

Basic microbiology -have bacteria got a free travel pass at your facility?

Kieran Jordan

Department of Food Safety

Teagasc Food Research Centre Moorepark

Topics to be covered

Bacteria – focus on those to be avoided!

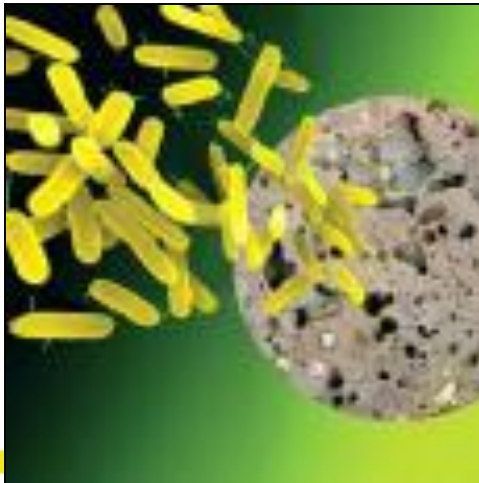
Survival/Inactivation of bacteria

Survival versus growth

Examples of bacteria

Practical considerations in control

**Bacteria are very small
and must be magnified
1000 times in order to
see them**



**There are some harmful
bacteria (called pathogens)
and others not harmful**

Not harmful

Lactobacilli

Lactococci

Bifidobacteria

Streptococci

Pseudomonas



Harmful

***E. coli* O157**

Listeria

monocytogenes

Bacillus cereus

Enterobacter sakazakii

Salmonella

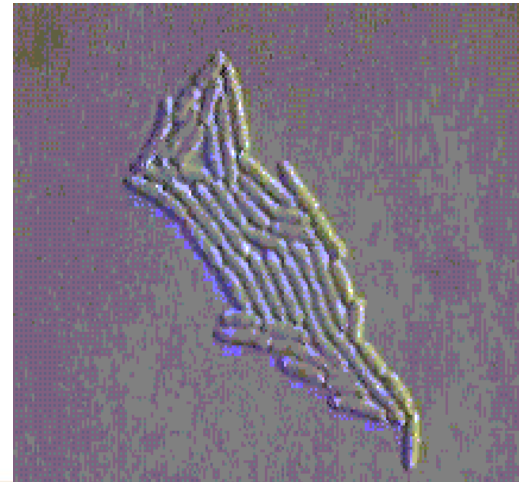
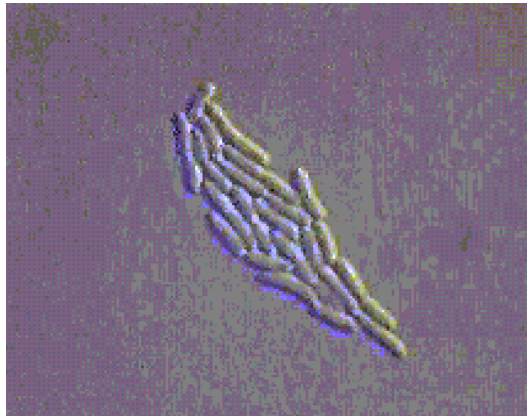
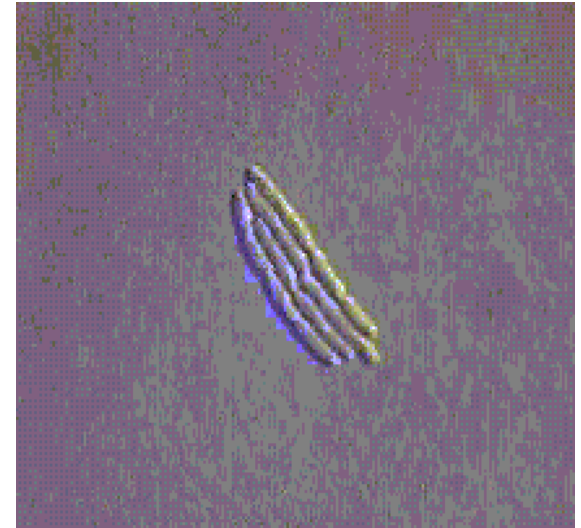
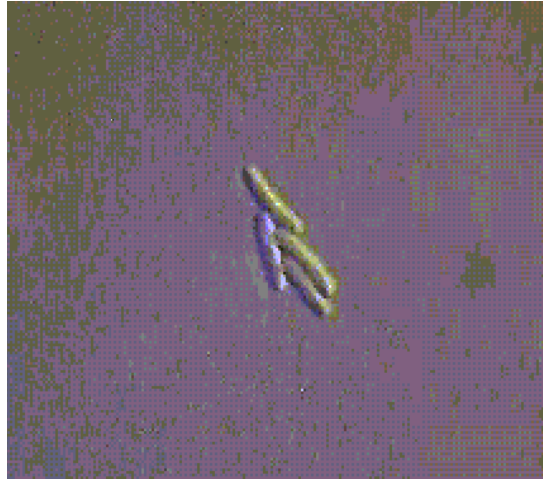
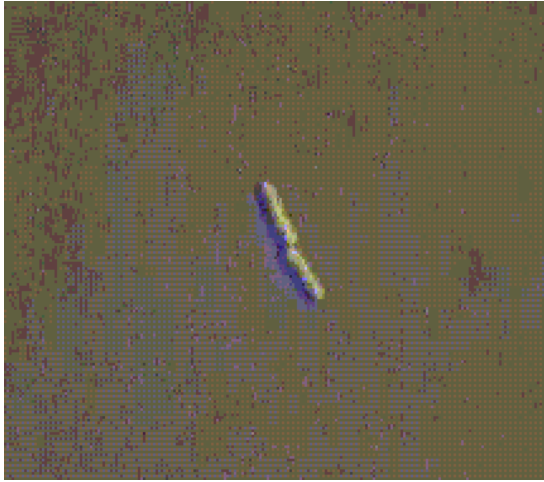


Cell division (growth)

Cells can divide every 30 minutes
(population doubles)

1 cell to 10,000,000 cells in 12 hours

It is the ability of bacteria to multiply
rapidly that causes milk to spoil



Bacterial growth

If conditions are suitable bacteria will grow

- **Temperature**
- **Nutrients**
- **Moisture**
- **Acidity – acid v alkaline**

Bacterial survival

If conditions are unfavourable bacteria can survive

Survival time varies with the bacteria and the severity of the conditions

Many bacteria have developed survival mechanisms

- **Spores**
- **Adaptation to higher temperatures (thermoduric bacteria)**

Survival versus growth

Bacteria can survive in product without actually growing

Opportunity to grow if conditions change

Important if only a few cells are needed to cause disease

Indicator bacteria

Not necessarily dangerous themselves, but indicate contamination

Easy to measure

Actions based on a positive result

Coliform, *E. coli*, *Streptococci*, Enterobacteriaceae

Enterobacteriaceae (EB)

Can be found in almost every environment. Many members of this family are a normal part of the bacterial population in humans and other animals and found in water or soil.

The bacterium cannot survive pasteurisation. Its occurrence in finished product is typically indicative of post processing contamination.

Some Enterobacteriaceae e.g. *Cronobacter sakazakii*, are very resistant to dry conditions and can survive in the environment for long periods of time. Once the bacterium gets a source of water and a food supply i.e. infant formula, it will grow rapidly.

Control of Bacteria

Avoid contamination!



Temperature is the most important factor

- **Danger zone 15 - 45°C**
- **Lower temperature, slower growth**

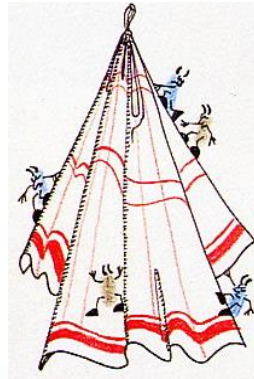
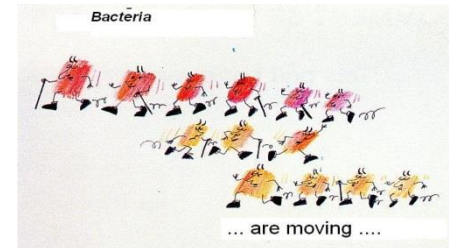
Practical issues – how do bacteria travel?



On hands

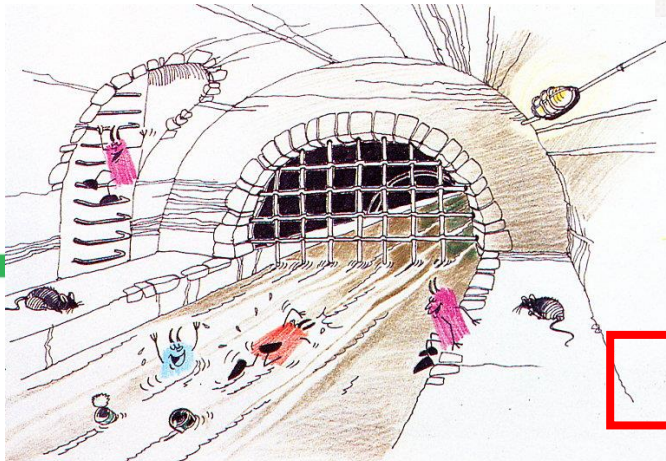


On tools



On clothes, shoes etc

On newspapers

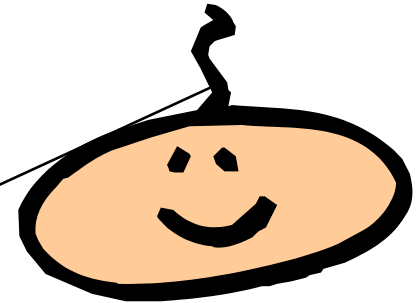


In water



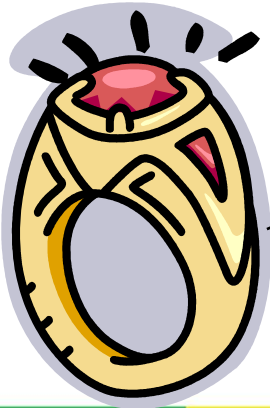
In food

Bacteria transported by hair



Jewellery

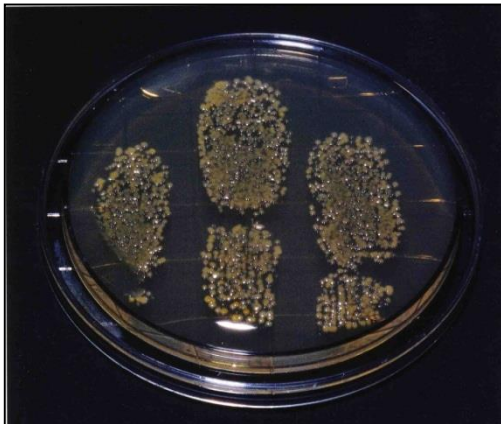
- Hidden places under jewellery, difficult to keep clean by washing



Hands

How may hands be the source of contamination?

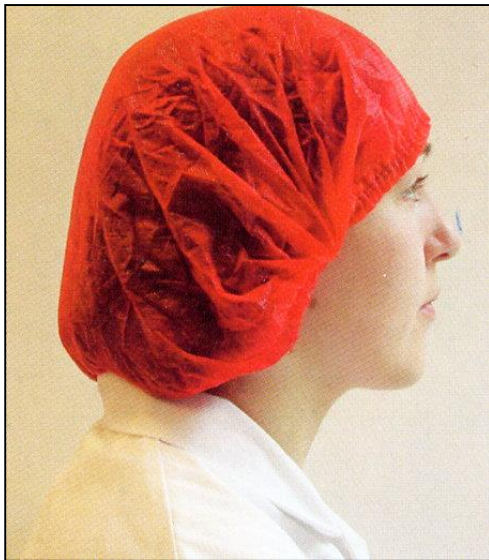
- Hands - natural skin flora, usually not dangerous, but in some cases pathogens are found - e.g. *Staph. aureus*
- Higher number of bacteria in case of wounds, in particular, if they are infected



Finger print on a microbiological media

Hair: Hygiene measures

How to protect our products from being contaminated by hair of the operator?



Hair net covering
the hair completely

Hair net to be
changed at least
once a day or if
damaged

Hands: Hygiene measures

Hygiene measures to avoid transmission of bacteria by person's hands

- Hand washing facilities
 - Touch-less tap
 - Washing & disinfection
 - Paper towel
 - Disposal container



Hand Washing: Hygiene measures

Hands have to be washed thoroughly

- Prior to entering production area
 - After each break in break room or visits to smoking area
 - After completing tasks with soiled hands
 - After using toilets
 - Correct Hand washing should take **at least 15 seconds**
- If People are not always washing and regularly sanitising their hands effectively then random swabbing will show bacterial contamination**
- Hand swabs may be performed to evaluate the effectiveness of personnel hand washing

Thank you for your attention