Medical Microbiology

Pneumonia-II

Pneumonia is an inflammatory condition of the lungs primarily affecting the small air sacs known as alveoli

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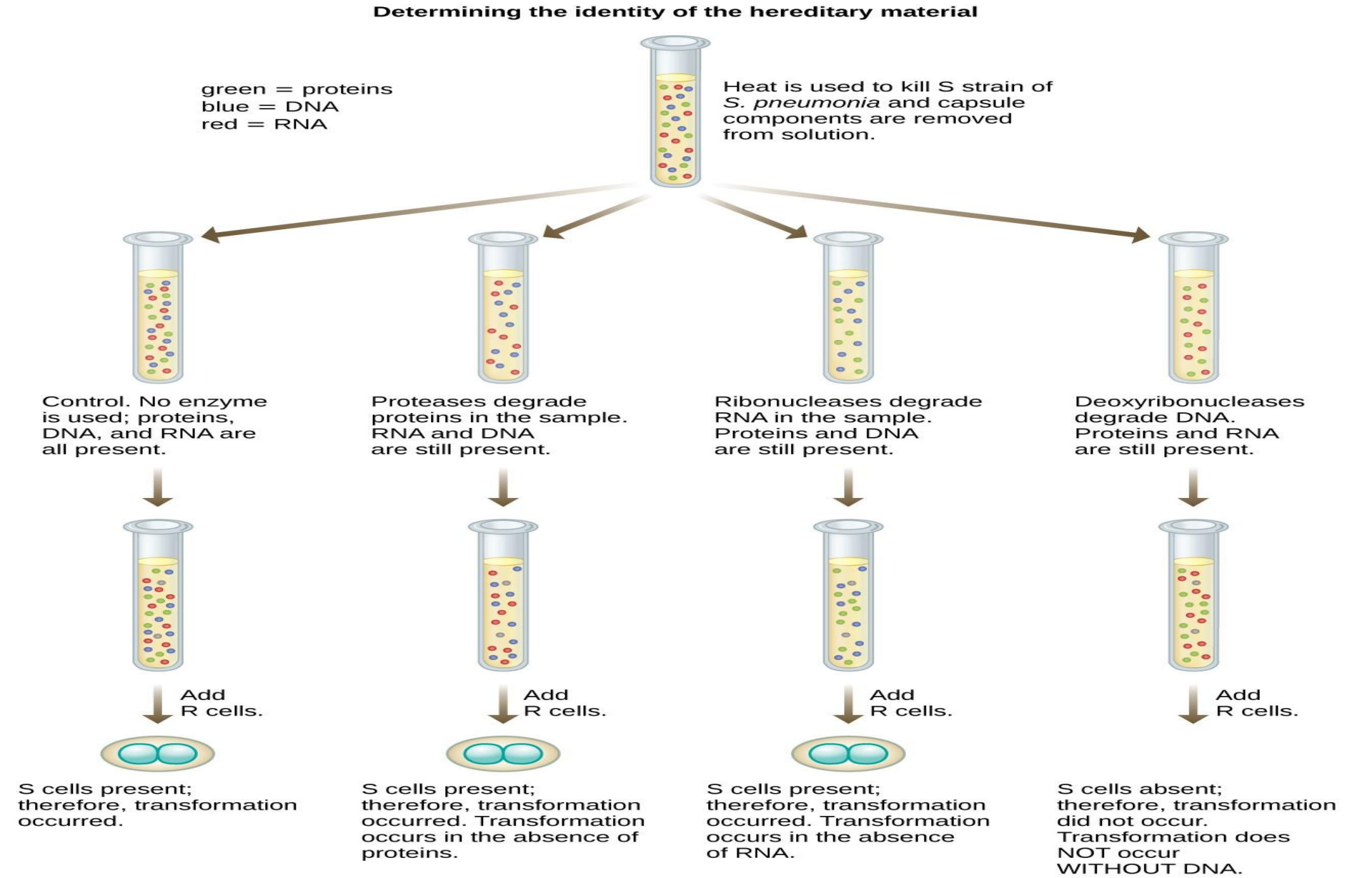
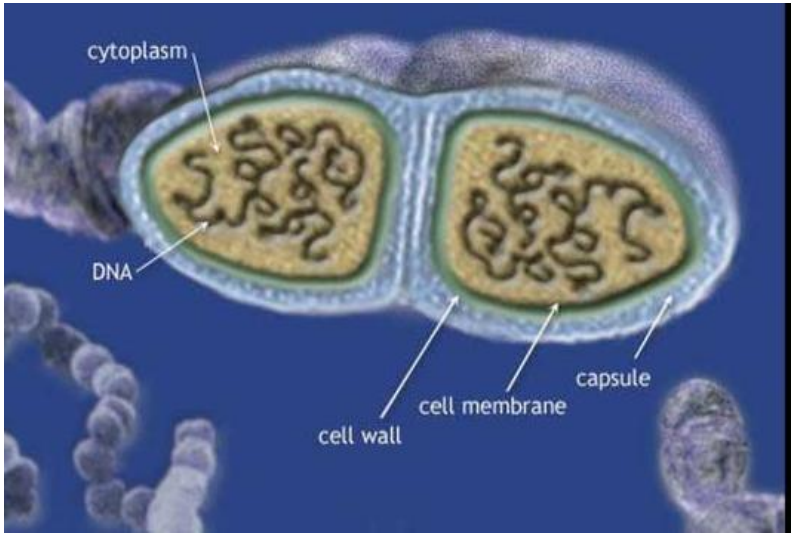
1928, Frederick Griffith

Control	Experiment 1	Experiment 2	Experiment 3
rough strain (nonvirulent)	heat-killed smooth strain	rough strain and heat-killed smooth strain	smooth strain (virulent strain recovered from dead mice in Experiment 2)
mouse lives	mouse lives	mouse dies	mouse dies



Oswald Avery, Colin MacLeod, and Maclyn McCarty
1944

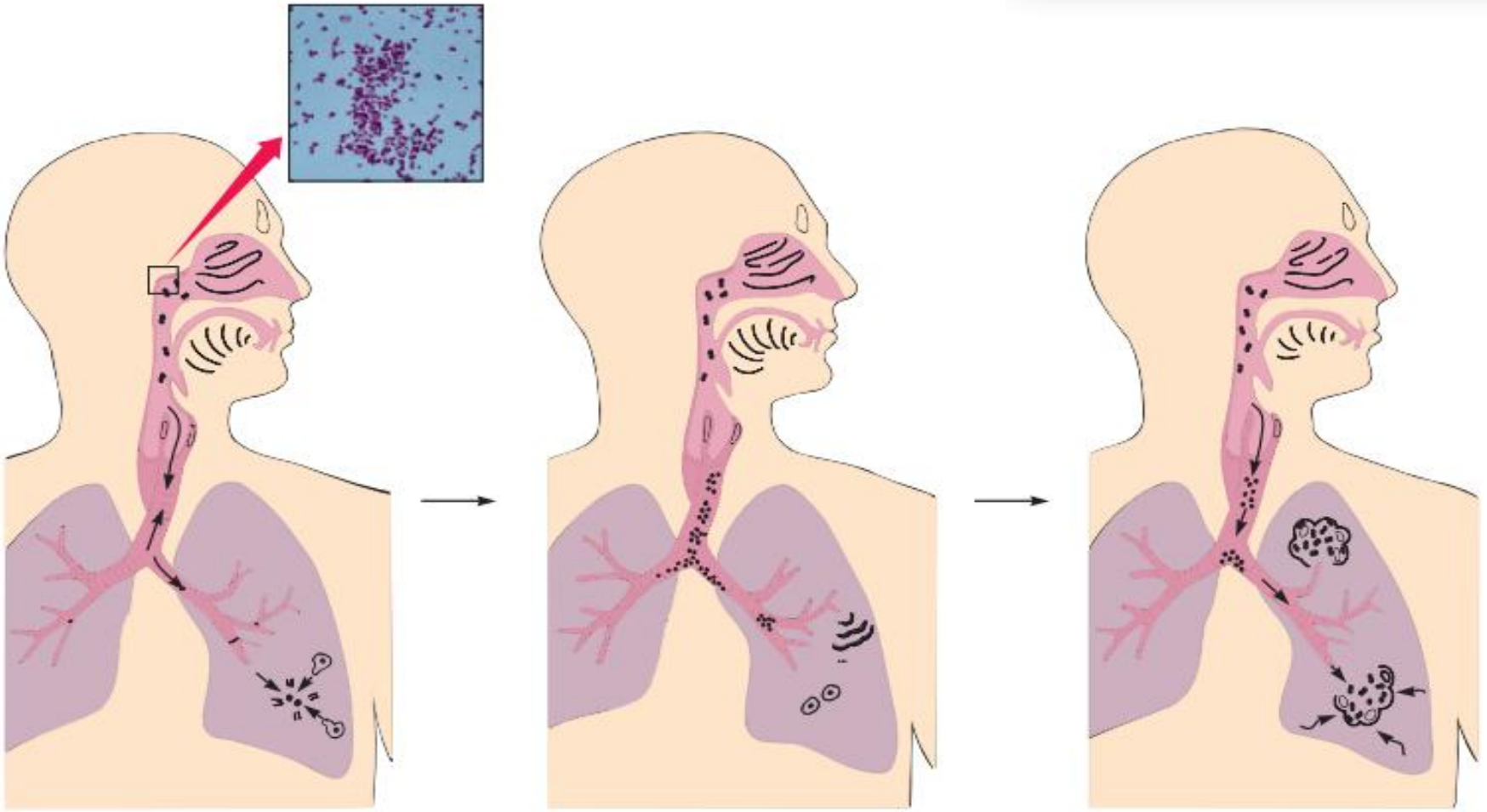




- *Streptococcus pneumoniae*, or pneumococcus, is a Gram-positive, spherical bacteria, facultative anaerobic member of the genus *Streptococcus*. They are usually found in pairs (diplococci) and do not form spores and are non motile.

- *S. pneumoniae* was recognized as a major cause of pneumonia in the late 19th century and resides asymptomatically in healthy carriers typically colonizing the respiratory tract.

- The individuals with weaker immune systems, the bacterium may become pathogenic. It spreads by direct person-to-person contact via respiratory droplets and a main cause of CAP.



Normal condition

1 Periodic colonization with streptococci
2 Some penetration into lower respiratory tract
3 Streptococci trapped by mucus and removed by ciliary action
4 Phagocytosed by macrophages

Predisposing factors

5 Ciliated epithelium damaged by viruses, toxins, smoking, chemicals
6 Fluid accumulation
7 Decreased activity of macrophages

Development of pneumonia

8 Growth of streptococci on damaged ciliated epithelium
9 Growth in fluids and in alveoli, both of which stimulate increased fluid accumulation

Predisposition to and the Development of Streptococcal Pneumonia

Streptococcus pneumoniae can be differentiated from the viridans streptococci, some of which are also alpha-hemolytic, using an optochin test, as *S. pneumoniae* is optochin-sensitive.

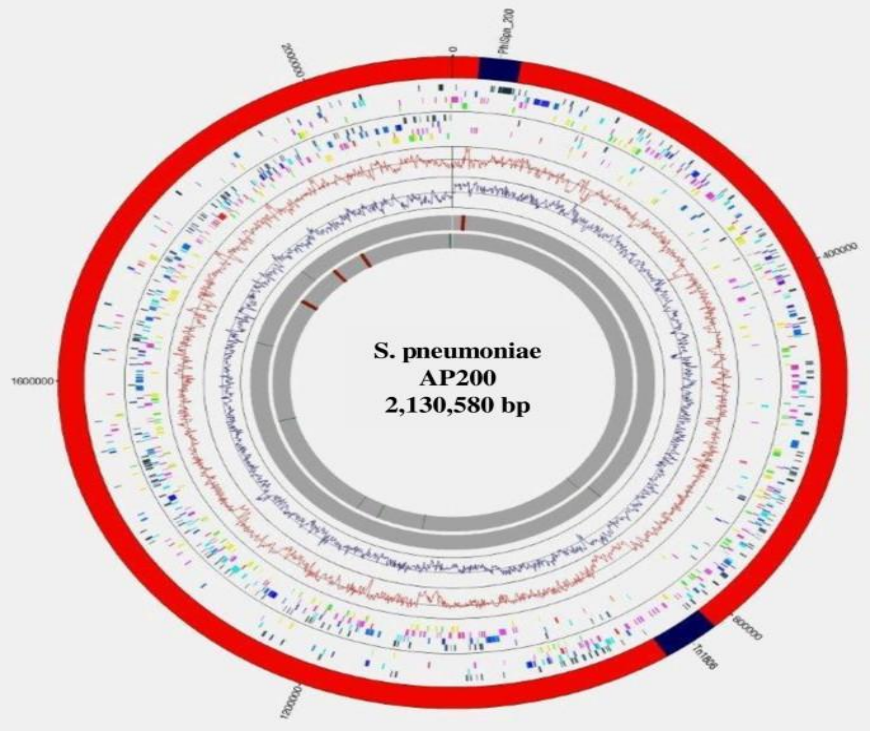
- They have a polysaccharide capsule that acts as a virulence factor for the organism; more than 90 different serotypes are known, and these types differ in virulence, prevalence, and extent of drug resistance.
- The organism was termed Diplococcus pneumoniae in 1920 and was renamed *Streptococcus pneumoniae* in 1974

α-hemolysis: Alpha-hemolysin partially breaks down the red blood cells and leaves a greenish color because of biliverdin

β-hemolysis: Beta-hemolysin breaks down the red blood cells and hemoglobin completely.

γ-hemolysis: If the organism does not produce hemolysins and does not break down the blood cells, no clearing will occur.

- The genome of *S. pneumoniae* is a closed, circular DNA structure that contains between 2.0 and 2.1 mbp with 1553 genes, plus 154 genes in its virulome.
- The pneumococcal genome is known to contain a large and diverse repertoire of antimicrobial peptides, including 11 different lantibiotics



Diagnosis

- **Positive culture from a sample**
- **Optochin senstivity**
- **PCR-based detection Xisco gene in *S. pneumoniae***

Optochin (a derivative of hydroquinine) sensitivity

Vaccine

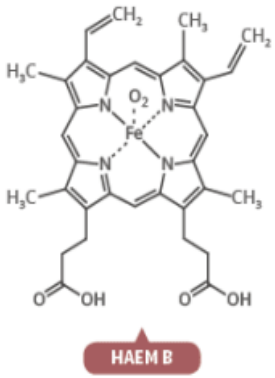
Conjugate vaccines and polysaccharide vaccines. They are given by injection either into a muscle or just under the skin

Resistant pneumococcal strains are called penicillin-resistant pneumococci (**PRP**), penicillin-resistant *Streptococcus pneumoniae* (**PRSP**), *Streptococcus pneumoniae* penicillin resistant (**SPPR**) or drug-resistant *Strepotococcus pneumoniae* (**DRSP**).

THE CHEMISTRY OF BODILY FLUID COLOURS

Blood, urine, and faeces are quite distinct. However, the compounds that give them their colours are chemical relatives! We take a look at them here.

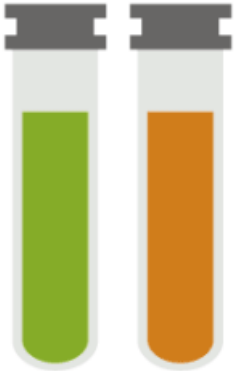
BLOOD: HAEMOGLOBIN

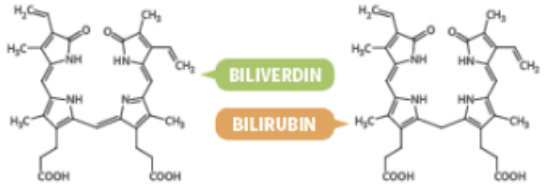


Haemoglobin is a protein found in blood, built up of smaller sub-units containing 'haems'. These haems contain iron, and their structure gives our blood its red colour when oxygenated.

As blood dries it gradually turns brown, as haemoglobin is oxidised to methaemoglobin.

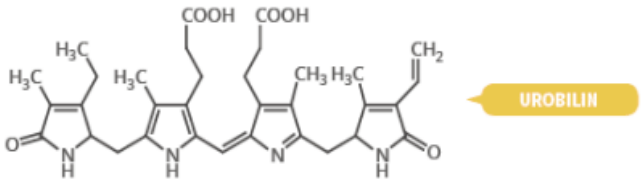
BILE: BILIVERDIN & BILIRUBIN





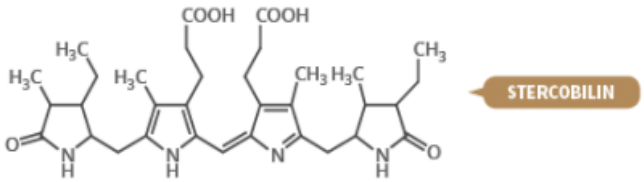
Haem in old and damaged red blood cells can be broken down, first into the green pigment biliverdin, which itself is converted to the brown pigment bilirubin. Both are found in bile, and can also cause the colouration around bruises.

URINE: UROBILIN



Bilirubin is broken down by microbes in the intestines, producing urobilinogen. This can then be absorbed into the bloodstream, and oxidised to produce urobilin. Urobilin is excreted by the kidneys, and gives urine its yellow colour.

FAECES: STERCOBILIN



Urobilinogen produced by breakdown of bilirubin in the intestines can continue through the digestive system and be reduced to stercobilin. This is excreted from the body in the faeces, and is responsible for their brown colouration.

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Detection of "Xisco" gene for identification of *Streptococcus pneumoniae* isolates

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https://www.researchgate.net/publication/321846056_Detection_of_Xisco_gene_for_identification_of_Streptococcus_pneumoniae_isolates