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Future Microbiological Trends

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Food Microbiology- we know all about that !

- We can often be lead to believe we know all there is to know about food microbiology
- The microbiological hazards are well know
- The controls are well known
- Its old science
- We know it all !

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So:

- Why do an estimated 25% of the UK population suffer from food poisoning every year
- Why was the estimated number of cases of food poisoning 43% higher in 2008/9 than 1993/6
- And its not just in the UK
  - Annually in the USA foodborne illness causes
    - 1 in 6 Americans to be ill,
    - 128,000 to be hospitalized
    - 3,000 to die

Ref: UK FSA- IID 2 Study 2012
Ref: USA CDC- http://www.cdc.gov/foodborneburden/index.html

FSA Incidents Report 2013

	2006	2013
Total Food Incidents reported by FSA	1344	1562
Microbiological Incidents	147 (11%)	322 (21%)

- Microbiology is the only category where the number of incidents has increased every year since 2006

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Food Microbiology- there's lots to learn

- Changing Microorganisms of concern
- About external factors that effect the microbiology of our food
- About the processes and procedures we use to control microbiological hazards
- About the people who eat our food

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Do we have emerging pathogens?

- Campylobacter
  - Until 1972- only 12 cases of Campylobacter infections had been reported
- Listeria
  - 1982- First conclusive evidence Listeriosis could be caused by consuming contaminated foods- Canada
- E.coli O157
  - 1982- first isolation from a foodborne outbreak- USA, (1983, UK)

Why do they emerge?

- Why don't we know about them, where do they come from
- Campylobacter- caused foodborne infections continuously- no methods to detect it.
- Listeria- caused foodborne infections continuously- no methods to detect it
- E.coli O157- PHLS retrospective survey of 15000 - E.coli isolates 1978-1982, 1 isolate. Not found in any diarrhoea outbreaks 1973 to 1983*
  - O157 recently evolved from an E.coli O55:H7 by gaining and losing genes

- * Pennington. Infect Drug Resist 2014, 7, 211-222

So why do new organisms appear?

- They are always there and we just can't see them or their effects- a test method issue
- Organisms evolve over time

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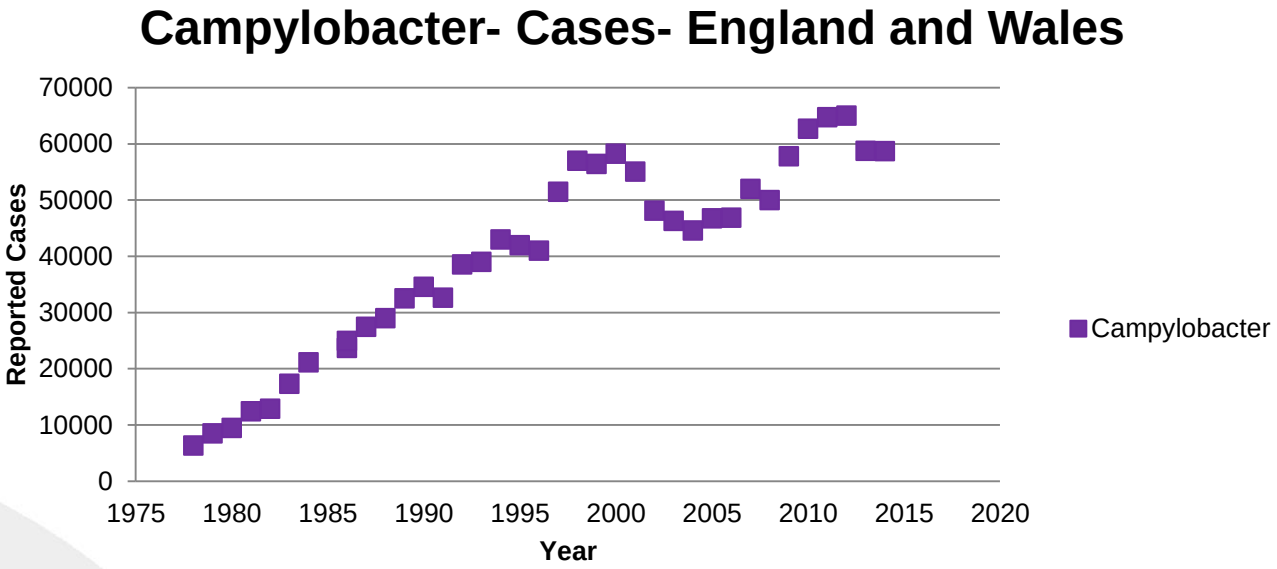
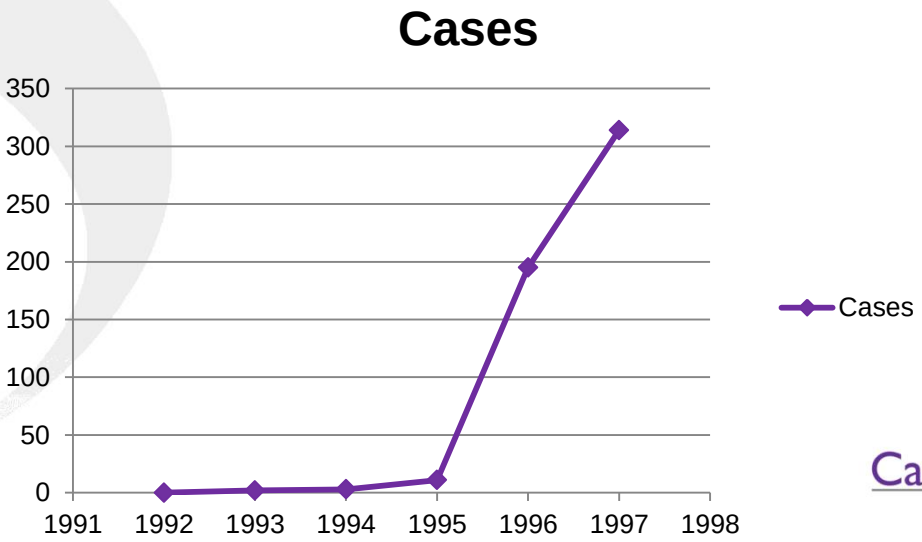
The Trends

- Firstly—beware statistics without interpretation

Campylobacter UK



E.coli O157 Sweden



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Microbial Issues

- Campylobacter
- Listeria monocytogenes
- E.coli O157 and VTEC/STEC
- Foodborne Viruses
  - Norovirus
  - Hepatitis A and E

Listeria monocytogenes

- UK- 2014 illness figures 5.5% greater than 2013
- 87% non-pregnancy associated
- 65% cases >60yrs old, 41% were 70 to 79 yr old
- Change in epidemiology and clinical effect

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Listeria

- They like cold wet conditions
- Can grow at fridge temperatures
- Are killed easily by heating
- But can be hard to eliminate in chilled production areas
- Chilled Ready To Eat foods pose a risk and must be tested for Listeria-- its an EU Regulation

Verocytotoxin Producing E.coli

- VTEC or STEC (Shiga Toxin Producing E.coli)
- We know all about O157:H7
- There are hundreds of other serotypes of VTEC
- E.g. O104:H4—2011 sprouted seeds Germany
- Until recently we've had no methods to test for these

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RASFF Information on VTEC -2014 Data

- enteropathogenic Escherichia coli (O26H1, eae +, stx -) in raw milk cheese
- shigatoxin-producing Escherichia coli (O125-H-; stx2+ /25g) in frozen kangaroo meat
- shigatoxin-producing Escherichia coli (O26H11 serotype with eae and stx1 genes) in raw milk camembert
- shigatoxin-producing Escherichia coli (O26, O103, O145 stx1+, stx2+, eae+) in frozen deer goulash meat
- shigatoxin-producing Escherichia coli (stx1+, stx2+, eae+, O128 /25g) in frozen lamb
- shigatoxin-producing Escherichia coli (O-26H-11 stx+ eae+) in raw milk cheese
- shigatoxin-producing Escherichia coli (stx2+, eae+, O8) in chilled lamb
- shigatoxin-producing Escherichia coli (O104, O128 & O159; stx1+, stx2+, eae-) in frozen lamb meat
- shigatoxin-producing Escherichia coli (O26H11 stx+, eae+) in raw goat milk cheese
- shigatoxin-producing Escherichia coli (O26-H11 eae+ stx+) in goat cheese made from raw milk
- shigatoxin-producing Escherichia coli (O26 H11 eae+ stx1+) in cow's milk cheese made with raw milk
- enteropathogenic Escherichia coli (O26 H11; eae positive) in raw goat milk cheese
- shigatoxin-producing Escherichia coli (O123 stx1+ stx2 eae- /25g) in boneless lamb meat (Ovis aries)
- shigatoxin-producing Escherichia coli (stx1, stx2, eae, O145) in chilled deer meat
- shigatoxin-producing Escherichia coli in frozen lamb meat
- shigatoxin-producing Escherichia coli (positive) in frozen sheep meat
- shigatoxin-producing Escherichia coli in frozen lamb meat (Ovis aries)
- shigatoxin-producing Escherichia coli in frozen lamb from
- shigatoxin-producing Escherichia coli (STEC 0103:H2 stx1 eae) in frozen minced
- shigatoxin-producing Escherichia coli (STEC O26) in chilled beef

Viruses

- Norovirus
- Hepatitis A-
- Hepatitis E-

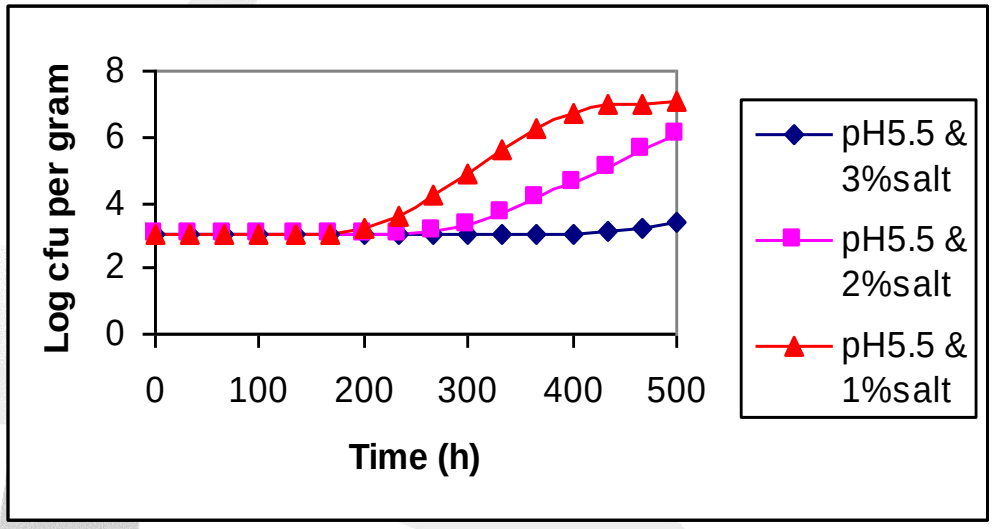
- Viruses : cannot grow in or on foods organisms- they are just carried by them
- Difficult to detect in foods
- Limited understanding of how food processing affects them
  - Hep E has reported to have a high heat resistance

Viruses

- 2014 there were 5734 reported cases Norovirus in England & Wales
- But under-reported by 1 to 300 ratio
- But is it foodborne or person to person?
- Issue in soft fruits- a problem
  - Frozen raspberries & strawberries (Germany 10000 cases norovirus 2012- Frozen strawberries)
  - Frozen Berries and Hepatitis A around the world 2013 (USA, Italy Ireland etc.)

Other things to consider

- Recipe change/process change
  - Low salt, low sugar, low fat, preservative free



- Process change will affect microbial survival
  - Broth Aw 0.99 10 fold reduction 62C 24 sec
  - Wheat flour Aw 0.6 10 fold reduction 62C 14.6 h
- Low temperature cooking- fresher result
  - 70ºC for 2 min – kills a million Listeria
  - 65ºC for 9.3 min
  - 60ºC for 43.5 min

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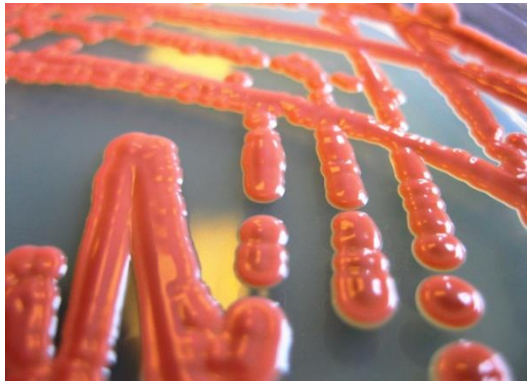
Consumers

- Aging population
- Effects of prescribed drugs
- A greater proportion of the population more susceptible to infection

The changing base of analytical methods

- Microbiologists grow cultures on agar
- If it grows its there and its alive
- What if its there and it can't grow?



- New DNA/RNA based methods make unculturable organisms visible.
- But if they are unculturable, are they infective

- What does the presence of "genomic material" mean
  - How would you interpret that result

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Conclusions

- There are emerging infectious organisms
- It is likely that changes to analytical methods will highlight more organisms of concern in the future
- We need to rapidly develop test methods and understand the effects of food production controls on them
- We need to understand that changes to production methods can affect survival & growth of microorganisms
- The consumer is changing and will continue to do so
- Our test methods are going through a quantum change- we will have a great challenge in understanding and interpreting the results of new methods.