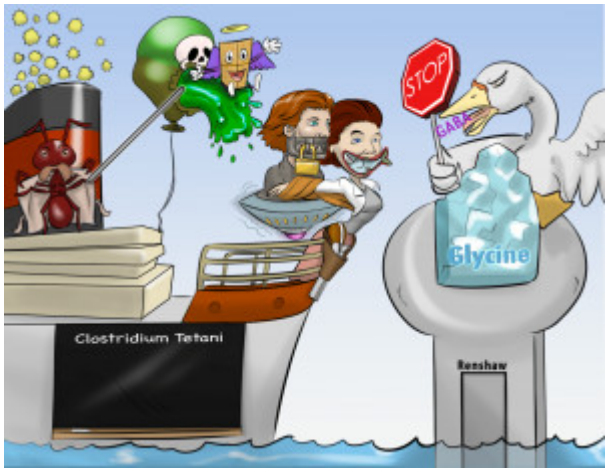
Clostridium tetani

Clostridium tetani is a gram-positive anaerobic bacillus that causes tetanus, a disease characterized by painful muscle spasms. Like the other Clostridium species, it is a spore-forming organism. These spores are naturally found in the soil or gastrointestinal tract of animals, while the infection is usually caused by traumatic implantation into tissues with low oxygenation (e.g. stepping on a rusty nail, puncture, burns, unsterile surgery). This organism releases a potent exotoxin, called tetanus toxin, or tetanospasmin, which acts at the presynaptic membrane of inhibitory motor nerve endings of Renshaw cells in the anterior horn cells of the spinal cord. This tetanus toxin blocks inhibitory signals by interfering with the release of inhibitory neurotransmitters, including GABA and glycine, which results in an increased firing rate of alpha motor neurons. This causes rigidity, unopposed muscle contractions, and spasms. Characteristic features include risus sardonicus, lockjaw, and opisthotonus. Death typically results from paralysis of the throat and respiratory muscles.



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Characteristics

Gram-Positive
Graham-cracker Positive-angel
Clostridium tetani stains positively on Gram stain because of its thick peptidoglycan layer, which absorbs crystal violet. In contrast, organisms without this peptidoglycan layer cannot absorb crystal violet staining, making them gram-negative.

Bacilli
Rod
These bacteria are bacilli, or rod-shaped organisms.

Obligate Anaerobic
Ant-in-robe
Clostridium tetani is an obligate anaerobe, meaning it cannot survive in the presence of oxygen.

Exotoxin
Bursting-toxic-balloon
An exotoxin is classified as a toxin released by bacteria into the environment. Clostridium tetani releases a potent exotoxin called tetanospasmin (or tetanus toxin), which acts at the presynaptic membranes of inhibitor motor nerve endings of Renshaw cells in the spinal cord. Specifically, tetanus toxin, which is an exotoxin with neurotoxic activity, blocks inhibitory signals by interfering with the release of inhibitory neurotransmitters, including GABA and glycine.

Spore-Forming
Spores
As Clostridium tetani bacteria mature, they develop terminal spores. These spores are extremely resilient, resistant to heat, and are widely distributed in soils. The spores of Clostridium tetani typically enter their host through a wound in the skin, where they replicate and produce toxins.

Renshaw Cells in the Spinal Cord
Renshaw-wrench
Renshaw cells are inhibitory interneurons found in the gray matter of the spinal cord. They function to send an inhibitory axon to synapse with the cell body of an alpha motor neuron. The inhibitory activity of this pathway leads to an increased firing rate of alpha motor neurons, ultimately manifesting as spasms in those affected.

Blocks Glycine and GABA Release
Glycine-glacier and GABA-goose with Stop-sign
Tetanus toxin blocks inhibitory signals by interfering with the release of inhibitory neurotransmitters, including GABA and glycine.

Signs and Symptoms

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Spasms

Spasm-spaceship

In patients infected by Clostridium tetani there is a loss of inhibitory signals to alpha motor neurons. This causes an increased firing rate, which leads to rigidity, unopposed muscle contractions, and spasms.

Risus Sardonicus

Sardine Smile

Risus sardonicus is described as the appearance of raised eyebrows and an open grin caused by an abnormal sustained spasm of the facial muscles. This is a characteristic finding in those affected by tetanus.

Lockjaw

Locked-jaw

Lockjaw, also called trismus, is a pathological condition in which the mouth is held shut by a sustained spasm of the jaw muscles. Lockjaw commonly arises as one of the first signs of tetanus.

Opisthotonus

Severe Hyperextension of Pistol-body

Opisthotonus is a characteristic finding of tetanus. This term refers to a state of pronounced hyperextension caused by severe back muscle spasms, characterized by arching of the head, neck, and spinal column.

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