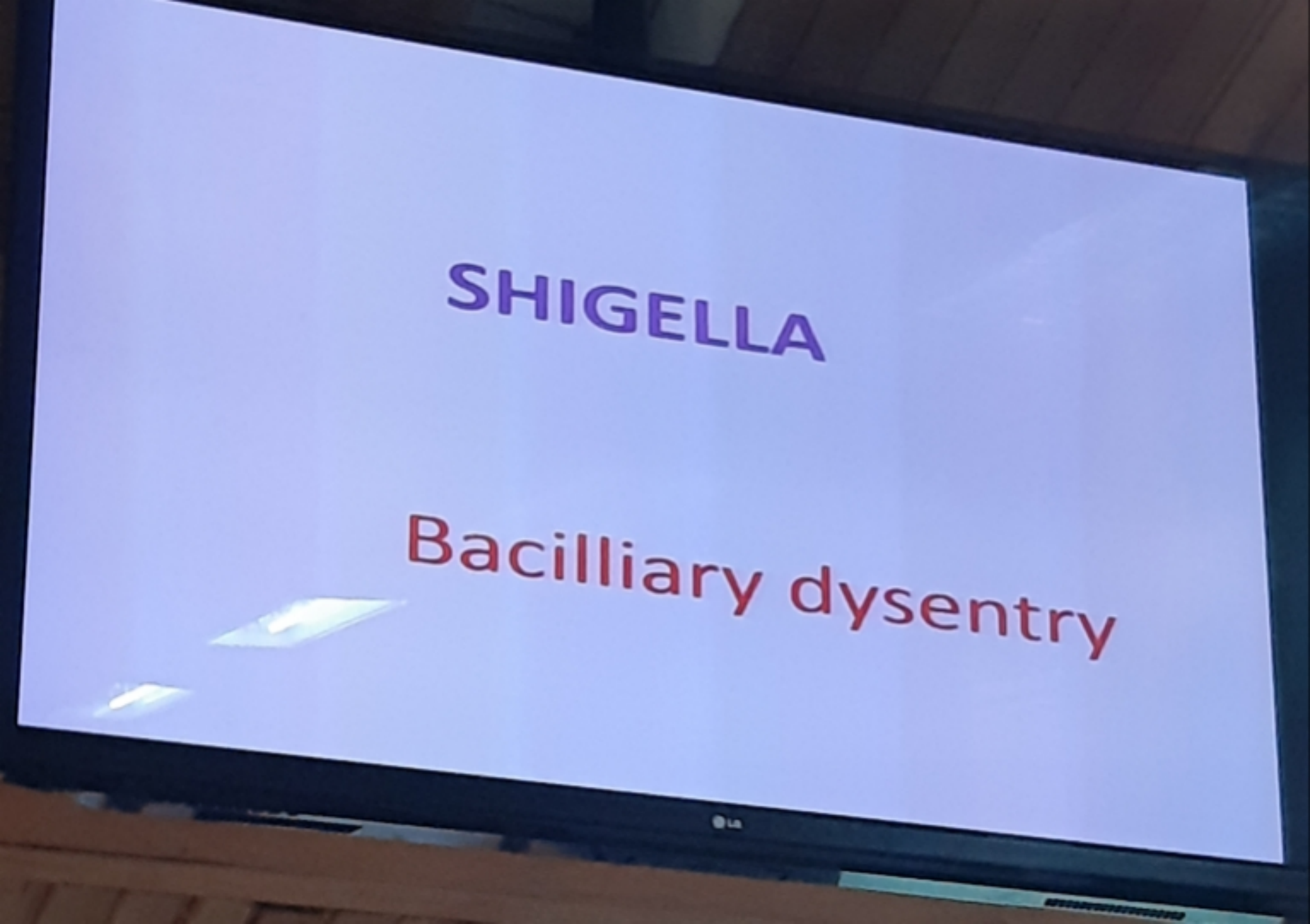

SHIGELLA
Bacilliary dysentry

- The genus is named after Kiyoshi Shiga, who first discovered it in 1897.
- is a genus of gram-negative, facultative anaerobic, nonspore-forming, non-motile, rod-shaped bacteria genetically closely related to *E. coli*

IMPORTANT PROPERTIES

Genus - 4 species based on serology and biochemical reactions:

- *S. dysentriae* -10 serotypes
- *S. boydii* -15 serotypes
- *S. flexneri* -6 serotypes.
- *S. sonnei* -serologically homogenous and are therefore typed by other means.
- Causes bacillary dysentery by an invasive mechanism identical to Enteroinvasive E. coli (EIEC).

IMPORTANT PROPERTIES

- Pathogens of man and other primates.
- Spread by contaminated food and water.
- Transmission: fecal oral route, with the principle factors in transmission being fingers, flies, food and feaces.

PATHOGENESIS

- Cause disease almost exclusively in the GIT.
- Small infective dose, 10- 100 organisms.
- Shigellae have innate tolerance to low PH and bile in the digestive tract.
- Site of infection- M cells in the Payer's patches in the large intestine.

PATHOGENESIS

- Association with intestinal mucosal cells initiates intestinal inflammation..
- Necrosis of epithelial cells and ulcers form.
- Leucocytes, red blood cells, epithelial cells seen microscopically in stool...bloody diarrhoea
- Eukaryotic cell invasion is linked to the presence of plasmid encoded proteins.

pathogenesis

S. flexneri strains produce toxins ShET1 and ShET2, which may contribute to diarrhea

S. dysenteriae strains produces the Shiga toxin which is associated with causing potentially fatal hemolytic-uremic syndrome

The toxin prevents protein synthesis and causes cell death.

...pathogenesis

- *Shigella* uses a type-III secretion system, which acts as a biological syringe to translocate toxic effector proteins to the target human cell
- After invasion, *Shigella* cells multiply intracellularly and spread to neighboring epithelial cells, resulting in tissue destruction and characteristic pathology of shigellosis

CLINICAL FEATURES

- Incubation period is 2 to 3 days.
- Initial symptom is abdominal colic
- Progresses to frequent passage of small volumes of stool consisting predominantly of bloody mucus.
- Severity of disease associated with the species and the age of the patient.

CLINICAL FEATURES

- Symptoms typically last five to seven days.
- Complications include hemolytic uremic syndrome (triad of hemolytic anaemia- anaemia due to destruction of RBCS, acute kidney failure-uremia, and a low platelet count-thrombocytopenia)..esp with *Shig. dysentriae*
- Shigella rarely invades other tissues hence septicaemia and metastatic infection rarely occurs.

LABORATORY DIAGNOSIS

- Gram negative bacilli
- NLFs on MAC agar.
- *Sh. sonnei* is the only late lactose fermenter.
- Stool specimen cultured on SS, XLD or DCA.
- TSI: alkaline slant, acid butt, no gas, no H_2S.
- Suspiscious colonies- confirmed with species specific antisera followed by type specific antisera.

TREATMENT

- Most cases are mild and self limiting, so are treated with oral rehydration therapy rather than with antibiotics.
- Antibiotics may be indicated in severe infections, patients of extreme age or the immunocompromised.
- Options include ciprofloxacin, co- trimoxazole
- Antiperistaltic drugs are contraindicated-they prolong the fever, diarrhea and excretion of the organism.

PREVENTION

- Largely dependent on interruption of fecal oral transmission by proper sewage disposal/proper handling of food.

See recommendations on prevention of salmonellosis

- Adequate chlorination of water.
- Good personal hygiene.
- Public health education

PSEUDOMONAS

Nosocomial infections

Epidemiology and Transmission

- **Natural habitat:**
  - Temperature between 4 to 36°C (can survive up to 42°C)
  - Found throughout nature in moist environment (hydrophilic) (e.g. sink drains, vegetables, river water, antiseptic solutions, mineral water, etc.)
  - Acquisition is from the environment, but occasionally can be from patient-to-patient spread

Classification

- Many Taxonomic Changes in Last Decades.

- Species include *Ps. aeruginosa*, *Ps. putida*, *Ps. fluorescens* , *Ps. stutzeri* and *Ps. mendocina*.

- *Ps. aeruginosa* is the species that has been most implicated in human disease.

Biological Characteristics

- Non- fastidiuos
- Distinct sweet fruity smell.
- Most strains produce diffusible pigments eg pyocyanin- bluish, pyoverdin- yellow green, pyorubin (red), pyomelanin (brown).
- Epidemiological typing using phenotypic markers eg susceptibility to phages.

Pathogenesis

- This pathogen is both toxigenic and invasive.
- The process of infection has 3 stages:
  - attachment and colonization
  - local invasion
  - dissemination and systemic disease.
- Assoc. with multiple virulence factors produced depending on site and nature of infection.

VIRULENCE FACTORS	BIOLOGIC EFFECT
Structural components	
Capsule	Adhesin, antiphagocytic
Pili	Adhesin
Lipopolysaccharide	Endotoxic activity
Pyocyanin	Impairs ciliary funtion etc
Toxins and Enzymes	
Exotoxin A	Inhibits protein synthesis
Exotoxin S	"
Leukocidin	Disrupts leukocyte function
Elastase	Disrupts tissues with elastin
Phospholiase C	Heat labile hemolysin

Range of clinical infections caused by *P. aeruginosa*

- *P. aeruginosa* mainly causes opportunistic infections: Individuals with normal host defenses are not at risk for serious infection with *P. aeruginosa*
- Those at risk for serious infections include:
  - Profoundly depressed circulating neutrophil count (e.g. cancer chemotherapy)
  - Thermal burns
  - Patients on mechanical ventilation

Range of clinical infections caused by *P. aeruginosa*

- Immunocompetent Host:
  - Most common cause of osteochondritis of foot following puncture wounds (running shoes)
  - Hot tub folliculitis
  - Swimmer's ear (acute otitis externa)
  - Conjunctivitis in contact lens users (poor hygiene or if lenses are worn for extended periods)
- Other Hosts:
  - Malignant otitis externa in diabetics
  - Meningitis post trauma or surgery
  - Sepsis and meningitis in newborns
  - Endocarditis or osteomyelitis in IV drug users
  - Community-acquired pneumonia in pts with bronchiectasis
  - UTI in patients with urinary tract abnormalitis

Laboratory Diagnosis

- Specimen depends on site of infection eg wound swabs
- It grows best at 37^0c, in Aerobic conditions.
- Characteristic fruity odour and pigments:
  - Pyocyanin (blue)
  - Pyoverdin (yellow green fluorescent)
  - Pyorubrin(red)
  - Pyomelanin (brown).
- Non- lactose fermenters on MAC
- Gram-negative bacillus

...Laboratory Diagnosis

- Rapidly Oxidase positive, Catalase positive
- Urease negative.
- TSI: alkaline slant, alkaline butt, no gas, no H_2S.
- Serotyping is used for epidemiological purposes
- Motile, Non-capsulate, Non-sporing
- Broad antibiotic resistance

Treatment

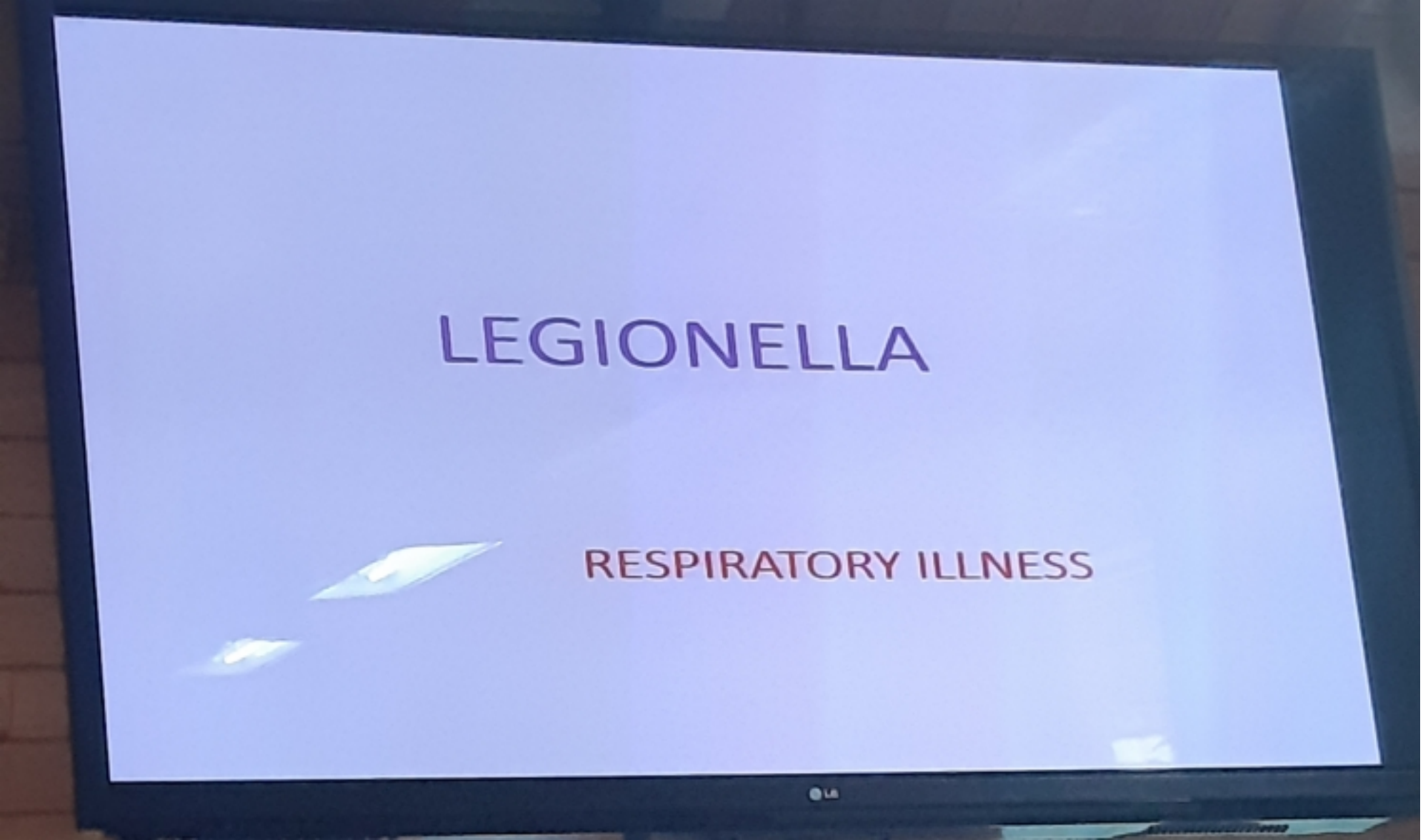
Antibiotic susceptibility of isolates has to be done due to resistance.

Antipseudomonal agents include:

- Fluoroquinolones- ciprofloxacin
- Aminoglycosides- gentamycin, tobramycin
- antipseudomonal penicillins eg piperacillin,
- carbapenems – imipenem, meropenem
- Polymyxins- polymyxin B
- Monobactams- aztreonam

Control

- Hospital infection control methods should concentrate on preventing contamination of sterile medical equipment and nosocomial infections.


LEGIONELLA
RESPIRATORY ILLNESS

General characteristics

- Gram negative bacterium
- *Legionella* is common in many environments, especially water sources
- 50 species and 70 serogroups identified
- *L. pneumophila*: most important species
- Exists in rod-like formations

Structure

- Inner and outer membranes typical of Gram-negative bacteria
- Possesses **pili** (fimbriae),
- Motile by means of a single polar flagellum

Growth requirements

Legionella is a fastidious organism, requirements are:

- Iron
- L- Cysteine

Energy is derived from amino acids rather than carbohydrates

Habitat

non-marine aquatic environments such as lakes and ponds, optimum growth temperature range: 20-45

thrives in areas where there are high concentrations of rust, algae, and organic particles

Frequently found in close association, possibly endosymbiotic relationship, with certain protozoa

- ✓ *Hartmanella vermiformis*
- ✓ *Tetrahymena thermophila*
- ✓ *Acanthamoeba castellani*

Transmission

ansmission is via aerosols — the inhalation of
ist droplets containing the bacteria
ommon sources include

- air conditioning cooling towers
- shower heads, pipes, heat exchange bumpers
- whirlpools, humidifiers
- respiratory therapy devices, and grocery store misters

Pathogenesis

- *Legionella* is a facultative intracellular parasite
- bacteria bind to alveolar macrophages via the complement receptors
- are engulfed into a phagosomal vacuole, and block the fusion of lysosomes with the phagosome
- The bacilli multiply within the phagosome
- Eventually, the cell is destroyed, releasing a new generation of microbes to infect other cells

Clinical features

Legionnaire's Disease and Pontiac fever

Legionnaire's disease

Initial stages: fever, chills, and dry cough

Advanced stages: diarrhoea, nausea, pneumonia

Pontiac fever

Fever, headache, Severe muscle aches

It is self-limited

Does not cause pneumonia

Diagnosis

- based on a history of respiratory tract
- radiological finding of pulmonary infiltrates
- specific etiology is determined by the results of microbiologic tests

Specimen collection/Culture medium

- isolated from a number of specimens, including blood, lung tissue, lung biopsy specimens, respiratory secretions
- extrapulmonary sites such as bone marrow, prosthetic heart valves, and sternal wounds
- Isolated on: buffered charcoal-yeast extract (BCYE) agar

Treatment

- Macrolides
- quinolones.