

***Campylobacter
jejuni & coli***

15.04.2021

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<https://www.cdc.gov/campylobacter/faq.html>

Campylobacter spp.

Gram-negative, non-spore forming, curved S-shaped or spiral rods

Single polar flagellum at one or both ends & exhibits corkscrew-like motion

C. jejuni & *C. coli* are pathogenic and cause almost similar disease symptoms

>80% of *Campylobacter* infections are caused by *C. jejuni*.

Susceptible to drying, heating, freezing, disinfectants, and acidic conditions.



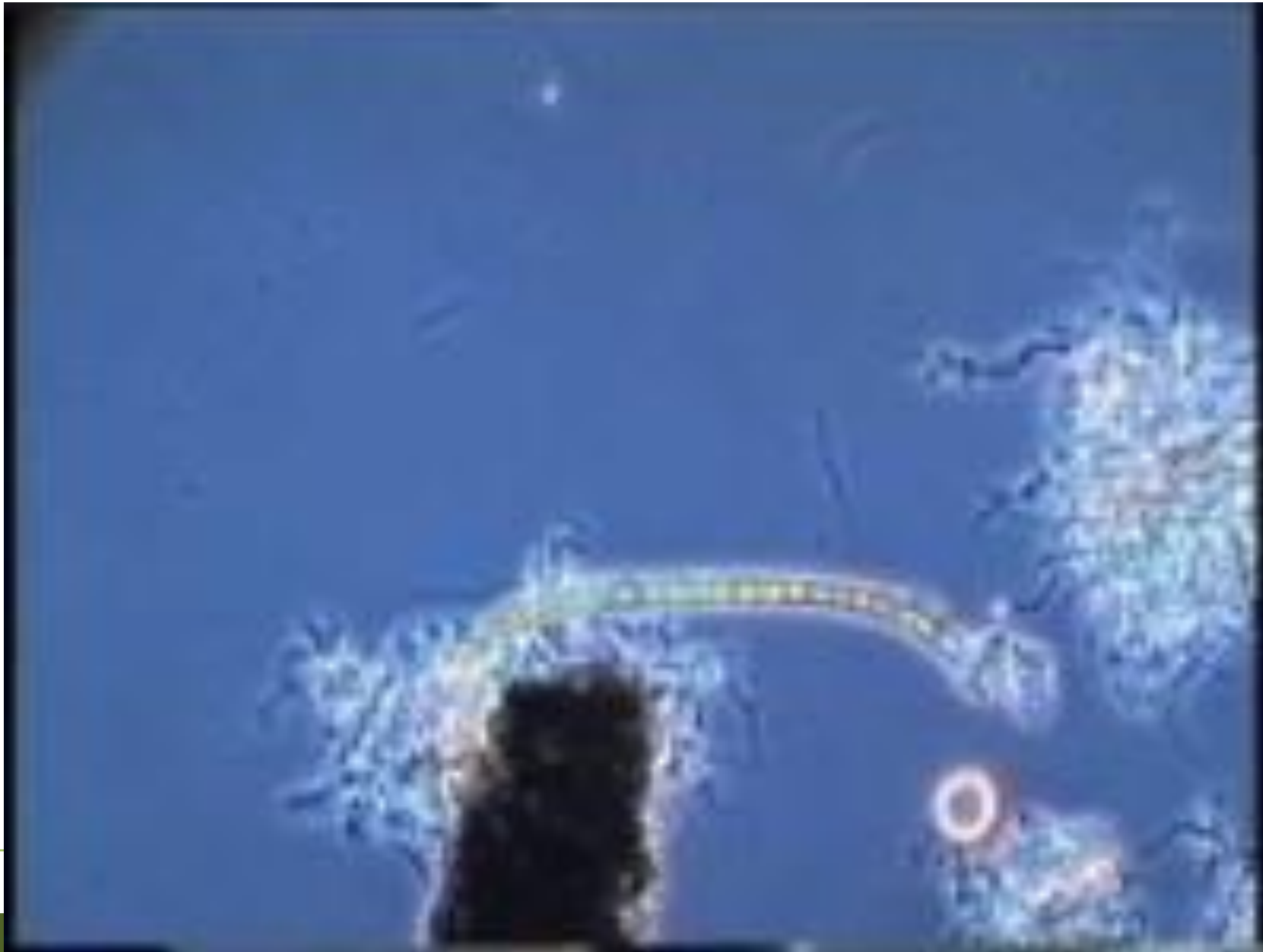
Microaerophile:
Grow best at low oxygen levels
(3 -5% oxygen and CO₂ of 3-10%)

Thermophiles – grow optimally at 42-45°C, no growth below 28-30°C,

Optimum pH: 6.5- 7.5

Growth is limited by osmotic stress (2% NaCl), desiccation, and pH 4.9.

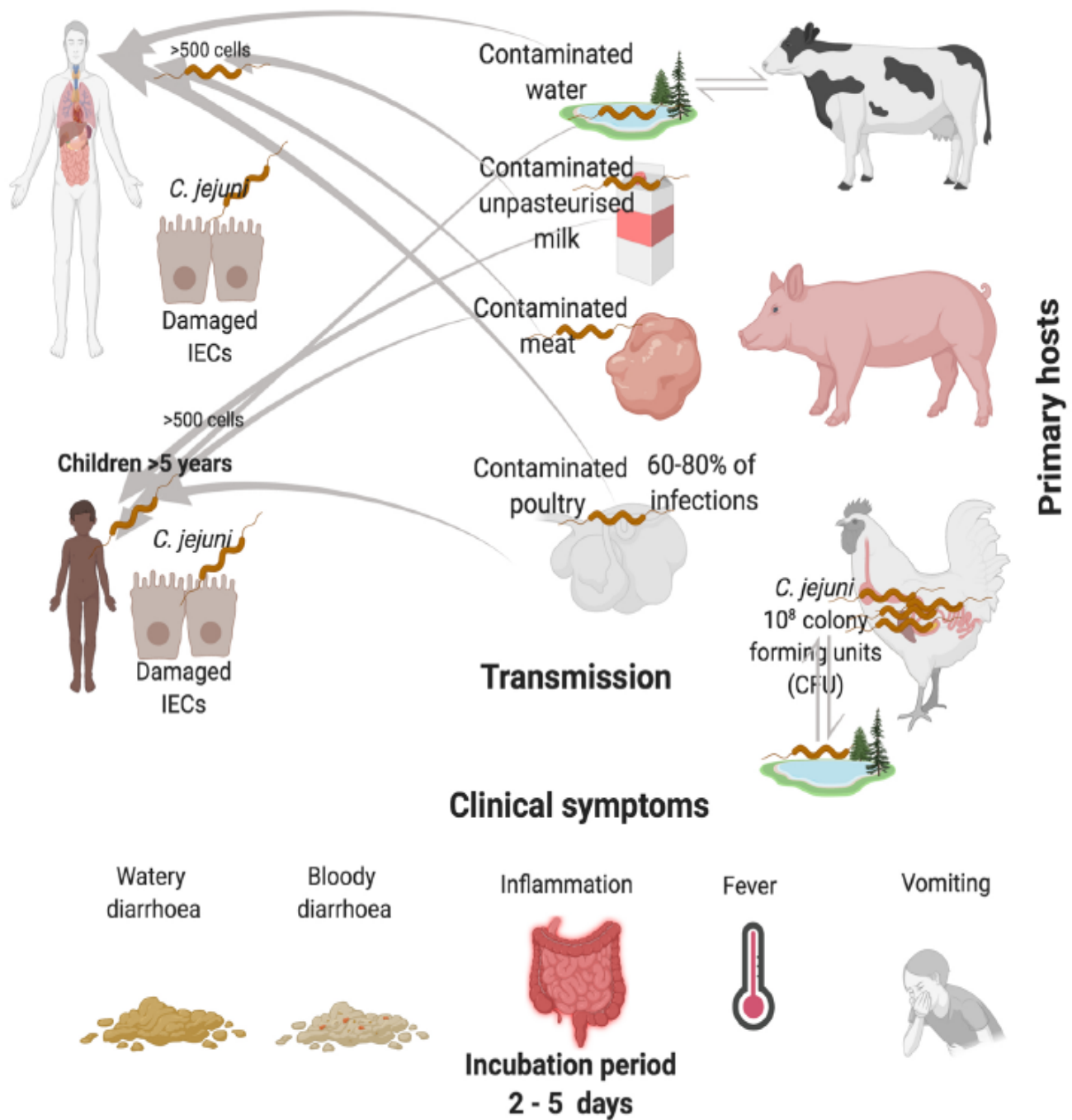
Corkscrew-like motion of *Campylobacter*



SOURCES

- ❑ **Reservoir:** Gastrointestinal tract of animals: livestock (pigs, cattle, sheep), birds (poultry), Polluted water & environment
- ❑ Meat/chicken
 - Animal carry *Campylobacter* in the intestines, liver, and other organs but show no sign of illness
 - The bacteria can be transferred to other edible parts when animal is slaughtered & eviscerated (removal of internal organ)
- ❑ Milk
 - *Campylobacter* infection in cow's udder (mastitis – inflammation of breast tissue) → contaminate milk
- ❑ Fruits & vegetables
 - Contaminated through contact with soil/water containing animal feces





Overview of sources, transmissions and outcomes of *Campylobacter jejuni* infection

Elmi et. al. (2021)

<https://doi.org/10.3389/fcimb.2020.607704>

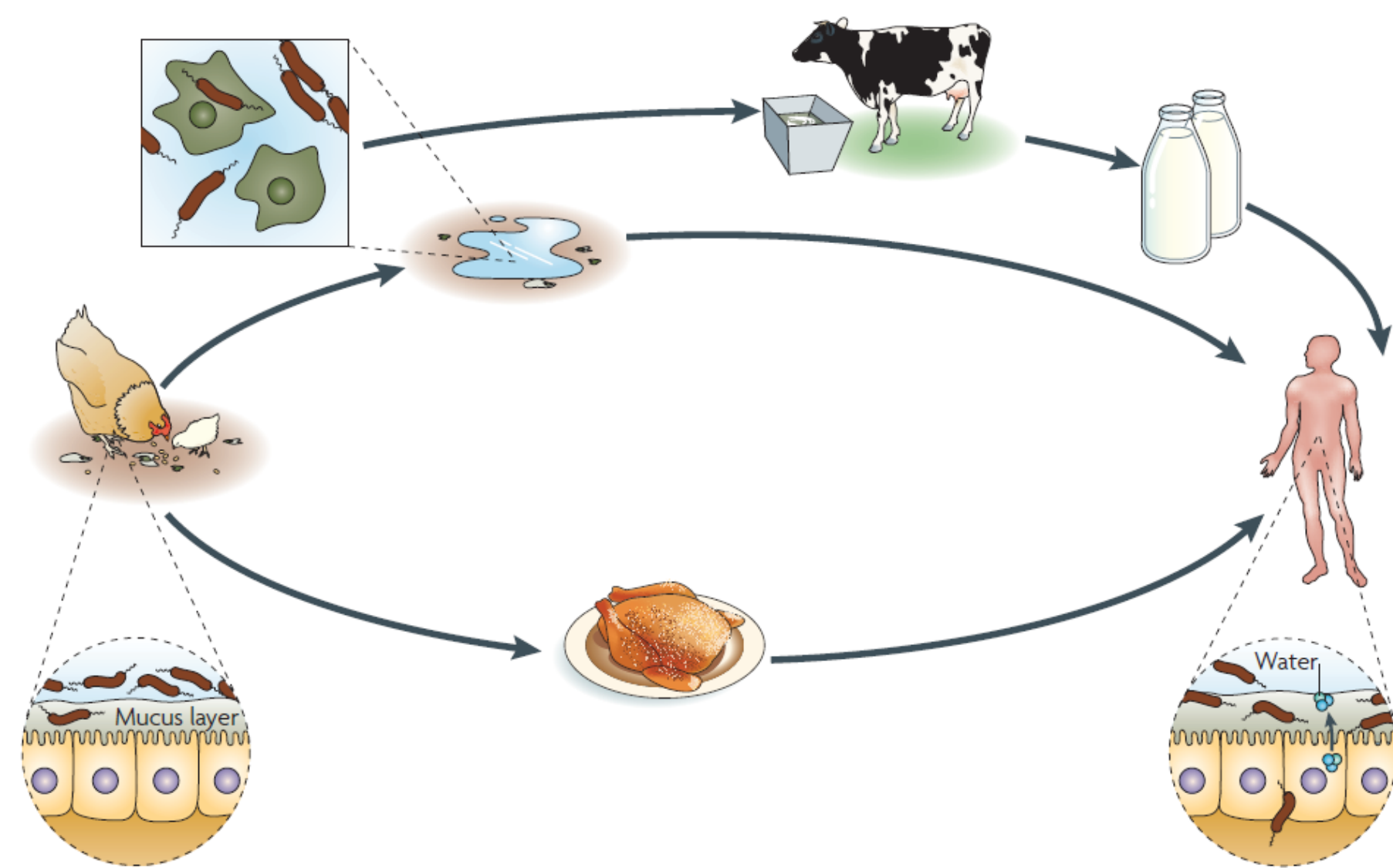


Figure 1 | **The sources and outcomes of *Campylobacter jejuni* infection.** Several environmental reservoirs can lead to human infection by *C. jejuni*. It colonizes the chicken gastrointestinal tract in high numbers, primarily in the mucosal layer, and is passed between chicks within a flock through the faecal–oral route. *C. jejuni* can enter the water supply, where it can associate with protozoans, such as freshwater amoebae, and possibly form biofilms. *C. jejuni* can infect humans directly through the drinking water or through the consumption of contaminated animal products, such as unpasteurized milk or meat, particularly poultry. In humans, *C. jejuni* can invade the intestinal epithelial layer, resulting in inflammation and diarrhoea.

Young et al. (2007)

<https://doi.org/10.1038/nrmicro1718>

Antibiotic resistance

- *Campylobacter* usually cause self-limiting diarrhea –
- No antibiotic is required except for severe cases (systemic infection)
- **Problems:**
 - Antibiotic is also used for therapy and growth promotion in livestock and poultry farm
 - Misuse of antibiotic lead to the emergence of antibiotic-resistant bacteria
 - *E.g. C. jejuni* and *C. coli* are resistant to fluoroquinolones and macrolide
 - FDA has banned the use of fluoroquinolones as growth promoting supplement in poultry production

Example of antibiotics and their function

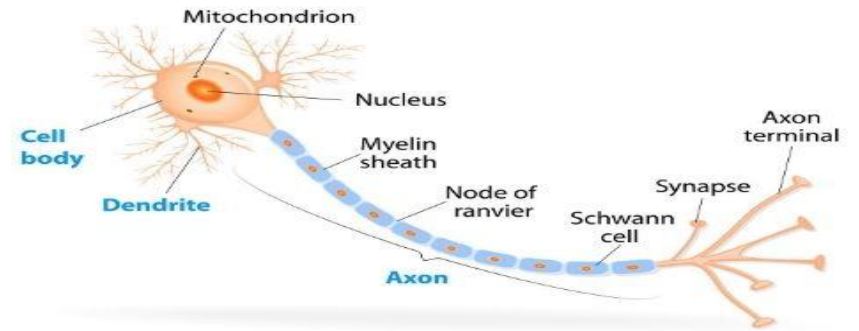
- A. Inhibition of bacterial cell wall synthesis (penicillin's, cephalosporins, bacitracin, vancomycin)
- B. Inhibition of protein synthesis (chloramphenicol, erythromycin, streptomycin, tetracyclines)
- C. Inhibition of essential metabolites (sulfanilamide and trimethoprim prevent folic acid synthesis)
- D. Injury to plasma membrane (polymyxin b, nystatin, miconazole)
- E. Inhibition of nucleic acid replication and transcription (quinolones, rifampin)

CAMPYLOBACTERIOSIS

- ❑ Campylobacteriosis – gastrointestinal disease caused by *Campylobacter*,
 - ❑ *Most common* in the US – 845,000 cases, 8000+ hospitalizations, 70+ death annually
 - ❑ Infective dose: 500 to 10^4 , Onset: 2 to 5 days.
 - ❑ Duration of illness: 2 to 10 days – **Most people** with campylobacteriosis **recover** completely.
 - ❑ Duration of fecal shedding: 2 - 7 weeks
 - ❑ **Severe complications:** bacteraemia and infection of various organ systems, such as meningitis, hepatitis, and pancreatitis.
- ❑ **Target population**
 - Children younger than 5 years old
 - The highest incidence of infection is among infants 6 to 12 months old.
 - Pregnant women – leading to infection of fetus, cause miscarriage
 - People with HIV/AIDS or receiving chemotherapy - infection is greater & can spread to the bloodstream
 - ❑ Clinical symptoms of *C. jejuni* infection can be watery or bloody diarrhea accompanied by abdominal cramps, nausea, fever and sometimes vomiting
 - ❑ *C. jejuni* infection is self-limiting
 - ❑ Post infection may lead to severe neurological disorder (Guillain-Barre syndrome) (1:1000)

WEAKNESS and TINGLING
in Your Extremities are
Usually the First
Symptoms

GUILLAIN BARRE SYNDROME



**Limb
Weakness**



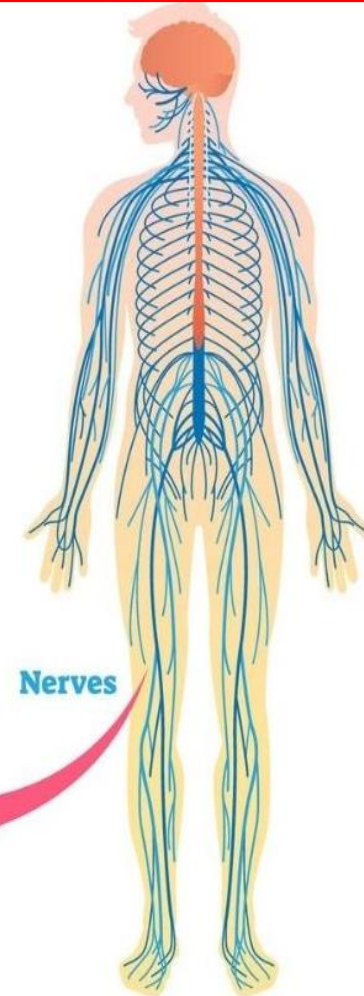
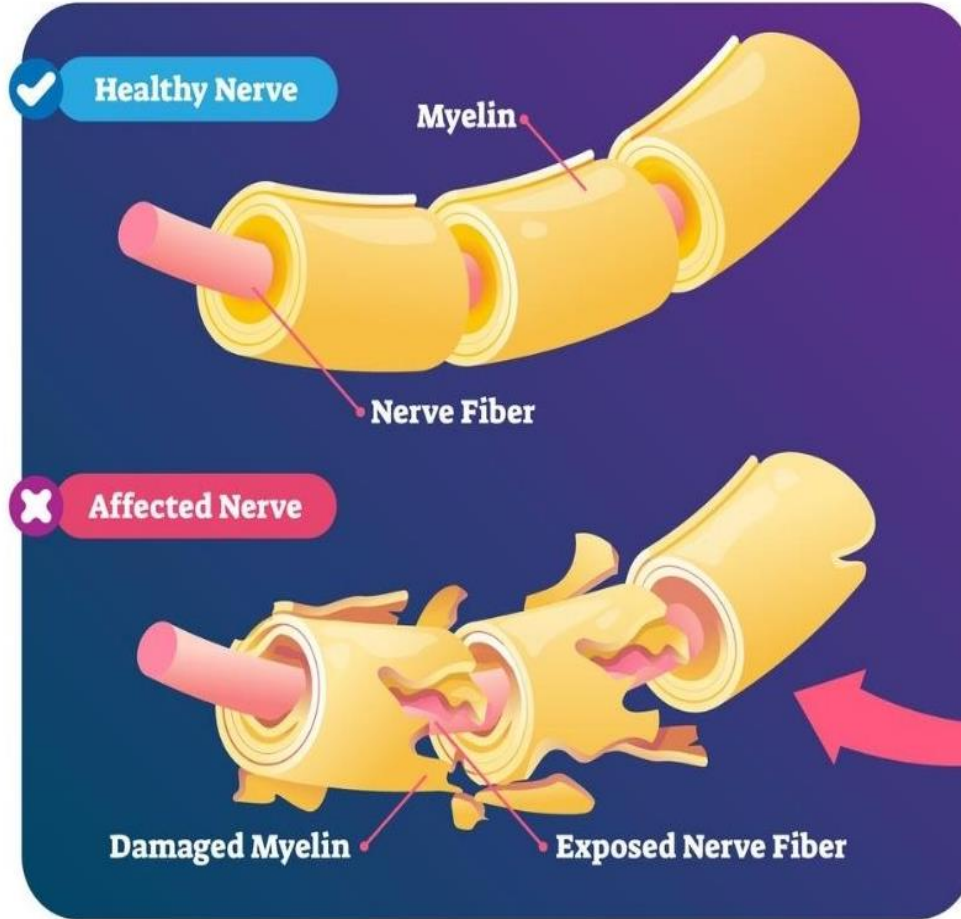
**Difficulty
Swallowing**



**Shortness
of Breath**



**Flaccid
Paralysis**



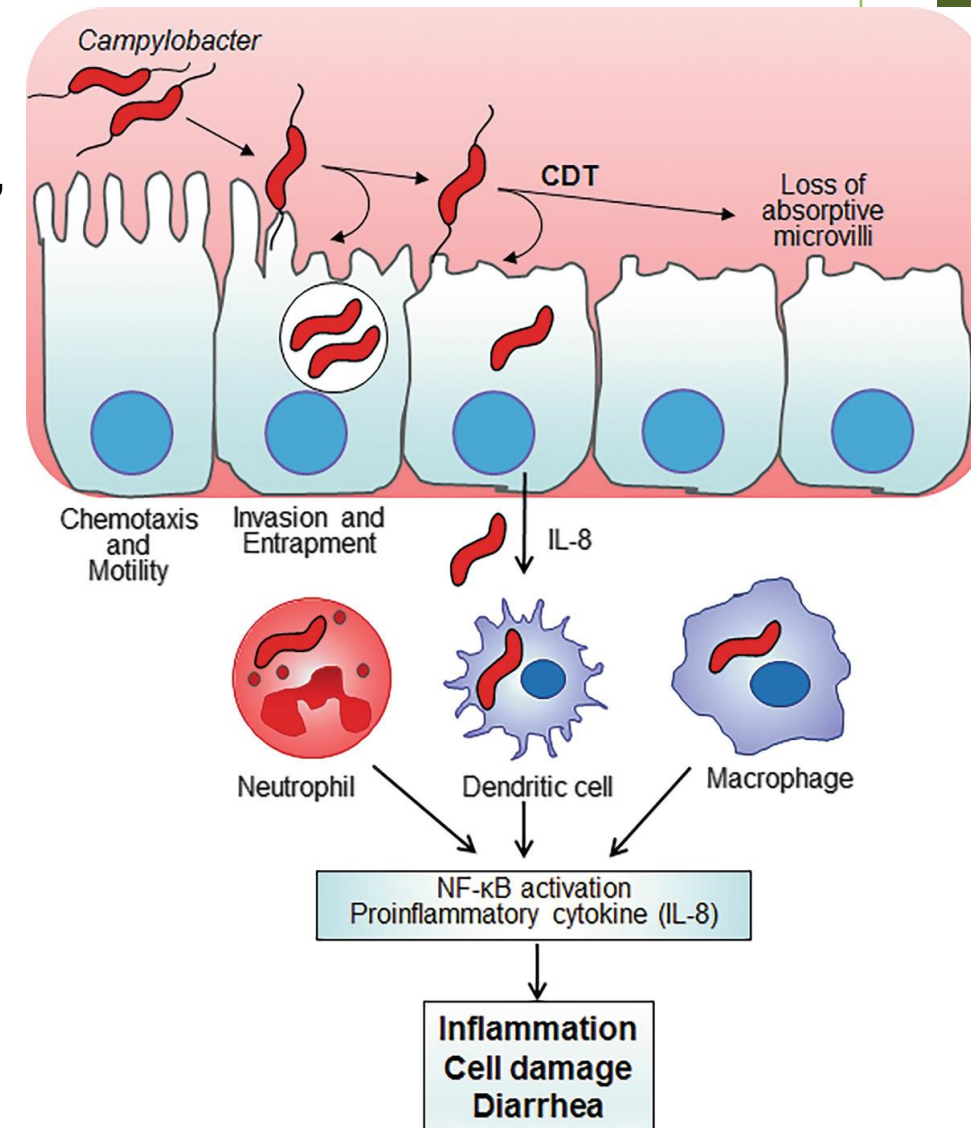
Long-term complication:

Guillain-Barré syndrome (GBS) (Ghee-YAN Bah-RAY) - autoimmune disorders

- A rare disorder in which your body's immune system attacks your nerves
- Causing muscle weakness and sometimes paralysis that last for weeks - years
- Some may have permanent nerve damage
- People develop GBS after infections such as C. jejuni, zika virus, Epstein-Barr virus, side effect of vaccine

VIRULENCE FACTORS & PATHOGENESIS

- ❑ *Campylobacter* **heat-shock proteins (HSP)** – aid in the thermotolerance during survival in bird intestines (gut temp: 42°C)
- ❑ Iron acquisition – the ability to acquire essential nutrient from host, eg. Ferric ion
- ❑ Motility by **flagella** – penetrate mucus barrier
- ❑ **Adhesion protein / adhesins** (CadF and FlpA) – adherence, colonization, and invasions
- ❑ Binding to host cells & **induce phagocytosis**
 - Trigger host cell cytoskeletal rearrangement
 - **Allow bacterial internalization** into the host cell
 - **Survive and replicate** inside the vacuole/host cell
- ❑ **Cytolethal Distending Toxin (CDT)** –main toxin
 - CDT disturb the absorptive function of microvilli and induce diarrhea
 - CDT is heat labile (70C for 30 min)
- The invasion lead to **epithelial cell damage** and trigger **inflammation**



PREVENTION METHOD

□ Industry

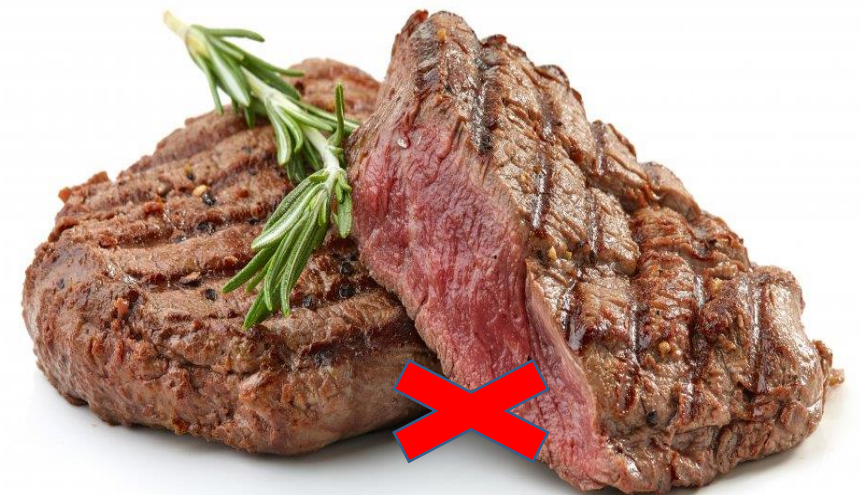
- Hygienic slaughter and processing procedure
- Cleaning & disinfection practice. E.g. changing clothes & footwear before entering the broiler flocks
- Decontamination of carcass . Eg. Use steam / hot water, chilling & freezing, gamma irradiation
- Pasteurization of milk
- Treatment of water

□ Food service establishment/household

- Thorough cooking of meat/chicken
- Prevent cross-contamination on contact surfaces
- Personal hygiene

□ Customer

- Avoid eating raw or partially cooked meat/milk/poultry etc..



OUTBREAKS

- [2019 multidrug-resistant outbreak linked to pet store puppies](#)
- [2016–2018 multidrug-resistant outbreak linked to pet store puppies](#)
- [2014 outbreak in Utah associated with raw milk](#)
- [2012 outbreak in the northeastern U.S. associated with undercooked chicken livers](#)
- [2011 Guillain-Barré syndrome outbreak in U.S. and Mexico associated with tap water](#)



Notes from the Field: Campylobacteriosis Outbreak Associated with Consuming Undercooked Chicken Liver Pâté – Ohio and Oregon, December 2013-January 2014

Weekly

April 17, 2015 / 64(14);399

Magdalena Kendall Scott¹, Aimee Geissler², Tasha Poissant¹, Emilio DeBess¹, Beth Melius³, Kaye Eckmann³, Ellen Salend of text)

On January 8, 2014, the Ohio Department of Health notified the Oregon Public Health Division (OPHD) of campylobacteriosis in two persons who had consumed chicken liver pâté* at an Oregon restaurant. On January 10, OPHD received additional reports of campylobacteriosis in two persons who had consumed chicken liver pâté at another Oregon restaurant. Campylobacter jejuni was isolated in cultures of fecal specimens from three patients. OPHD investigated to determine the sources of the illnesses and to institute preventive measures.

Both restaurants reported using undercooked chicken livers to prepare their pâté; an environmental health investigation revealed that the livers were purchased from the same U.S. Department of Agriculture Food Safety and Inspection Service (FSIS)-regulated establishment in the state of Washington. The establishment reported that livers were rinsed with a chlorine solution before packaging. However, culture of five of nine raw liver samples from both restaurants and from the establishment yielded *C. jejuni*; none of three pâté samples from the restaurants yielded *C. jejuni*. One human stool specimen and three liver samples were typed by pulsed-field gel electrophoresis (PFGE); the human isolate and one liver sample had indistinguishable PFGE patterns when digested by the restriction enzyme *Sma*I. The human isolate was susceptible to all antimicrobials tested by CDC's National Antimicrobial Resistance Monitoring System.

A presumptive case was defined as diarrhea lasting >2 days, within 7 days after consumption of undercooked chicken liver; a confirmed case was defined as laboratory evidence of *C. jejuni* infection within 7 days after consumption of undercooked chicken liver. In all, three laboratory-confirmed and two presumptive cases of campylobacteriosis following consumption of chicken livers were reported in Ohio and Oregon. Illness onsets ranged from December 24, 2013, to January 17, 2014. Patient age range was 31–76 years; three were women. Based on OPHD's recommendation, both restaurants voluntarily stopped serving liver. The FSIS-regulated establishment also voluntarily stopped selling chicken livers.



- [2012: Outbreak in the northeastern U.S. associated with undercooked chicken livers](#)

Campylobacter jejuni Infections Associated with Raw Milk Consumption — Utah, 2014

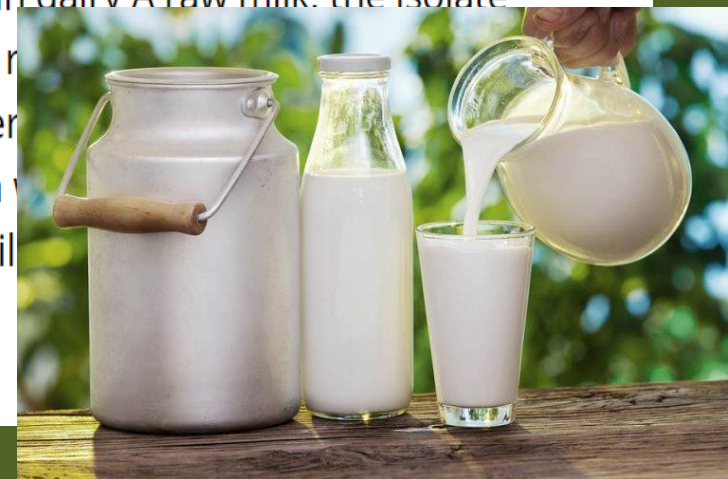
Weekly / April 1, 2016 / 65(12);301–305

Kenneth R. Davis, MPH¹; Angela C. Dunn, MD²; Cindy Burnett, MPH¹; Laine McCullough¹; Melissa Dimond, MPH³; Amy Carter⁴; Sarah Willardson, MPH⁵; Allyn K. Nakashima, MD¹ ([View author affiliations](#))

A total of 99 cases (59 confirmed and 40 probable) of campylobacteriosis, including 10 patients who were hospitalized, and one who died, occurred in an outbreak in northern Utah associated with a single raw milk dairy. The outbreak was documented by epidemiologic, environmental, and laboratory evidence. Despite routine testing of raw milk showing results within acceptable limits, the milk still contained dangerous bacteria.

In May 2014, the Utah Public Health Laboratory (UPHL) notified the Utah Department of Health (UDOH) of specimens from three patients infected with *Campylobacter jejuni* yielding indistinguishable pulsed-field gel electrophoresis (PFGE) patterns. All three patients had consumed raw (unpasteurized and nonhomogenized) milk from dairy A. In Utah, raw milk sales are legal from farm to consumer with a sales permit from the Utah Department of Agriculture and Food (UDAF). Raw milk dairies are required to submit monthly milk samples to UDAF for somatic cell and coliform counts, both of which are indicators of raw milk contamination. Before this cluster's identification, dairy A's routine test results were within acceptable levels (<400,000 somatic cells/mL and <10 coliform colony forming units/mL). Subsequent enhanced testing procedures recovered *C. jejuni*, a fastidious organism, in dairy A raw milk: the isolate matched the cluster pattern. UDAF suspended dairy A's raw milk permit during August 4–October 1, and repeat cultures were negative. Additional cases of *C. jejuni* infection were identified in October, and UDAF permitted to sell raw milk on December 1. During May 9–November 6, 2014, a total of 99 cases of *C. jejuni* infection were identified. Routine testing of somatic cell and coliform counts of raw milk do not ensure its safety. Consumers should be educated that raw milk does not meet routine testing standards.

- 2014: Outbreak in Utah associated with raw milk



THANK YOU

