

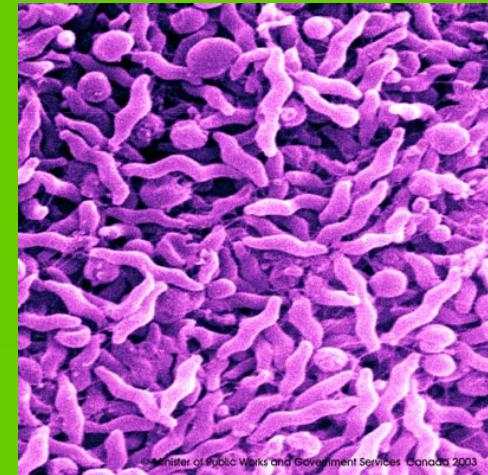
'Biopreservation'

Antimicrobial lactic-acid bacteria for improving fresh meat safety and storage

Rhys Jones & Adrian Cookson

<http://www.agresearch.co.nz>

<http://www.mirinZ.co.nz>



Farming, Food and Health. **First**

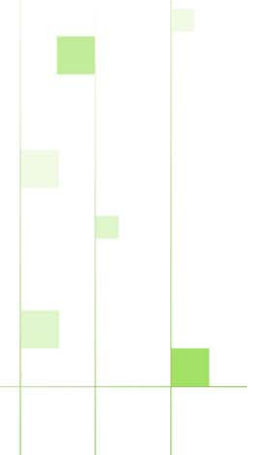
Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi

Bacterial contamination of fresh meat is unavoidable

Some contaminants can cause problems

- spoilers *B. thermosphacta*, *C. estertheticum*, some LABs

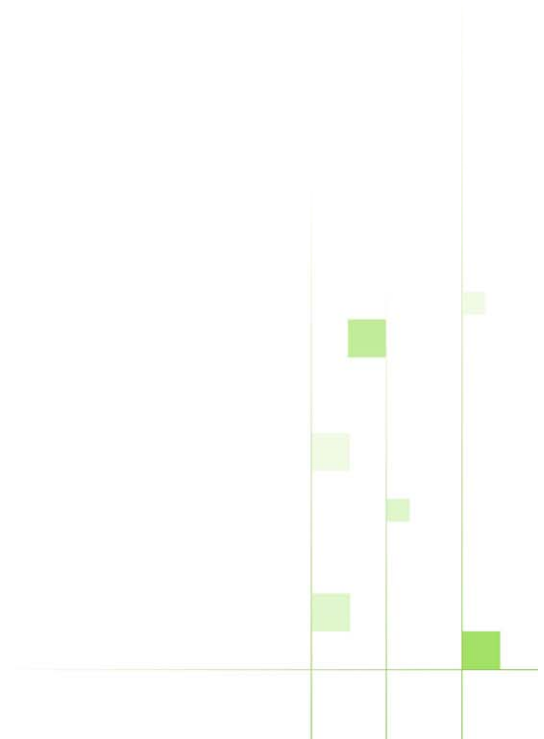
C. estertheticum blowing
of vac-packed venison



Bacterial contamination of fresh meat is unavoidable

Some contaminants can cause problems

- **spoilers** *B. thermosphacta*, *C. estertheticum*, some LABs
- **pathogens** *E. coli*, *L. monocytogenes*, *C. jejuni*

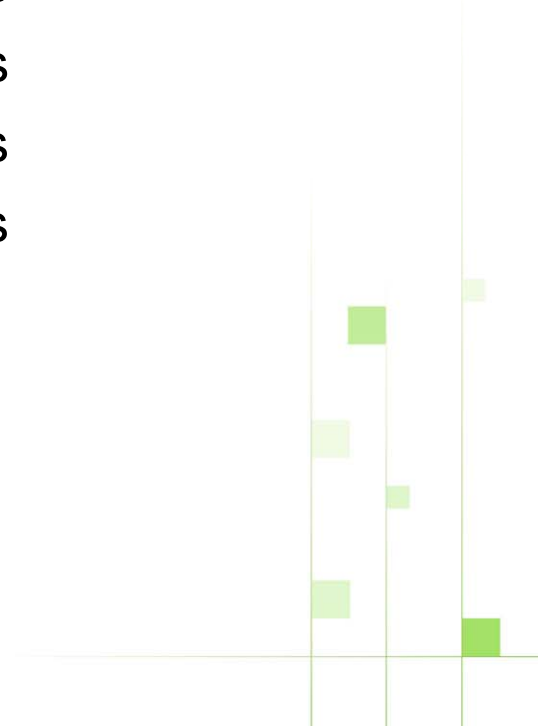


Campylobacteriosis cases NZ public health surveillance report



<i>Period</i>	<i>Notifications</i>
October-December 2005	370.2 cases*
January-March 2006	395.3 cases
April-June 2006	432.4 cases
July-September 2006	431.4 cases
October-December 2006	424.8 cases
January-March 2007	390.5 cases
April-June 2007	362.1 cases

per 100,000 population



How to restrict contaminant proliferation?

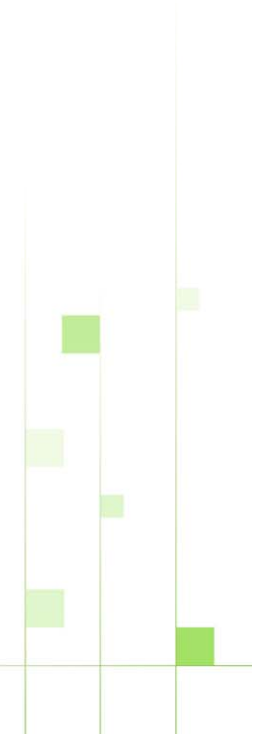
vacuum-packaging/MAP - aerobes e.g. *Pseudomonas*

chilling - growth rate, high-end mesophiles (e.g. *E. coli*)

irradiation – kill all

chemical rinses - initial counts

‘biopreservation’



Bio-preservation.....

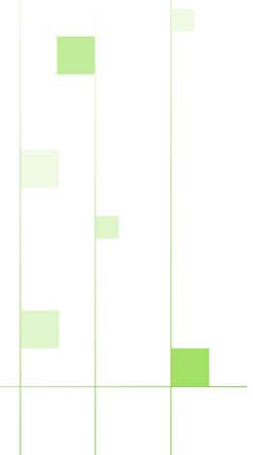
- meat contains niche environments open to bacterial colonisation
- there's a risk of pathogens or spoilers filling those niches

so

- we can try and keep those environments empty
(GMP, washes, packaging etc)

or

- we can fill niches with bacteria we know are harmless/useful
(biopreservation)



Biopreservation

- Lactic-acid bacteria (LAB) = natural flora of stored meat
 - *Lactobacillus*, *Leuconostoc*, *Carnobacterium*, *Lactococcus* + other genera
- Some LAB grow during storage and can restrict the development of other bacteria
 - organic acids (lactate, acetate....)
 - bacteriocins
 - small molecules (reuterin, hypothiocyanate, ethanol)
 - competition for space and substrate
- Application of such strains to meat could have a preservation effect

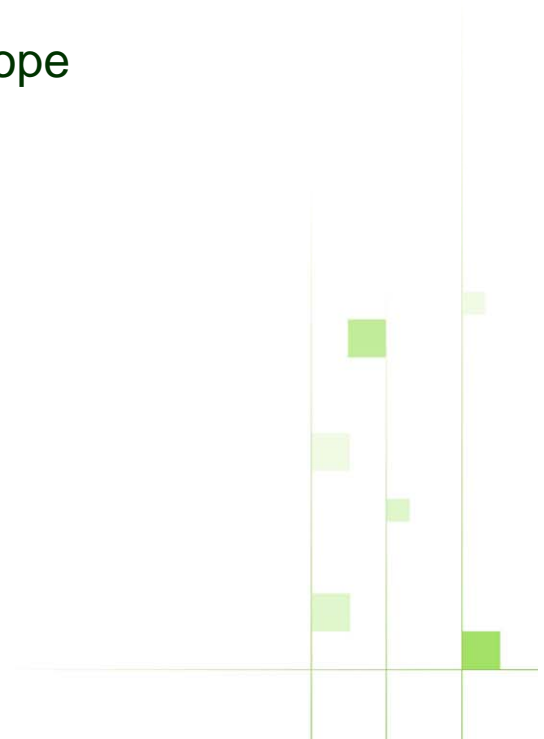


Some biopreservation products are available commercially



SafePro range (Chr. Hansen, Denmark)

- *Lactobacillus sakei*, *L. curvatus*, *Leu. carnosum*
 - anti *Listeria*, *B. thermosphacta* in VP and MAP
 - minimal sensory effect
 - regulatory approval in parts of Europe
 - USDA approval in process



Some biopreservation products are available commercially

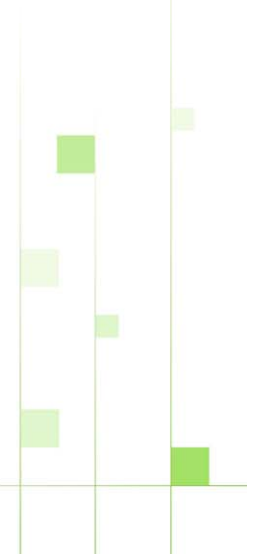


Bovamine Meat Culture (NPC, USA)

- *L. acidophilus*, *L. crispatus*, *P. acidilactici*, *Lc. lactis*
 - synergistic reduction of *E. coli* O157:H7 and *Salmonella*
 - passed FDA GRAS
 - USDA approval imminent

MicroGard (Danisco Denmark)

- *Propionibacterium* milk ferment
 - active against a range of organisms
 - approved by USDA for use on meat
- oriented toward processed meat



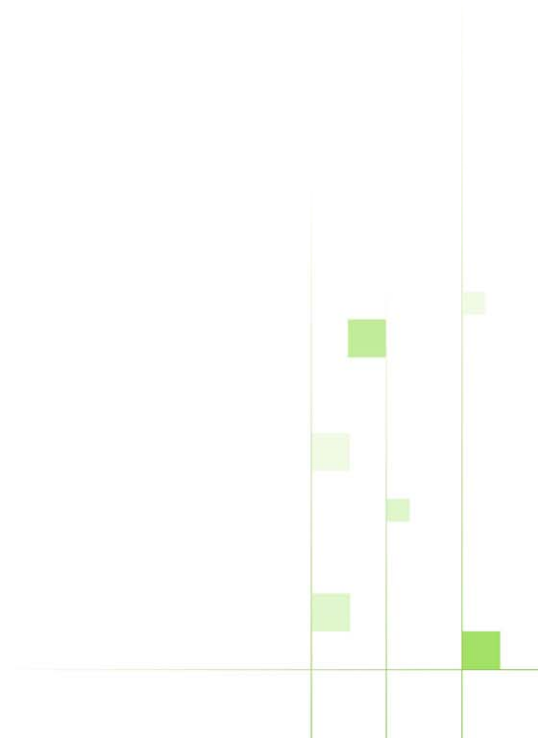
Potential for biopreserving export meat with antimicrobial LAB strains naturally found in NZ?

Projects

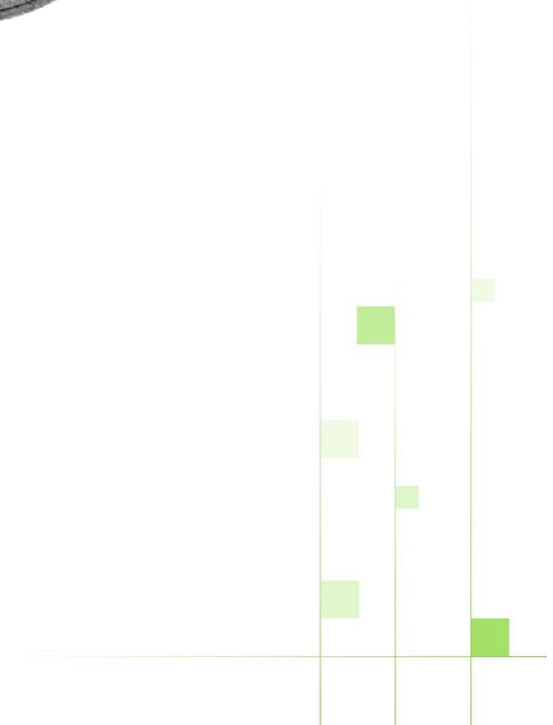
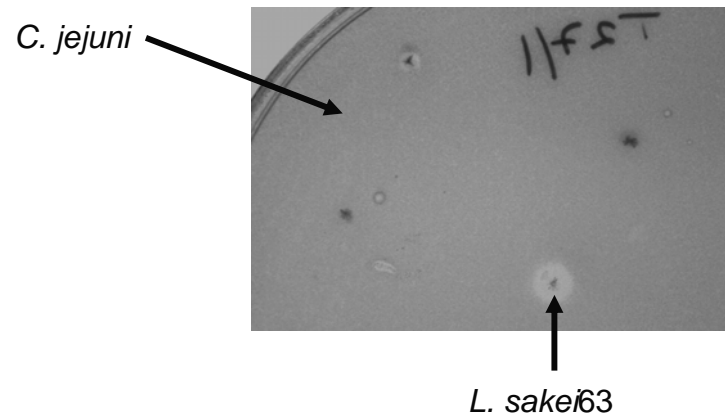
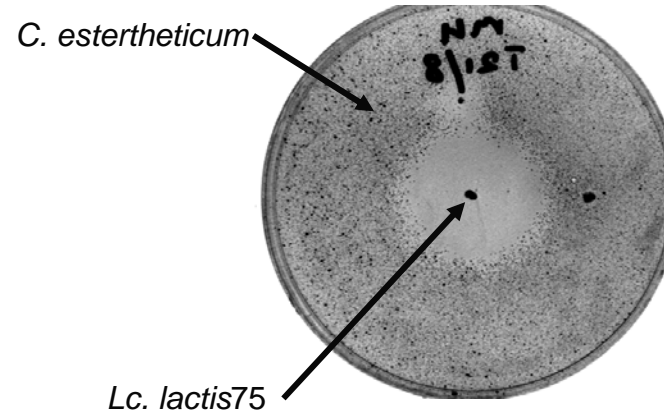
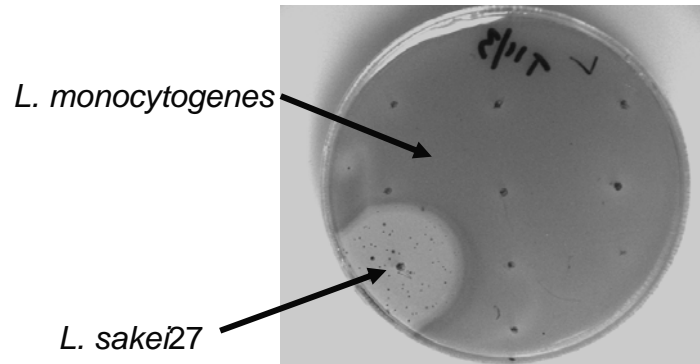
- ARC (Agresearch Internal Funding)
- MWNZ
- new FoRST (Value from Quality)
- new MIRINZ Inc

Collaborations

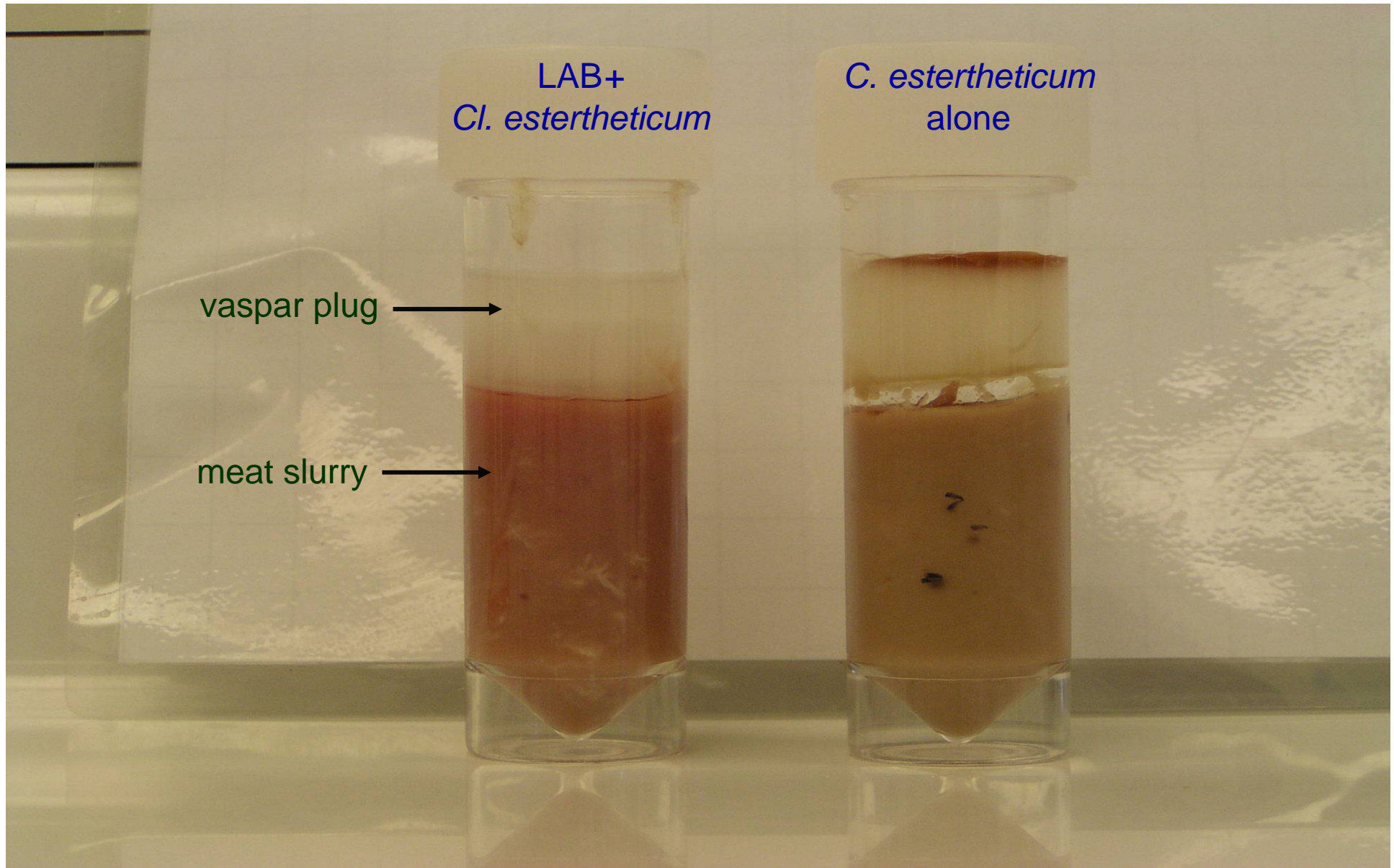
- Otago University
- INRA



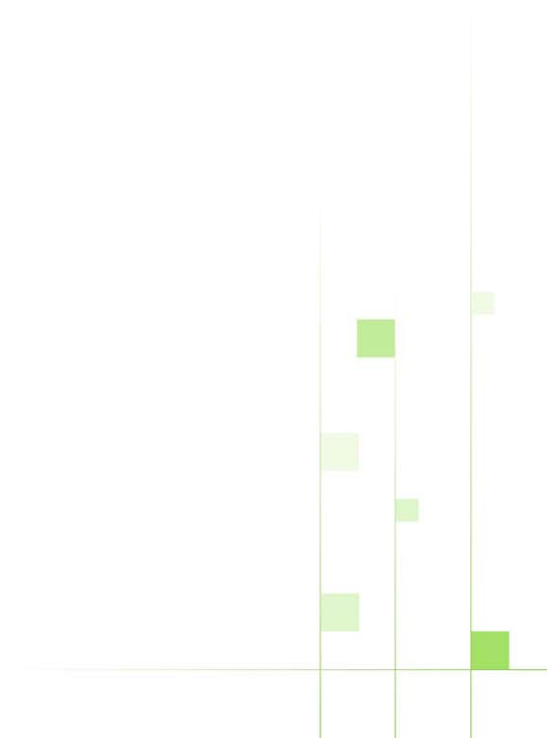
NZ LAB strains found inhibitory in agar-based studies



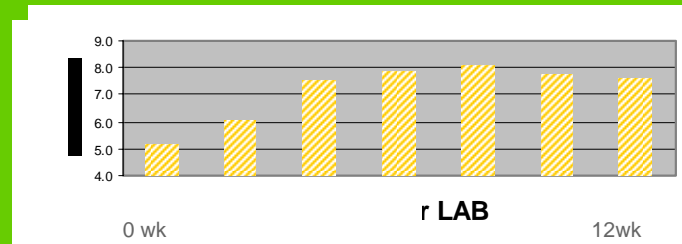
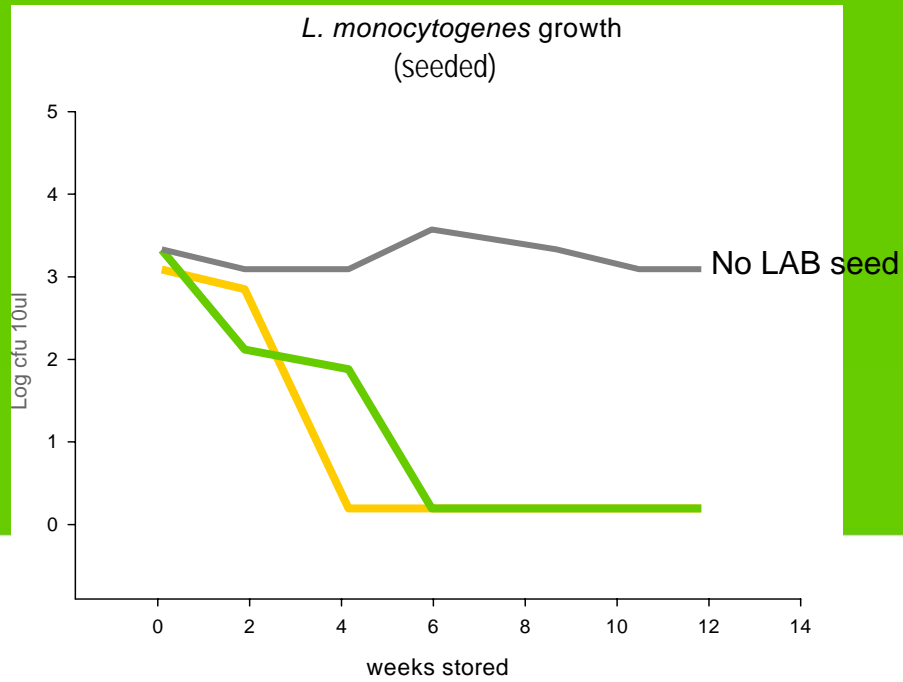
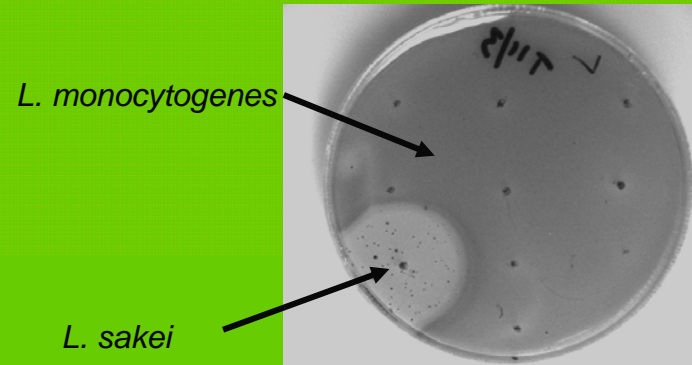
Meat slurry experiments are closer to stored meat environment



Growth of some strains is also associated with reduced target numbers in meat storage experiments



VP boned lamb shoulders stored at -1.5°C 12wks

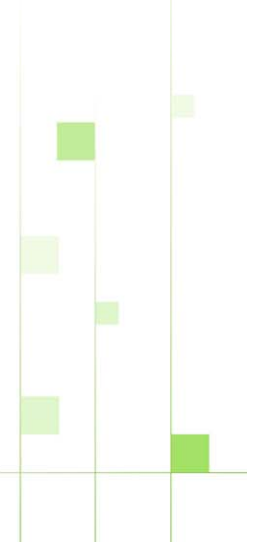


This is where we're up to
– testing potential strains in stored meat

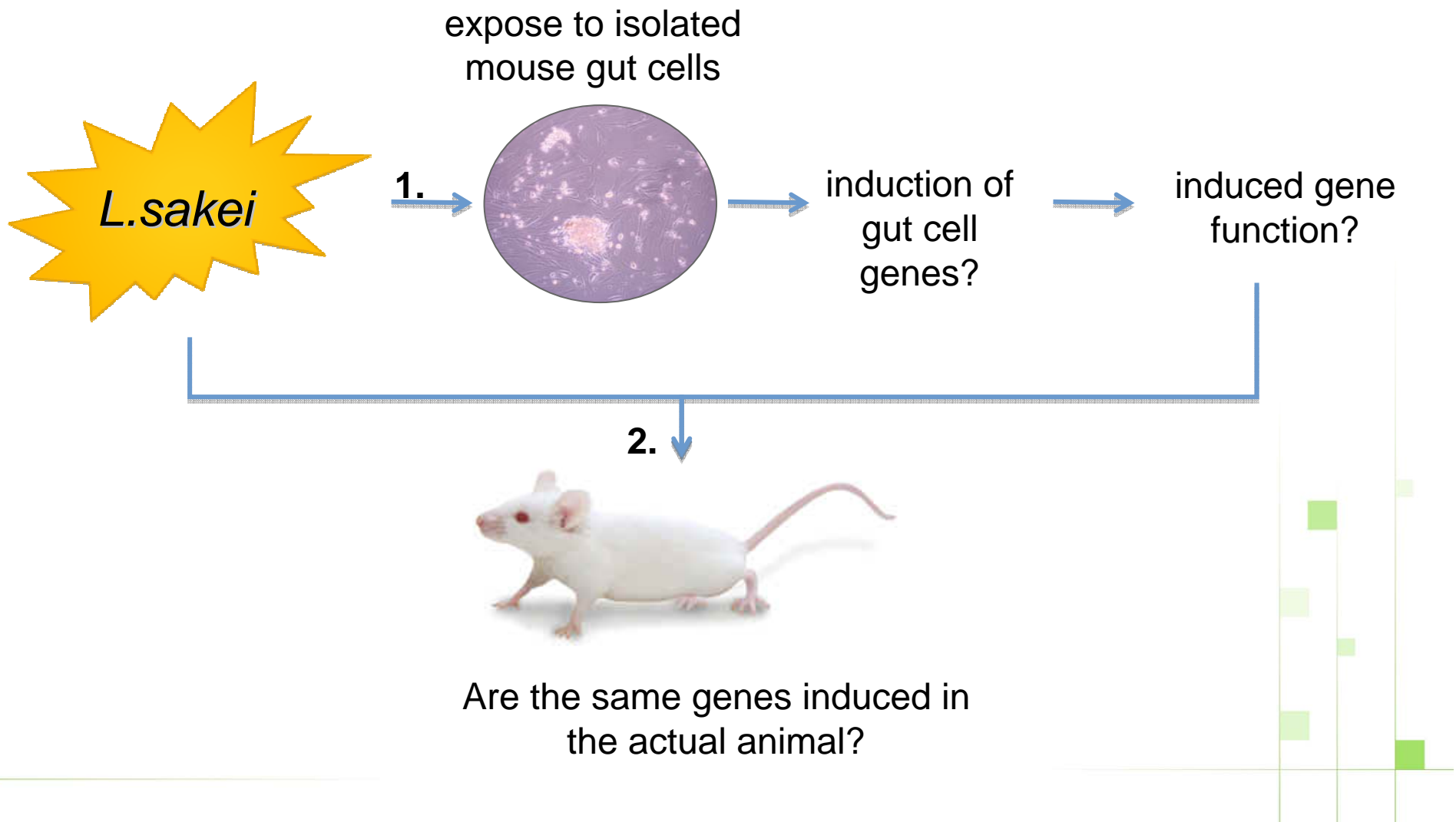
Safety?

What consequences might there be of introducing large numbers of biopreservative organisms to the gut?

Liam Cassidy – study on how *L. sakei* influences gene responses in the gut using a mouse model.



The effect of *L.sakei* on the gastrointestinal tract at the genetic level...



Summary

LAB isolated that inhibit spoilers and pathogens

– *L. monocytogenes*, *C. estertheticum*, *B. thermosphacta*, *C. jejuni*

- **Some strains work in stored meat**

Adoption of biopreservation would follow:

1. technical achievability
 - strain availability
 - safety
 - industrial adaptation
2. acceptance by officialdom (regulators, lawmakers)
3. acceptance by consumer

