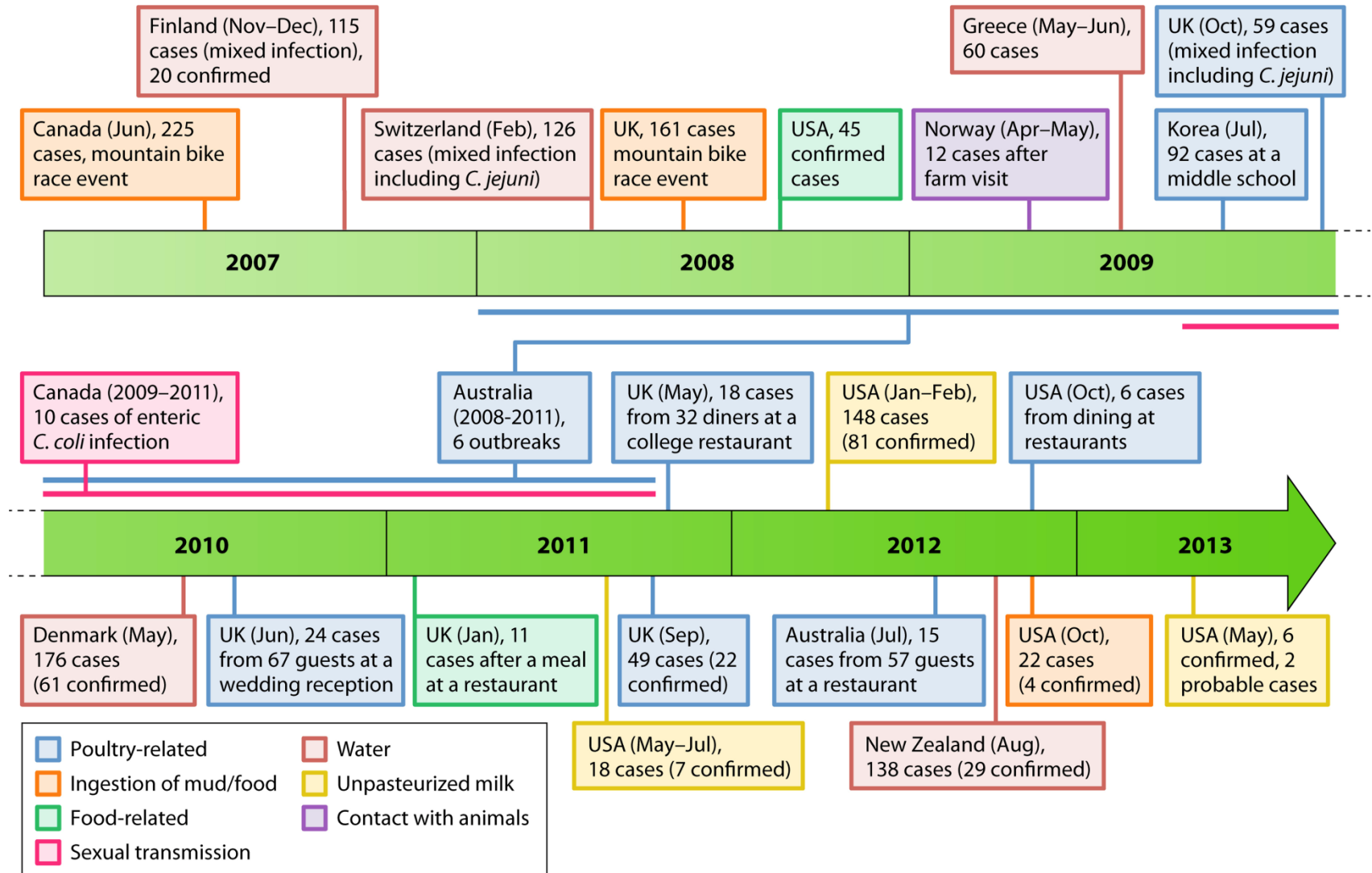


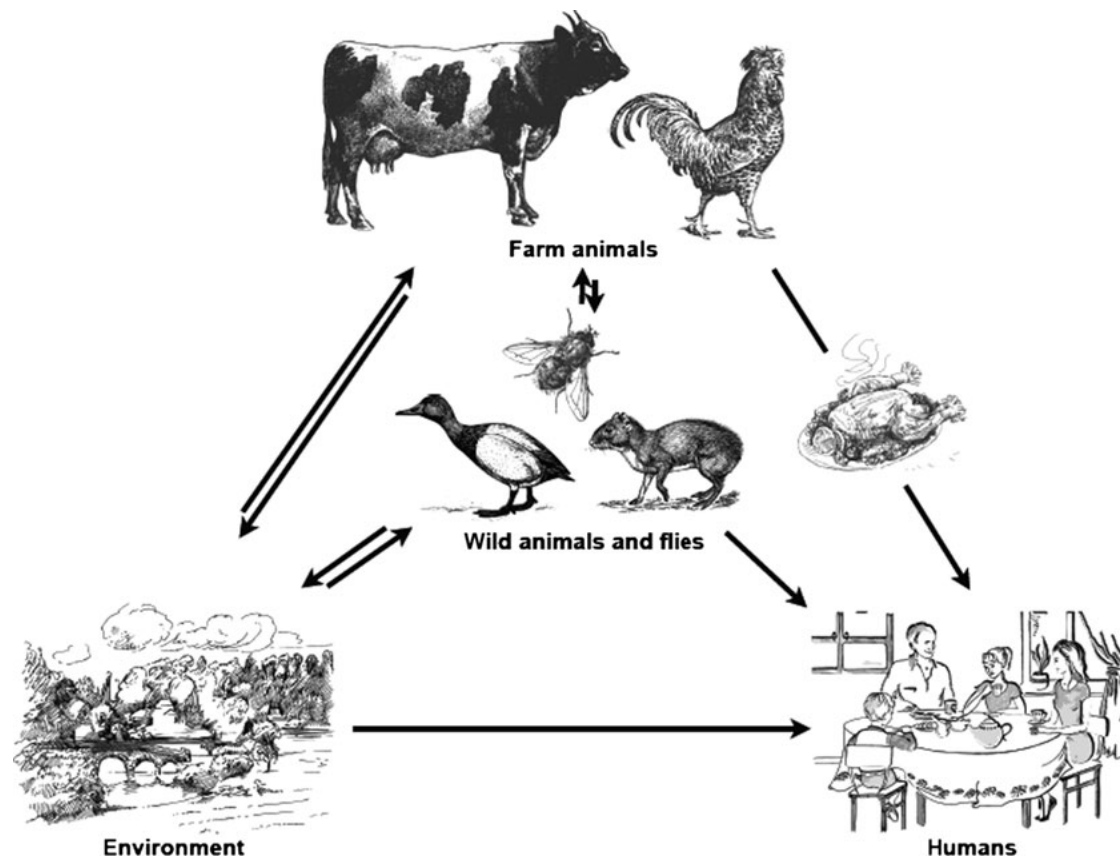


# Zoonotic *Campylobacter*: main microbiological and pathogenic features of a very successful bug

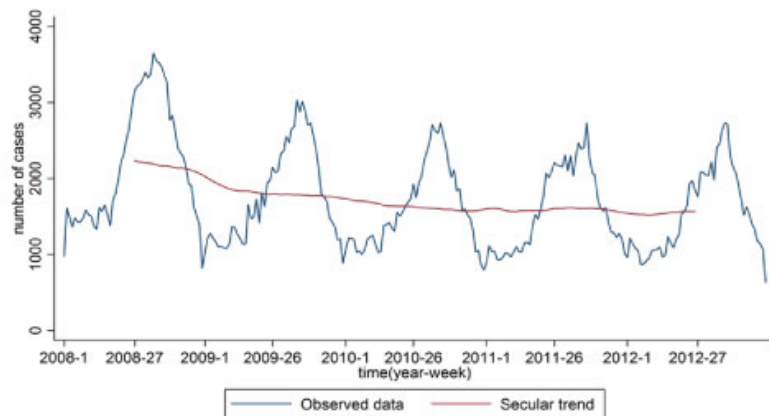
**Antonia Ricci**  
**Food Safety Department**  
**Istituto Zooprofilattico Sperimentale delle Venezie**



## Routes of transmission for *Campylobacter jejuni*



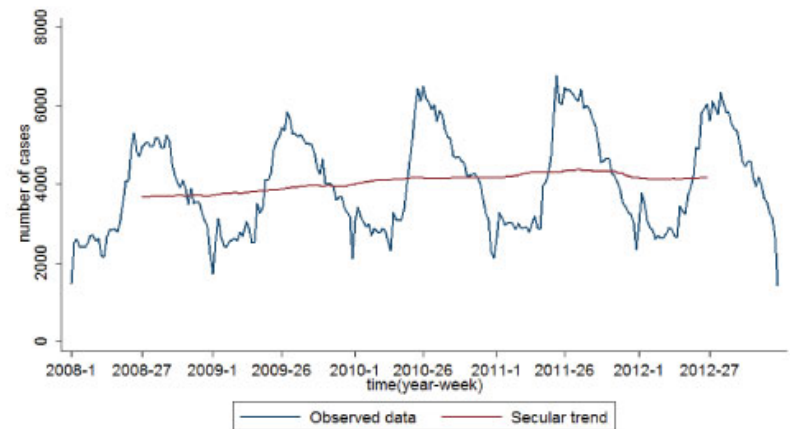
*Trend in reported confirmed cases of human salmonellosis in the EU, 2008–2012*



Source: 24 MSs: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Bulgaria and Poland are excluded as they reported only monthly data. Italy is excluded as its 2012 data were not representative.

EFSA, ECDC: EU Summary Report 2012, EFSA Journal 2014,12(2):3547

*Figure CA2. Trend in reported confirmed cases of human campylobacteriosis in the EU, 2008–2012*



Source: Data for EU trend 24 MSs: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Bulgaria is excluded because only monthly data were reported and Greece and Portugal do not have surveillance systems for this disease.

EFSA, ECDC: EU Summary Report 2012, EFSA Journal 2014,12(2):3547

Despite its importance, the effective control of *Campylobacter* in the food chain and the design of disease prevention strategies are hindered by a **poor understanding** of the genetics, physiology and virulence of this organism.

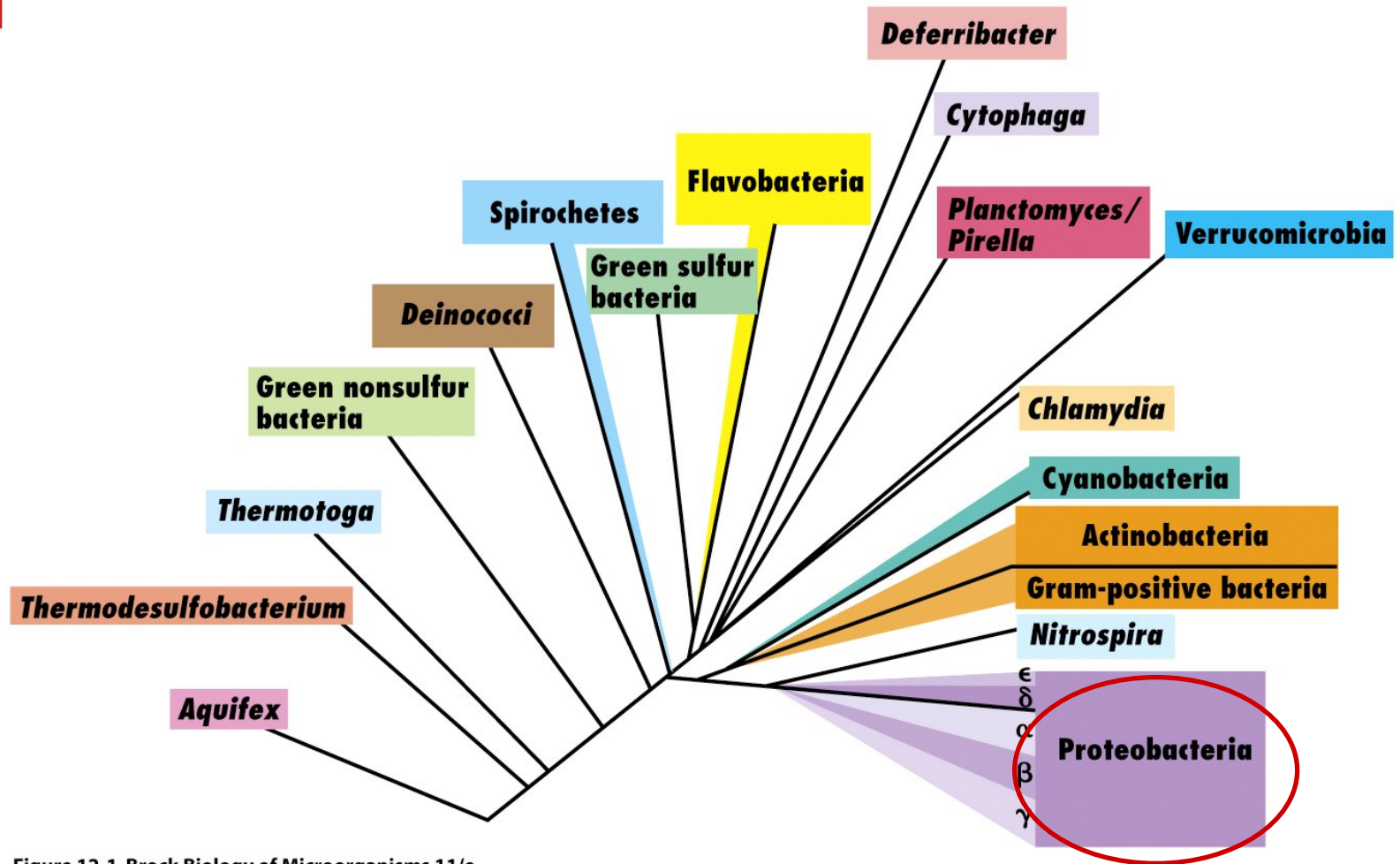
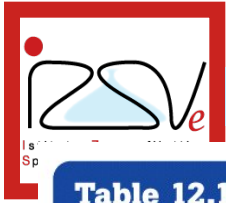


Figure 12-1 Brock Biology of Microorganisms 11/e  
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The same *phylum*, different classes.....






**Table 12.1 Major genera of Proteobacteria<sup>a</sup>**

Subdivision	Genera	
<b>Alpha</b>	<i>Acetobacter</i>	<i>Nitrobacter</i>
	<i>Agrobacterium</i>	<i>Paracoccus</i>
	<i>Alcaligenes</i>	<i>Rhodospirillum</i>
	<i>Azospirillum</i>	<i>Rhodopseudomonas</i>
	<i>Beijerinckia</i>	<i>Rhodobacter</i>
	<i>Bradyrhizobium</i>	<i>Rhodomicrobium</i>
	<i>Brucella</i>	<i>Rhodovulum</i>
	<i>Caulobacter</i>	<i>Rhodopila</i>
	<i>Ehrlichia</i>	<i>Rhizobium</i>
	<i>Gluconobacter</i>	<i>Rickettsia</i>
	<i>Hyphomicrobium</i>	<i>Sphingomonas</i>
	<i>Methylocystis</i>	<i>Zymomonas</i>
<b>Beta</b>	<i>Aquaspirillum</i>	<i>Oxalobacter</i>
	<i>Bordetella</i>	<i>Polaromonas</i>
	<i>Burkholderia</i>	<i>Ralstonia</i>
	<i>Chromobacterium</i>	<i>Rhodocyclus</i>
	<i>Dechloromonas</i>	<i>Rhodoferax</i>
	<i>Gallionella</i>	<i>Sphaerotilus</i>
	<i>Leptothrix</i>	<i>Spirillum</i>
	<i>Methylophilus</i>	<i>Thiobacillus</i>
	<i>Neisseria</i>	<i>Zoogloea</i>
	<i>Nitrosomonas</i>	

<sup>a</sup> This table is not meant to be inclusive but only lists some well-described genera of Proteobacteria. For a complete list of genera of Proteobacteria and genera of other lineages of *Bacteria*, see Appendix 2.

Table 12-1 part 1 Brock Biology of Microorganisms 11/e  
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**Table 12.1 Major genera of Proteobacteria<sup>a</sup>**

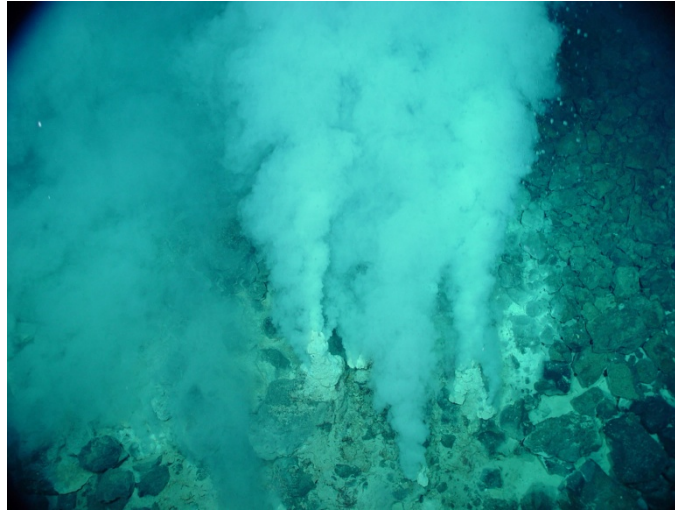
Subdivision	Genera	
<b>Gamma</b>	<i>Acetobacter</i>	<i>Photobacterium</i>
	<i>Acinetobacter</i>	<i>Pseudomonas</i>
	<i>Azotobacter</i>	<i>Methylococcus</i>
	<i>Chromatium</i>	<i>Methylobacter</i>
	<i>Escherichia</i>	<i>Nitrosococcus</i>
	<i>Ectothiorhodospira</i>	<i>Nitrococcus</i>
	<i>Erwinia</i>	<i>Thermochromatium</i>
	<i>Francisella</i>	<i>Thiomicrospira</i>
	<i>Halomonas</i>	<i>Thiospirillum</i> and other purple sulfur bacteria
	<i>Halorhodospira</i>	<i>Salmonella</i> and other enteric bacteria
	<i>Halothiobacillus</i>	<i>Vibrio</i>
	<i>Legionella</i>	<i>Xanthomonas</i>
	<i>Leucothrix</i>	
	<i>Methylomonas</i>	
<b>Delta</b>	<i>Oceanospirillum</i>	
	<i>Acinetobacter</i>	<i>Geobacter</i>
	<i>Aeromonas</i>	<i>Halomonas</i>
	<i>Bdellovibrio</i>	<i>Moraxella</i>
	<i>Desulfuromonas</i>	<i>Myxococcus</i> and other myxobacteria
	<i>Desulfovibrio</i> and most other sulfate-reducing bacteria	<i>Pelobacter</i>
	<i>Francisella</i>	<i>Syntrophobacter</i>
<b>Epsilon</b>	<i>Campylobacter</i>	<i>Thiovulum</i>
	<i>Helicobacter</i>	<i>Wolinella</i>

<sup>a</sup> This table is not meant to be inclusive but only lists some well-described genera of Proteobacteria. For a complete list of genera of Proteobacteria and genera of other lineages of *Bacteria*, see Appendix 2.

Table 12-1 part 2 Brock Biology of Microorganisms 11/e  
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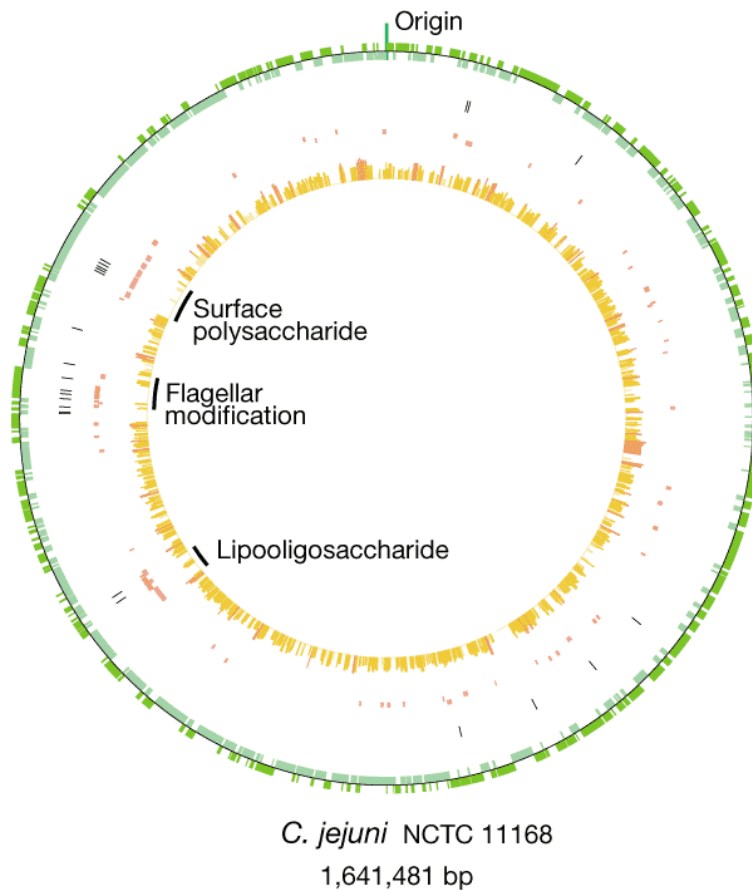


Share the capacity of surviving in hostile environments.....



## Some unique features:

- ❑ Almost complete lack of repetitive DNA sequences (only four);
- ❑ No functional inserted sequences or phage-related sequences;
- ❑ Little organization of genes into operons or clusters (apart from the two ribosomal protein operons and gene clusters involved in LOS biosynthesis, EP biosynthesis and flagellar modification);
- ❑ Broad set of regulatory systems to adapt to varying environmental conditions;
- ❑ Presence of high rate of hypervariable sequences commonly found in genes encoding the biosynthesis or modification of surface structures



## Motility

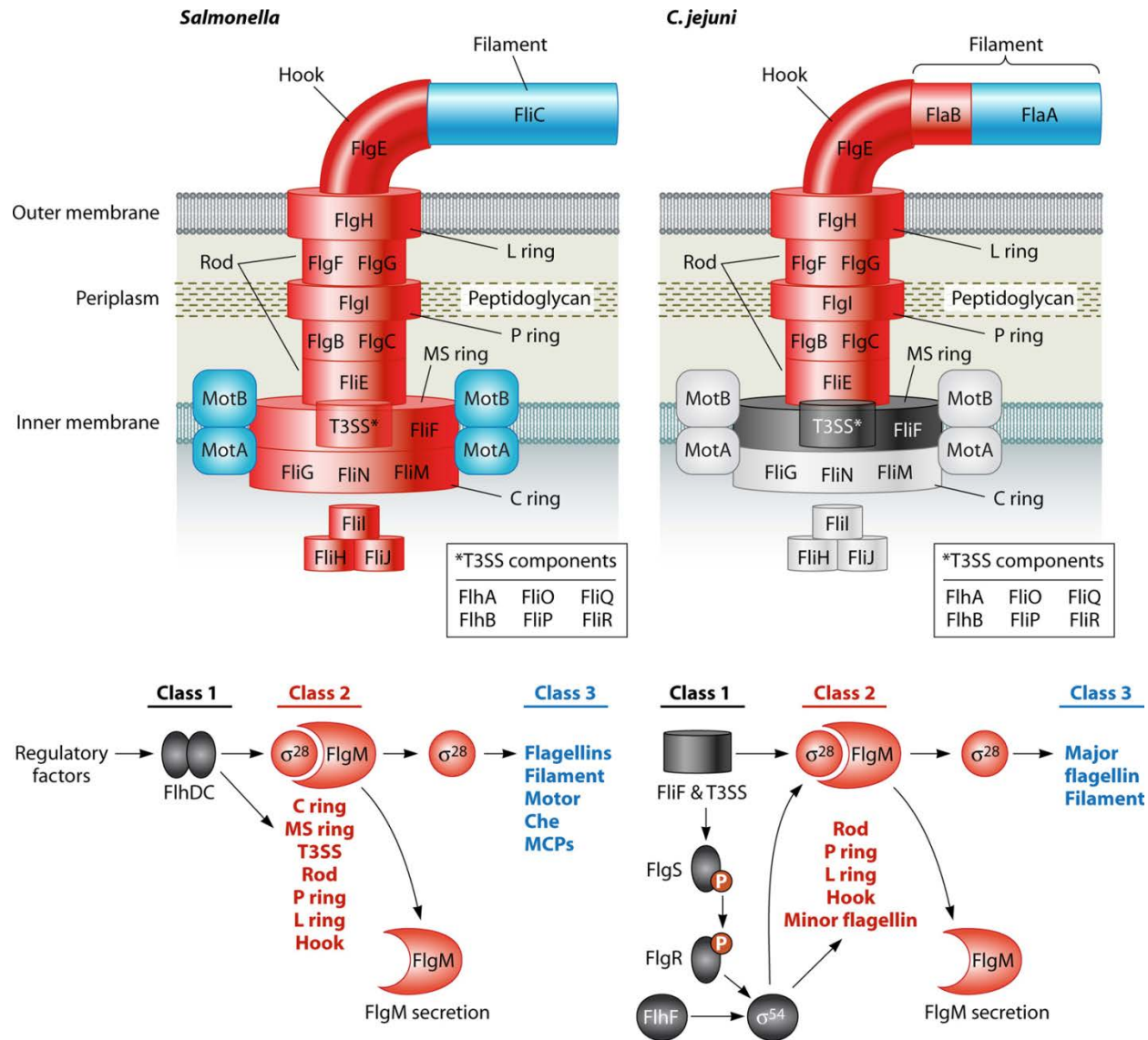
Campylobacter demonstrates roughly twice the velocity of rod-shaped bacteria (Salmonella) in substances of low viscosity, and can retain this velocity as viscosity increases 40 to 80 fold.



50 m/s

1,74 m/s





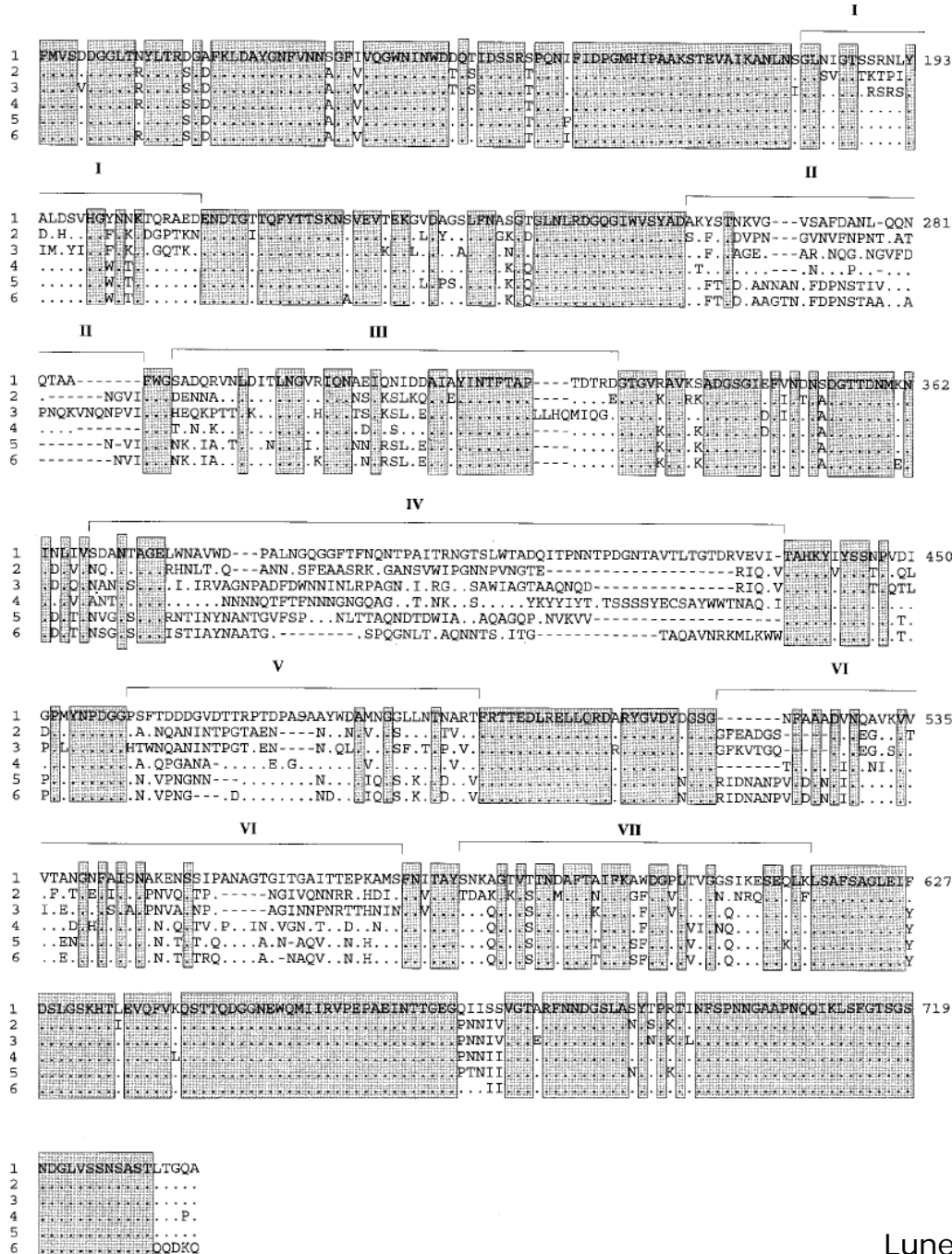


## The hook protein

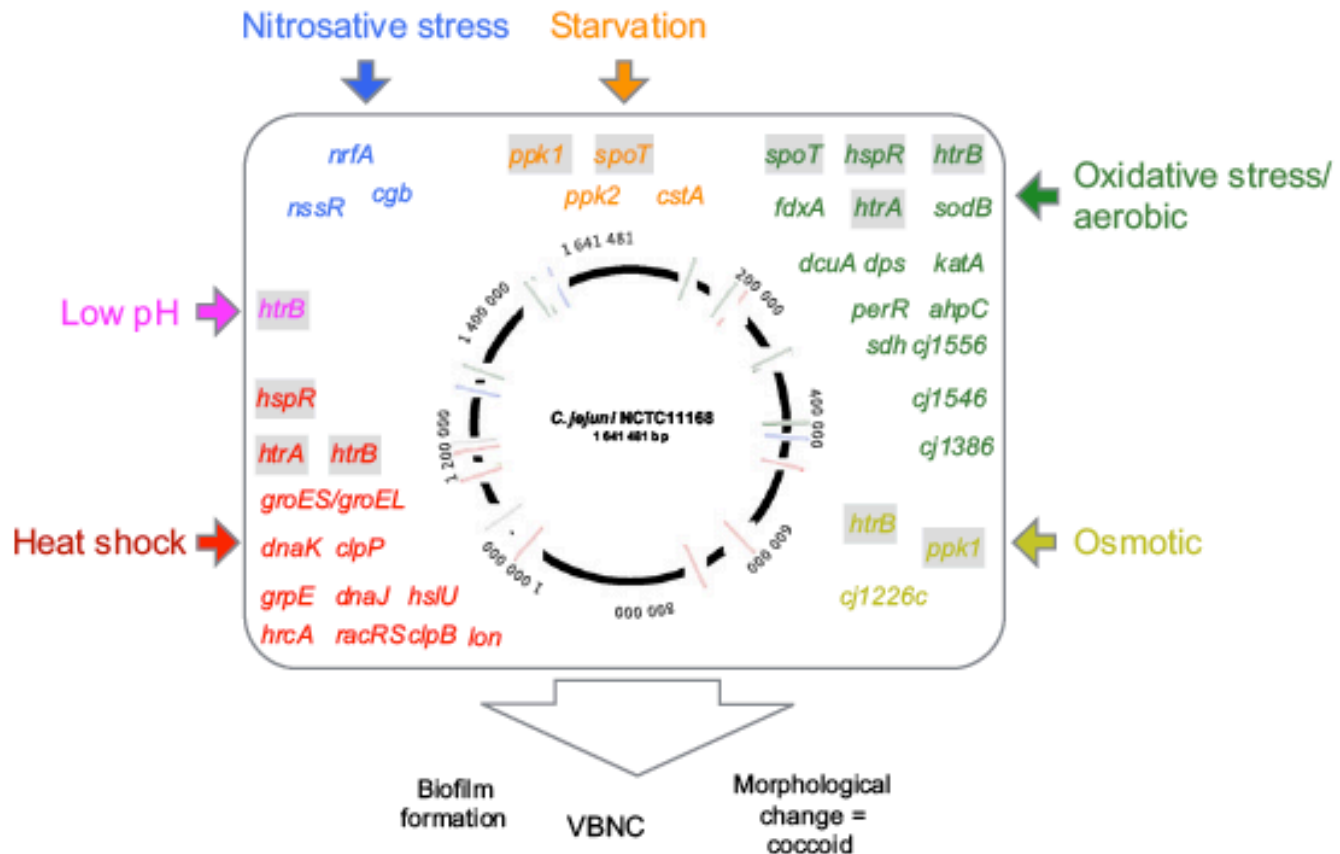
□ Is larger than that of any other bacterial hook known so far (molecular mass in the range of 90 to 94 kDa);

□ The large central region of the hook protein exhibits hypervariability among strains of one species and even of one serotype;

□ It confers selective advantages for antigenic diversity and immune escape



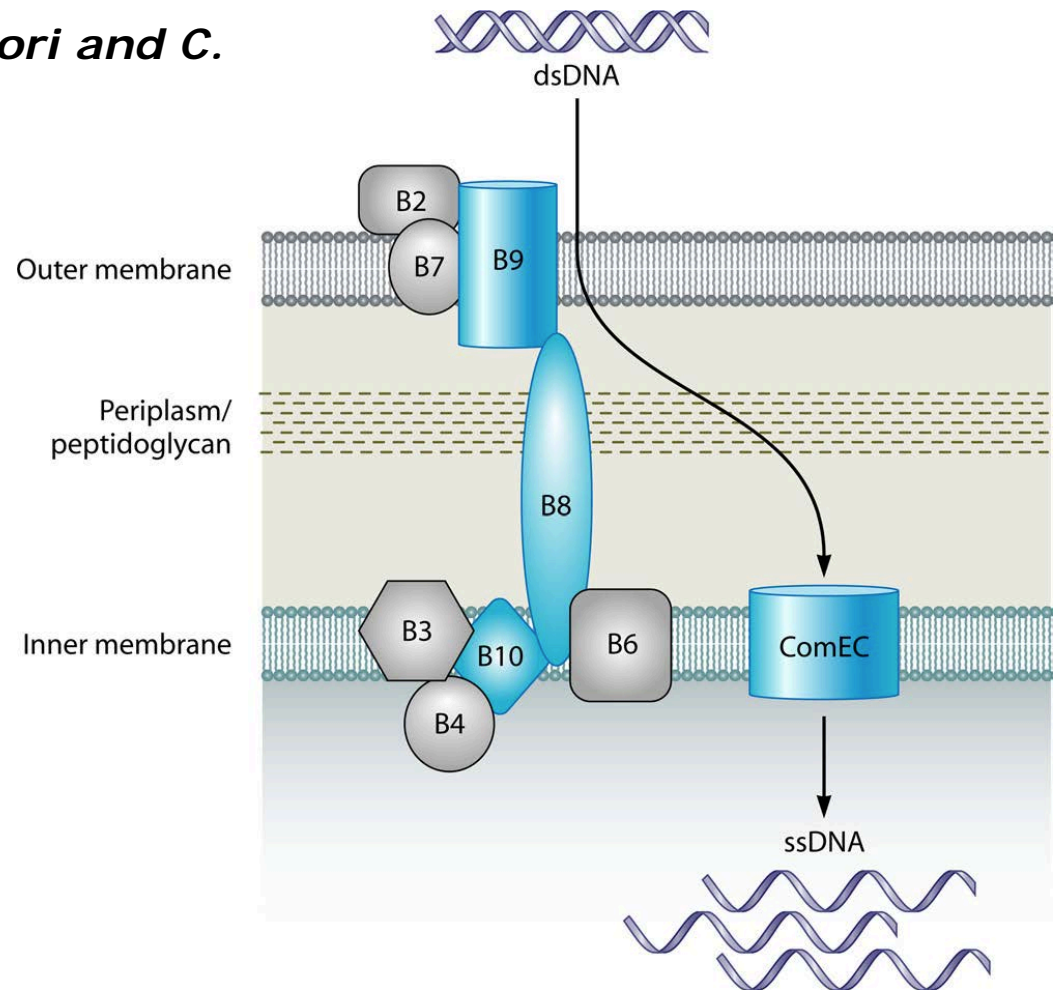
## *Campylobacter jejuni* responses to stresses



Bronowski C. et al., FEMS Microbiol Lett (2014) 356:8-19

## DNA uptake system of *H. pylori* and *C. jejuni*.

One unique aspect of natural transformation in some strains of *C. jejuni* is the presence of a plasmid-based (pVir) DNA uptake system





## Host susceptibility

Key factors are the local microbiota in the intestine, the status of protective processes like the physical barriers at the gastrointestinal mucosal surfaces, and the nonspecific host defense. When such inherent protective processes are overcome, specific acquired host immunity becomes critically important for the outcome of infection.

*Havelaar et al., Critical Reviews in Microbiology, 2009; 35(1): 1–22*

