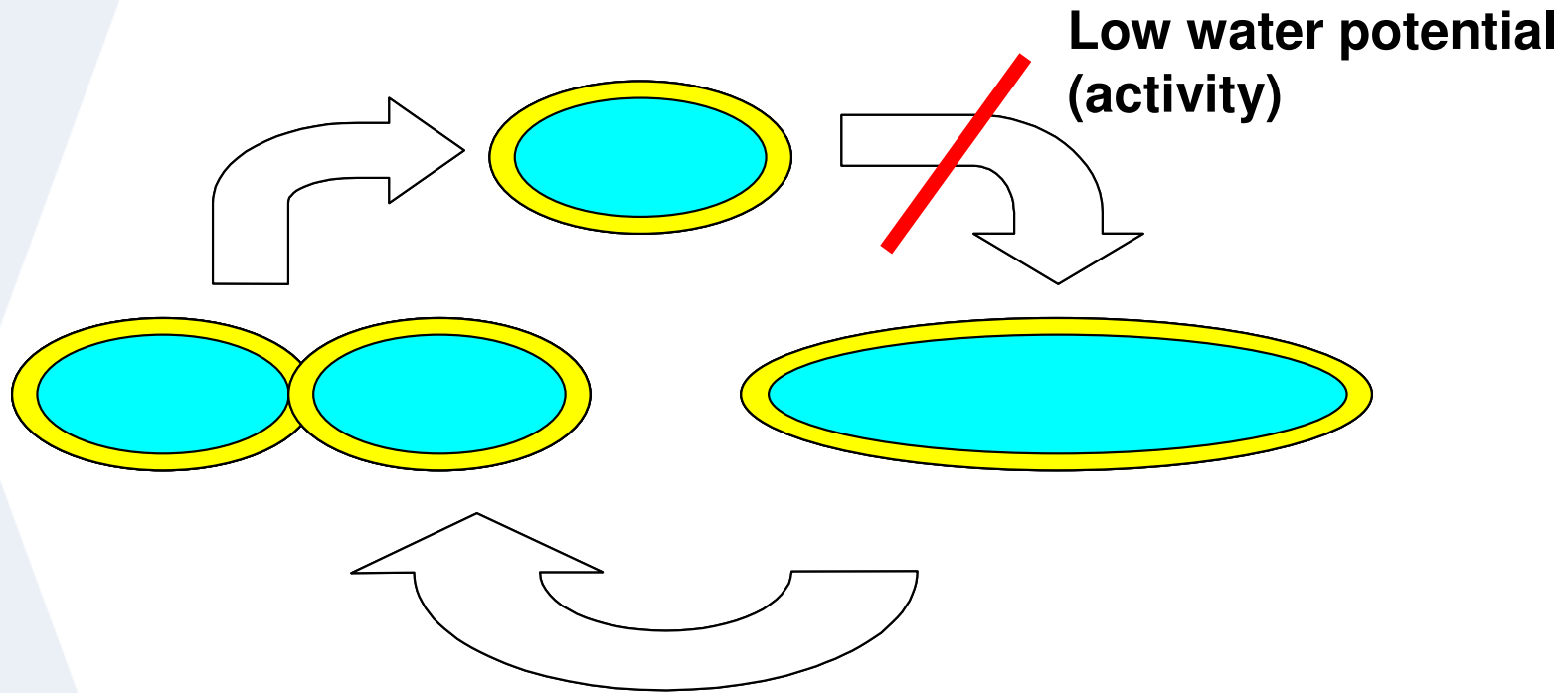
## Feed Back Mechanism

- Micro organism derives energy from glycolysis (energy metabolism)
- Due to concentration of lactate or acetate outside the cell, the proton pump pathway is blocked
- Slows down glycolysis (interference with energy metabolism)



# *Opti-Form* MODE OF ACTION

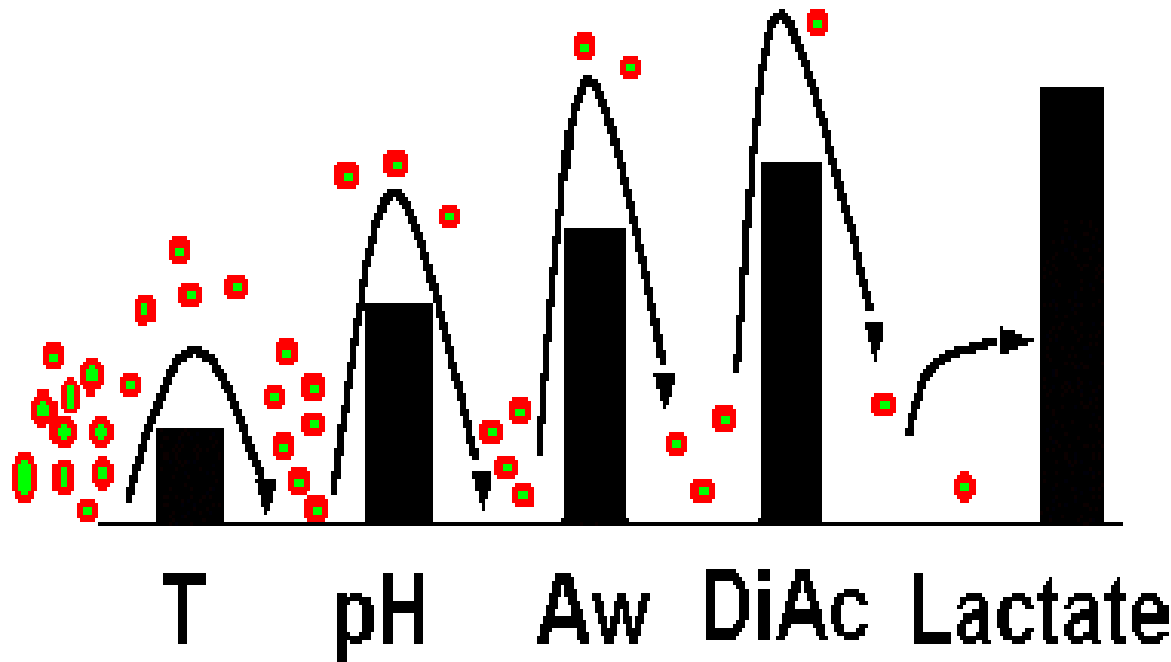
## Reduces water activity



- Lower water potential ( $\Psi$ ) leads to lower turgor pressure. High turgor pressure is essential for cell growth and cell division

$\Psi = \Psi_s + \Psi_p$  ( $\Psi_s$  : solute part,  $\Psi_p$  : hydrostatic pressure part/turgor pressure)

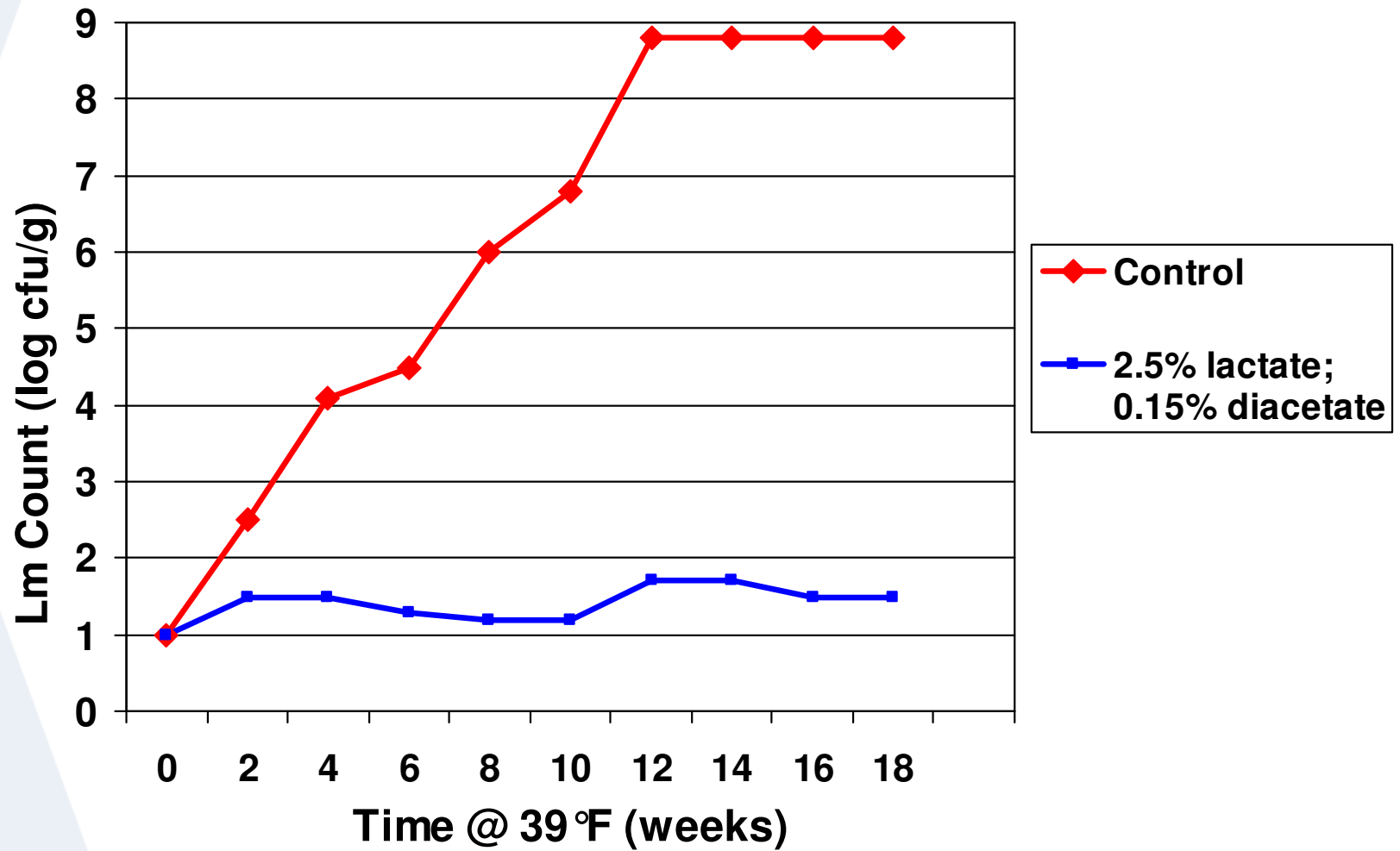
# Food Preservation Multiple Hurdle Technology



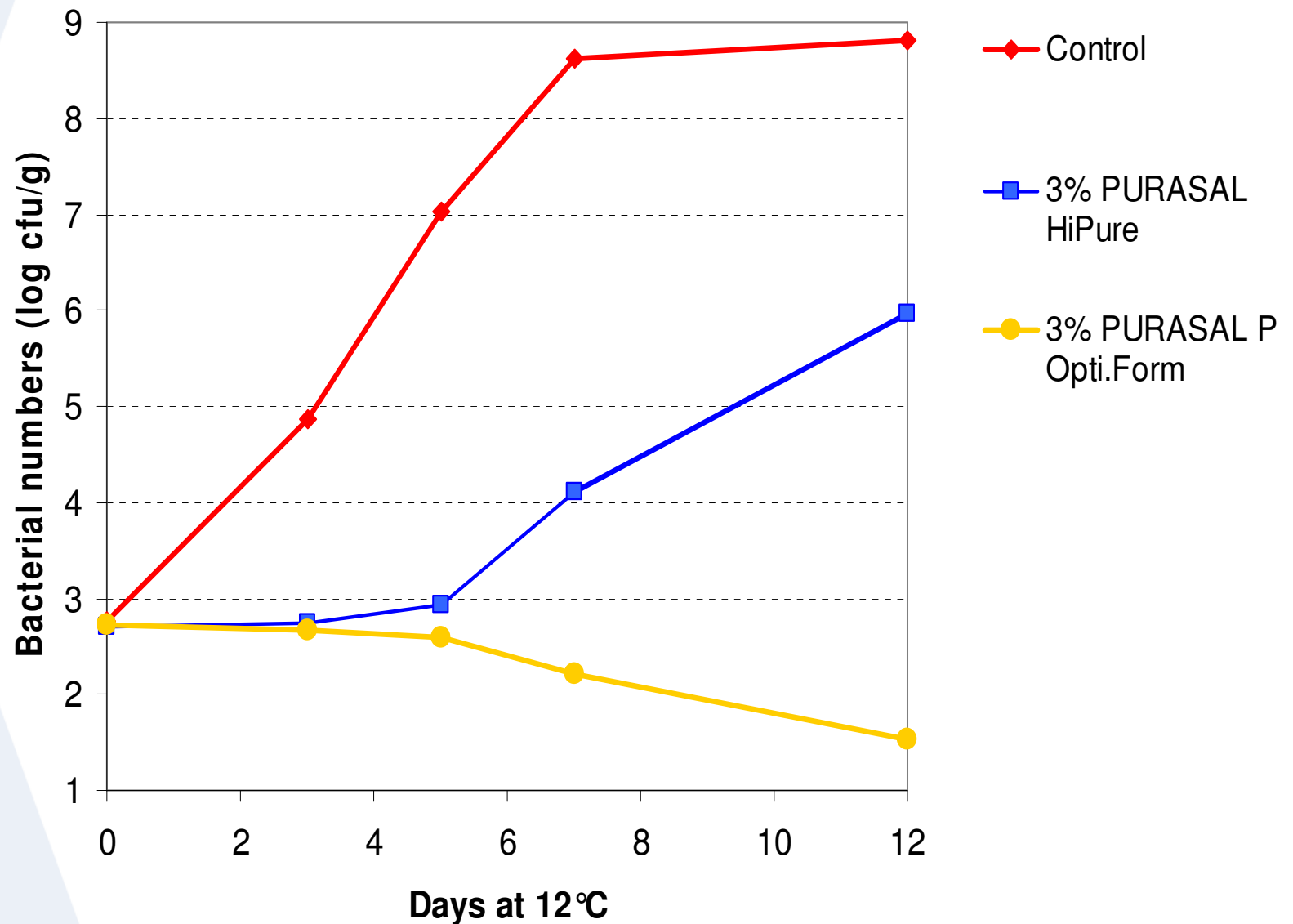
- Each hurdle affects the growth of micro organisms
- More hurdles means more restrictions for bacteria growth
- Many small hurdles contribute to protecting food safety

**PURASAL**  
*Opti.Form*

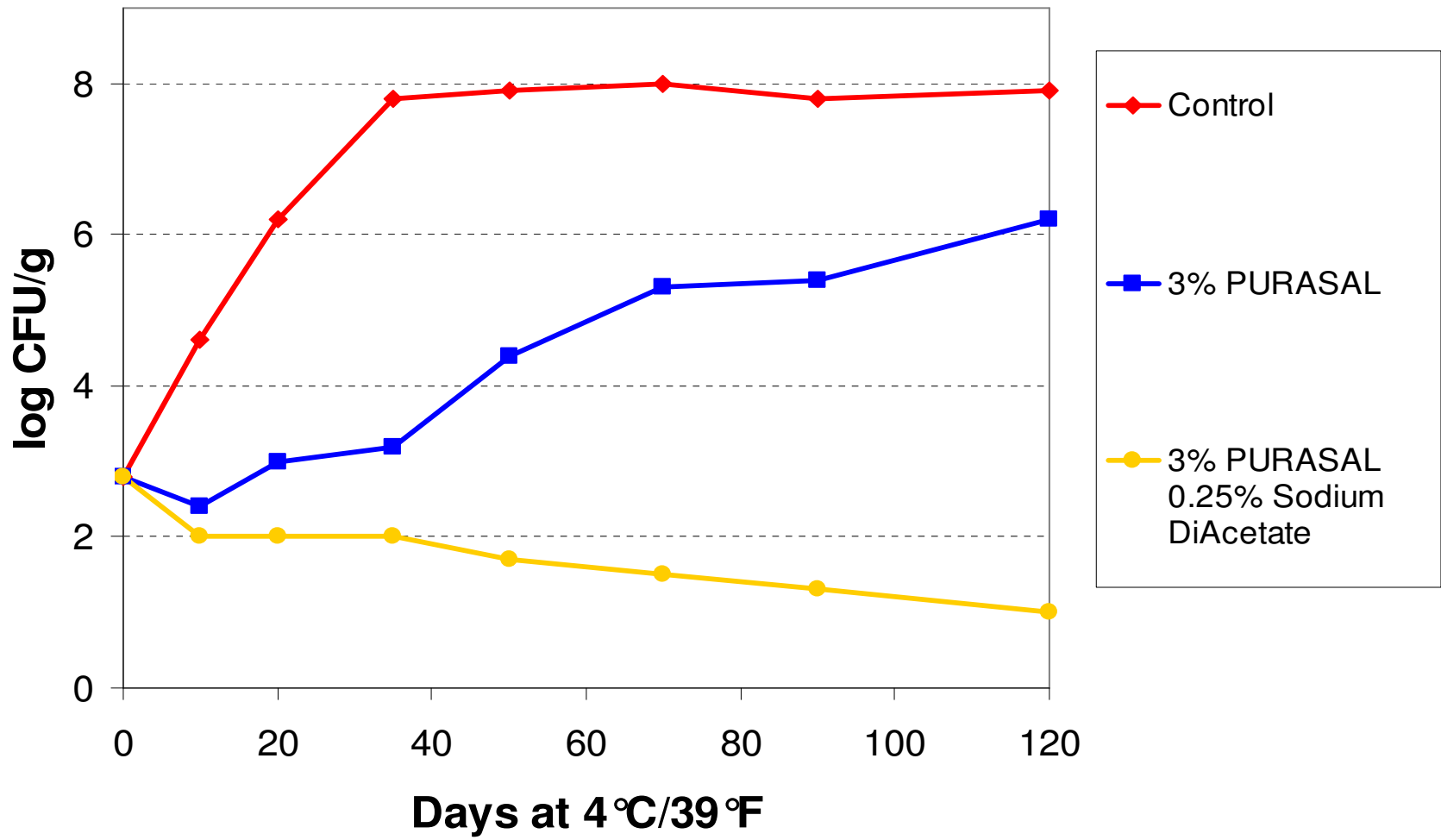
# Effect of Lactate and Diacetate on *Listeria* in Ham



# Effect of *Opti-Form* on *Listeria* in uncured cooked sausage



# Effect of *Opti-Form* on *Listeria* in Frankfurters



# 2007 Model for Cured and Uncured meats



## Opti.Form® Listeria Control Model 2007



- :: [Run the Model](#)
- :: [About the Model](#)
- :: [About PURASAL Opti.Form](#)
- :: [Product Information](#)
- :: [Regulations](#)
- :: [FAQ](#)
- :: [Literature](#)
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- :: [Contact Us](#)

Includes latest new products  
*Opti.Form* Vinegar  
and Highly concentrated  
PURASAL *Opti.Form* PD Plus

[Download Adobe Reader](#)



*Opti-Form.com*



# Listeria Control Model 2007

- Mathematical model to simulate *Listeria m.* growth in cooked meat products
- Variables;
  - Lactate concentration
  - Storage temperature
  - pH
  - Salt content
  - Moisture content
  - Cured or uncured
  - Initial count of *Listeria*
- Validated with 30 application studies

# New features



## Opti.Form<sup>®</sup> Listeria Control Model 2007

**PURAC Ingredient**  
Select PURAC ingredient: **PURASAL HiPure P Plus** (dropdown menu)  
HiPure P Plus (%w/w):  [datasheet](#)

**Finished Product Data**  
Name:   
Temperature (°C):   
pH:   
Salt (%w/w):   
Moisture (%):   
Product contains nitrite:

**Microorganism Data**  
Initial level (Log numbers):   
Maximum level (Log numbers):

### Growth of *Listeria monocytogenes*

Time (days)	95 % confidence (log N)	90 % confidence (log N)
0	1.0	1.0
10	1.1	1.0
20	1.2	1.0
30	1.4	1.1
40	1.6	1.2
50	1.8	1.3
60	2.0	1.4
70	2.2	1.5
80	2.4	1.6
90	2.6	1.7

“Uncured products”

(100 ppm ingoing cured)

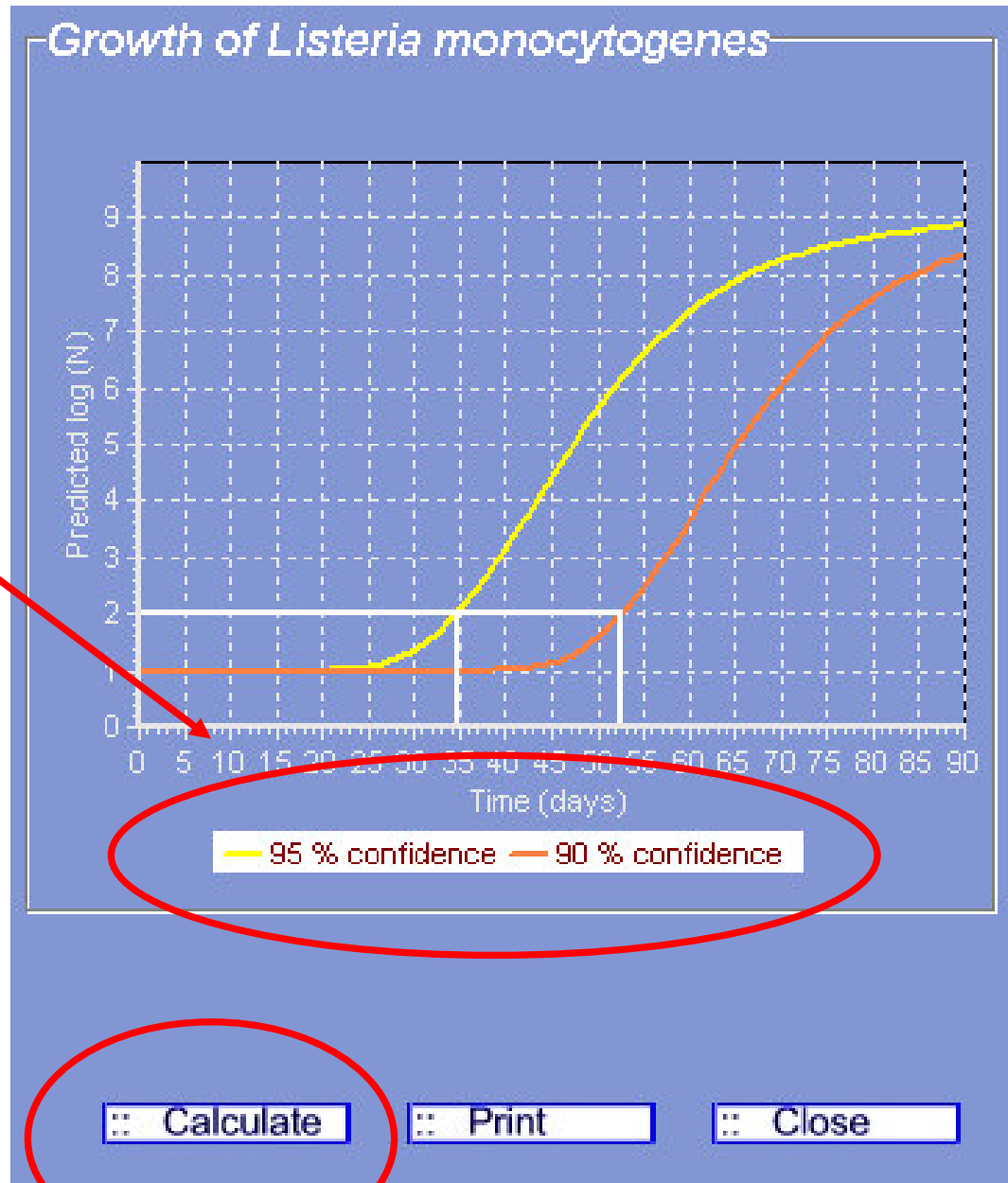
Includes latest introductions;  
**Opti ■ Form<sup>®</sup> Vinegar,**  
**Opti ■ Form<sup>®</sup> Powder, P Plus and**  
**Opti ■ Form<sup>®</sup> Ultra**



# Confidence levels

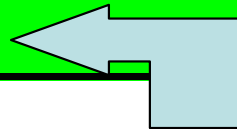
Estimate on a  
90% and 95%  
confidence  
level

“Press  
calculate”



# Product Line

Benefit	Product	Description	Flavor
Shelf life extension	PURASAL S	Sodium lactate	Mild saline
	PURASAL HiPure P PLUS 78% Assay	Potassium lactate	Neutral
	PURASAL Lite	Sodium & potassium lactate blend	Balanced
Food safety	PURASAL Opti.Form <b>Vinegar</b>	Potassium lactate and vinegar	Mild vinegary
	PURASAL Opti.Form SD4 <b>ULTRA</b>	Lactate and sodium diacetate blends	Mild / neutral (best liquid flavor profile)
	PURASAL Opti.Form PD4 <b>ULTRA</b>		
	PURASAL Opti.Form Lite <b>ULTRA</b>		
Powders	PURASAL S 100 Powder	Sodium lactate	Slight salty
	PURASAL Opti.Form Powder	Sodium lactate and sodium diacetate	Mild salty vinegary
Pathogen killer	<b>Protect M</b>	Lauric Arginate (not yet approved in Canada)	Flavorless liquid



- **GRAS, surface treatment, derived from coconuts, palm oil and arginine (an essential amino acid)**
- **Provides kill of gram positive and gram negative organisms**

# Conclusions

- *Listeria monocytogenes* is a bad bug
- Ongoing suppression is critical to controlling outgrowth of Lm
- Lactates and *Opti-Form* provide ongoing growth suppression of pathogens
- Food safety should be non-competitive, consider different alternative interventions.
- Food safety is everyone's job!

**Do you know where your lactates come from. Are they "Made in China"? Are you sure?**

# Thank you!

**Lee Galligan**  
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**WWW.PURAC.COM**

