### Mycobacteria:

[***Mycobacterium tuberculosis***](http://en.wikipedia.org/wiki/Mycobacterium_tuberculosis)

The main cause of TB is [***Mycobacterium tuberculosis***](http://en.wikipedia.org/wiki/Mycobacterium_tuberculosis), a small, [aerobic](http://en.wikipedia.org/wiki/Aerobic_organism), nonmotile [bacillus](http://en.wikipedia.org/wiki/Bacillus). The high [lipid](http://en.wikipedia.org/wiki/Lipid) content of this pathogen accounts for many of its unique clinical characteristics.  Mycobacteria have an [outer membrane](http://en.wikipedia.org/wiki/Bacterial_cell_structure) lipid bilayer. If a [Gram stain](http://en.wikipedia.org/wiki/Gram_stain) is performed, MTB either stains very weakly "Gram-positive" or does not retain dye as a result of the high [lipid](http://en.wikipedia.org/wiki/Lipid) and [mycolic acid](http://en.wikipedia.org/wiki/Mycolic_acid) content of its cell wall. MTB can withstand weak [disinfectants](http://en.wikipedia.org/wiki/Disinfectant) and survive in a [dry state](http://en.wikipedia.org/wiki/Endospore) for weeks. The *M. tuberculosis* complex (MTBC) includes four other TB-causing [mycobacteria](http://en.wikipedia.org/wiki/Mycobacterium): [*M. bovis*](http://en.wikipedia.org/wiki/Mycobacterium_bovis), [*M. africanum*](http://en.wikipedia.org/wiki/Mycobacterium_africanum), [*M. canetti*](http://en.wikipedia.org/wiki/Mycobacterium_canetti), and [*M. microti*](http://en.wikipedia.org/wiki/Mycobacterium_microti). *M. bovis* was once a common cause of tuberculosis, but the introduction of [pasteurized milk](http://en.wikipedia.org/wiki/Pasteurisation) has largely eliminated this as a public health problem in developed countries.

## Signs and symptoms

Tuberculosis may infect any part of the body, but most commonly occurs in the lungs (known as pulmonary tuberculosis). Extra pulmonary TB occurs when tuberculosis develops outside of the lungs.

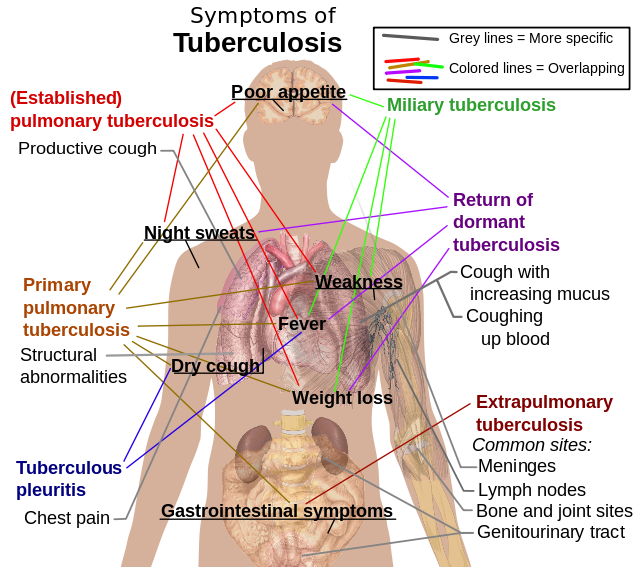
### Pulmonary

If a tuberculosis infection does become active, it most commonly involves the lungs (in about 90% of cases). Symptoms may include [chest pain](http://en.wikipedia.org/wiki/Chest_pain) and a prolonged cough producing sputum. About 25% of people may not have any symptoms (i.e. they remain "**asymptomatic**"). Occasionally, people may [**cough up blood**](http://en.wikipedia.org/wiki/Hemoptysis) in small amounts, and in very rare cases, the infection may erode into the [**pulmonary artery**](http://en.wikipedia.org/wiki/Pulmonary_artery), resulting in massive bleeding .Tuberculosis may become a chronic illness and cause extensive scarring in the upper lobes of the lungs. The upper lung lobes are more frequently affected by tuberculosis than the lower ones. **The reason** for this difference is not entirely clear. It may be due either to better air flow, or to poor [lymph](http://en.wikipedia.org/wiki/Lymph) drainage within the upper lungs.

### Extrapulmonary

In 15–20% of active cases, the infection spreads outside the lungs, causing other kinds of TB. These are collectively denoted as "extrapulmonary tuberculosis". Extrapulmonary TB occurs more commonly in [**immunosuppressed**](http://en.wikipedia.org/wiki/Immunosuppression)persons and **young children**. In those with **HIV,** this occurs in more than 50% of cases.

* Notable extrapulmonary infection sites include the [pleura](http://en.wikipedia.org/wiki/Pleural_cavity) (in tuberculous pleurisy),
* the [central nervous system](http://en.wikipedia.org/wiki/Central_nervous_system)
* the [lymphatic system](http://en.wikipedia.org/wiki/Lymphatic_system)
* the [genitourinary system](http://en.wikipedia.org/wiki/Genitourinary_system)
* the bones and joints aform of [osteomyelitis](http://en.wikipedia.org/wiki/Osteomyelitis)
* tuberculous ulcer originating from nearby infected lymph nodes is painless, slowly enlarging and more serious, widespread form of TB is called "disseminated" TB, commonly known as [miliary tuberculosis](http://en.wikipedia.org/wiki/Miliary_tuberculosis).



### Pathogenesis:

About 90% of infection with *M. tuberculosis* have [asymptomatic](http://en.wikipedia.org/wiki/Asymptomatic), **latent TB infections** (sometimes called LTBI), with only a 10% lifetime chance that the latent infection will progress to overt, **active tuberculous disease**.

TB infection begins when the mycobacteria reach the [pulmonary alveoli](http://en.wikipedia.org/wiki/Pulmonary_alveolus), where they invade and replicate within [endosomes](http://en.wikipedia.org/wiki/Endosomes) of alveolar[macrophages](http://en.wikipedia.org/wiki/Macrophages). Macrophages identify the bacterium as "foreign" and attempt to eliminate it by phagocytosis. During this process, the entire bacterium is enveloped by the macrophage and stored temporarily in a membrane-bound vesicle called a phagosome. The phagosome then combines with a lysosome to create a phagolysosome. In the

phagolysosome, the cell attempts to use reactive oxygen species and acid to kill the bacterium. However, M. tuberculosis has a thick, waxy mycolic acid capsule that protects it from these toxic substances. M. tuberculosis actually reproduces inside the macrophage and will eventually kill the immune cell.

## Diagnosis

**Active tuberculosis**:

Diagnosing active tuberculosis based on   [chest X-ray](http://en.wikipedia.org/wiki/Chest_X-ray) and multiple [sputum cultures](http://en.wikipedia.org/wiki/Sputum_culture) for [acid-fast bacilli](http://en.wikipedia.org/wiki/Acid-fast_bacilli) are typically part of the initial evaluation. culture process made by identifying *M. tuberculosis* in a clinical sample (e.g. sputum, [pus](http://en.wikipedia.org/wiki/Pus), or a [tissue](http://en.wikipedia.org/wiki/Tissue_(biology)) [biopsy](http://en.wikipedia.org/wiki/Biopsy)). However, the difficult culture process for this slow-growing organism can take two to six weeks for blood or sputum culture. Thus, treatment is often begun before cultures are confirmed.

### Latent tuberculosis

[](http://en.wikipedia.org/wiki/File:Mantoux_tuberculin_skin_test.jpg)

[Mantoux tuberculin skin test](http://en.wikipedia.org/wiki/Mantoux_test)

**The**[**Mantoux tuberculin skin test**](http://en.wikipedia.org/wiki/Mantoux_test) is often used to screen people at high risk for TB. Those who have been previously immunized may have a **false-positive test result**.

The most common acid-fast staining techniques are the [Ziehl–Neelsen stain](http://en.wikipedia.org/wiki/Ziehl%E2%80%93Neelsen_stain), which dyes a bright red that stands out clearly against a blue background,

## Prevention

Tuberculosis prevention and control efforts primarily rely on the vaccination of infants and the detection and appropriate treatment of active cases.

### Vaccines

The only available [vaccine](http://en.wikipedia.org/wiki/Vaccine)  is [bacillus Calmette-Guérin](http://en.wikipedia.org/wiki/Bacillus_Calmette-Gu%C3%A9rin) **(BCG).** In children it decreases the risk of getting the infection by 20% and the risk of infection turning into disease by nearly 60%.

It is the most widely used vaccine worldwide, with more than 90% of all children being [vaccinated](http://en.wikipedia.org/wiki/Vaccinated).  The immunity it induces decreases after about ten years.

**Enterobacteriaceae:**

Enterobacteria are **bacteria** from the family Enterobacteriaceae, which are primarily known for their ability to cause intestinal upset. Enterobacteria are responsible for a variety of human illnesses, including **urinary tract infections, wound infections**, **gastroenteritis** , **meningitis** , **septicemia**, and **pneumonia** .

Most enterobacteria reside normally in the large intestine, but others are introduced in contaminated or improperly prepared foods or beverages. Several enterobacterial diseases are spread by **fecal-oral transmission** and are associated with **poor hygienic conditions**. Enterobacterial gastroenteritis can cause extensive fluid loss through vomiting and diarrhea, leading to dehydration.The **Enterobacteriaceae** are a large [family](http://en.wikipedia.org/wiki/Family_(biology)) of [Gram-negative](http://en.wikipedia.org/wiki/Gram-negative_bacteria) [bacteria](http://en.wikipedia.org/wiki/Bacteria) that includes, along with many harmless [symbionts](http://en.wikipedia.org/wiki/Symbiosis), many of the more familiar [pathogens](http://en.wikipedia.org/wiki/Pathogenic_bacteria), such as [*Salmonella*](http://en.wikipedia.org/wiki/Salmonella), [*Escherichia coli*](http://en.wikipedia.org/wiki/Escherichia_coli), [*Yersinia pestis*](http://en.wikipedia.org/wiki/Yersinia_pestis), [*Klebsiella*](http://en.wikipedia.org/wiki/Klebsiella) and [*Shigella*](http://en.wikipedia.org/wiki/Shigella). Other disease-causing bacteria in this family include [*Proteus*](http://en.wikipedia.org/wiki/Proteus_(bacterium)), [*Enterobacter*](http://en.wikipedia.org/wiki/Enterobacter), [*Serratia*](http://en.wikipedia.org/wiki/Serratia), and [*Citrobacter*](http://en.wikipedia.org/wiki/Citrobacter).

***Proteus* spp:**

is a genus of [Gram-negative](http://en.wikipedia.org/wiki/Gram-negative) .  are widely distributed in nature as saprophytes, motile, aerobic rod-shaped bacilli .

**Symptoms:**

The most common infection involving **Proteus mirabilis** occurs when the bacteria moves to the urethra and urinary bladder. Although Proteus mirabilis mostly known to cause urinary tract infections, the majority of urinary tract infections are due to E. coli. Urinary tract infections caused by P. mirabilis occur usually in patients under long-term catherization.

1-**urethritis** are mild including frequency of urination and pyuria

2-**Cystitis** (bladder infection)

3-**hematuria** (presence of red blood cells in the urine)   
**4-Pyelonephritis** (kidney infection) can occur when the bacteria migrates from the lower urinary tract.

**PATHOGENICITY/TOXICITY**:   
**1-**The flagellum of P. mirabilis is crucial to its motility, a characteristic that helps the organism colonize. aiding in the bacteria’s resistance to defenses of the host and select antibiotics.

**2-** P. mirabilis also relies on its pili for adhesion to avoid being flushed out of the urinary tract system.  
**3-**Important to Proteus mirabilis is urease, responsible for raising the pH and consequently making it easier to thrive. Increased pH allows stone formation to take place. On occasion the stones fill the entire renal pelvis. **4-** Also present endotoxins, responsible for induction of the inflammatory response system and forming hemolysins .

# *Klebsiella*

***Klebsiella*** is a [genus](http://en.wikipedia.org/wiki/Genus) of [non-motile](http://en.wikipedia.org/wiki/Motility), [Gram-negative](http://en.wikipedia.org/wiki/Gram-negative), [oxidase-negative](http://en.wikipedia.org/wiki/Oxidase_test), rod-shaped [bacteria](http://en.wikipedia.org/wiki/Bacteria) with a prominent [polysaccharide](http://en.wikipedia.org/wiki/Polysaccharide)-based[capsule](http://en.wikipedia.org/wiki/Capsule_(microbiology)).

**PATHOGENICITY/TOXICITY:**

**1**-cell surface lipopolysaccharides (LPSs), and toxins, each of which plays a specific role in the pathogenesis of these species. Depending on the type of infection and the mode of infectivity.

**2**- Klebsiellaspp. may adhere and attack upper respiratory tract epithelial cells, cells in gastrointestinal tract, endothelial cells, or uroepithelial cells, followed by colonization of mucosal membranes

**Symptoms:**

Bacteria belonging to the genus Klebsiella frequently cause human nosocomial infections. In particular, the medically most important Klebsiella species, **Klebsiella pneumoniae**, accounts for a significant proportion of hospital-acquired

**1**-urinary tract infections, pneumonia,

**2**-septicemias, and soft tissue infections.

**The principal pathogenic reservoirs for transmission of Klebsiella are** **1-**the gastrointestinal tract and the hands of hospital personnel. Because of their ability to spread rapidly in the hospital environment, these bacteria tend to cause nosocomial outbreaks.

**2-**Hospital outbreaks of multidrug-resistant Klebsiella spp., especially those in neonatal wards, are often caused by new types of strains, called

extended-spectrum-β-lactamase (ESBL) producers. The incidence of ESBL-producing strains among clinical Klebsiella isolates has been steadily increasing over the past years.