

Intralytix inc.  
a biotech solution company for  
food safety and pro-biotics

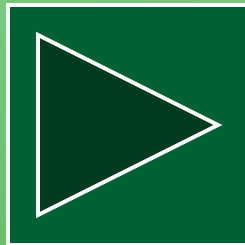
Greg Strang

Senior Director of Food Safety

# Bacteriophages

- Viruses that attack bacteria
- From the Greek “phago” meaning “to eat” and “bacteria”
- Estimated 3 billion years old
- Discovered in 1915-1917
- Most ubiquitous organisms in nature
- Play a key role in maintaining balanced bacterial populations in all ecosystems where bacteria exist
- Highly specific for bacterial host

All things compared...

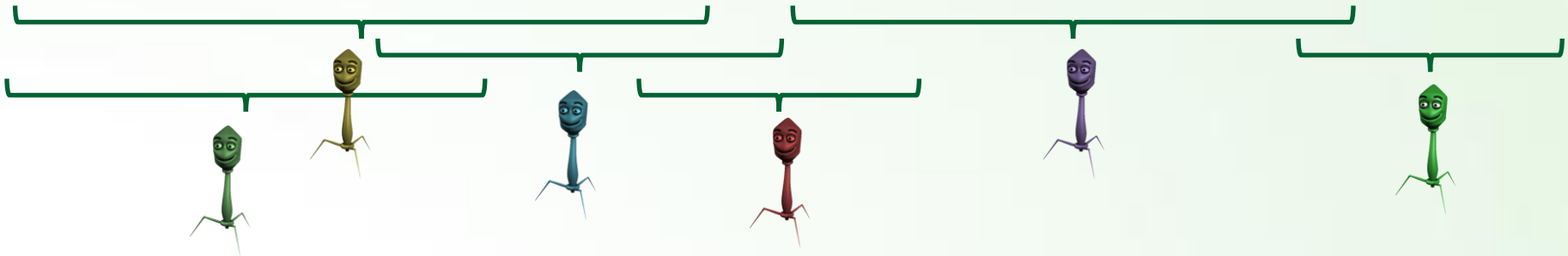


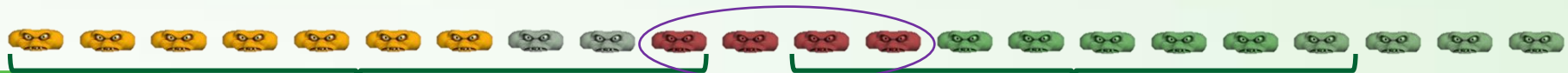
## Most ubiquitous organisms on earth

- Total number of phages on Earth is estimated to be  $1 \times 10^{30} - 1 \times 10^{32}$ 
  - Outweigh world's population of elephants
- More than 100 million phage species
- In 1mL non-polluted water,  $\sim 2 \times 10^8$  PFU of phages
- Common in human mouth and GI tract
  - $10^{15}$  phages in human gut

# Phages are common in foods

- Fresh ground beef
- Canned corned beef
- Fresh pork sausage
- Fresh chicken meat
- Delicatessen meat
- Farmed freshwater fish
- Oil sardines
- Cheese and raw milk
- Levels ranged:
- $4 \times 10^{10}$  PFU/100g fresh chicken and pork
- $3 \times 10^{10}$  PFU/100g roast turkey breast
- Up to  $10^9$  PFU/mL of yogurt and cheese whey
- 67-83% of all animal feed, ingredients, & diets examined





# Food safety regulatory approvals

Date	Agency	Phage preparation	Target application
2006, August	FDA, 21 CFR 172.785	ListShield	RTE meats
2006, October	FDA, GRN 198	Listex	Cheese
2007, January	USDA, FSIS Directive 7120.1	E.coli O157:H7 targeted	Hides of livestock
2007, March	USDA, FSIS Directive 7120.1	Salmonella-targeted	Hides of livestock
2007, June	FDA, GRN 218	Listex	Foods, generally
2008, July	USDA, FSIS Directive 7120.1	Salmonella-targeted	Feathers of live poultry
2010, September	Health Canada	Listex	RTE meat, dairy, fish
2011, February	FDA, FCN 1018	EcoShield	Ground beef
2012, August	FSANZ	Listex	Meat, seafood, cheese, RTE foods
2013, February	FDA, GRN 435	SalmoFresh	Poultry, fish, fruits, vegetables
2013, December	FDA, GRN 468	Salmonex	Pork and poultry
2014, August	Health Canada	SalmoFresh	Poultry, fish, fruits, vegetables
2014, August	Israel Ministry of Health	SalmoFresh	Poultry, fish, fruits, vegetables
2014, August	Israel Ministry of Health	ListShield	RTE meats
2014, August	Israel Ministry of Health	EcoShield	Ground beef
2014, December	FDA, GRN 528	ListShield	Fruits, vegetables, dairy, fish

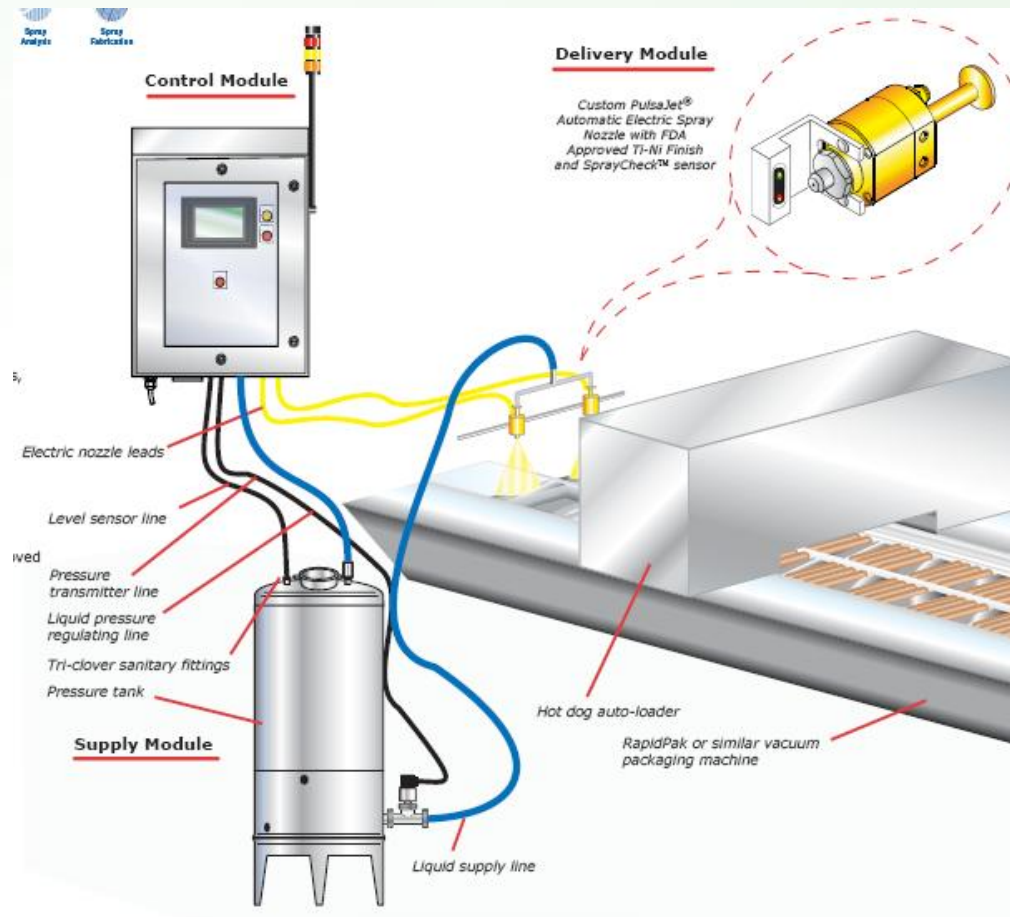




## Food safety applications

- Pre-harvest interventions
- Environmental decontamination
- Direct food applications

# Spray system for Direct Food Application



# Phages: Safety by nature

## Pros

- Environmentally-friendly, green
- Processing aide – no labelling
- Safe and effective
- Does not affect taste, appearance, smell of food
- Does not alter organic, Halal, or Kosher designations
- On RTE Meat items, Using phage technology will achieve Alt2 Status. Alt1 possible with other inhibitors in formula
- Targets specific bacterial pathogens

## Cons

- Only effective against targeted pathogen
- Commonly used disinfectants may also inactivate
- Require refrigerated storage


## Additional considerations

- How effective is effective enough?
  - Complete eradication of targeted pathogen is not always achievable
- Costs to the producer?
  - Many food industries operate on thin profit margins, cost may need to be under 1 -1.5 cents / lb
- Application equipment?
  - Requires spray equipment to apply phages
- Consumer / customer acceptance?
  - All food additives unpopular, phages may face a special challenge




For more information:

- [www.intralytix.com](http://www.intralytix.com)
- <http://www.cfsan.fda.gov>
- <http://www.asm.org/division/M/M.html>
- <http://www.evergreen.edu/phage/>



Greg Strang  
gstrang@intralytix.com  
614-296-8781

Safety  
*by* Nature™



The Columbus Center  
701 East Pratt Street  
Baltimore, MD 21202

**T** 877-ITX-PHAGE  
**F** 410-625-2506  
**E** info@intralytix.com  
**W** intralytix.com