**LISTERIA MONOCYTOGENES**

1. is the **bacterium** that causes the infection **listeriosis**.

2. It is a **facultative anaerobic** bacterium, capable of surviving in the presence or absence of oxygen.

3. It can grow and reproduce inside the host’s cells and is one of the most **virulent** food-borne pathogens, with \( \gamma \) to \( \gamma \) percent of clinical infections resulting in death.

4. Responsible for an estimated \( \gamma \)\( ,\gamma \) illnesses and \( \gamma \)\( \gamma \) deaths in the United States (U.S.) annually,

5. **listeriosis** is the third leading cause of death among food borne bacterial pathogens, with fatality rates exceeding even **Salmonella** and **Clostridium botulinum**.

6. *L. monocytogenes* is a **Gram-positive bacterium**, in the division **Firmicutes**, named after **Joseph Lister**.

7. **Motile** via **flagella** at \( \gamma \)°C and below, but usually not at \( \gamma \gamma \)°C,

8. *L. monocytogenes* can instead move within **eukaryotic** cells by explosive **polymerization** of **actin** filaments (known as comet tails or actin rockets).

9. Studies suggest up to \( \gamma \gamma \)\% of human **gastrointestinal tracts** may be colonized by *L. monocytogenes*. 
Clinical diseases due to *L. monocytogenes* are more frequently recognized by **veterinarians**, especially as **meningoencephalitis** in **ruminants**.

Due to its frequent **pathogenicity**, causing meningitis in newborns (acquired transvaginally), pregnant mothers are often advised not to eat soft cheeses, which may be contaminated with and permit growth of *L. monocytogenes*.

It is the third-most-common cause of meningitis in newborns.

**CLASSIFICATION**

*L. monocytogenes* is a Gram-positive, non spore-forming, motile, facultatively anaerobic, rod-shaped bacterium as shown in figure (1). It is catalase-positive and oxidase-negative, and expresses a beta hemolysin, which causes destruction of red blood cells. This bacterium exhibits characteristic tumbling motility when viewed with light microscopy. Although *L. monocytogenes* is actively motile by means of peritrichous flagella at room temperature (20–25 °C), the organism does not synthesize flagella at body temperatures (37 °C).

*Figure (1)*
**PATHOGENESIS**

Invasive infection by *L. monocytogenes* causes the disease listeriosis. When the infection is not invasive, any illness as a consequence of infection is termed febrile gastroenteritis. The manifestations of listeriosis include septicemia, meningitis (or meningoencephalitis), encephalitis, corneal ulcer, pneumonia, and intrauterine or cervical infections in pregnant women, which may result in spontaneous abortion (second to third trimester) or stillbirth. Surviving neonates of fetomaternal listeriosis may suffer granulomatosis infantiseptica — pyogenic granulomas distributed over the whole body — and may suffer from physical retardation. Influenza-like symptoms, including persistent fever, usually precede the onset of the aforementioned disorders. Gastrointestinal symptoms, such as nausea, vomiting, and diarrhea, may precede more serious forms of listeriosis or may be the only symptoms expressed. Gastrointestinal symptoms were epidemiologically associated with use of antacids or cimetidine. The onset time to serious forms of listeriosis is unknown, but may range from a few days to three weeks. The onset time to gastrointestinal symptoms is unknown but probably exceeds 18 hours. An early study suggested that *L. monocytogenes* is unique among Gram-positive bacteria in that it might possess lipopolysaccharide, which serves as an endotoxin. Later it was found to not be a true endotoxin. *Listeria* cell walls consistently contain lipoteichoic acids, in which a glycolipid moiety, such as a galactosyl-glucosyl-diglyceride, is covalently linked to the terminal phosphomonoester of the teichoic acid. This lipid region anchors the polymer chain to the cytoplasmic membrane. These
lipoteichoic acids resemble the lipopolysaccharides of Gram-negative bacteria in both structure and function, being the only **amphipathic** polymers at the cell surface.

*L. monocytogenes* has D-Galactose residues on its surface that can attach to D-Galactose receptors on the host cell walls. These host cells are generally **M cells** and **Peyer's patches** of the intestinal mucosa. Once attached to this cells, *L. monocytogenes* can translocate past the intestinal membrane and into the body.

The infective dose of *L. monocytogenes* varies with the strain and with the susceptibility of the victim. From cases contracted through raw or supposedly pasteurized milk, one may safely assume that, in susceptible persons, fewer than \(1,000\) total organisms may cause disease. *L. monocytogenes* may invade the gastrointestinal epithelium. Once the bacterium enters the host's **monocytes**, **macrophages**, or **polymorphonuclear leukocytes**, it becomes blood-borne (septicemic) and can grow. Its presence intracellularly in **phagocytic** cells also permits access to the brain and probably transplacental migration to the fetus in pregnant women. The pathogenesis of *L. monocytogenes* centers on its ability to survive and multiply in phagocytic host cells.

**DETECTION**

Colonies of typical *Listeria monocytogenes* as they appear when grown on *Listeria*-selective **agar**

**Anton Test** : A test used in the identification of Listeria monocytogenes; instillation of a culture into the conjunctival sac of a rabbit or guinea pig causes severe keratoconjunctivitis within
Culture Characteristics: Listeria grows on media such as Mueller-Hinton agar. Identification is enhanced if the primary cultures are done on agar containing sheep blood, because the characteristic small zone of hemolysis can be observed around and under colonies. Isolation can be enhanced if the tissue is kept at 4°C for some days before inoculation into bacteriologic media. The organism is a facultative anaerobe and is catalase-positive and motile. Listeria produces acid but not gas in a variety of carbohydrates. The motility at room temperature and hemolysin production are primary findings that help differentiate listeria from coryneform bacteria.

**TREATMENT**

When listeric meningitis occurs, the overall mortality may reach 70%, from septicemia 50%, and from perinatal/neonatal infections greater than 80%. In infections during pregnancy, the mother usually survives. Reports of successful treatment with parenteral penicillin or ampicillin exist. Trimethoprim-sulfamethoxazole has been shown effective in patients allergic to penicillin.

**CANCER VACCINE**

A live attenuated *L. monocytogenes* cancer vaccine, ADXS\-\-\-\-\-, is under development as a possible treatment for cervical carcinoma.

**ROUTES OF INFECTION**

*L. monocytogenes* has been associated with such foods as raw milk, pasteurized fluid milk, cheeses (particularly soft-ripened
varieties), ice cream, raw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats (of all types), and raw and smoked fish. Its ability to grow at temperatures as low as \(0\) °C permits multiplication in refrigerated foods. At refrigeration temperature, such as \(4\) °C, the amount of ferric iron can affect the growth of \(L.\ monocyctogenes\).

**INFECTION CYCLE**

The primary site of infection is the intestinal epithelium, where the bacteria invade non phagocytic cells via the "zipper" mechanism. Uptake is stimulated by the binding of listerial internalins (Inl) to E-cadherin, a host cell adhesion factor, or Met (c-Met), hepatocyte growth factor. This binding activates certain Rho-GTPases, which subsequently bind and stabilize Wiskott-Aldrich syndrome protein (WAsp). WAsp can then bind the Arp2/3 complex and serve as an actin nucleation point. Subsequent actin polymerization creates a "phagocytic cup", an actin-based structure normally formed around foreign materials by phagocytes prior to endocytosis. The net effect of internalin binding is to exploit the junction-forming apparatus of the host into internalizing the bacterium. \(L.\ monocyctogenes\) can also invade phagocytic cells (e.g., macrophages), but requires only internalins for invasion of non phagocytic cells.

Following internalization, the bacterium must escape from the vacuole/phagosome before fusion with a lysosome can occur. Three main virulence factors that allow the bacterium to escape are listeriolysin O, phospholipase A and phospholipase B. Secretion of these materials disrupts the vacuolar membrane and
allows the bacterium to escape into the cytoplasm, where it may proliferate.

Once in the cytoplasm, *L. monocytogenes* exploits host actin for the second time. ActA proteins associated with the old bacterial cell pole actin nucleation at a specific area of the bacterial cell surface. Actin polymerization then propels the bacterium unidirectional into the host cell membrane. The protrusion that is formed may then be internalized by a neighboring cell, forming a double-membrane vacuole from which the bacterium must escape using LLO and PlcB. This mode of direct cell-to-cell spread involves a cellular mechanism known as paracytophagy.