

IMproved PATHOGEN Control Technologies for New Zealand Meat

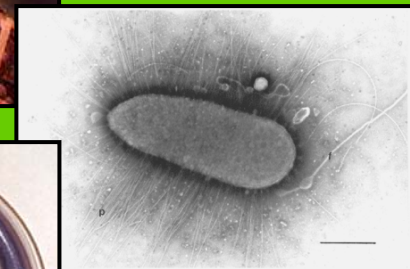
IMPACT

Biocontrol by Controlling Bacterial Cell Signalling.

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16 October 2007

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

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

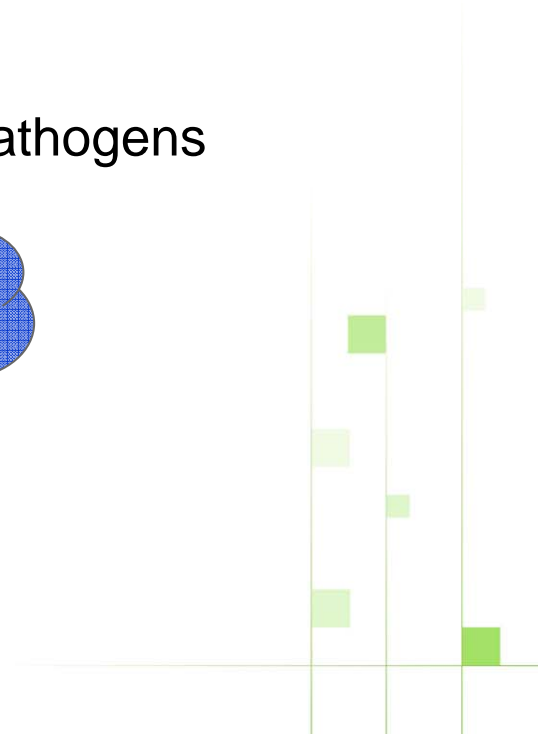
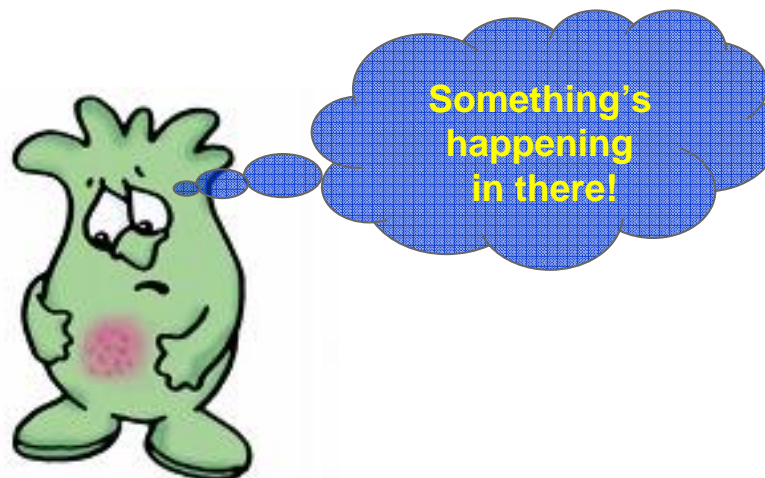


Farming, Food and Health. **First**

Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi

Aim of Programme

1. Identify **novel methods of biocontrol** which will provide industry with viable alternatives for pathogen control
2. To determine **effective delivery** protocols
3. Provide a platform for **rapid response** to future pathogens



Objective 3: Biocontrol by controlling bacterial signalling



Hypothesis

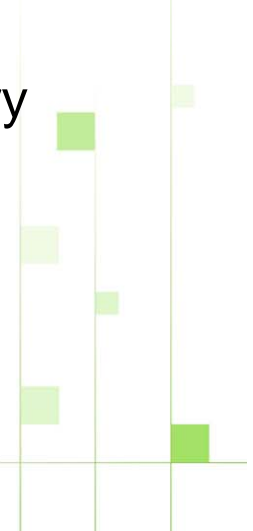
- **Signalling-related activities are important** for pathogen survival/growth on meat and meat products
- Bacterial signalling forms a **novel target** for biocontrol strategies

Research Foci

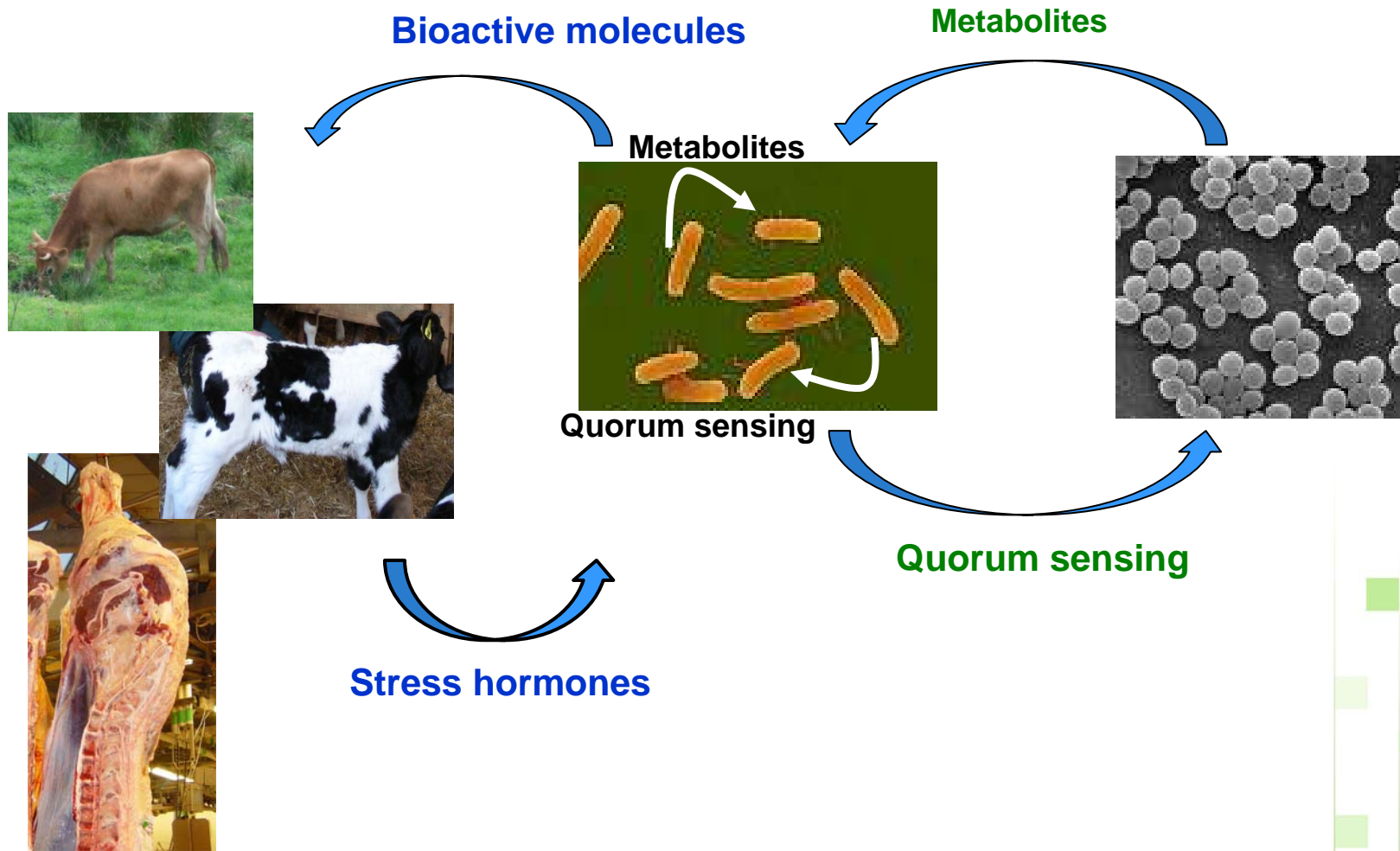
- **Identification** of the signal molecules produced by microorganisms when in contact with meat
- Examine the **effect** of signal molecules on bacterial behaviour
- **Develop** interventions that target these pathways as a biocontrol suitable for application in the export meat industry

The Model

- *Escherichia coli* O157:H7
- The principle can be applied to other pathogenic bacteria



Possible Signalling Pathways

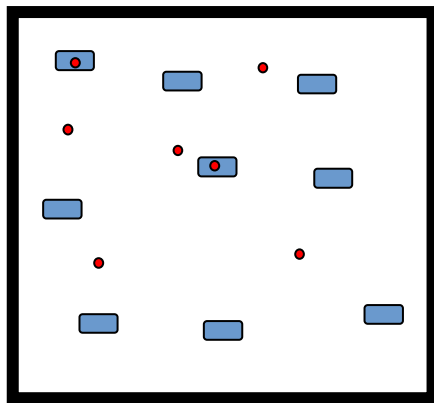


Bacterial Communication (Quorum Sensing)

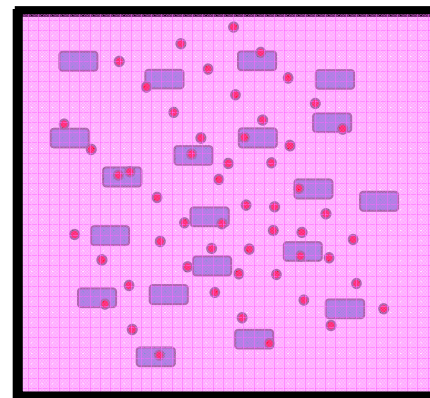


Bacteria produce chemical signals

- More cells → more signal molecules
- Density-dependent signalling leading to co-ordinated behaviours



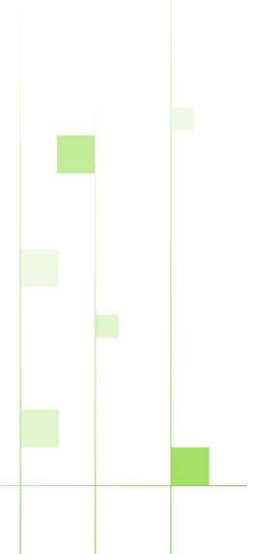
Low Cell Density



High Cell Density

- Some bacteria can produce more than one signal type
- Some bacteria do not produce any signals
- Some bacteria can listen in on other bacterial conversations

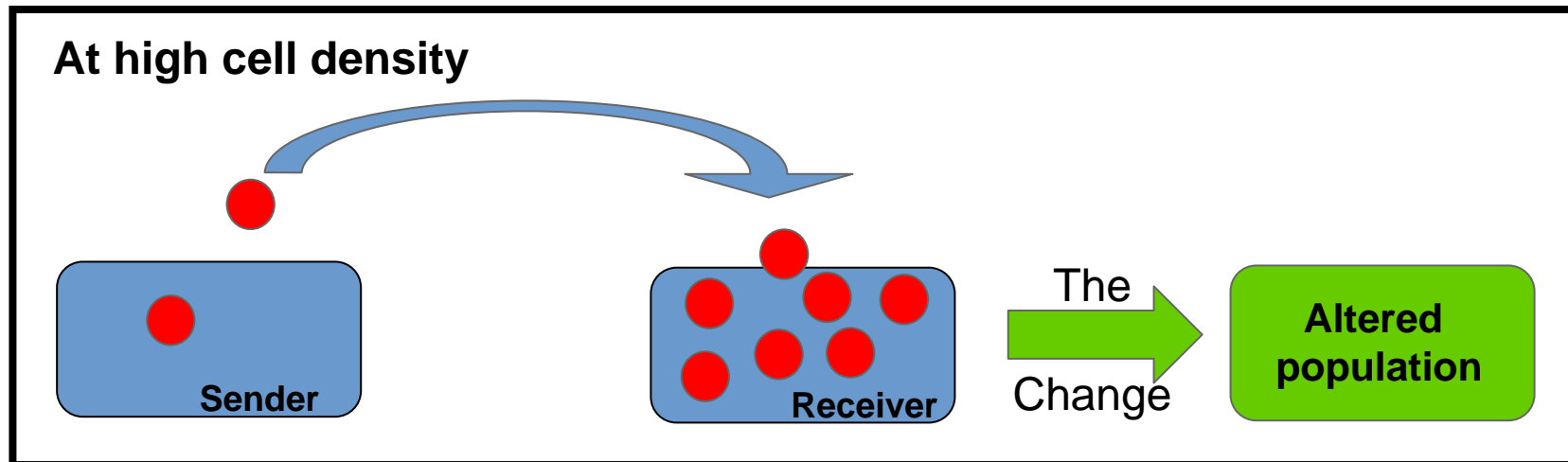
eg: *E. coli* O157:H7



Why do bacteria need to communicate?

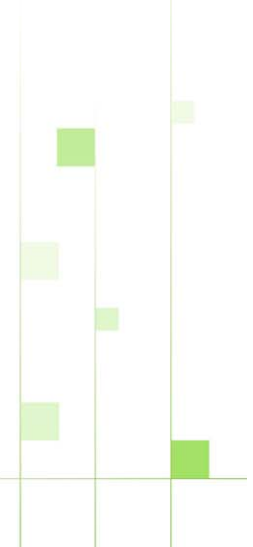


★ A group effort is more effective than going it alone!

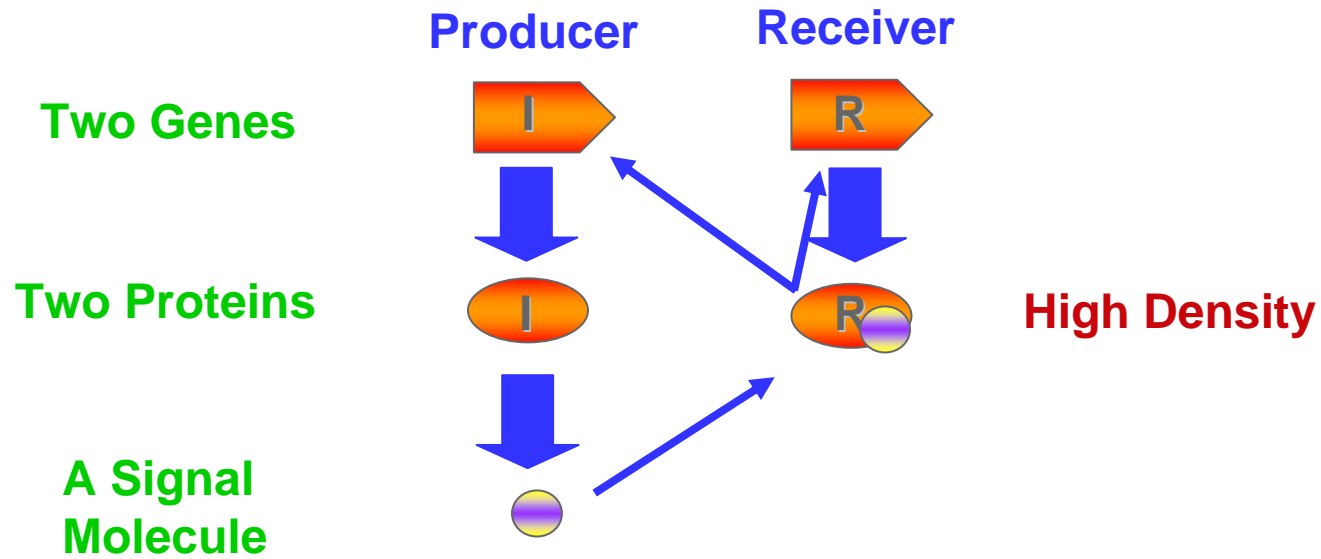


What do bacteria communicate about?

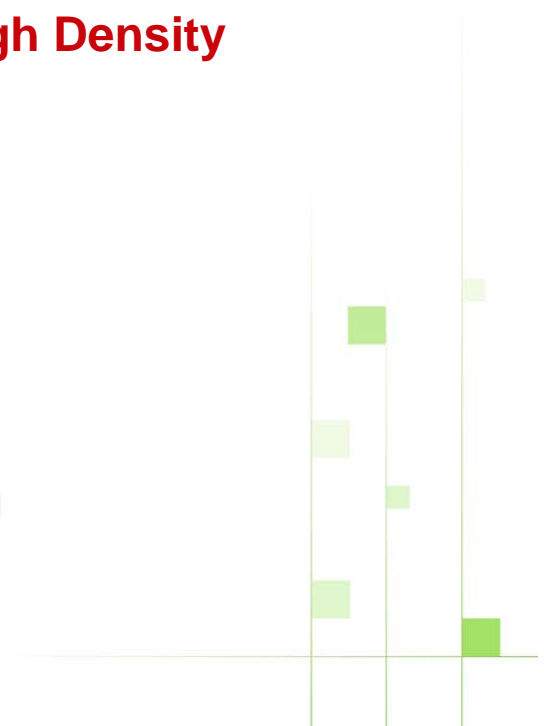
- Community growth and surface attachment (e.g. Biofilms)
- Adaptation leading to increased survival
- Virulence
- Production of secondary metabolites



What do you need to have to communicate?

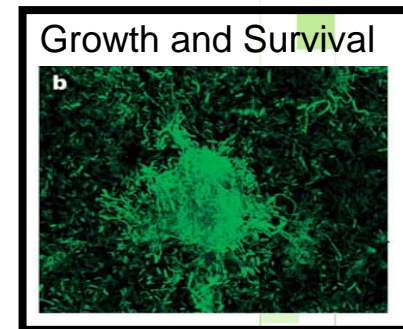
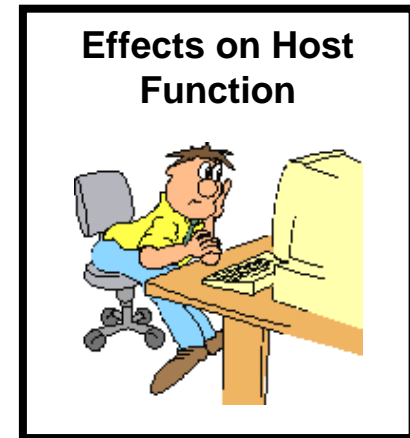
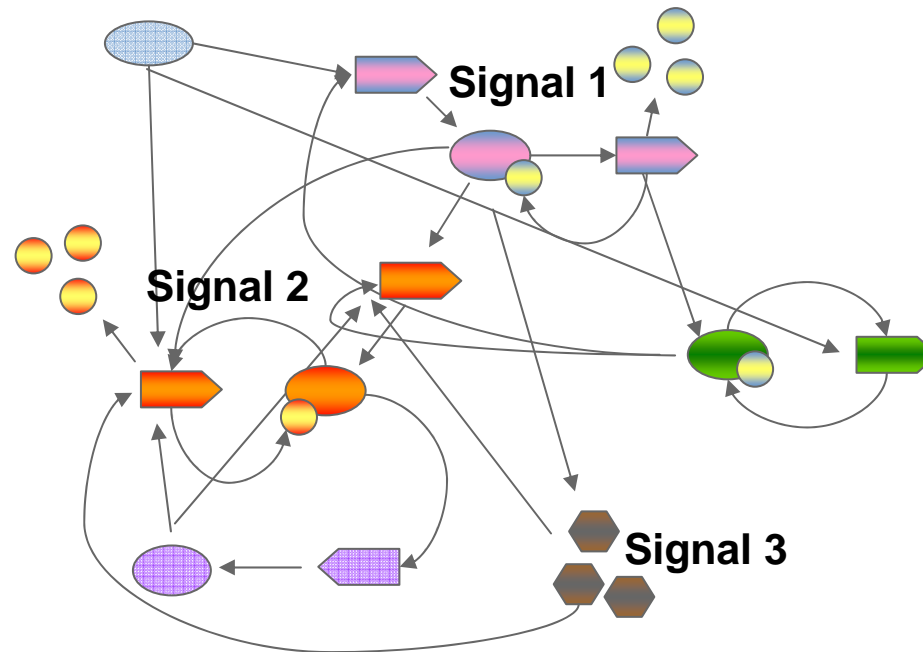
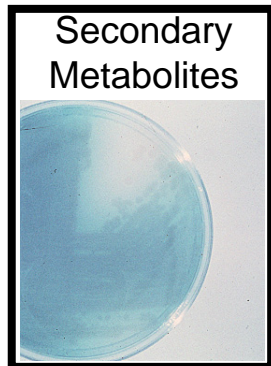
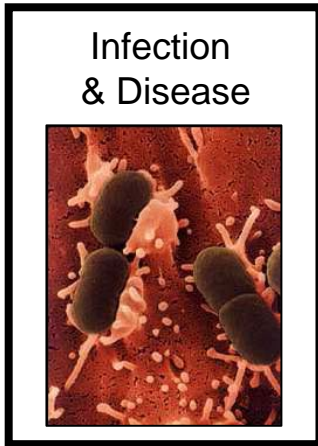


 **one signalling system**



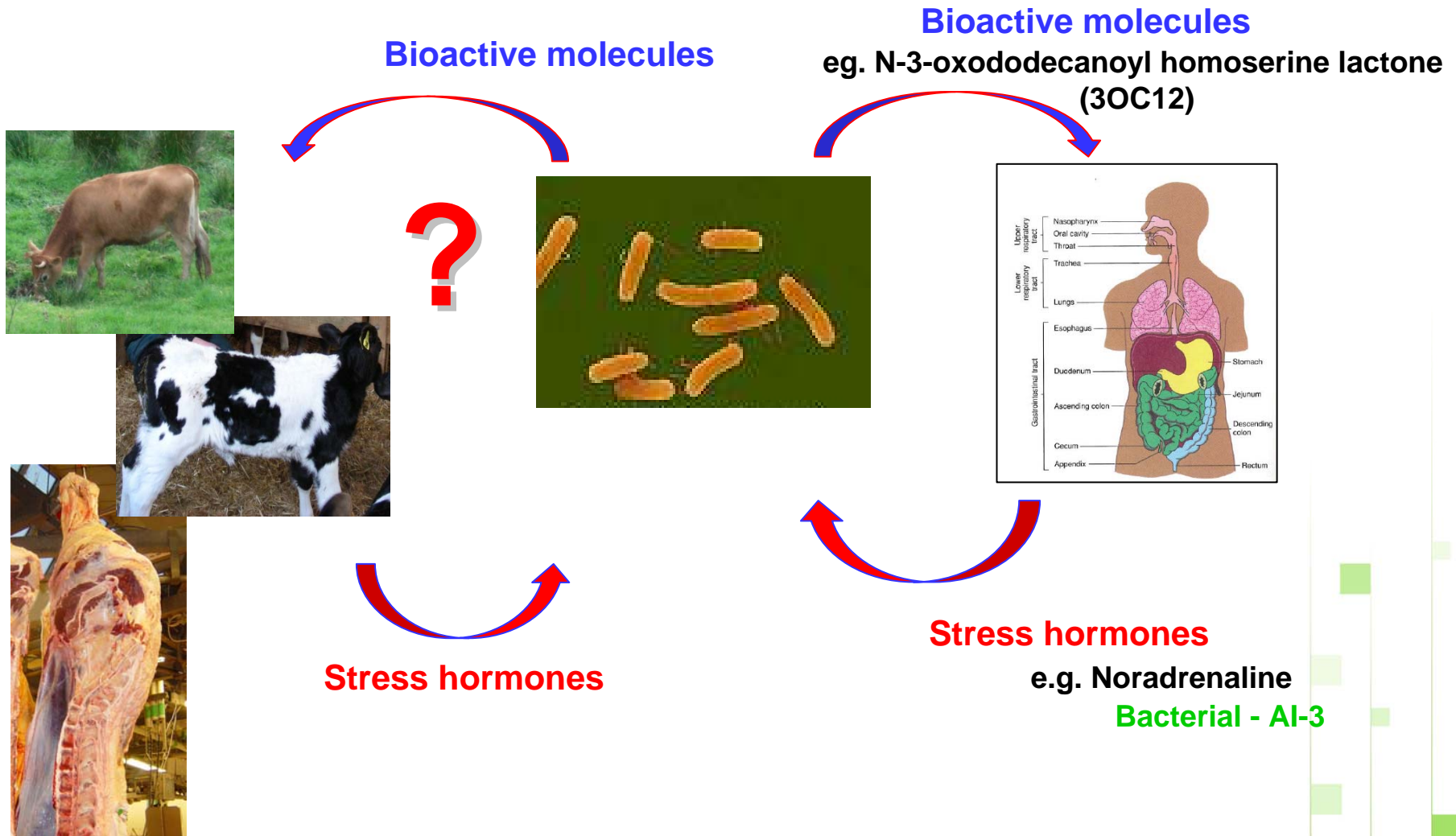
Quorum Sensing in Action

- A Regulatory Network in *Pseudomonas*

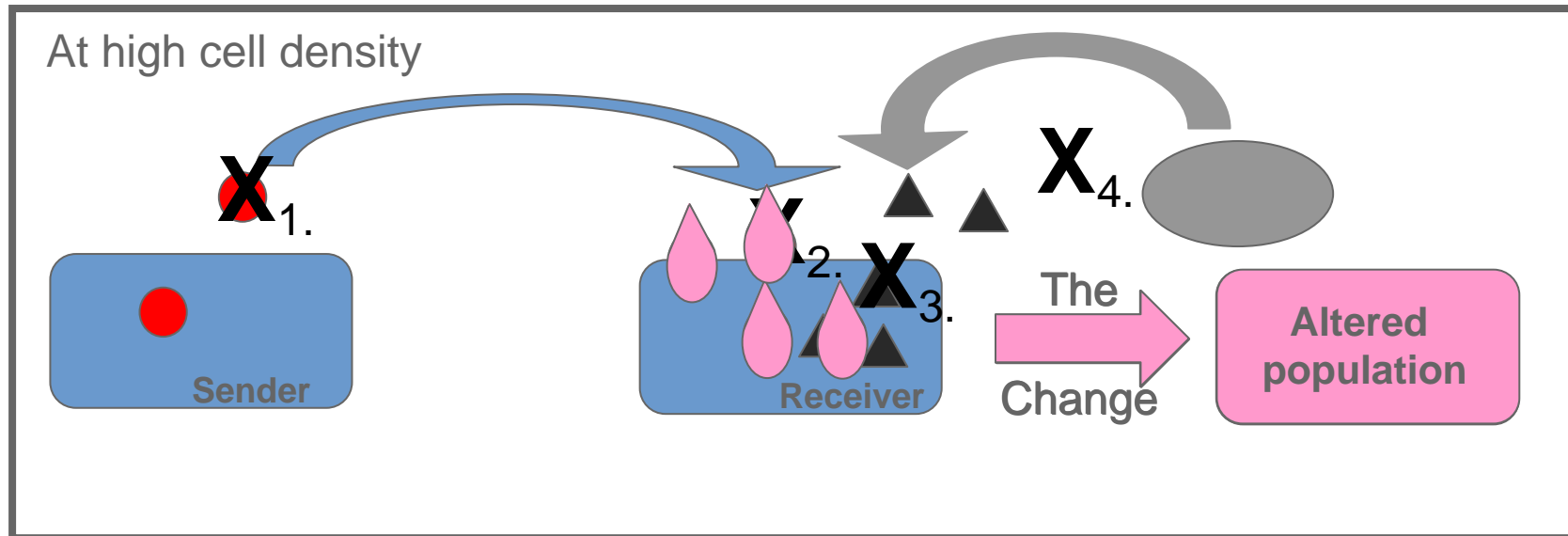


3 signalling systems
+
accessories

Possible Signalling Pathways



How can we use this to our advantage?



1. Enzymes which breakdown the signal molecule.
2. Signal antagonists/modification of the signal.
3. Mimics of signal molecules.
4. Other signals which cause an inappropriate response.

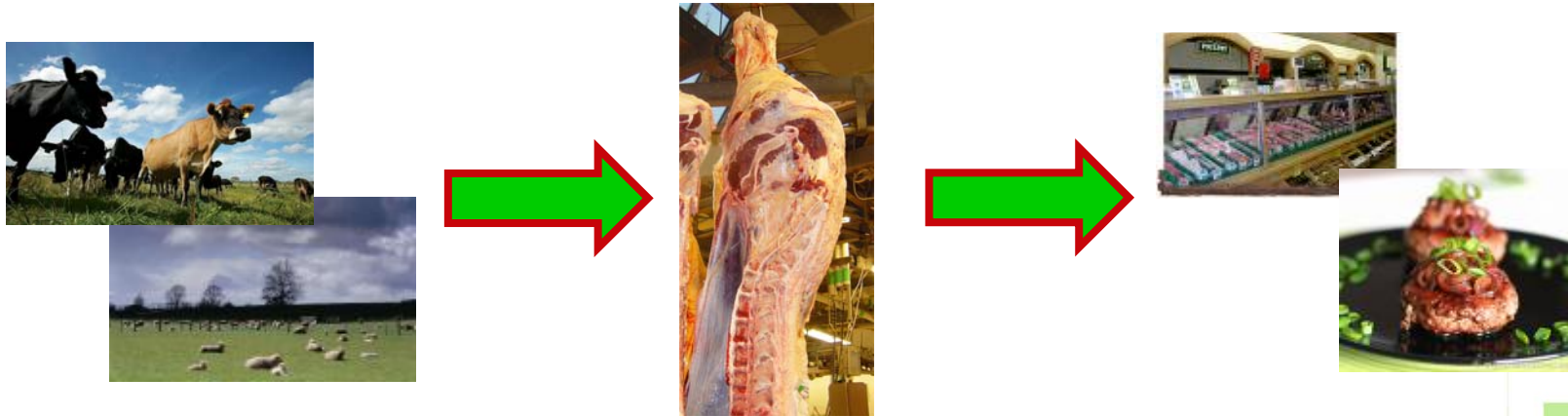


★ **Hijacking a bacterial system to gain an advantage!**

Outcomes



- Provide a novel, cost effective **biocontrol strategy** based on bacterial communication, providing industry with a viable alternative for pathogen control which will be acceptable to export markets
- To determine **effective delivery** methods and points for a quorum sensing biocontrol



- Provide a platform for a **rapid response** to future pathogens

