### Microorganisms Causing Foodborne Disease

**Family Vibrionaceae**
- *Vibrio cholerae*
- *Vibrio parahaemolyticus*
- *Vibrio vulnificus*

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### Family Vibrionaceae

- Gram-negative rods
  - Straight or curved
- Motile by polar flagella
  - Except *Enhydrobacter* (non-motile)
- Facultatively anaerobic
- Fermentative
- Oxidase positive
  - Few exceptions of no importance in food microbiology
- Most have aquatic habitats

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### Family Vibrionaceae

- Genera
  - *Aeromonas*
  - *Enhydrobacter*
  - *Photobacterium*
  - *Plesiomonas*
  - *Vibrio*
**Vibrio** species of medical importance

- *V. alginolyticus*
- *V. cholerae*
- *V. cincinnatiensis*
- *V. damsella*
- *V. fluvialis*
- *V. furnissii*
- *V. harveyi*
- *V. hollisae*
- *V. metschnikovii*
- *V. mimicus*
- *V. parahaemolyticus*
- *V. vulnificus*

**Morphology of Vibrio cells**

- Different serogroups
  - O1 is the serogroup associated with most pandemics
  - Non-O1 can also cause diarrhea
  - O111 has acquired great importance in India, Pakistan and the Middle East
**V. cholerae O1**

- Human pathogen
- Typically associated with water
  - Contaminated food played an important role during the Latin American pandemic
- There have been 7 pandemics over the history
  - We are currently suffering the 7th pandemic
  - Caused by *V. cholerae* biotype El Tor
  - Serotypes Ogawa, Inaba and Hikojima

**V. parahaemolyticus**

- Halophilic (needs salt to grow)
  - 0.5 – 8%, optimum 2-3%
- pH
  - Grows best at values above neutrality (7.5 – 8.5)
- Min $a_w$ is 0.937 – 0.986
  - Depending on solute
- Temperature
  - 10 – 43°C, optimum 37°C
- Grows rapidly
  - Generation time 7 – 9 min
  - Compare to GT of 20 min for enterobacteriaceae

**V. parahaemolyticus**

- Primarily associated with coastal inshore water
- Does not grow or survive well at water temperatures
  - <15°C or in deep waters (high pressure)
- Can survive in coastal sediments during the cold season at water temperature <10°C
- Its pathogenicity is related to a hemolysin that is detected by the Kanagawa test
  - Experimental ingestion of Kanagawa + isolates has resulted in diarrhea
  - Experimental ingestion of Ka – isolates does not produce diarrhea
**V. parahaemolyticus**
- *V. parahaemolytic* food poisoning
  - Incubation period 9 – 25 h
- Disease symptoms
  - Profuse watery diarrhea, fever, abdominal pain and vomiting
  - Last for up to 8 days
- Associated invariably with seafood
  - Both shellfish and finfish
- Outbreaks are occasionally reported in the U.S.
  - It is the most common cause of food poisoning in Japan

**V. vulnificus**
- Halophilic
- Marine habitat, coastal waters
- Highly sensitive to cold
- Isolated from coastal waters during warm seasons
  - Seldom recovered from water during cold season

Incidence of *V. vulnificus* in coastal waters by sampling month

![Incidence of V. vulnificus in coastal waters by sampling month](chart.png)

Oliver, 1987
**V. vulnificus**

- Highly invasive
- Syndromes:
  - Primary septicemia
    - 26 h Incubation period
    - Fatality rate (~50%)
    - Associated with eating raw oysters (85%)
    - Secondary lesions appear in patinet
  - Wound infections
    - 16 h Incubation period
    - Usually from harvesting or shucking oysters
    - Fatality rate of 22%
- Most cases occur with pre existing conditions
  - Liver disease, diabetes, alcoholism
  - High concentration of iron in serum

**Effects of V. vulnificus infection**

Isolation of Vibrio spp.

- Alkaline enrichment
  - Alkaline peptone water (pH 8.6 – 9.0)
  - Tellurite bile salt broth (pH 9.0 – 9.2)
- Isolation on thiosulfate citrate bile salts sucrose agar (TCBS)
  - *V. cholerae* produces acid from sucrose
  - *V. parahaemolyticus* and *V. vulnificus* do not produce acid from sucrose
  - *V. vulnificus* is differentiated from *V. parahaemolyticus* by its ability to ferment lactose
- Further biochemical and serological tests for species confirmation
Characteristics of *Vibrio* colonies on TCBS

- *V. cholerae*
- *V. parahaemolyticus*
- *V. vulnificus*