



Pertussis

By Chase McKinney



Quick Facts



1. Estimated 24.1 million cases a year and 160,700 deaths per year world wide.
1. Known as whooping cough because of the sound someone makes after a coughing fit when gasping for air.
1. Before the 1940s annual mortality count of pertussis was around 200,000 in US alone.
1. About half of babies under one who contract Pertussis will have to be hospitalized.

Bordetella Pertussis

- Bordetella pertussis is a gram-negative, aerobic bacteria
- First reported in the 16th century by Guillaume de Baillou
- First isolated by Jules Bordet and Octave Gengou in 1906
- It can be grown on Bordet-Gengou (BG) due to high starch content

History

In 1900, **Jules Bordet** along with **Octave Gengou** observed a small ovoid bacterium in the sputum of a 5-month old child suffering from **pertussis**, or whooping cough.



Jules Bordet
Belgian immunologist and
microbiologist



Octave Gengou
Belgian
bacteriologist

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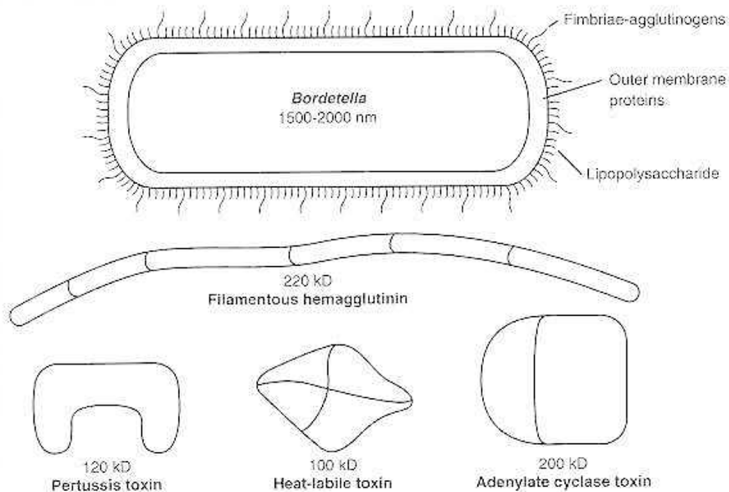
Structure

- Arranged singly or in small groups
- *B. pertussis* and *B. parapertussis* are nonmotile
- Produce numerous antigens and biologically active structural components

Finger, 1996



<https://www.ncbi.nlm.nih.gov/books/NBK7813/bin/ch31f2.jpg>



Pertussis Nasties

Pertussis has multiple antigenic and biologically active products, including pertussis toxin (PT), filamentous hemagglutinin (FHA), agglutinogens, adenylate cyclase, pertactin, and tracheal cytotoxin.

These products are responsible for the clinical features of pertussis disease.

An immune response to one or more of these products produces immunity following infection. Immunity following *B. pertussis* infection is not permanent.

🧑 Into The Body 🧑

Pertussis is a toxin-mediated disease and is spread via droplets from an infected hosts cough or sneeze. From there it makes its way into the respiratory tract, attaches to cilia of epithelial cells and paralyzes them using its various toxins.



This paralysis of the cilia spreads and alerts the immune system prompting a response. This response leads to an increase of inflammation leading to further restricted airflow. Pertussis antigens allow the organism to defend against the immune response by impairing chemotaxis but not lymphocytosis

In the Body



Pertussis has an incubation of 7 - 10 days followed by three main phases.

Catarrhal stage

Symptoms start to present themselves. Runny nose, low-grade fever, sneezing, and the occasional cough.

01

02

Paroxysmal stage

Typically where a diagnosis is delivered. Severe coughing attacks that occur due to expel mucus from the tracheobronchial tree.

03

Convalescence stage

The recovery stage which can last 2-3 weeks. The coughing becomes less intense and slowly the attacks stop.



Immune Response

1.

Resident macrophages and immature dendritic cells are the first cells of the innate immune system to sense and respond to pertussis infection.

2.

Initial infiltrate of DCs and macrophages is followed by an influx of neutrophils, then natural killer cells, and finally $\alpha\beta$ T cells

3.

Innate cells activated by cytokines secreted by NK cells and CD4⁺ T cells help to clear a primary infection. Immunity can last

Vaccine Development



Vaccines



Today there are
two commercially
available vaccines

DTaP



"Children younger
than seven get me!
I'm an acellular
vaccine."
—DTaP

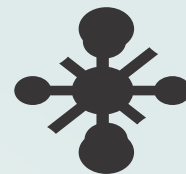
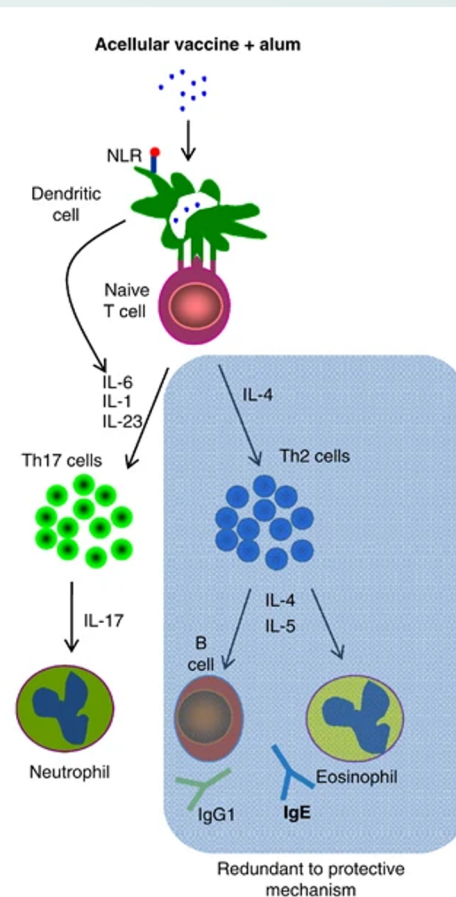
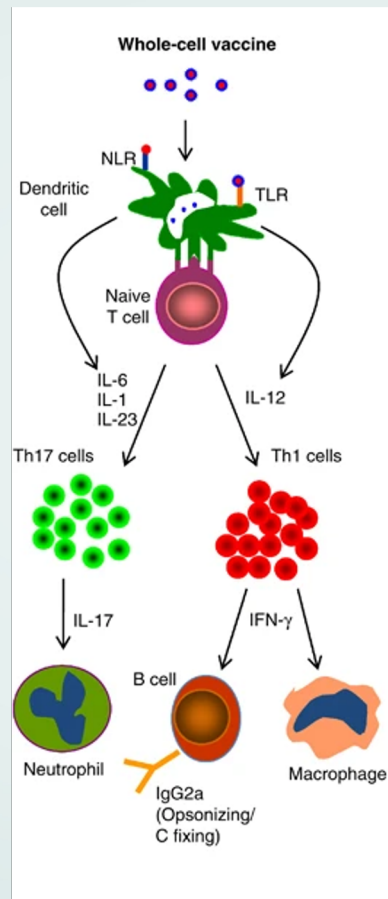
Tdap



"Children older than
seven get me! I'm a
whole cell vaccine."
—Tdap

Whole-cellular VS. Acellular

Whole weakened cells. Usually better to use if a slight immunity is already present.



Contains cellular material But not whole cells. Usually has less side effects.

The First Vaccine



It came in a combined vaccine known as DTP which was for pertussis, diphtheria, and tetanus.

The first Pertussis vaccine was licenced in 1914 and produced in 1948.



It needed four doses and was 70-90% effective. Some side effects were redness, swelling, pain at the injection site, fever, and other mild systemic events.





DTaP



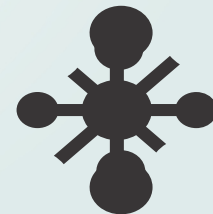
Infanrix and
Daptacel

Pediarix

Pentacel

Vaxelis

All are administered
between 6 weeks
and 4 years of age
and is administered
3-6 times.



Havers, 2021



Tdap

Boostrix and Adacel

- (Basically just a booster)

For adolescents age 11 through 18 years who have completed the recommended childhood DTP/DTaP vaccination series. Adults age 19 years or older who have not previously received Tdap should receive a single dose of Tdap. Mothers should also receive a dose during pregnancy.

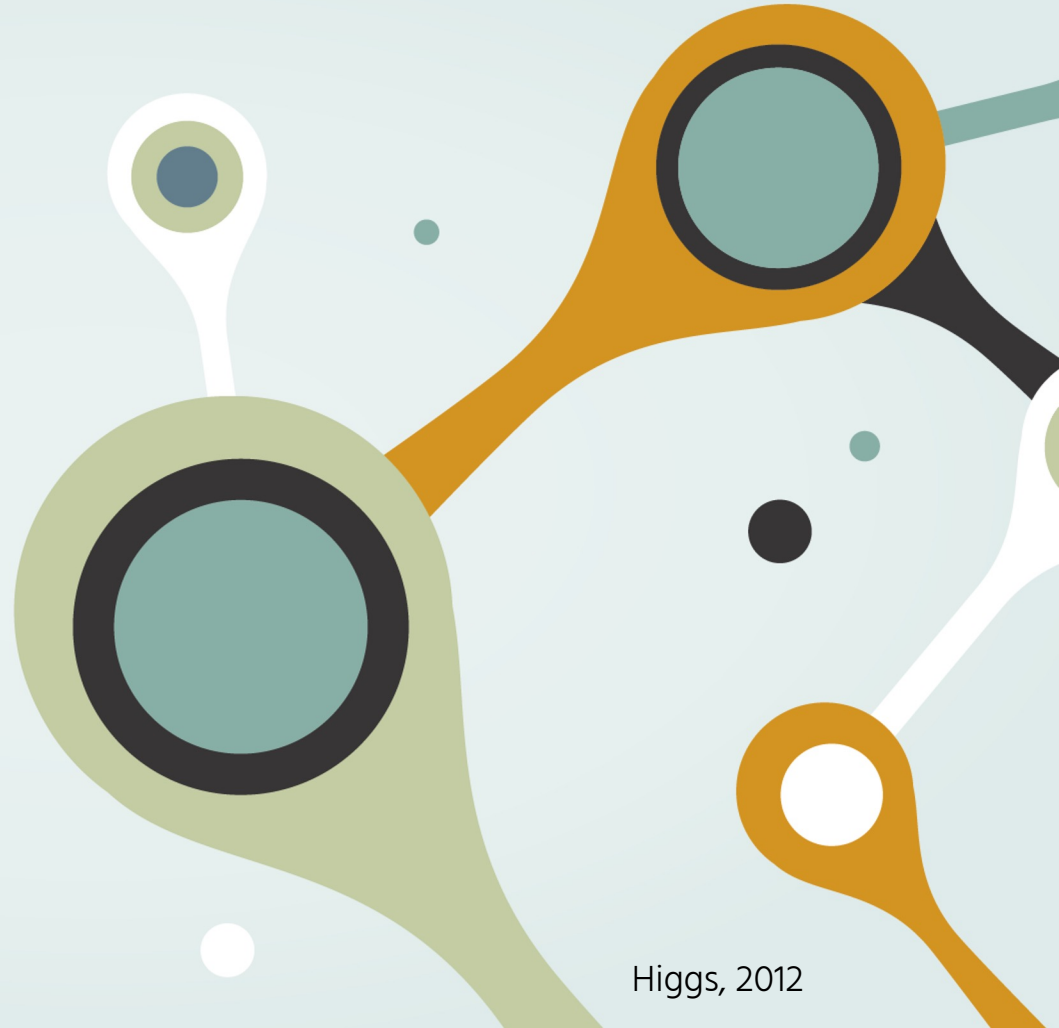


Treatment

- Antibiotics
 - Azithromycin
 - Erythromycin
 - Clarithromycin.

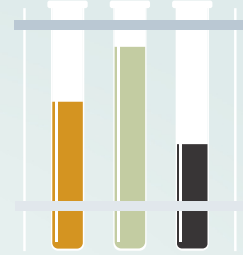
Target Population

The target population to receive the vaccine is pregnant women and children. Children, especially babies under the age of one are most susceptible to death from this diseases.



Higgs, 2012

Save the Babies



With Science



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Extra

- 4-dose series for children age 6 weeks through 4 years. It is administered to infants at age 2, 4, 6, and 15 through 18 months.
- 3-dose series for children age 6 weeks through 4 years. It is administered to infants at age 2, 4, and 6 months.
- Children age 6 weeks through 6 years, 3 doses at age 2, 4, and 6 months, a booster dose between age 15 through 18 months, and another booster dose between age 4 through 6 years.
- 3-dose series for children age 6 weeks through 6 years. It is administered to infants at age 2, 4, and 6 months.