Emerging Techniques for Pathogen Control

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Log10

Fairy Dust or Unicorn Horn

PROBIOTICS

Probiotics

- *Lactobacillus*
- *Bifidobacterium*

- Competitive Inhibitors
  - Space and nutrients
  - Acids, peroxides, extracellular molecules

They Do Other Things!!!

Protein

Lipids

Rna

Carbohydrates (EPS)

Every food manufacturing facility has biofilm.

Dna

Ions

Water

BIOFILMS

Every food manufacturing facility has a control strategy.

Cleaning and Sanitation Programs

BIOFILMS

Biofilm Control

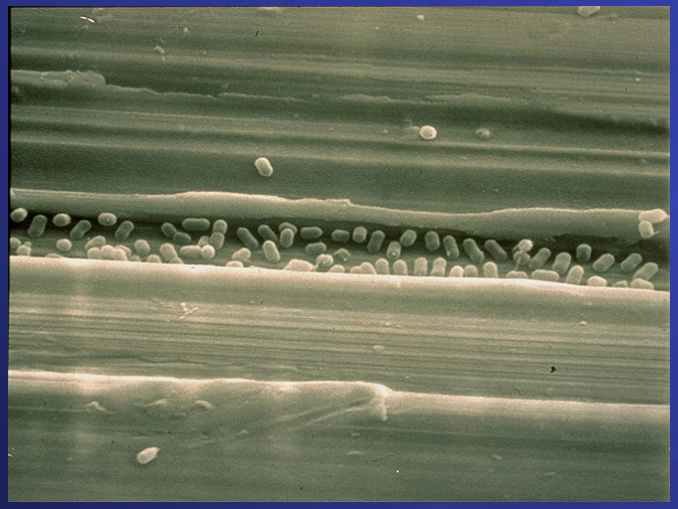
Detergents

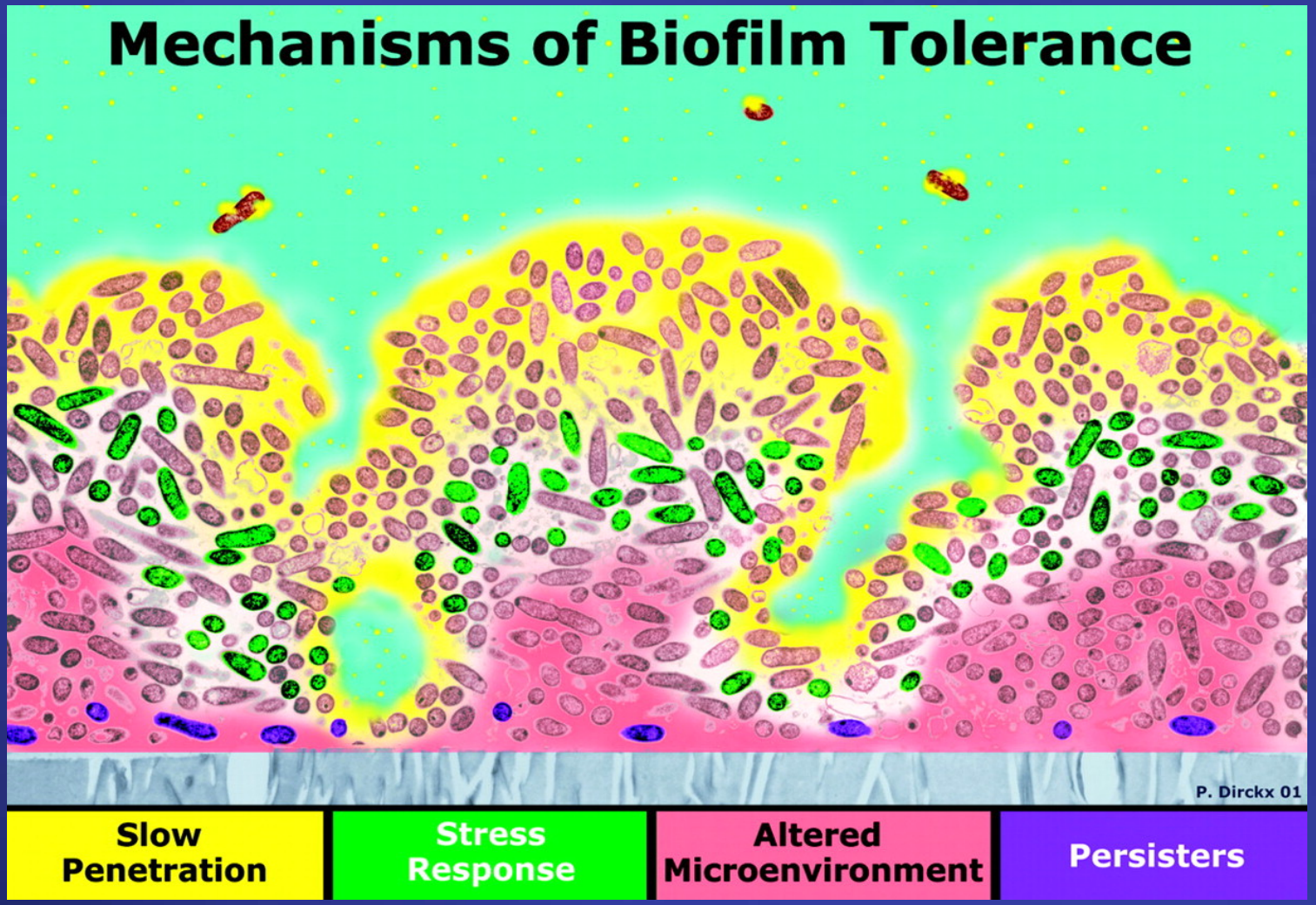
- Time, Temperature Agitation

Sanitizers

- Time, Temperature, Agitation

Biofilm Control





Jason D. Chambless et al. Appl. Environ. Microbiol. 2006;72:2005-2013

Applied and Environmental Microbiology

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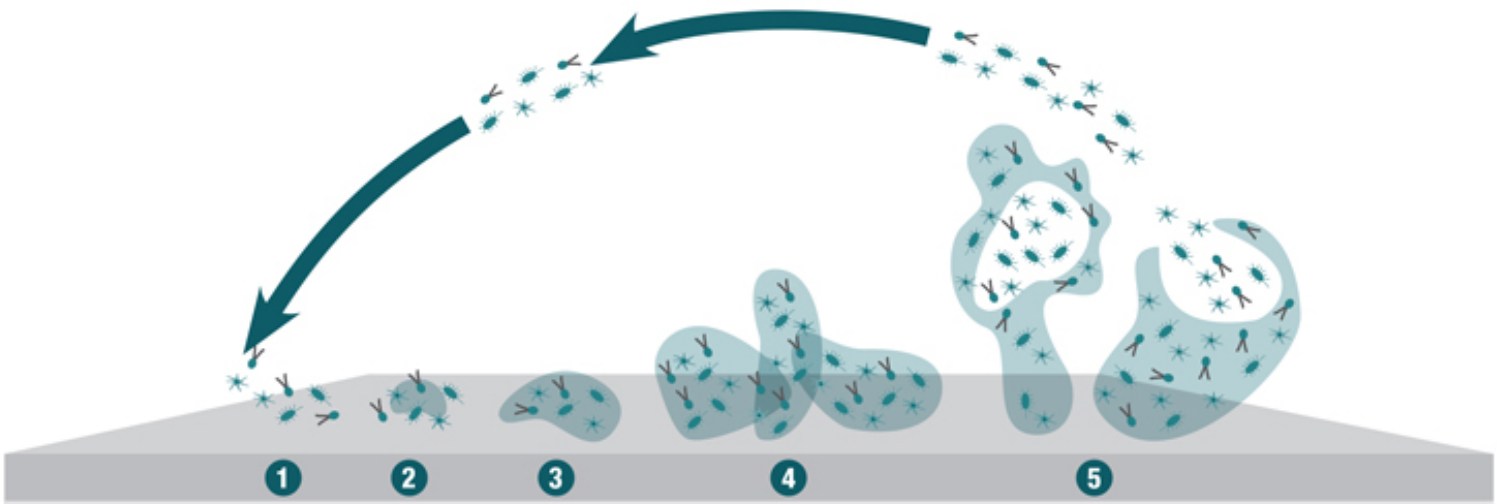


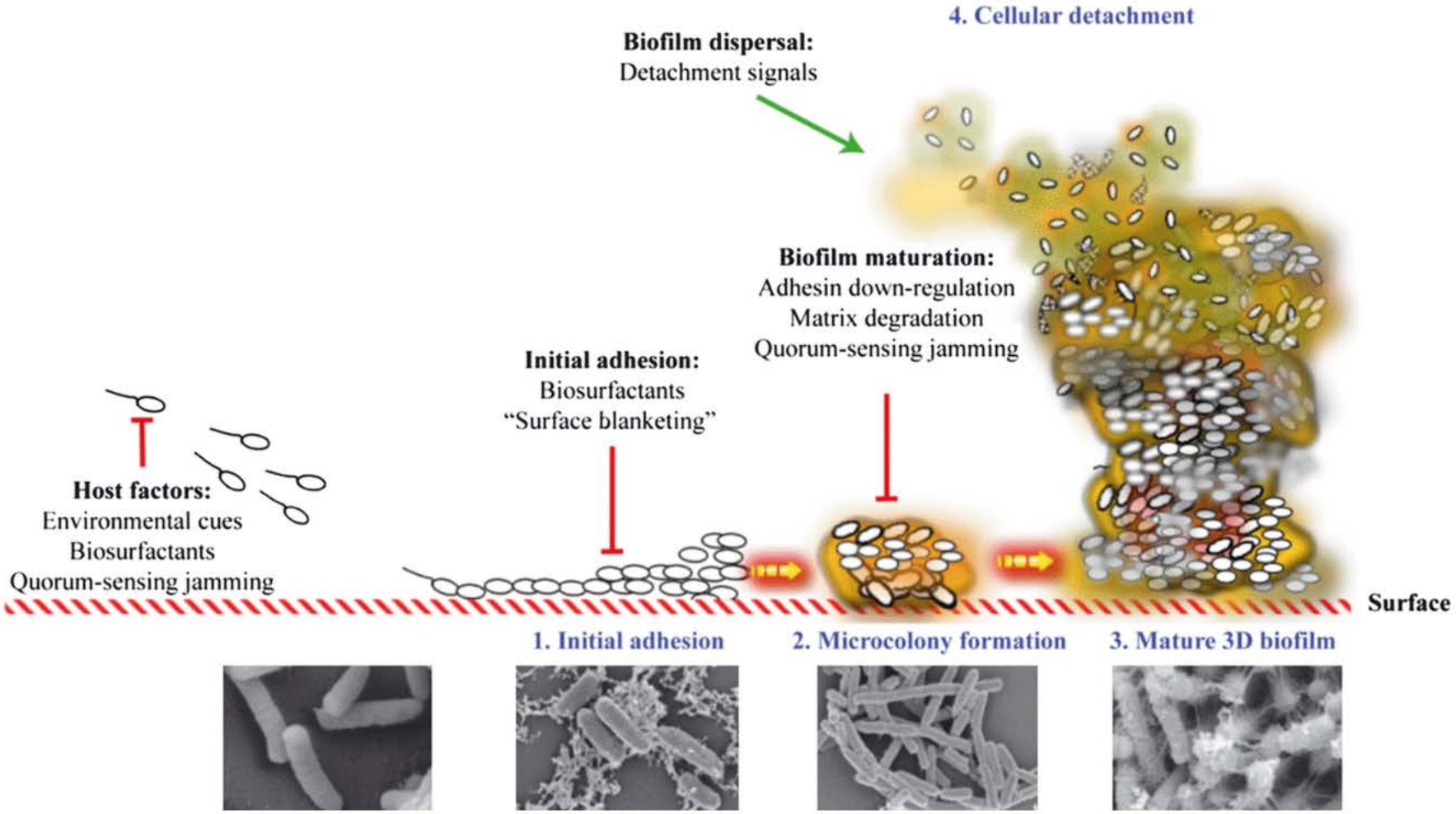
The life cycle of a biofilm consists of several events occurring in the following timeframes:

EVENT:	TIMEFRAME:
1. Bacteria adhere to a surface	Reversible, continuous
2. Attached bacteria divide and begin to excrete extracellular matrix	Within seconds to minutes
3. The matrix-cell mixture expands, forms architectural features of biofilms	Minutes to hours
4. Further expansion and microbial growth	Days
5. Dispersion of planktonic bacteria	Days to weeks

Source: www.oraclinical.com

BIOFILMS

Superficial Complexity: The Significance of Gastrointestinal Microbial Biofilms
http://www.cpmedical.net/newsletter/superficial-complexity



Multi-species biofilms: how to avoid unfriendly neighbors | FEMS Microbiology Reviews
http://femsre.oxfordjournals.org/content/36/5/972.figures-only

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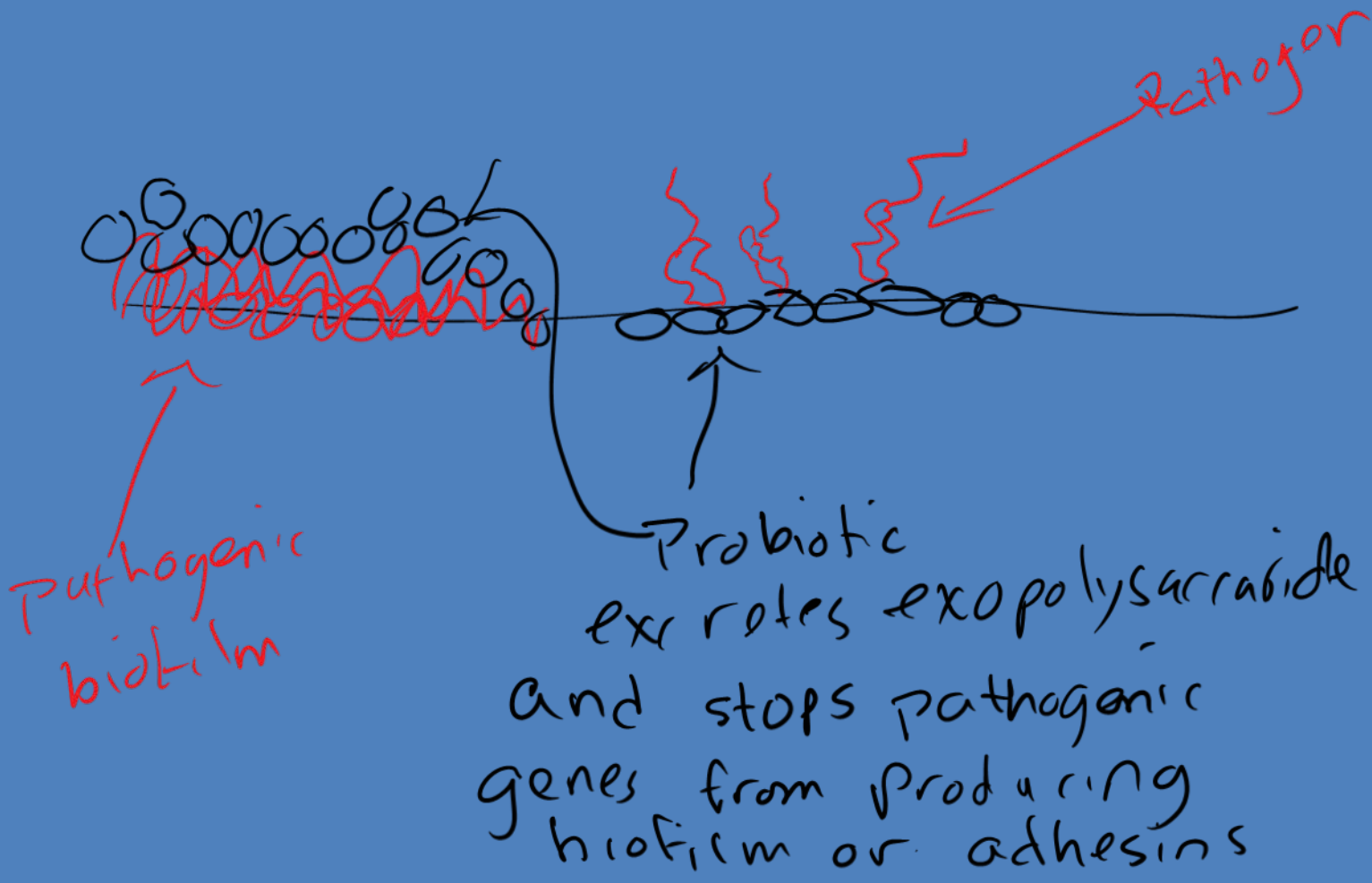
blanketing, the mechanism that can take place is by simply populating the food contact surface and preventing the pathogen from making the bond by taking up all the space.

initial inhibition, if the population is/was there and excreted of “anti-adhesion molecules” that change the molecular charge or the hydrophobicity of the surface preventing pathogen binding.

***Lactobacillus* biosurfactant production**, the "slippery detergent" that changes surface tension and thus allowing the surface to become wet and allow for dispersion of old biofilm or prevent pathogen adherence by letting them slide away, and not have time secrete their own biofilm or dissolve it as it was being produced.

Exopolysaccharide (EPS) production, or also known as anti-adhesion polysaccharides, can modulate the expression of pathogen genes that produce biofilms or surface adhesins. Especially Bifidobacterium, which also may use this EPS to build its own biofilm.



Dry Blend, food grade

Food Product

Human/Animal

Bifidobacterium

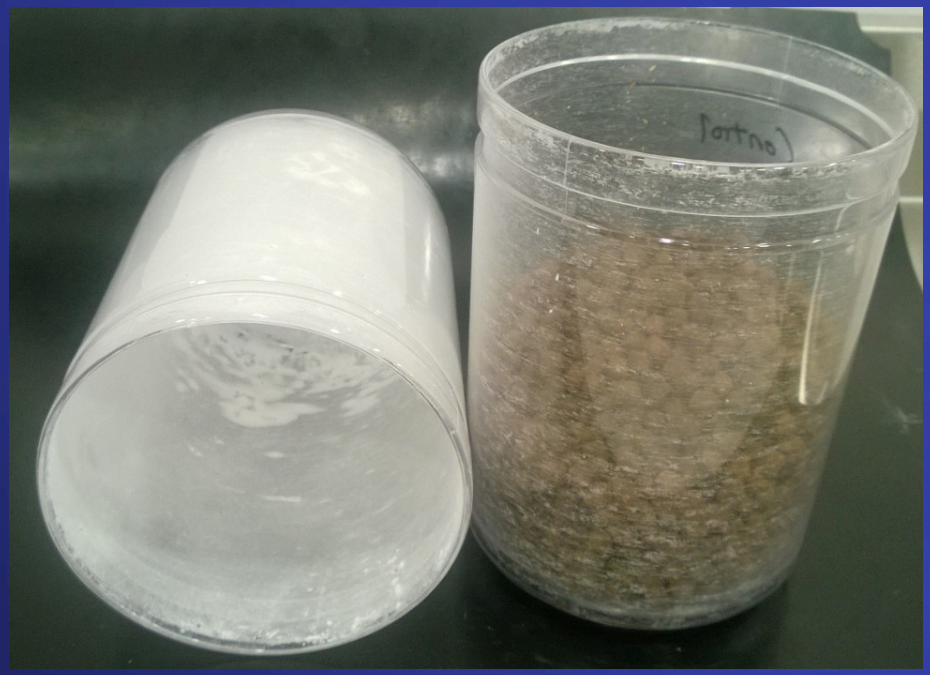
Lactobacillus

Prebiotic

Environment

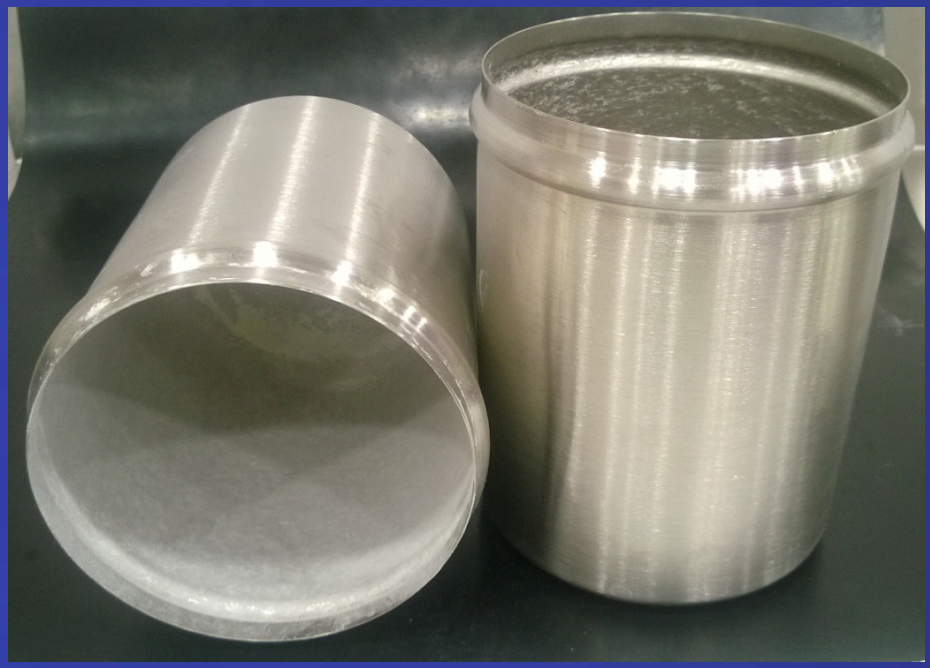
In the Laboratory-Food Contact Surface

- Food Grade Plastic



- *Salmonella* biofilm
- 1000 CFU/ml

- 304 SS



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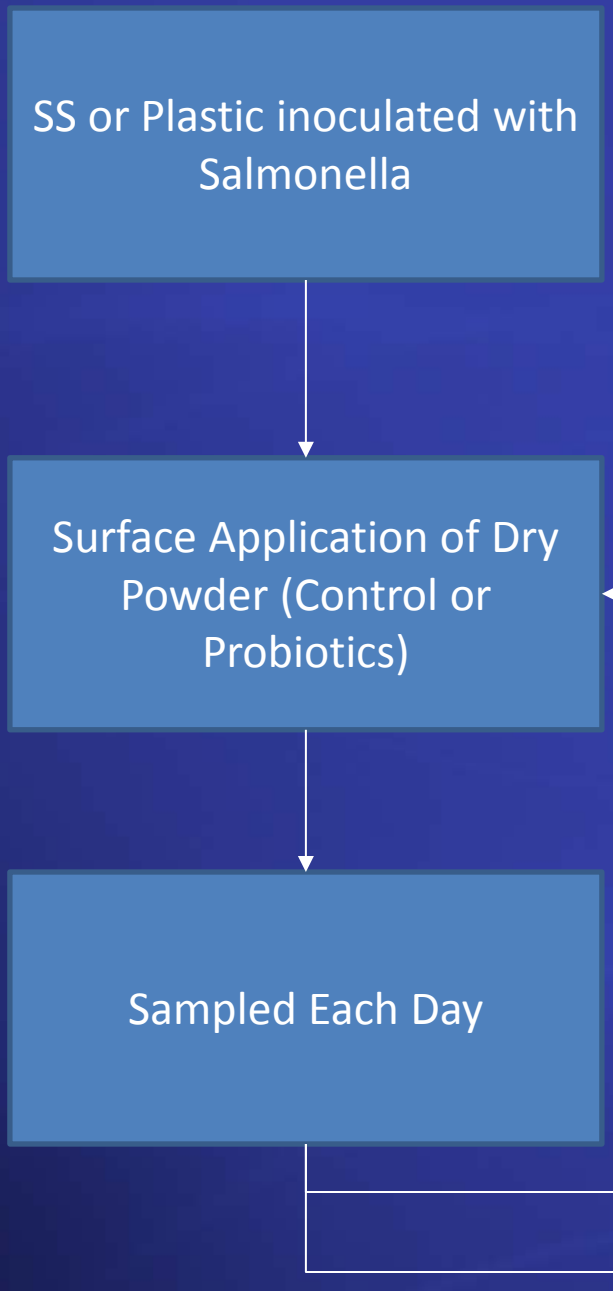


Let biofilm develop overnight at room temp

Added about 3.8 grams of dry product containing:

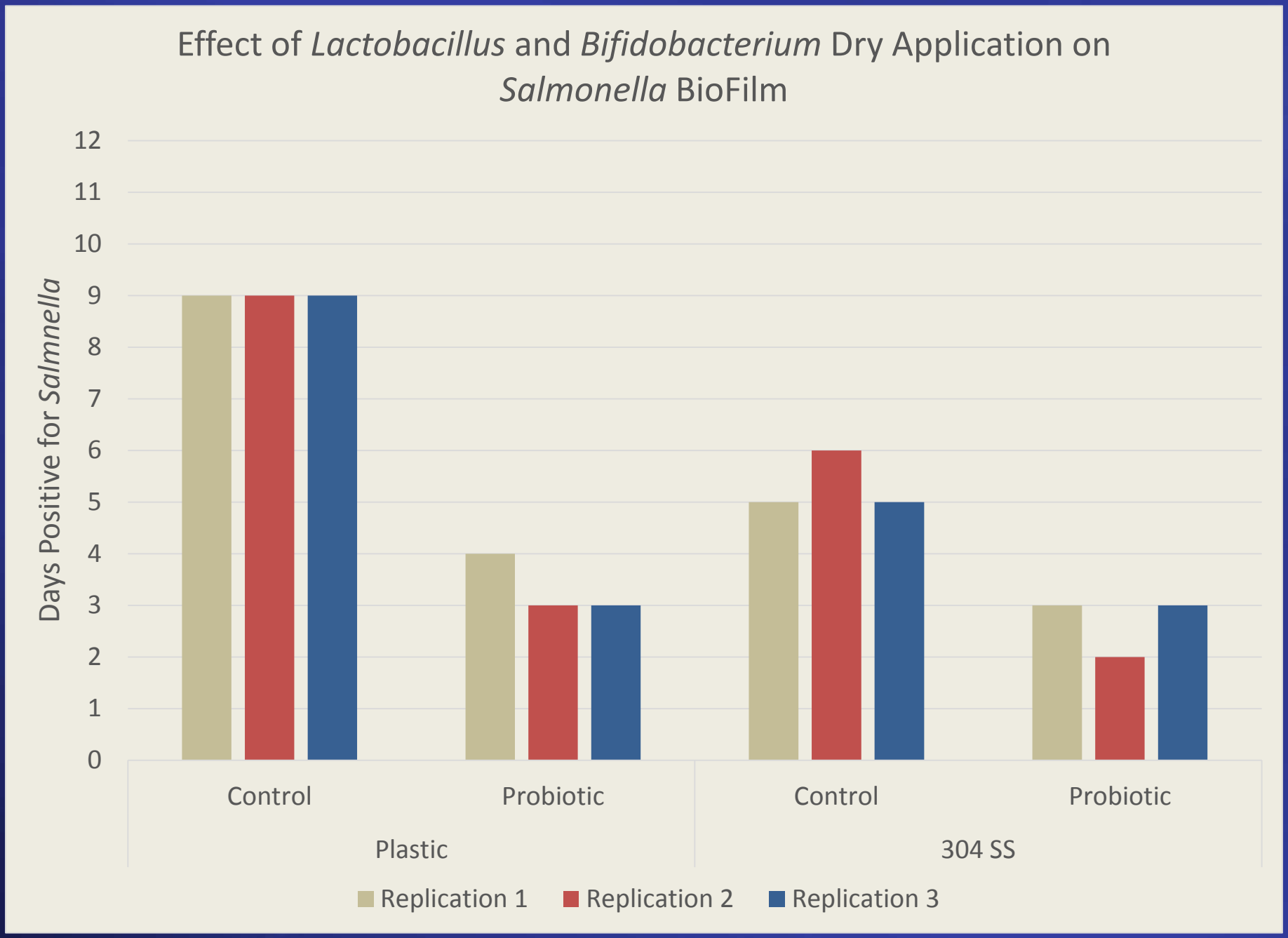
1) None
2) 1.0×10^{10} CFU/g Lactobacillus and Bifidobacterium

Applied and left overnight at room temp

Added 454 grams of sterile food kibble to wipe biofilm:

1) Everyday
2) Used all 454 grams for enriching
3) Used AOAC and FDA methods

In the laboratory


Effect of Lactobacillus and Bifidobacterium Dry Application on Salmonella BioFilm
Days Positive for Salmnella
12
11
10
9
8
7
6
5
4
3
2
1
0
Control
Probiotic
Control
Probiotic
Plastic
304 SS
Replication 1
Replication 2
Replication 3

What have we done??

Isolated host specific strains of Lactobacillus, Bifidobacterium, Enterococcus

Selected for anti-pathogen characteristics

BSL2 Laboratory

Pathogen and Culture Bank

What have we done??

FDA-ISO-BioPharma Manufacturing

Added probiotic to over 1 Billion pounds of food

Removed *Salmonella* >12 pet food processing plants


THANK YOU