effect of bacteria on the red blood cells and other elements of blood

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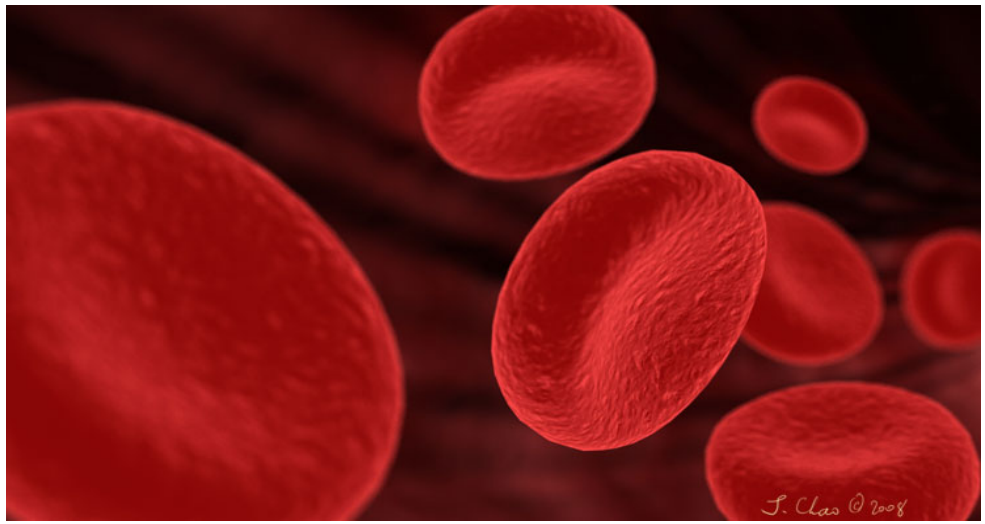
supervised: berzsu

RBC

- HAEMOLYTIC reaction: Effect of enzyme on break down of RBC ➔ membrane lysis + destruction of hemoglobin .
- On blood agar appearance of haemolytic zone/court around isolated colonies growing in the medium.



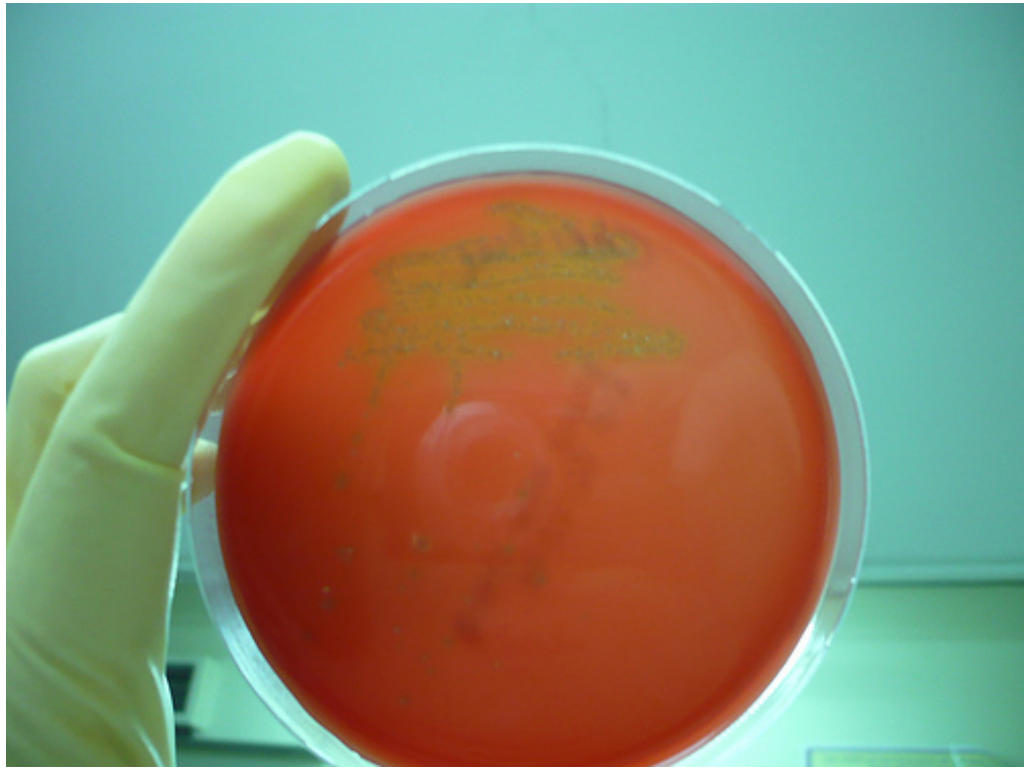
Types of haemolysis

- 1. α haemolysis
- 2. β haemolysis
- 3. γ haemolysis

α Haemolysis

- Lysis of membrane + incomplete breakdown of Hgb
- Green zone around colonies due to incomplete breakdown of Hgb (verdoglobin) production.
- Example: Streptococcus pneumoniae,
- Oral streptococci

Alpha Haemolysis



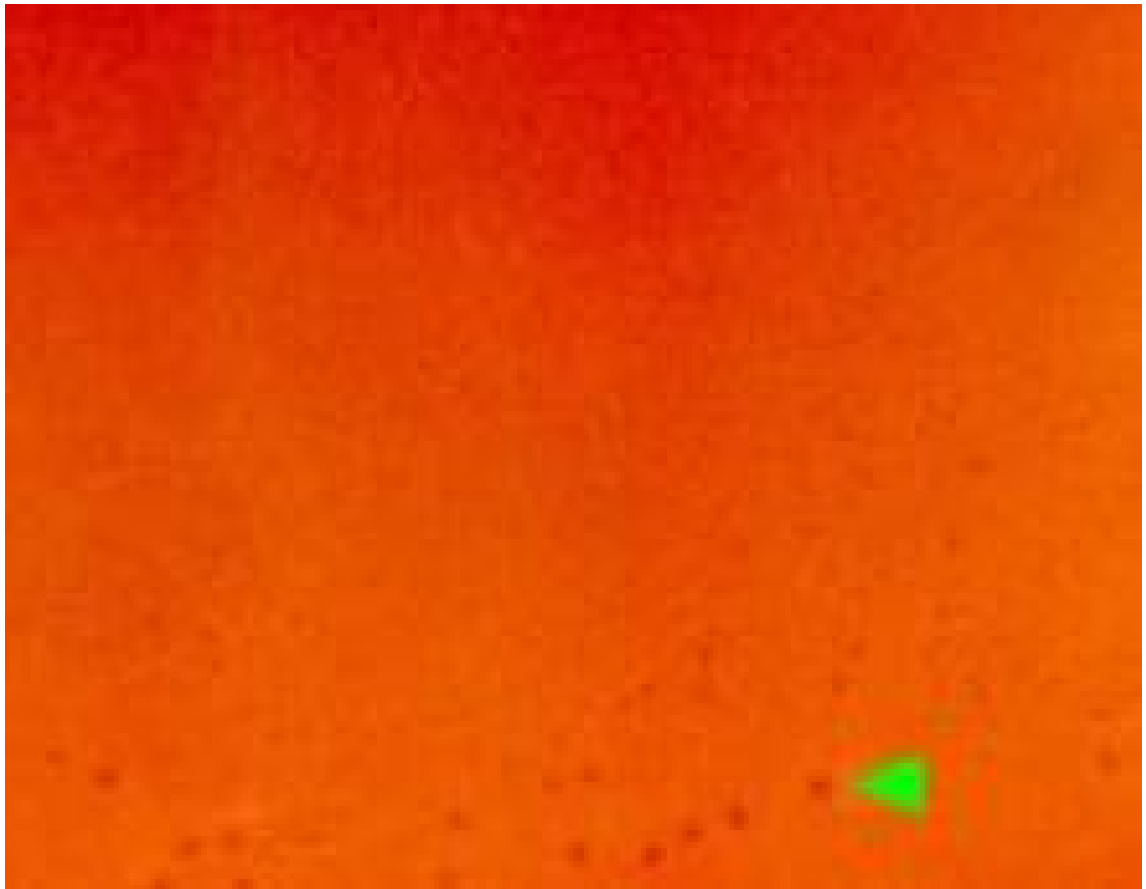
β Haemolysis

- Complete lysis of membrane and Hgb breakdown
- Zone mostly clear
- ↓ level of oxygen = bigger zone of haemolysis
- Example: Staphylococcus aureus, Streptococcus pyogenes, Streptococcus agalactiae


colony of
bacteria
beta
hemolysis
unhemolysed
blood agar

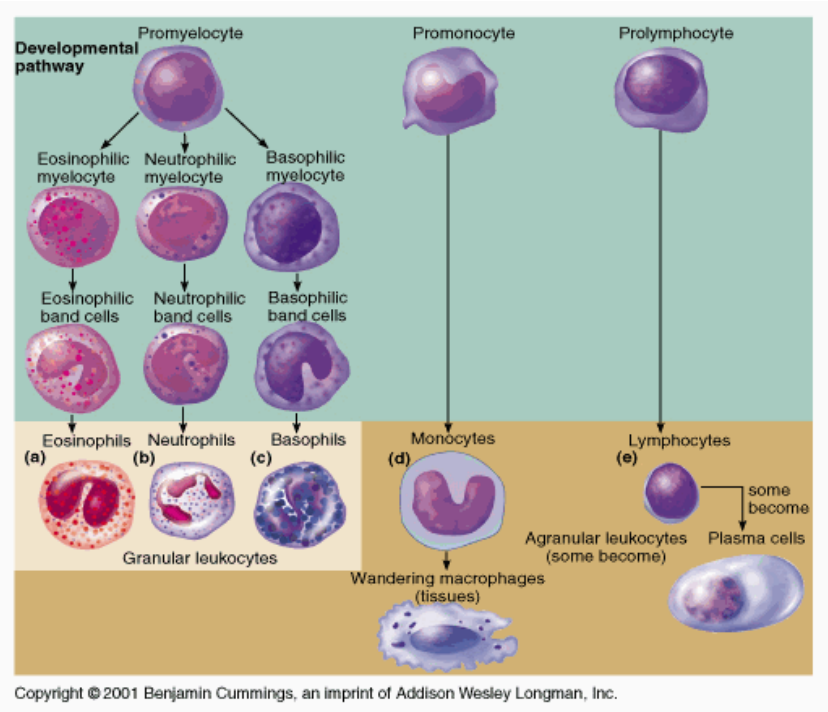
γ Haemolysis

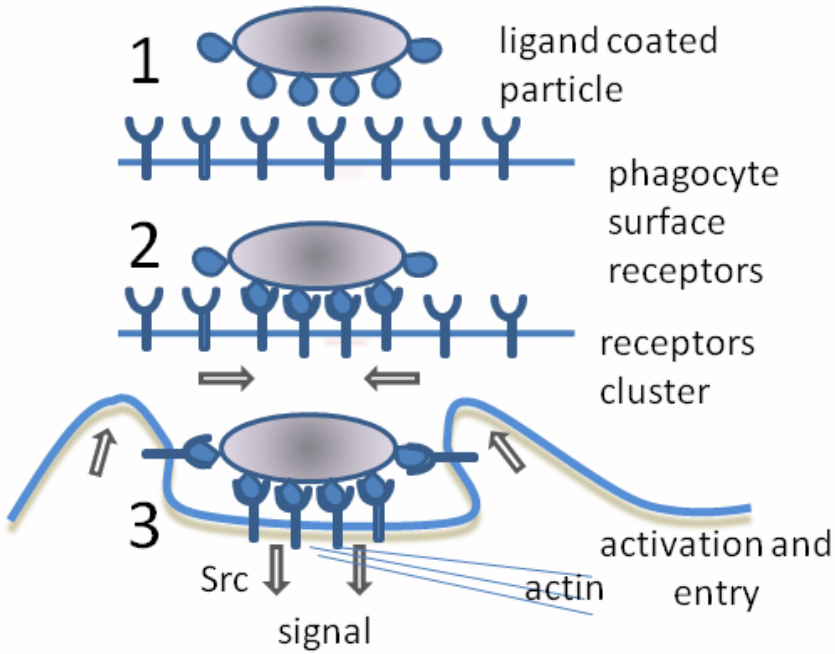
- No haemolysis
- Example: group D Streptococcus, Enterococcus



WBC

- On membrane by toxin called Leukocidin
- Inhibit phagocytosis





Leukocidin

- a cytotoxin produced by some pathogenic bacteria that is toxic to polymorphonuclear leukocytes (neutrophils).
- Mode of action: pore formation (pore forming toxin)
- Example: Staphylococcus aureus

Phagocytosis inhibition

- 1. Avoiding contact with phagocytes
- 2. Inhibition of phagocytic engulfment
- 3. Survival inside of cell
- 4. Products of bacteria that kill or damage phagocytes

1. Avoiding contact with phagocytes

- 1. By remain confined in regions inaccessible to mphagocytes in certain internal tissue (ex. urinary bladder) or surface tissue (ex. unbroken skin)
- 2. Avoid provoking an over whelming inflammatory response without inflammation; host is unable to focus the phagocytic defenses
- 3. Bacteria or products of bacteria that inhibit phagocyte chemotaxis (ex. streptococcal streptolysin suppresses neutrophil chemotaxis)

1. Avoiding contact with phagocytes

- 4. some pathogen cover surface of bacterial cell which is seen as self by the host; phagocytes and immune system

  (ex. S. aureus by formation clot, fibrin on bacterial surface;
  Treponema pallidum bind fibronectin;
  group A streptococci are able to produce capsule composed of hyaluronic acid)

2. Inhibition of phagocytic engulfment

- It's due to component of bacterial surface
- Example:

  1. polysacharide capsule: S. pnemoniae, Haemophilus influenzae, Treponema pallidum, Klebsiella pnemoniae

  2. M protein&fimbriae: Group A streptococci

  3. Surface slime (polysaccharide): biofilm by Pseudomonas aeruginosa

  4. O-Ag: associated with LPS of E. coli

  5. K antigen: E.coli (analogus of vi antigen of Salmonella typhi)

  6. protein A: S. aureus

3. Survival inside of cell

- This bacteria called intracellular parasites

mechanisms:

1. Inhibition of fusion of phagocytic lysosome (granules) ex. Salmonella, M. tuberculosis, Legionella, Chlamydia

2. Survive inside the phagolysosome: by producing surface component
ex. M. tuberculosis, M. leprae

3. Cell wall component ex. LPS of Brucella abortus

3. Survival inside of cell

- This bacteria called intracellular parasites

mechanisms:

4. Vigorous catalase & superoxid dismutase produces that neutralize toxic oxygen radicals
   ex. S. aureus
5. Outer membrane and capsular component of gram negative bacteria ex. Salmonella, Yersinia, Brucella, E. coli
6. Production of extracellular iron-binding compounds which supply iron to cell for growth.

4. Products of bacteria that kill or damage phagocytes

- Many gram positive pathogen like pyogenic cocci secrete extracellular substances that kill pathogen like haemolysins, and leukocidin .
- Example:

  1. streptolysin: bind to cholesterol in membrane of neutrophils and explode lysosomal granule and release of this lethal substance to cell cytoplasm

  2. Exotoxin: by Pseudomonas aeruginosa which kill macrophages

Platelets

- Platelet-endotoxin interaction is depend on presence or absence of immune adherence site on platelets membrane.
- Platelets response characterized by aggregation, clumping, and release of platelet constitutions (ADP, factor3, vasoactive amines: histamine, serotonin)

- Endotoxin in blood cause thrombus formation
- Deposition of leukocyte and platelets in small blood vessels and necrosis

  endotoxin in blood = ↓of platelets