PHAGOCYTOSIS

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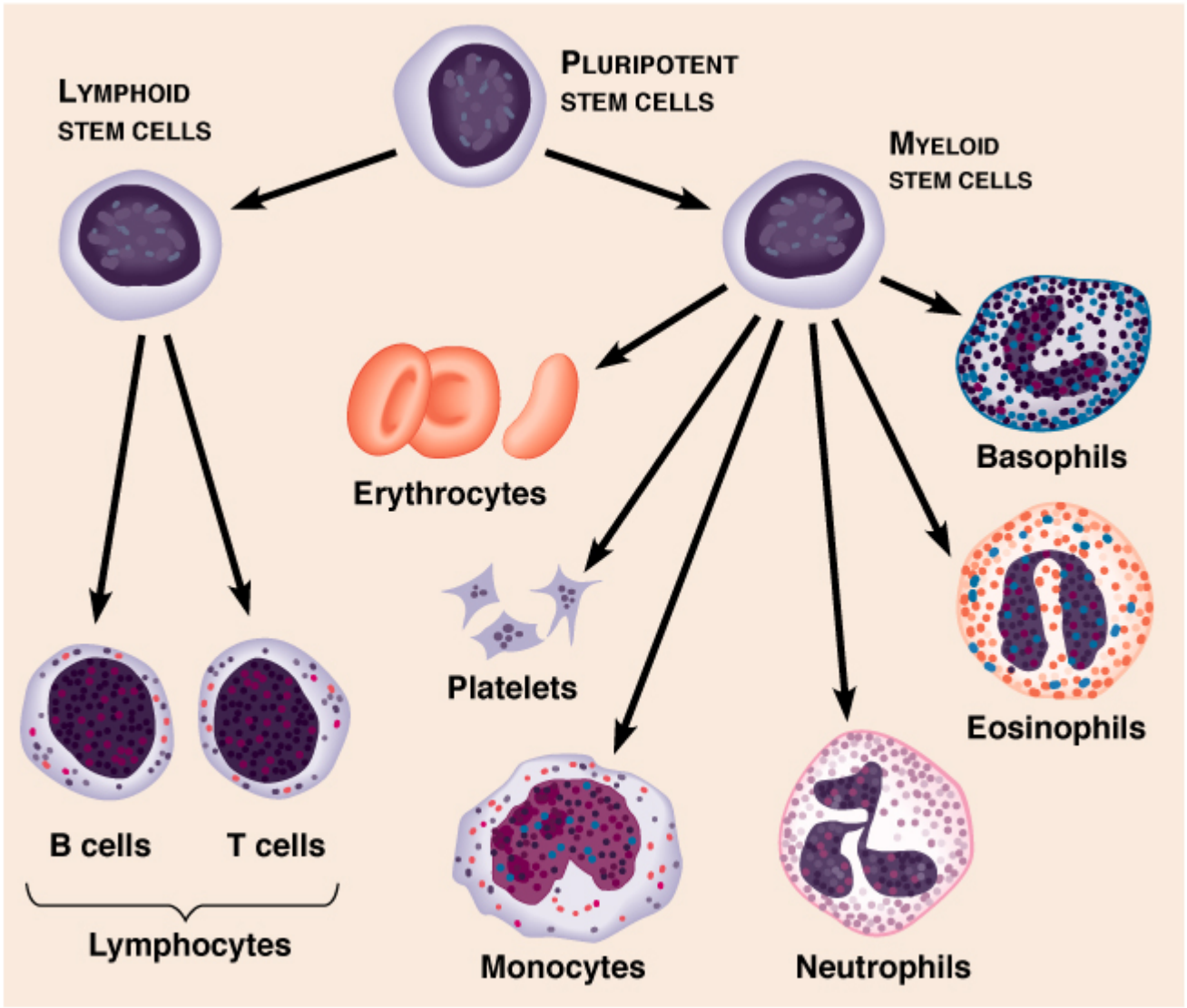
- Phagocytosis is a specific form of endocytosis by which cells internalise solid matter, including microbial pathogens
- Phago in Greek – Eat
- Professional phagocytes of the immune system
  - Macrophages,
  - Neutrophils
  - Immature dendritic cells
- Phagocytosis is a mechanism by which microorganisms can be
  - Contained & killed
  - Processed for antigen presentation

PHAGOCYTIC CELLS: MACROPHAGES (MONOCYTES), NEUTROPHILS & EOSINOPHILS

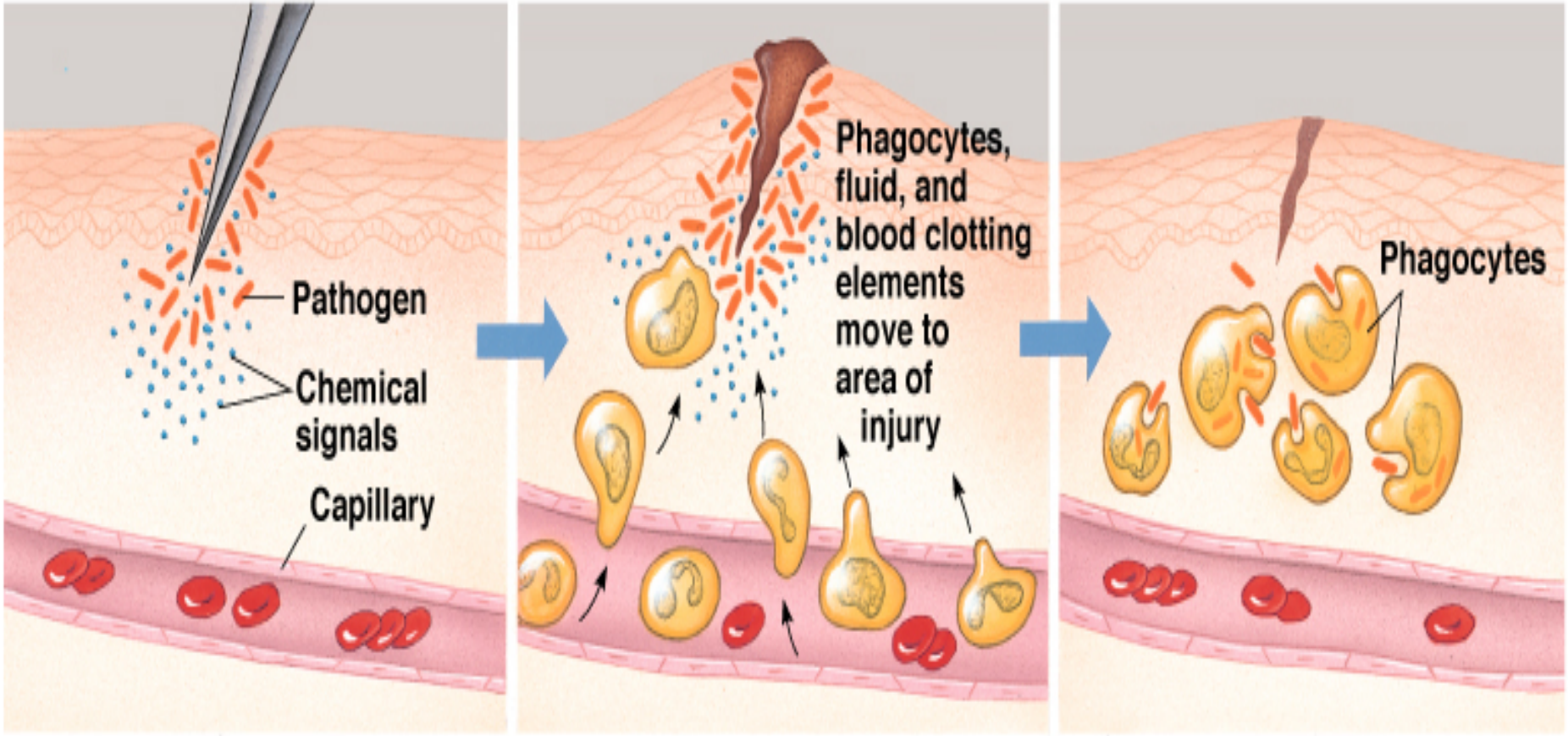


STEPS IN PHAGOCYTOSIS

1. Contact between phagocyte and microbial cell
2. Engulfment
3. Phagosome formation
4. Phagosome-lysosome fusion
5. Killing and digestion

1. Chemotaxis: Phagocytes are chemically attracted to site of infection.

2. Adherence: Phagocyte plasma membrane attaches to surface of pathogen or foreign material.
   - Adherence can be inhibited by capsules (*S. pneumoniae*) or M protein (*S. pyogenes*).
   - Opsonization: Coating process with opsonins that facilitates attachment.



❶ Tissue injury; release of chemical signals

❷ Dilation and increased permeability of capillary

❸ Phagocytosis of pathogens

3. Ingestion: Plasma membrane of phagocytes extends projections (pseudopods) which engulf the microbe. Microbe is enclosed in a sac called phagosome.

4. Digestion: Inside the cell, phagosome fuses with lysosome to form a phagolysosome.

   - Microorganisms are killed by
     - Oxygen dependent mechanism
     - Oxygen independent mechanism

5. After digestion, residual body with undigestable material is discharged.

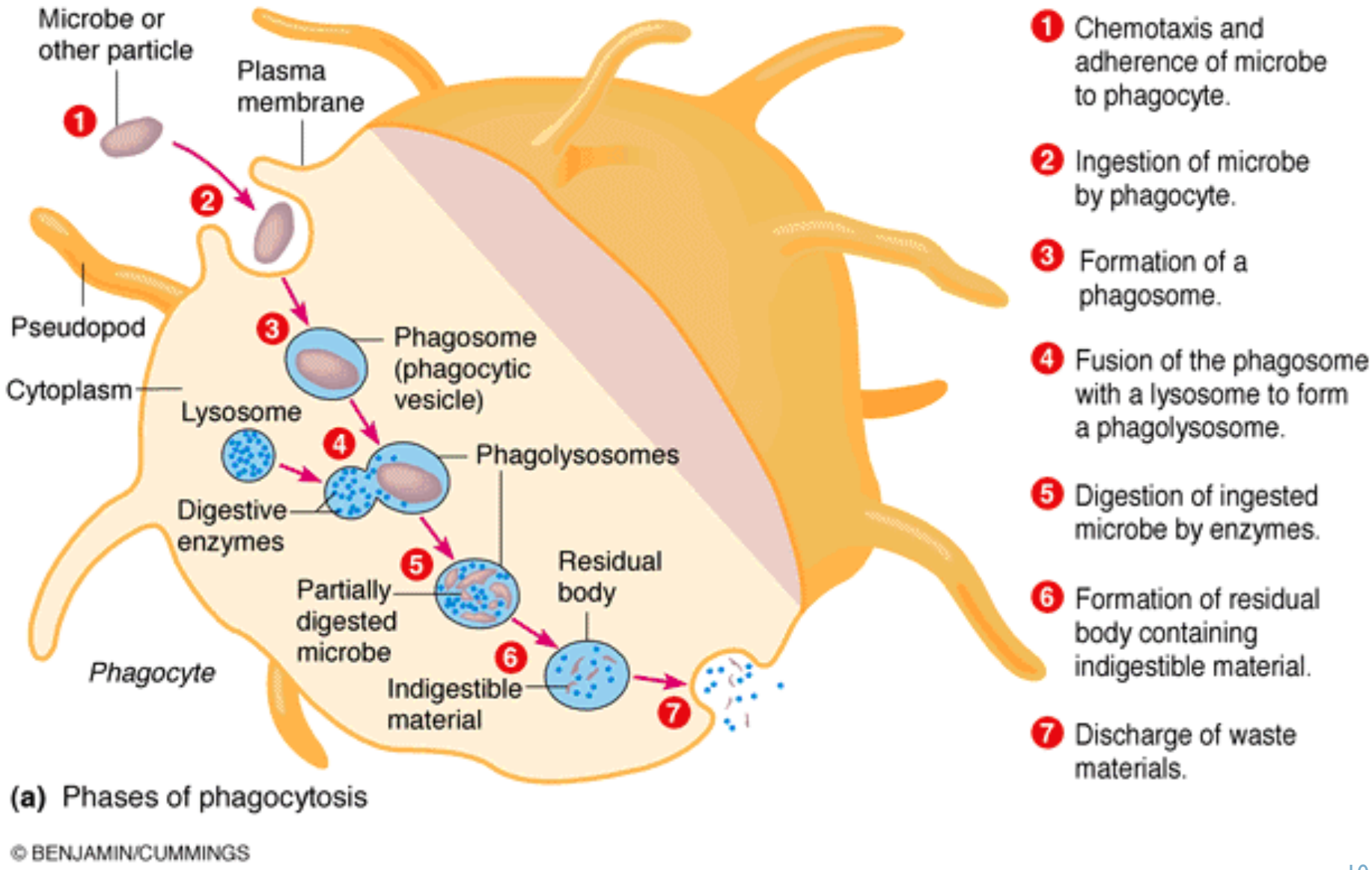
OXYGEN-DEPENDENT

- When a phagocyte ingests its oxygen consumption increases (respiratory burst)
- This produces reactive oxygen containing molecules
  - Superoxide, which is converted to hydrogen peroxide & singlet oxygen by superoxide dismutase
  - Superoxide also react with the hydrogen peroxide to form hydroxyl radicals
- The other type involves the use of the enzyme myeloperoxidase which is released into the phagolysozome. This uses hydrogen peroxide & chlorine to create Hypochlorite

OXYGEN-INDEPENDENT

- Lysosomal enzymes kill most bacteria within 30 minutes and include:
  - Lysozyme: Destroys cell wall peptidoglycan
  - Lactoferrins
  - Lipases and Proteases
  - RNAses and DNAses

PROCESS OF PHAGOCYTOSIS



(a) Phases of phagocytosis

ANIMATION OF PHAGOCYTOSIS

- http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__phagocytosis.html