



society for general
Microbiology



Royal College of Physicians in Ireland,
Kildare Street, Dublin 2
Monday 26th March, 2012

Microbes in food

- the good, the bad & *the unexpected*

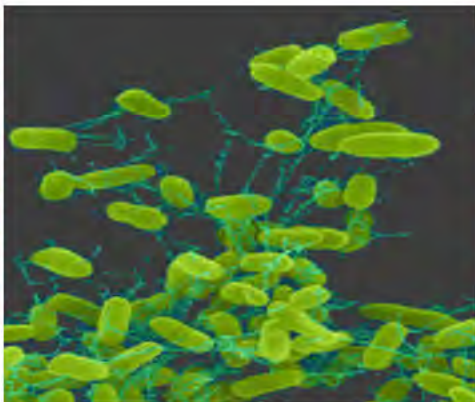


Professor Séamus Fanning,
UCD Centre for Food Safety,
UCD Institute of Food & Health,
WHO-collaborating centre for Research, Reference & Training on *Cronobacter*,
School of Public Health, Physiotherapy & Population Science,
University College Dublin, Ireland.



Food is not a (microbiologically) sterile matrix -

Bacteria



Salmonella spp.;
Campylobacter spp.;
Pathogenic *E. coli* &
Others



Foods of animal origin;
Salads &
Others

Fungi

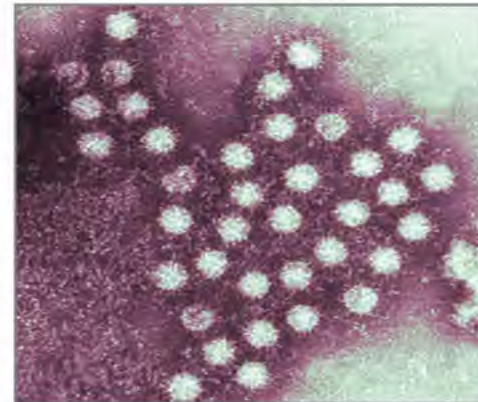


Aspergillus species;
Fusarium species;
Penicillium species &
Others



Cereals; Animal feed;
Nuts &
Others

Viruses

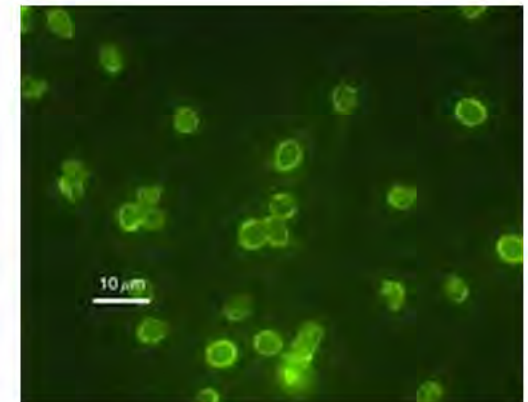


Norovirus;
Rotavirus;
Astrovirus &
Others



Shellfish;
Vegetables &
Others

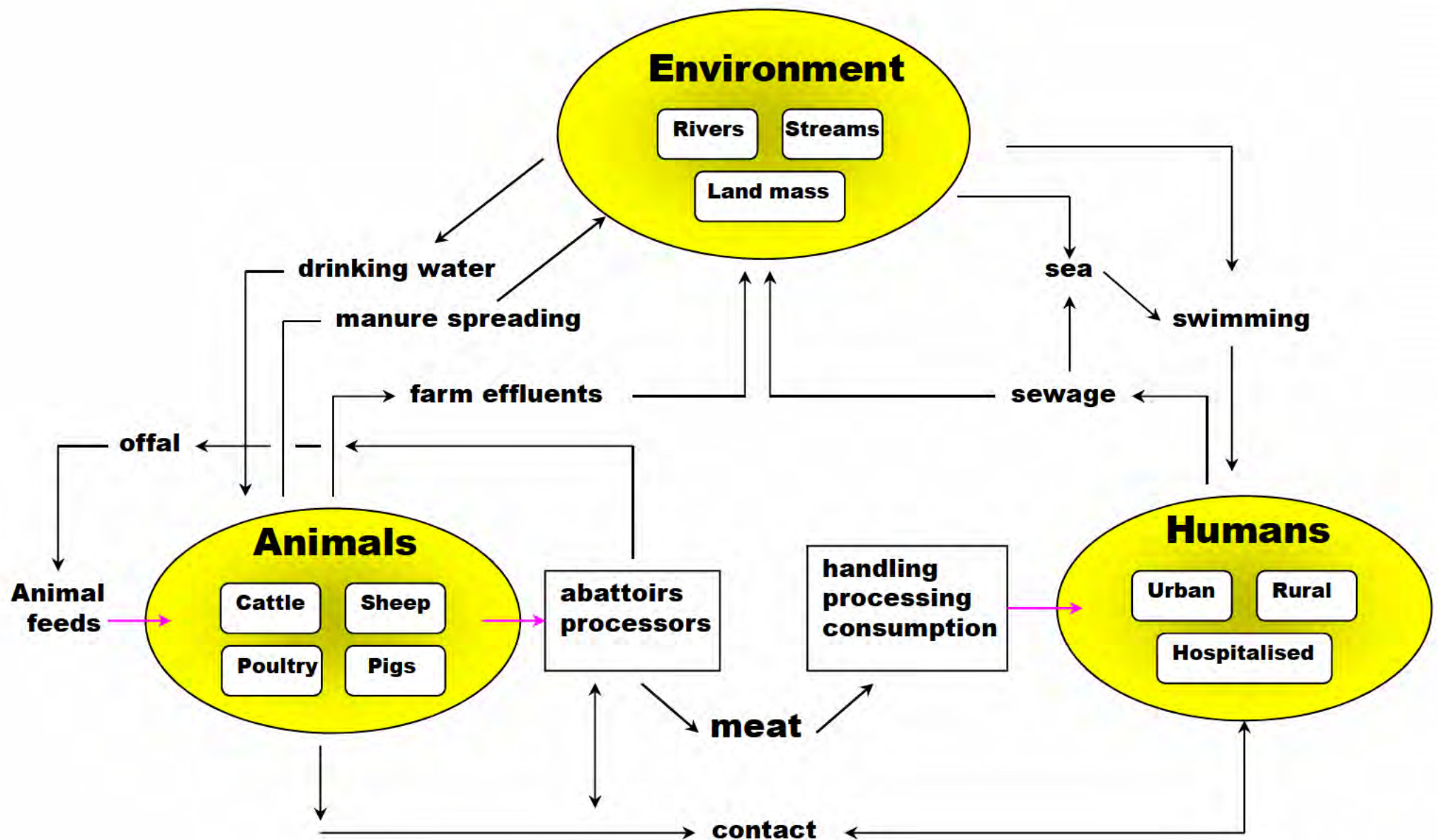
Protozoa



Cryptosporidium spp.;
Giardia spp.;
Cyclospora spp. &
Others



Water;
Fruit/Produce &
Others



Transmission routes to humans associated with food-borne microbes

Causes & consequences of microbiological food-borne illness-

- ❑ pathogen ***must be present*** in the food
- ❑ pathogen ***must survive the stresses***, encountered at diverse points across the *farm-to-fork* continuum
- ❑ pathogen ***load must be of sufficient magnitude*** to cause illness in the *susceptible* target host



Food-borne illness has a major impact on *public health & the economy*

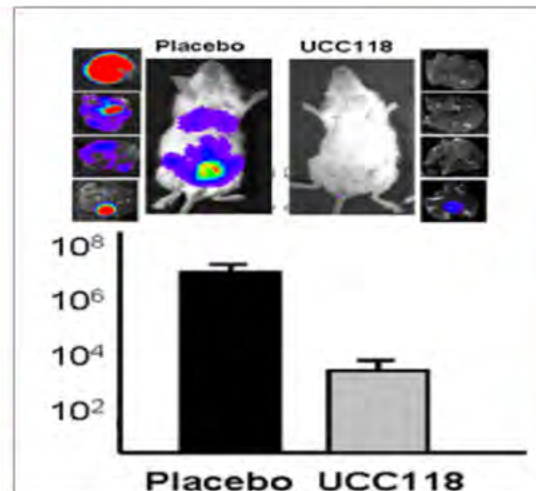
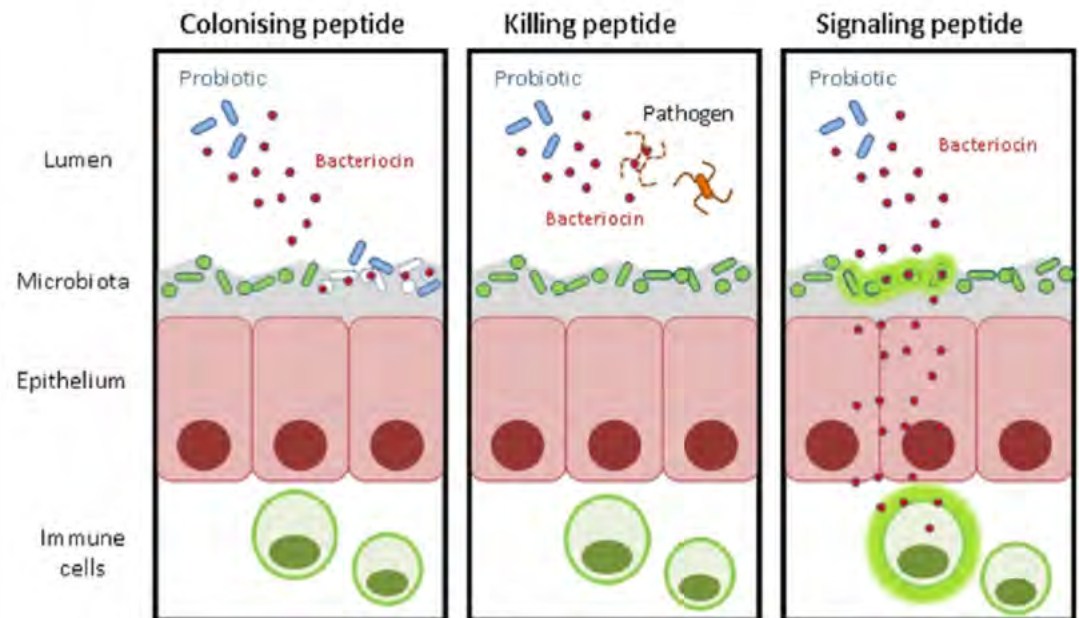
The good –probiotic bacteria



***Lactobacillus* species**

Probiotics are *live microorganisms*

- Lactic acid bacteria (LAB);
- non-pathogenic *E. coli*;
- bacilli;
- yeast
- ***potential biotherapeutic agents***



Anti-infective activity of ***Lactobacillus salivarius*** against ***Listeria monocytogens*** in a live murine model

The bad [1] – *Cronobacter* species

- ❑ Ireland is the worlds leading producer of PIF
- ❑ currently 15% of the global PIF supply
- ❑ PIF industry is valued of € 626 million/year
- ❑ most of the PIF produced is exported
- ❑ three global companies produce PIF



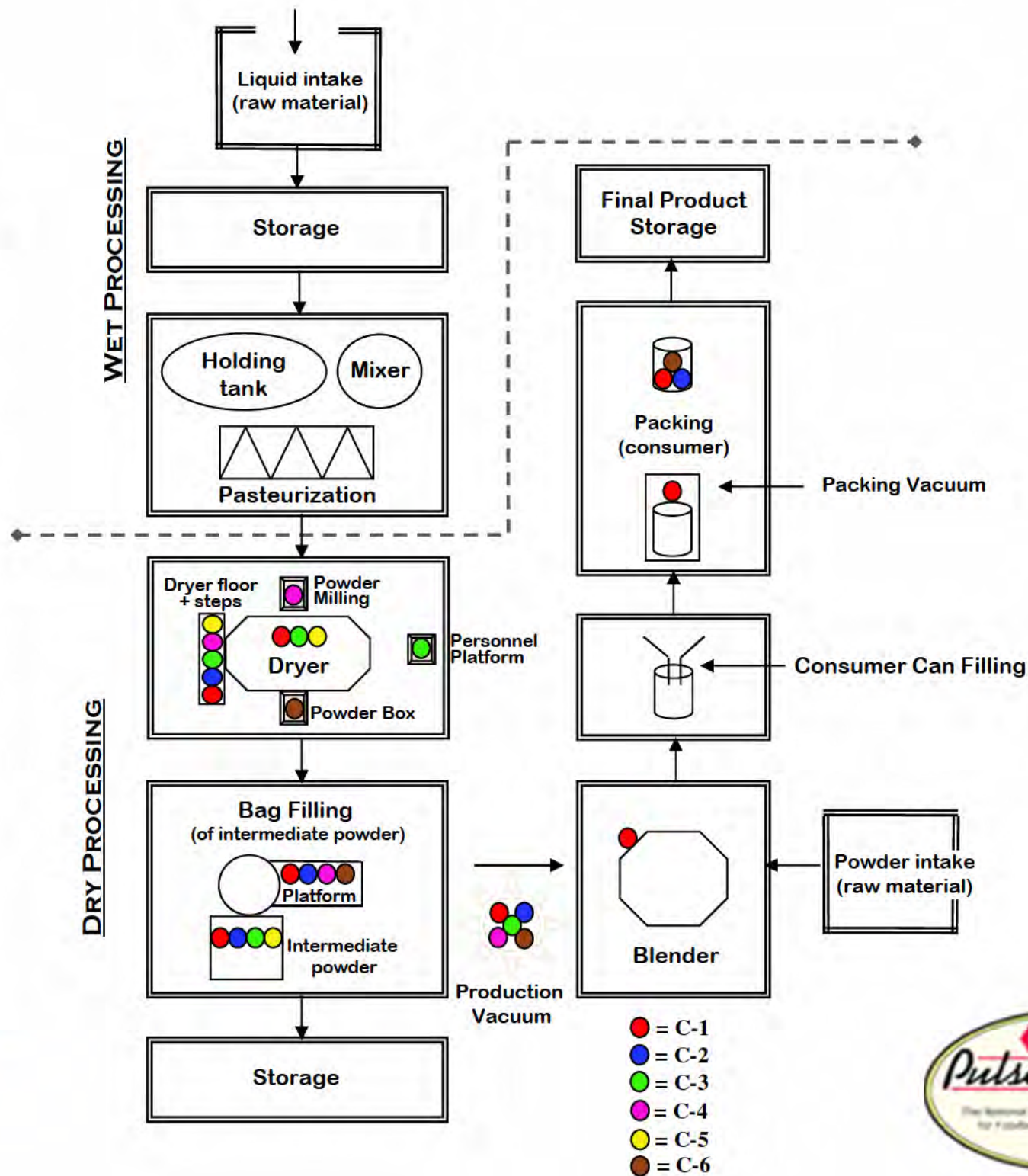
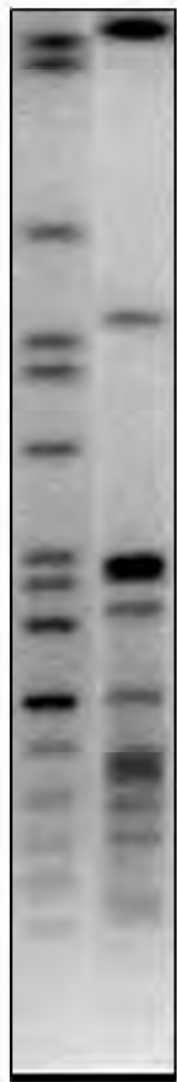
***Cronobacter* species**



Neonatal bacterial pathogen-

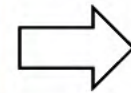
- ❑ associated with consumption of powdered infant formula (PIF);
- ❑ reported cases of infections are rare;
- ❑ outbreaks linked to brands of PIF, cause major reputational damage

Environmental control by DNA fingerprinting

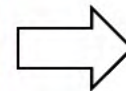




**Food-producing animals
are reservoirs of
zoonotic bacteria -
*zoonoses***



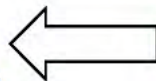
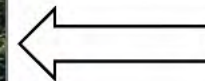
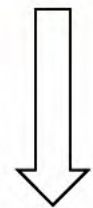
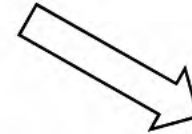
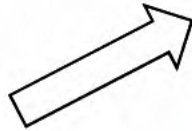
***E. coli* O157:H7
Salmonella Typhimurium**



***Campylobacter* spp.
Salmonella Enteritidis**

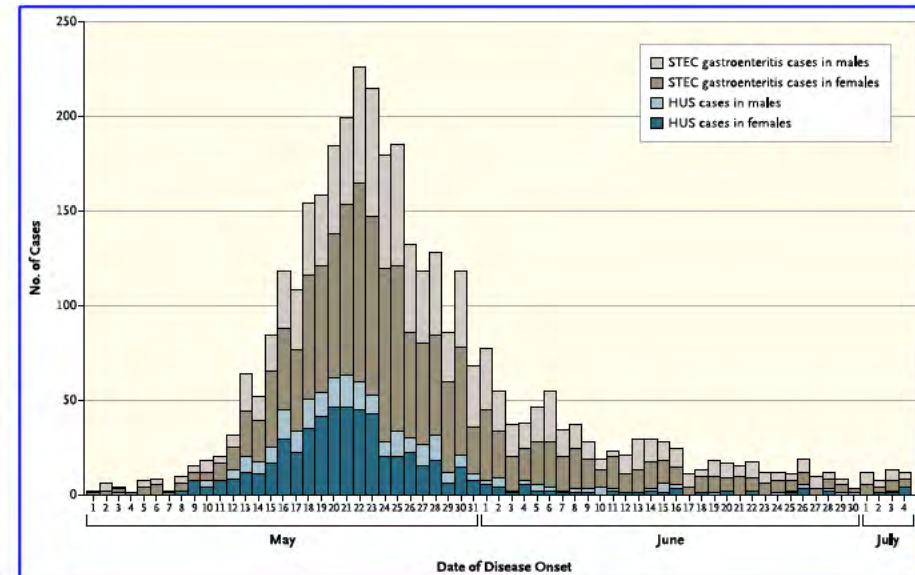
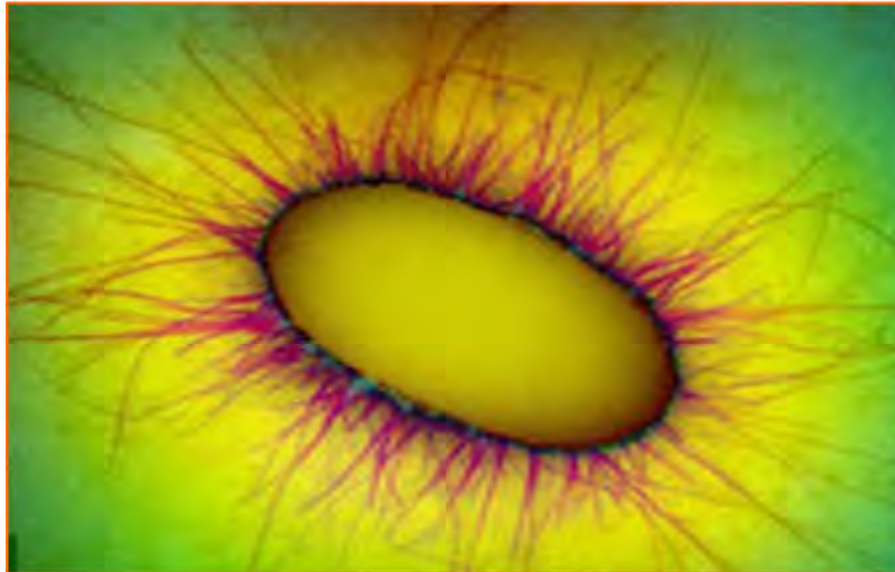
**How does a food-borne
outbreak occur?**

The bad [2] – *Escherichia coli* 0157



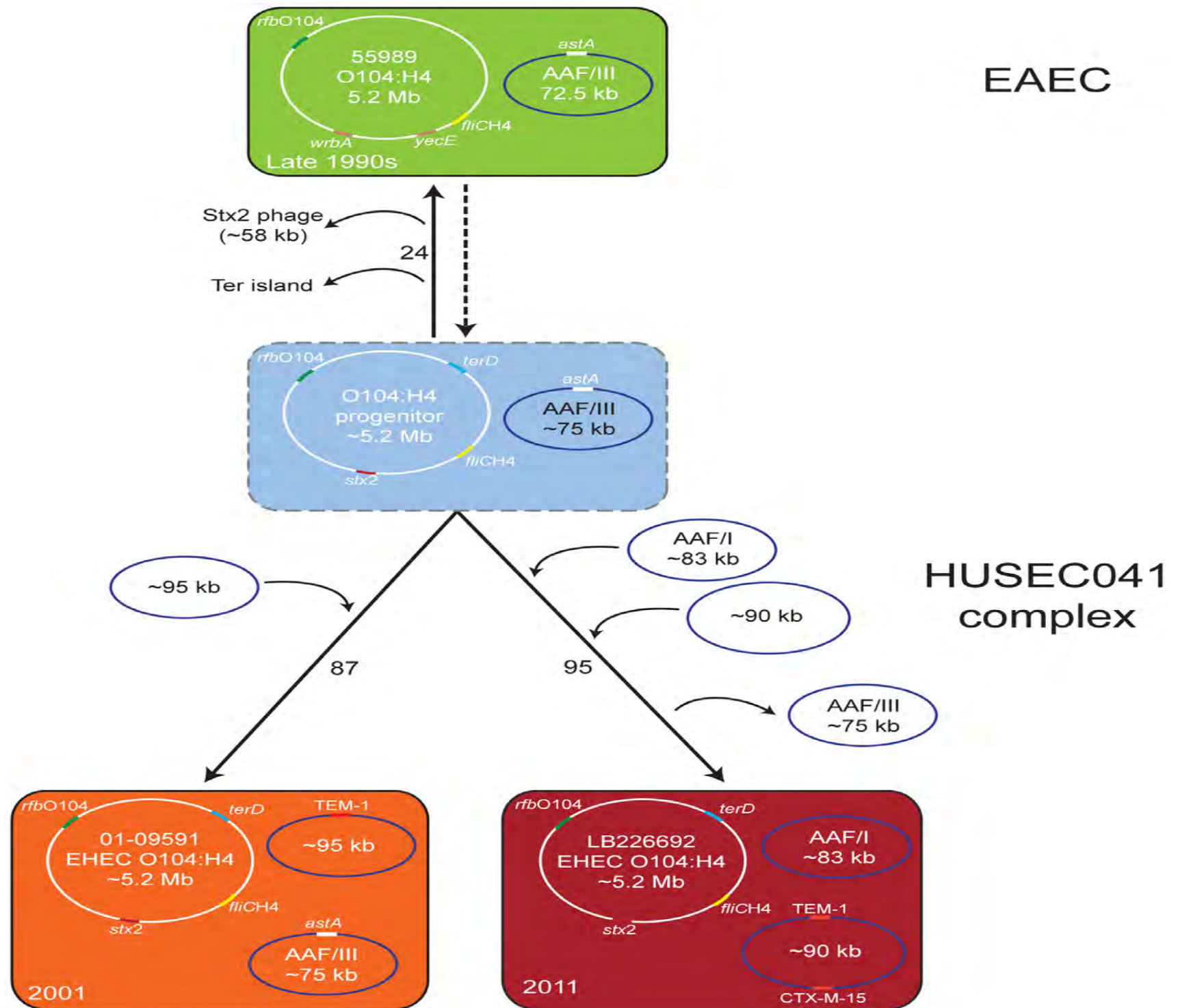
- the 1993 Jack-in-the Box outbreak
- contaminated burgers
- several US states linked and 723 cases reported
- **4 dead**

The unexpected – *Escherichia coli* O104

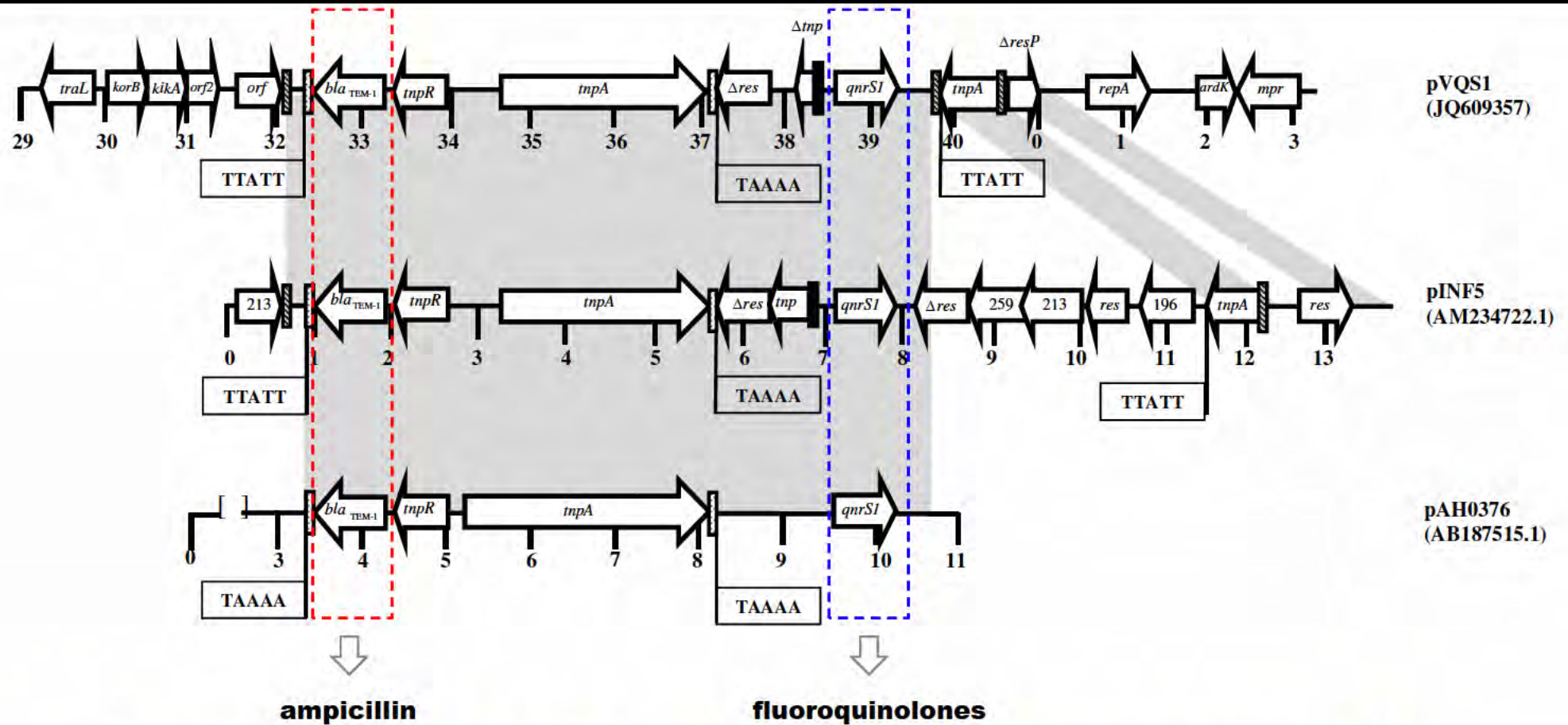


- ❑ **a total of 3,816 cases; 54 deaths**
- ❑ outbreak centered in northern Germany in Lower Saxony
- ❑ an atypical pathogenic *E. coli* was the aetiological agent
- ❑ outbreak strain was a clone
- ❑ resistant to certain b-lactam antibiotics
- ❑ **bacterial genome is dynamic**

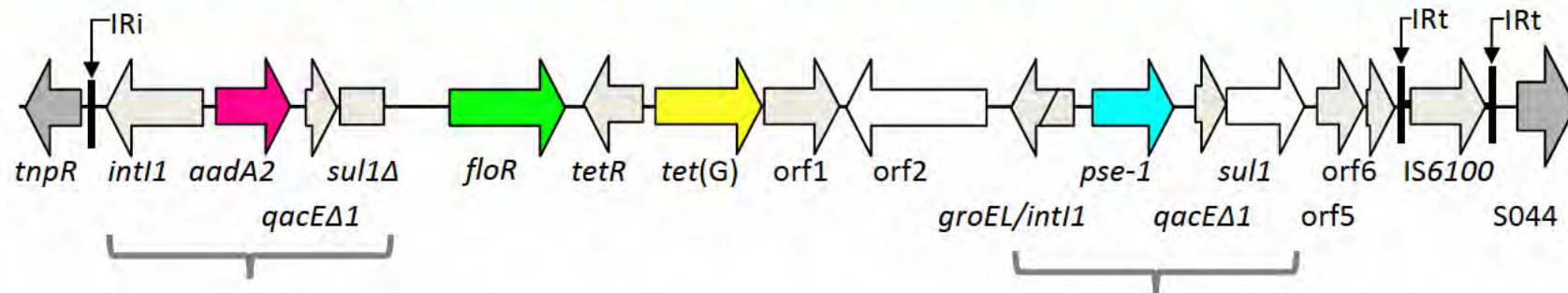




Antimicrobial resistance – *a new zoonoses?*

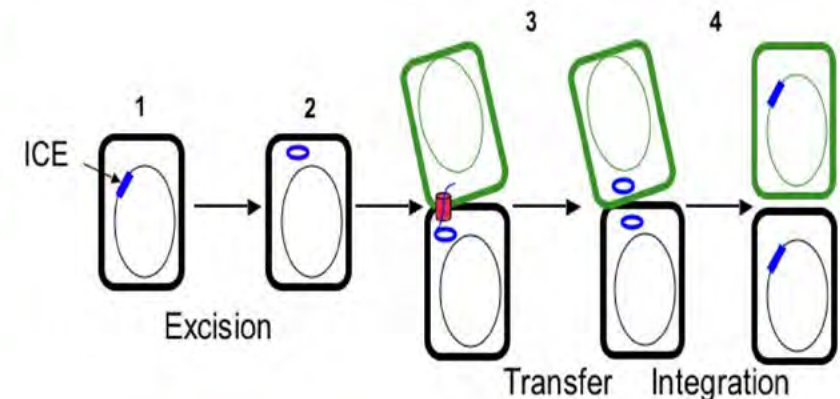
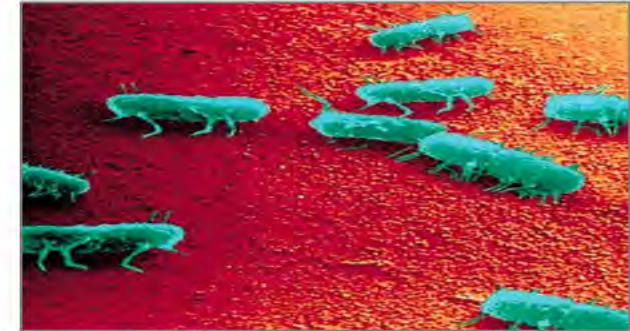


chromosomally-located cluster of resistance genes -*ICE*



Investing in microbiological research – *towards a safe and sustainable food supply*

- ❑ surveillance to improve our understanding of **microbial ecology** across the food chain, as a useful step to reduce transmission
- ❑ understand how **practices at various points** along the *farm-to-fork* continuum, contribute to the **adaptation and subsequent emergence** of food-borne pathogens
- ❑ develop **novel antimicrobial molecules** as a means to reverse multi-drug resistance
- ❑ **next generation detection methods** to enable an assessment of the risk posed by food-borne pathogens to public health





Thank you