Chapter 34:

Resistance of the Body to Infections:
II. Immunity and Allergy

Immunity

Innate = ability to resist damaging organisms and toxins
skin, gastric acids, tissue neutrophils
and macrophages, complement

Acquired = specific
humoral ----> circulating antibodies
cellular ----> activated cells

Sequence

Dormant lymphocytes

Invasion of body by foreign antigen

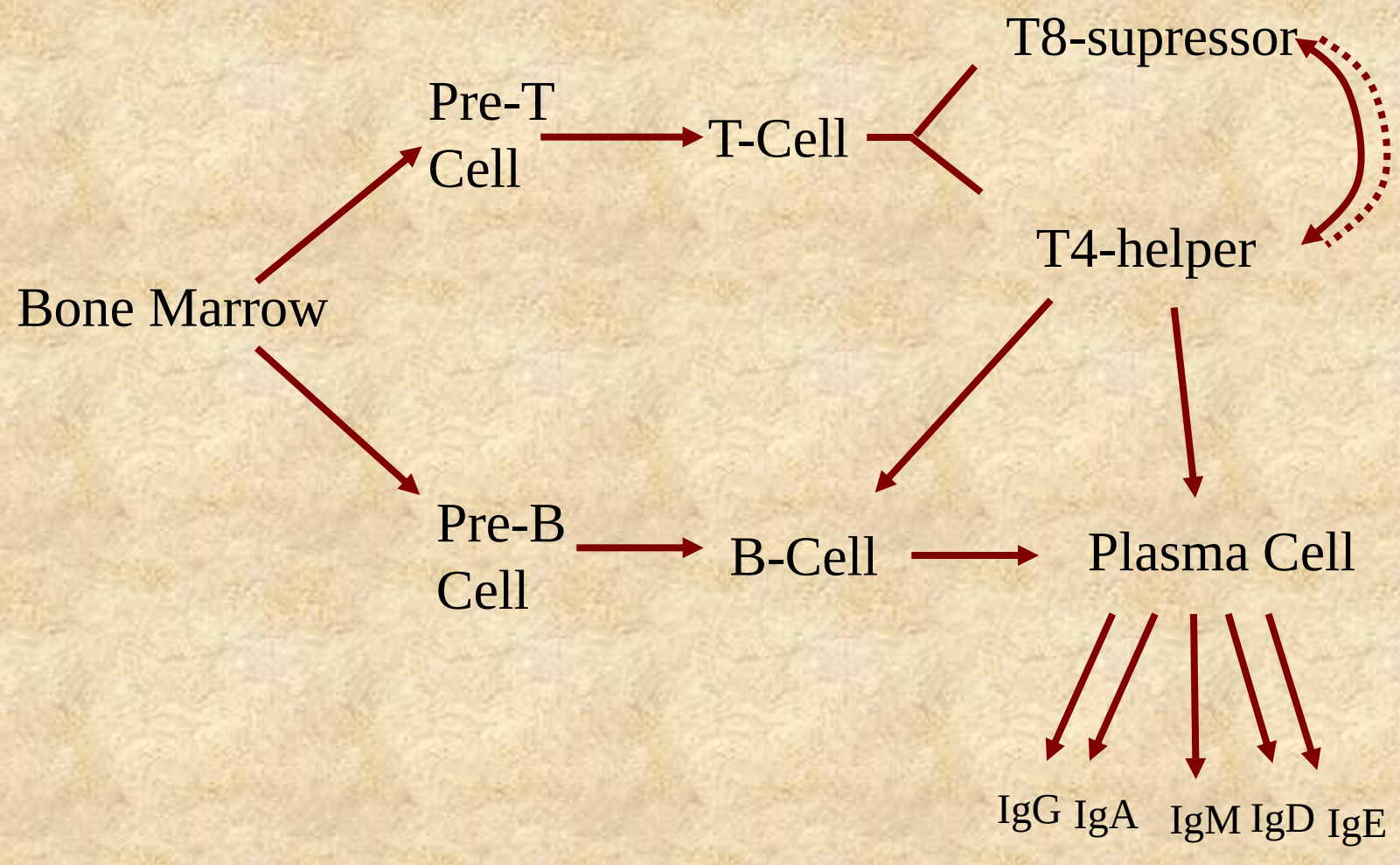
Phagocytosis by macrophages

Presentation of antigen to lymphocytes

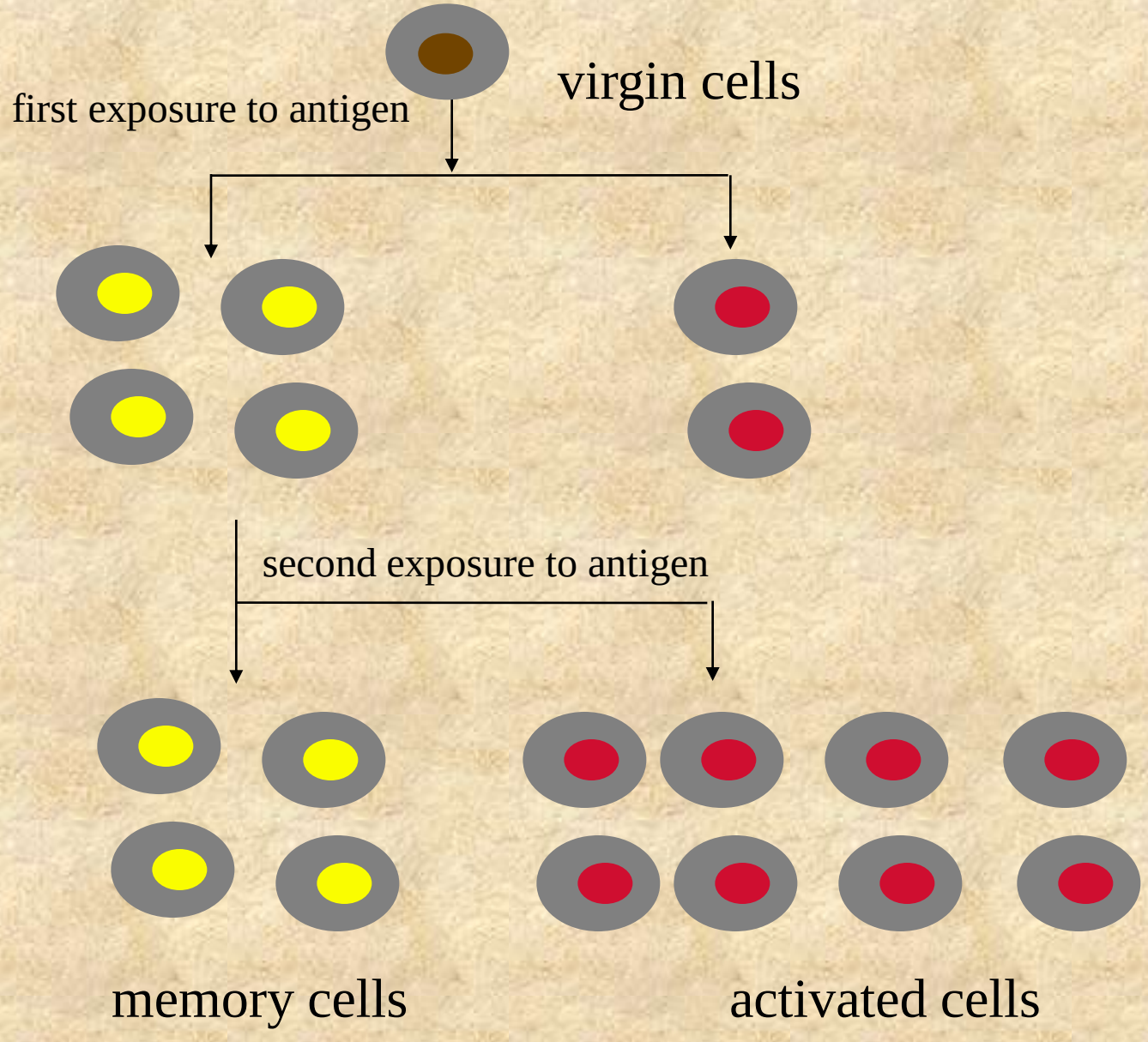
Antigen

An antigen is a substance that can induce an immune response when introduced into an immunocompetent host and that can react with the antibody produced from that response.

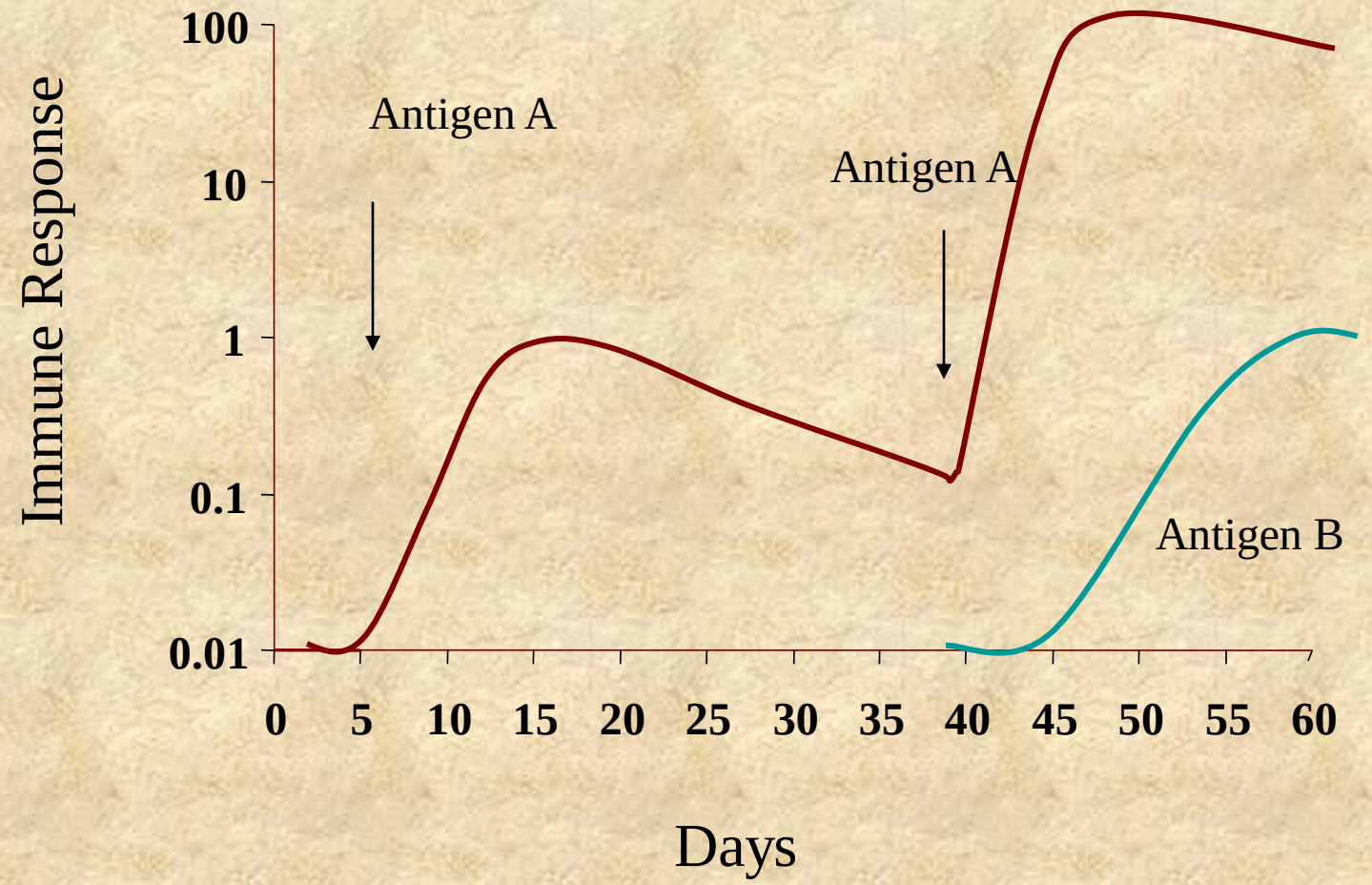
Interactions between T- and B-Cells



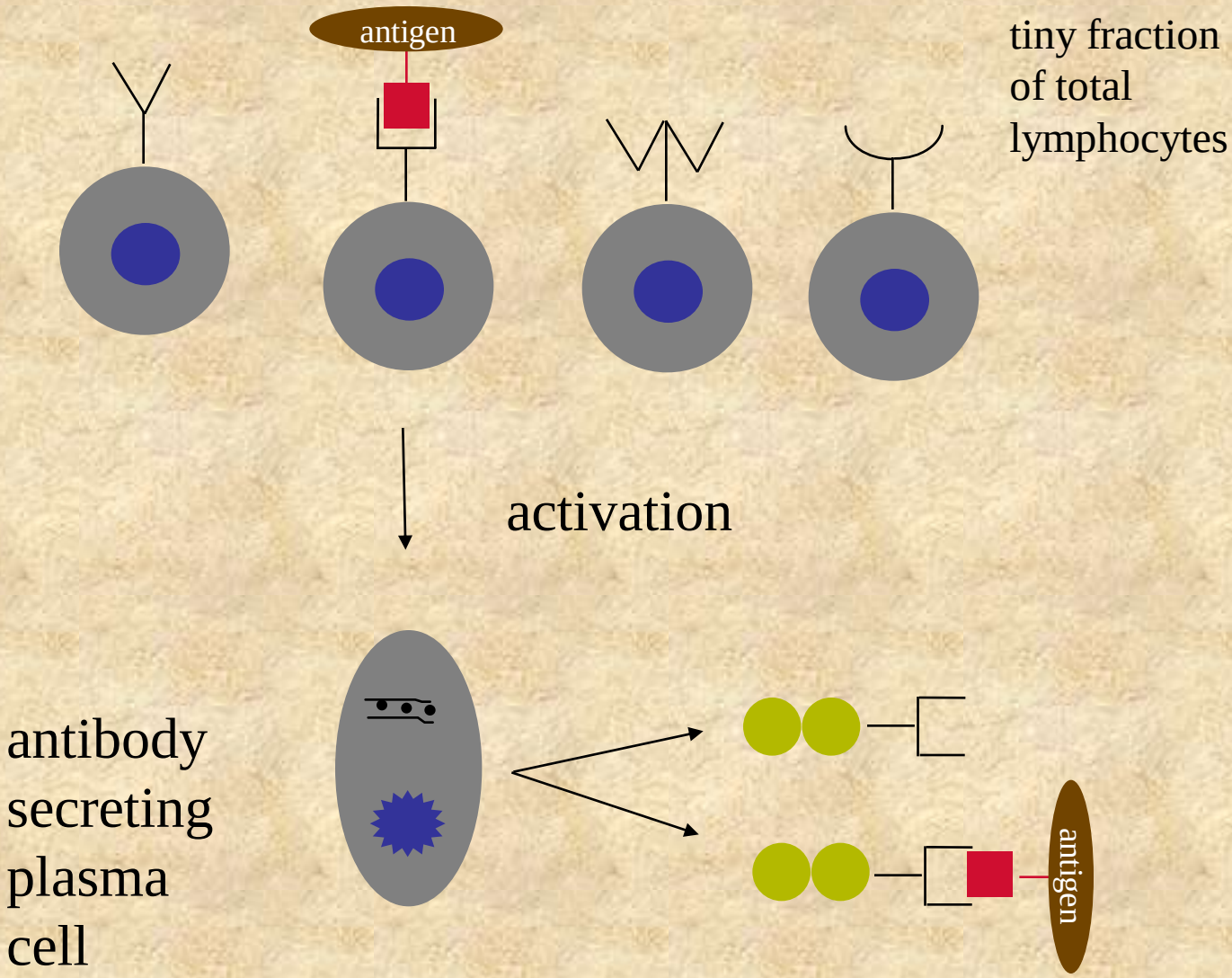
Formation of Activated and Memory Cells



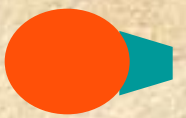
Primary and Secondary Response



Formation of Antibodies

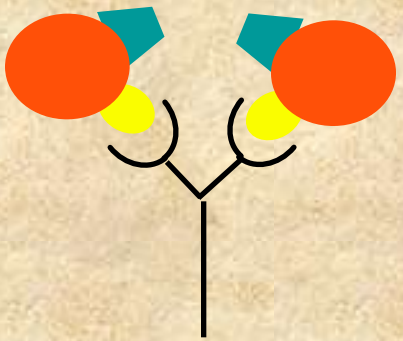


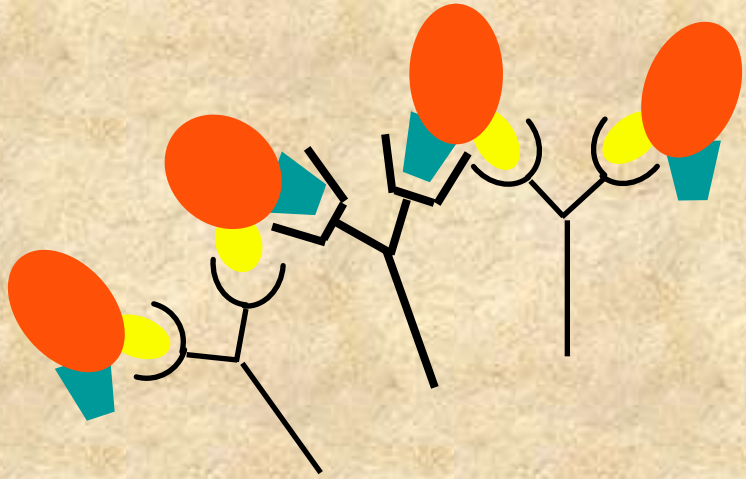
Binding of Antibodies to Antigens



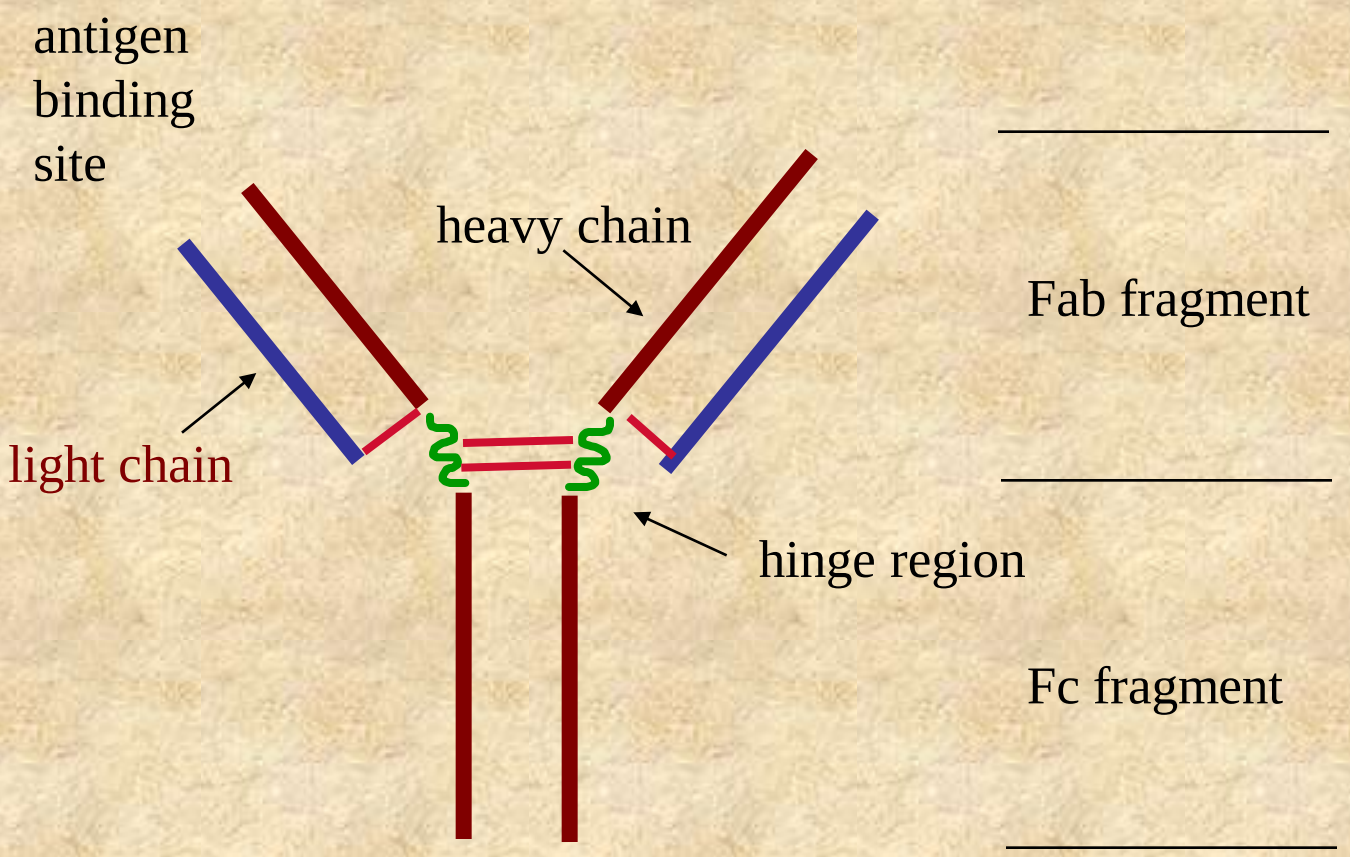
One antigenic determinant

Two antigenic determinants



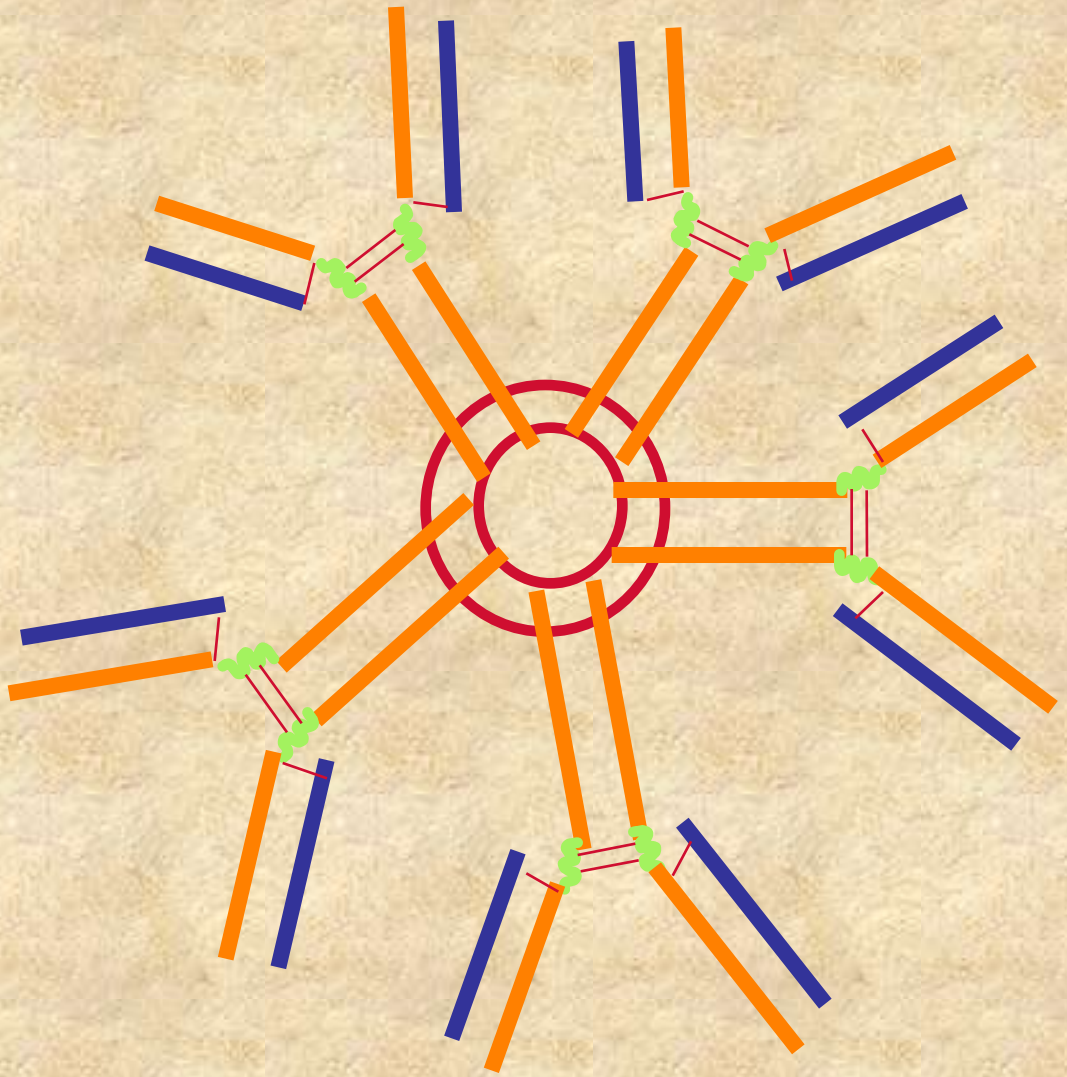


Antibodies



IgA, IgD, IgE, IgG, IgM

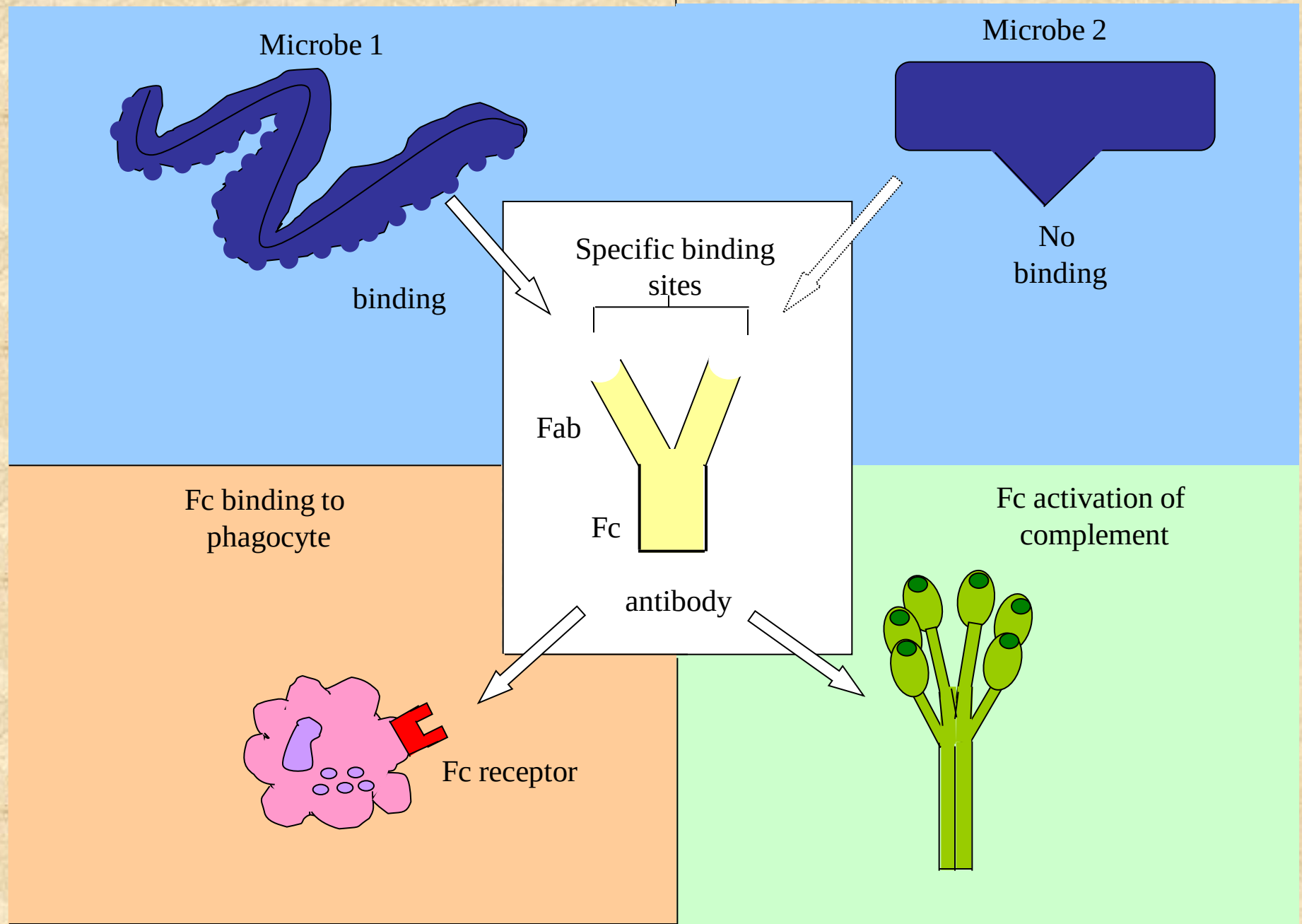
IgM Antibody



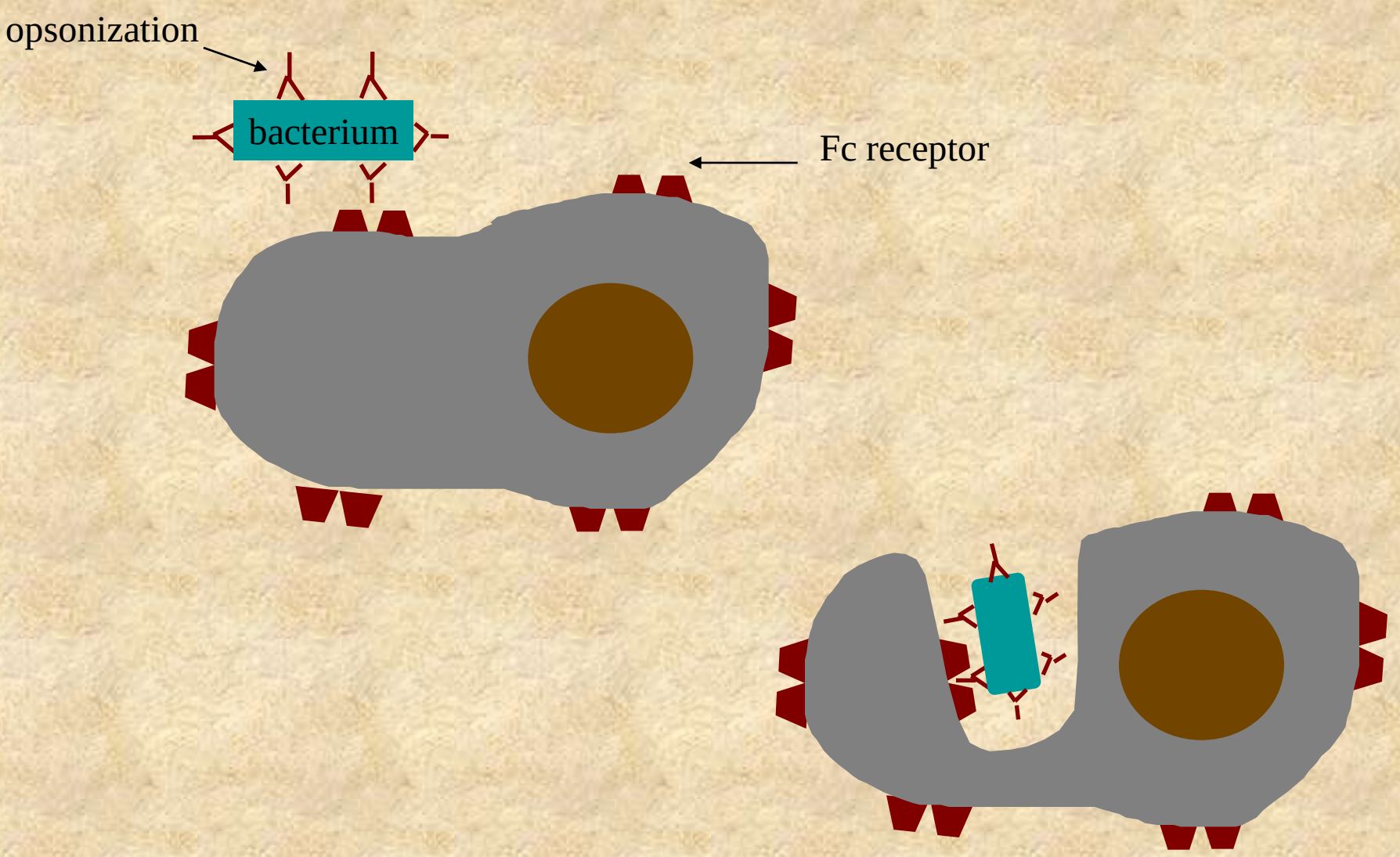
Antibodies

- IgG
  - 80% total, cross placenta, opsonization
- IgM
  - first produced, 10-15% total, activate complement
- IgD
  - not known, may help CD4 Th
- IgA
  - body fluid, tears, bronchiole secretions, saliva
- IgE
  - allergic reactions, histamine release

Antigen Antibody Action



Antibody-Activated Phagocytosis



Complement System

Series of ~ 20 proteins
Activated by microorganisms
Will coat the microorganisms

Adherence reactions

phagocytic cells have receptors for C3

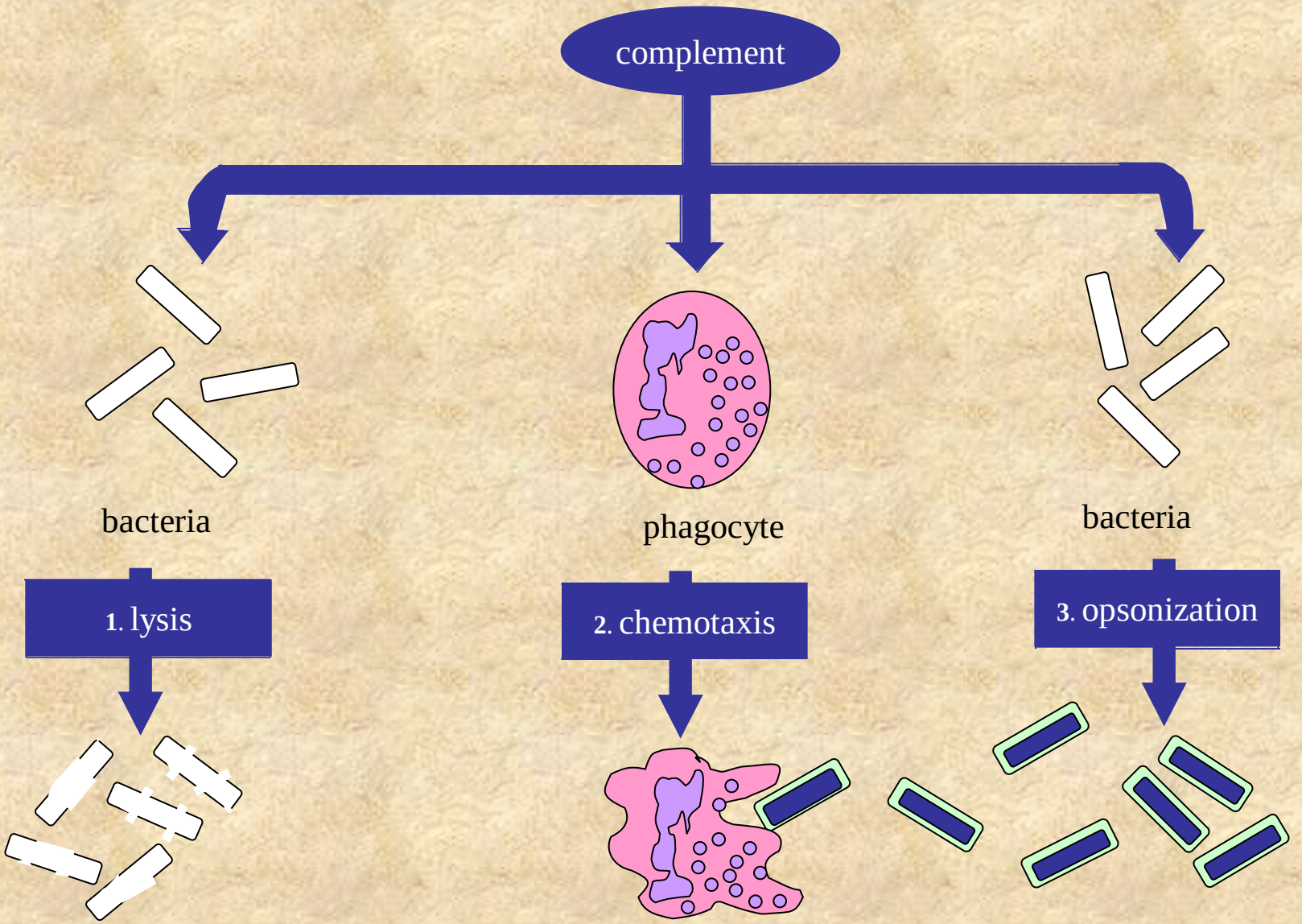
Biological active fragments

produce reactive oxygen intermediates

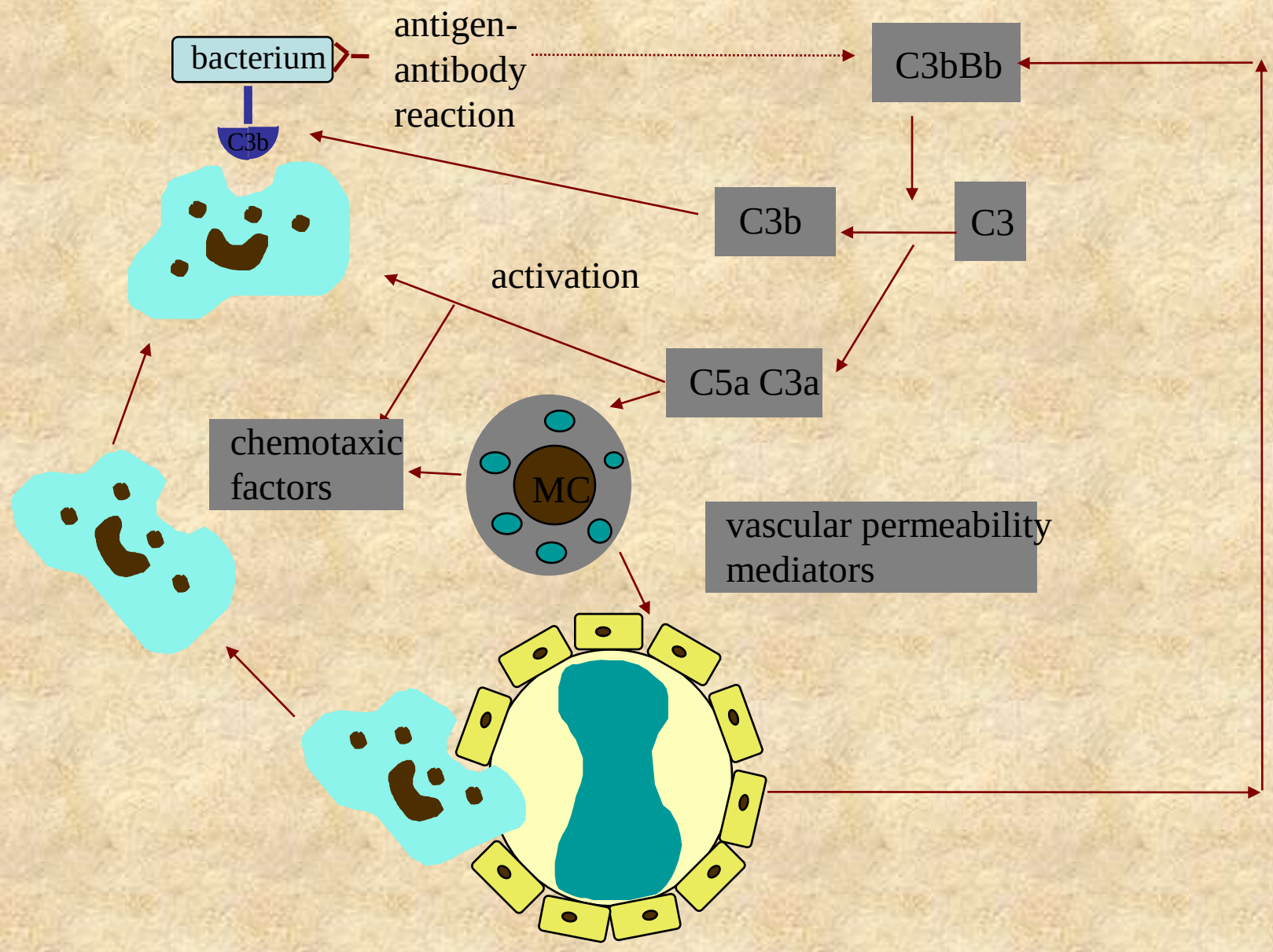
Membrane lesions

Activate mast cells

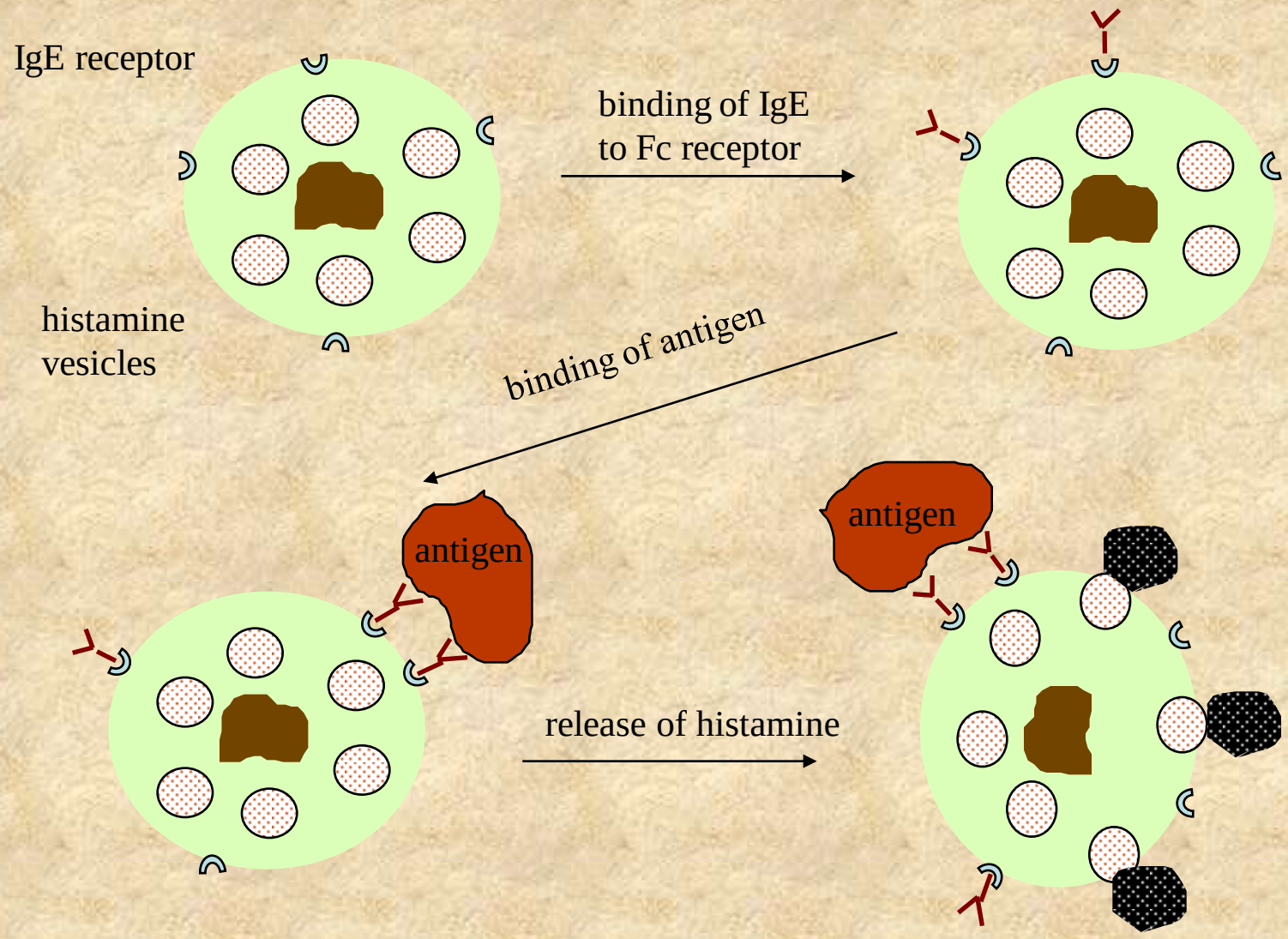
Functions of Complement Activation



Complement-Mediated Acute Inflammatory Reaction



IgE and Histamine Release



T-cells

Act over a short range

Interact with another cell in body
Can kill or signal other cell

Only recognize antigen when presented on surface of target cell

T-cells

Cytotoxic Cells

kill infected cells

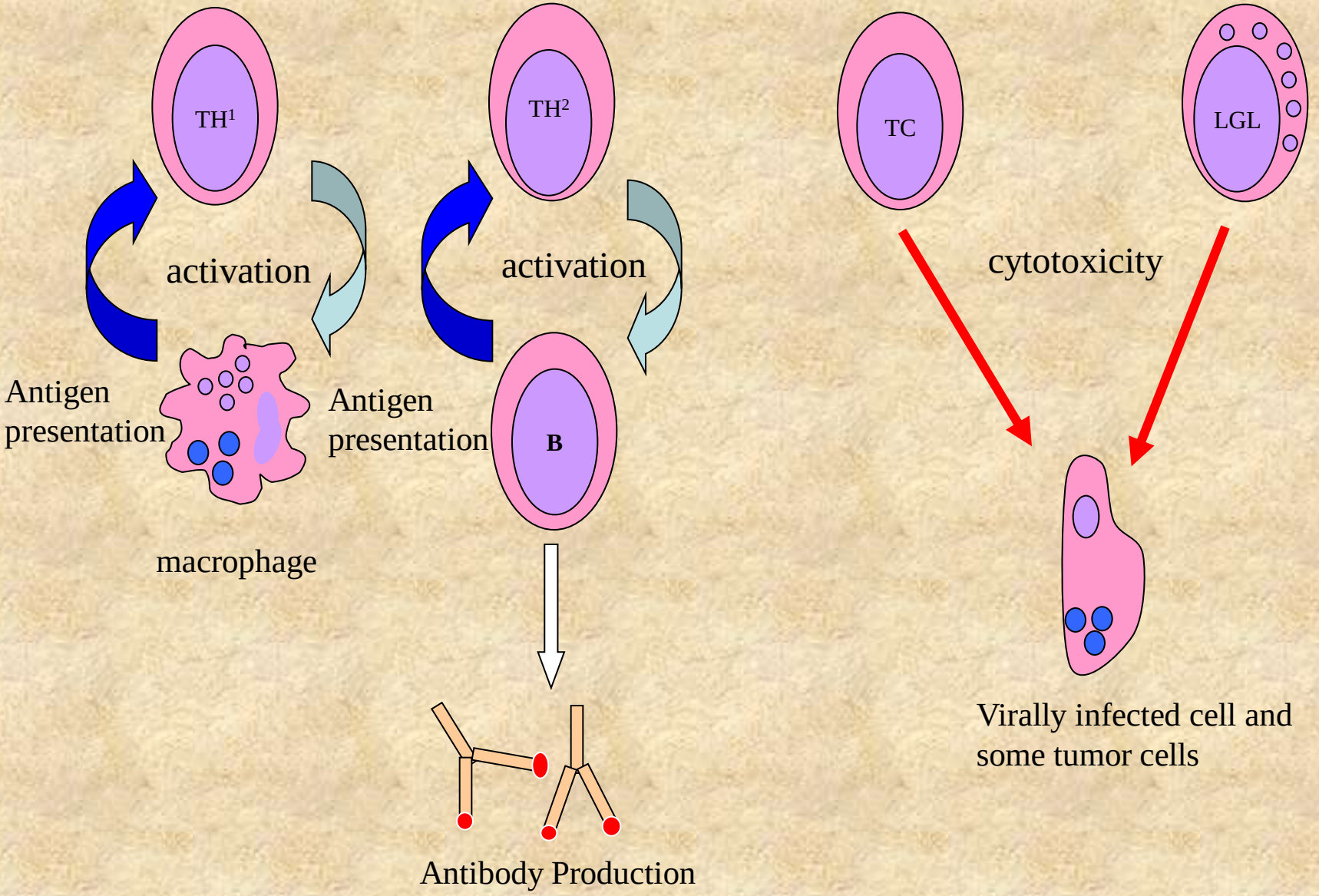
Helper Cells (two types)

activate macrophages and B-cells

Suppressor Cells

regulate activity

T-Cell Function



Mhc-molecules

MHC-I

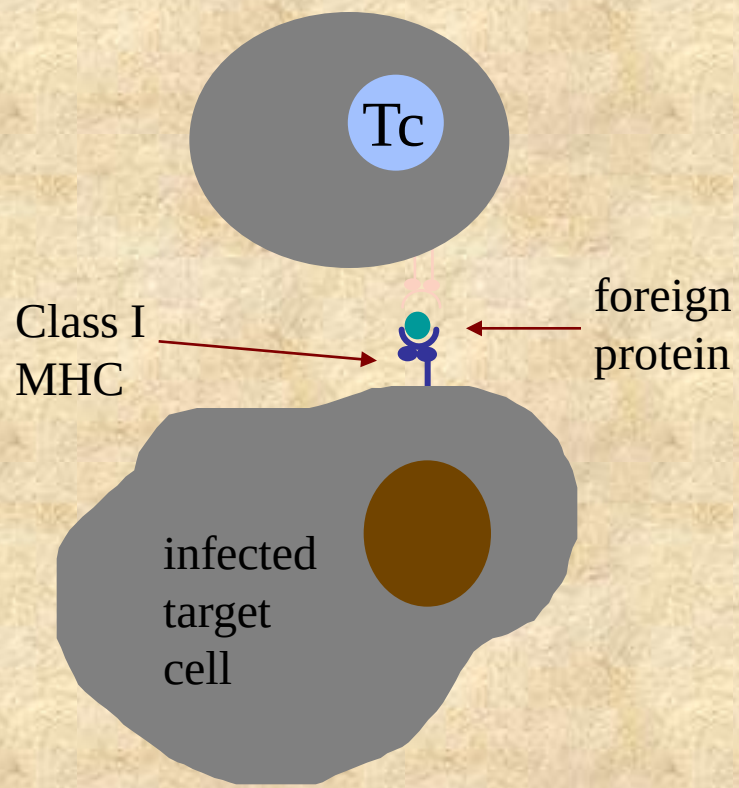
present foreign peptides to cytotoxic cells

MHC-II

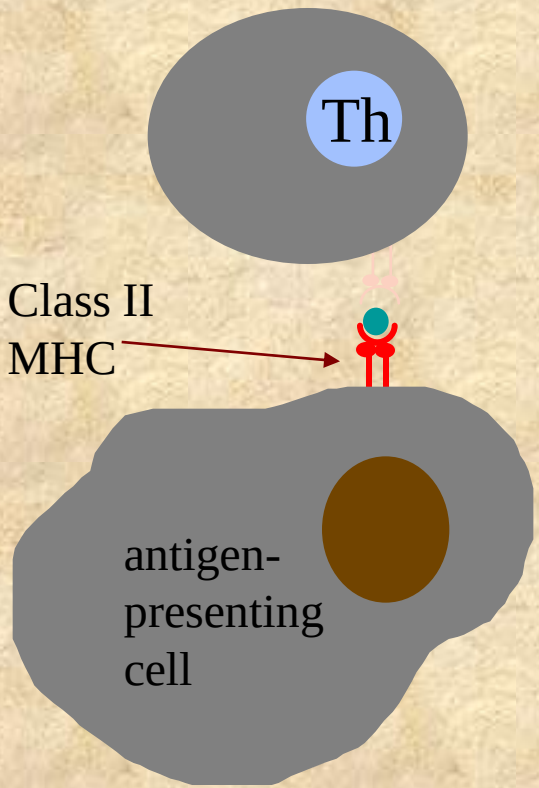
present foreign peptides to helper cells

Mhc-molecules

CYTOTOXIC T-CELLS



HELPER T-CELLS



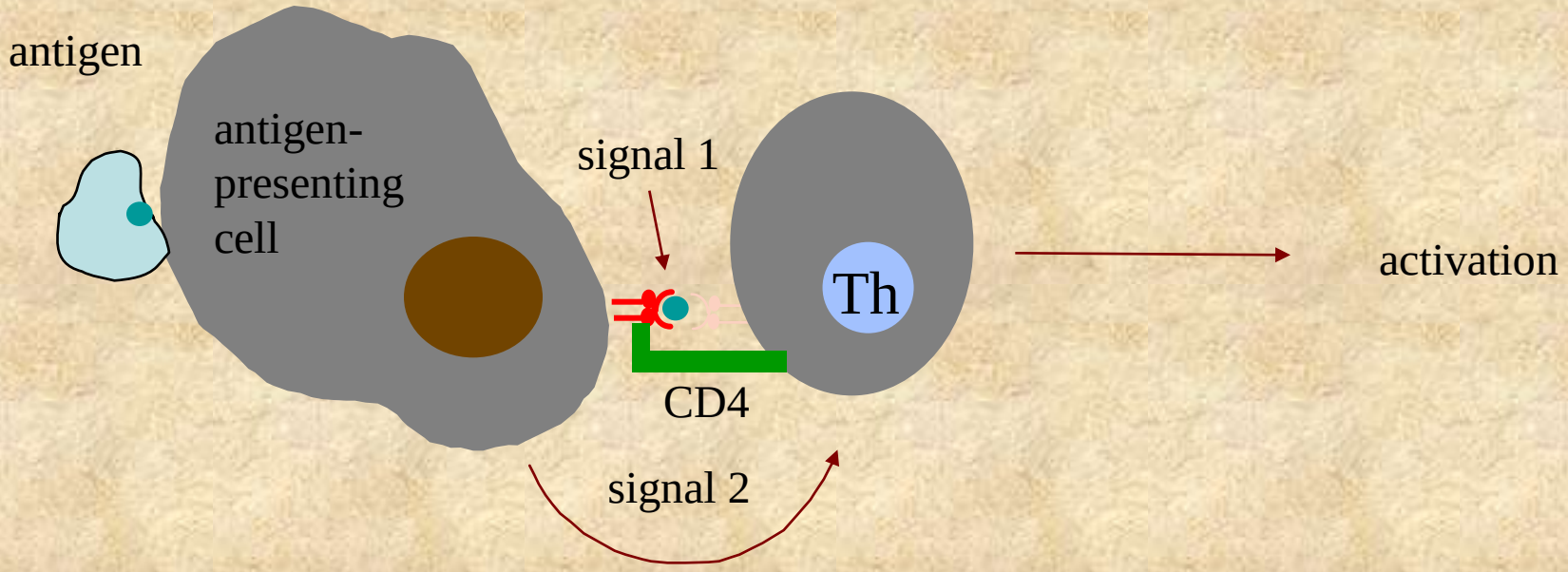
Helper T-cells

Helper T-Cells stimulate macrophages and B-cells

Helper T-Cells recognize foreign antigen bound to MHC-II proteins on surface of antigen-presenting cells

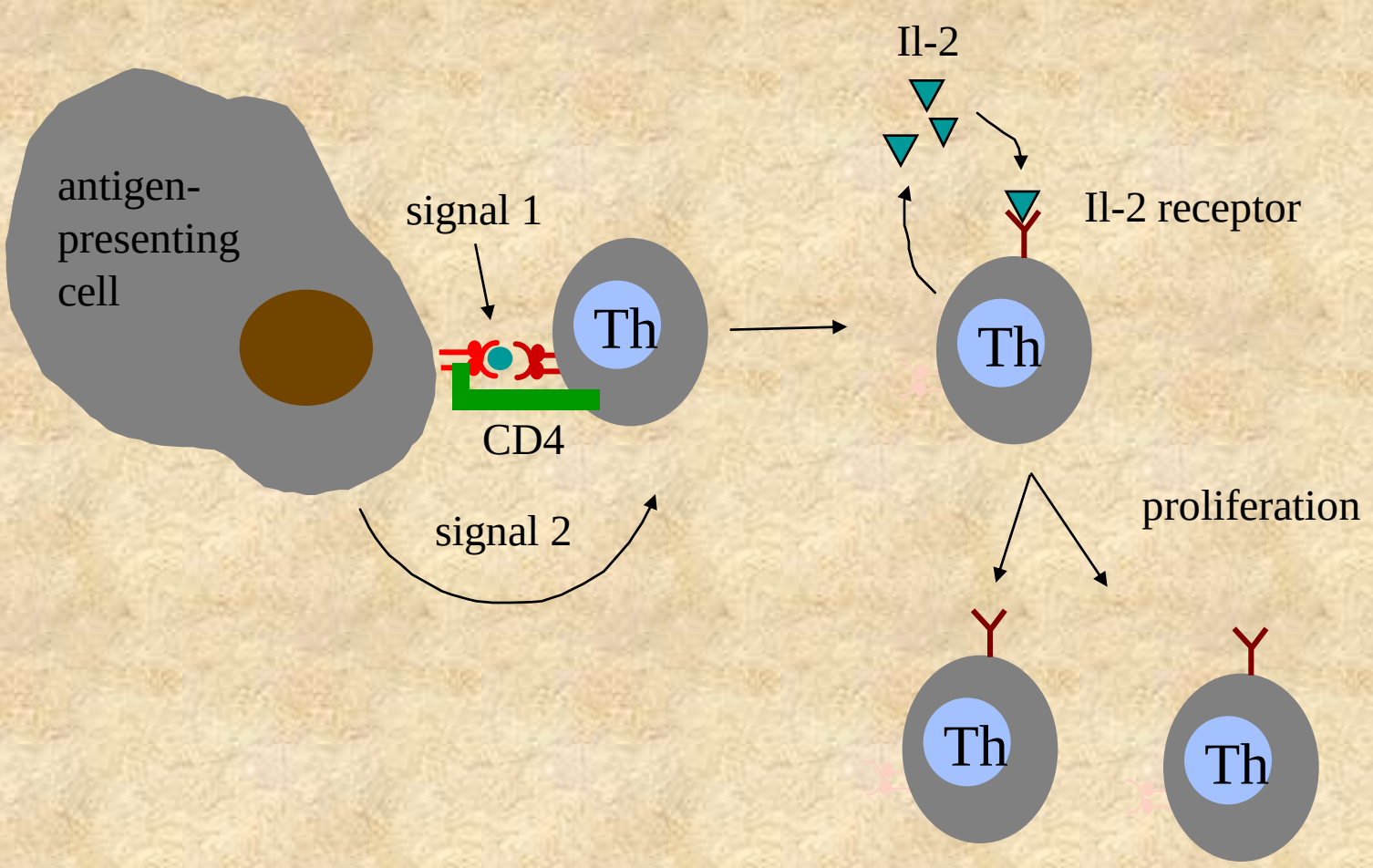
Two signals are required for activation of Helper T-Cells

Activation of Helper T-cells



signal 2 is chemical (interleukin-1) or membrane bound molecule

Activation of Helper T-cells



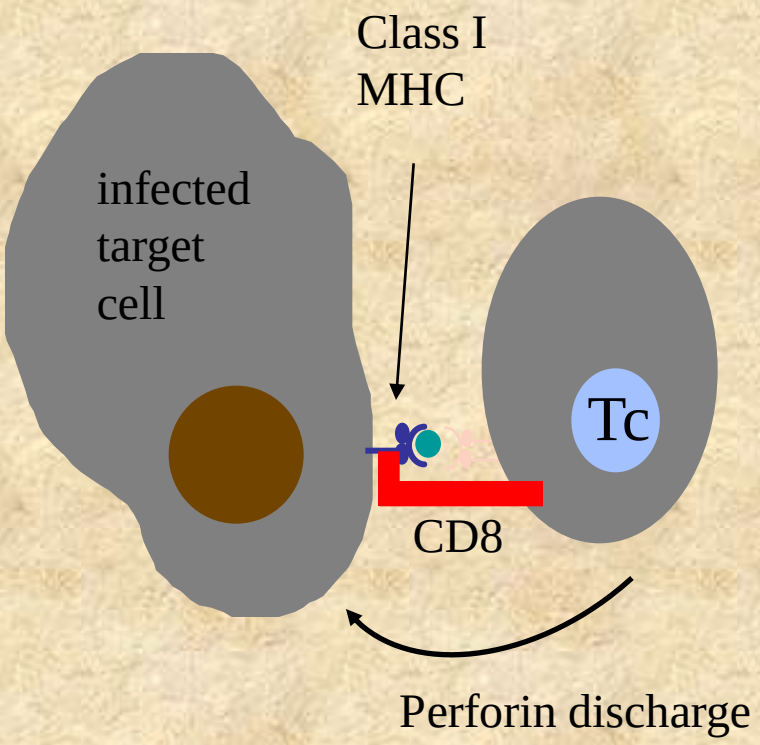
Cytotoxic T-cells

Cytotoxic T-Cells recognize viral protein fragments on surface of infected cells.

Cytotoxic T-Cells induce infected cells to kill themselves

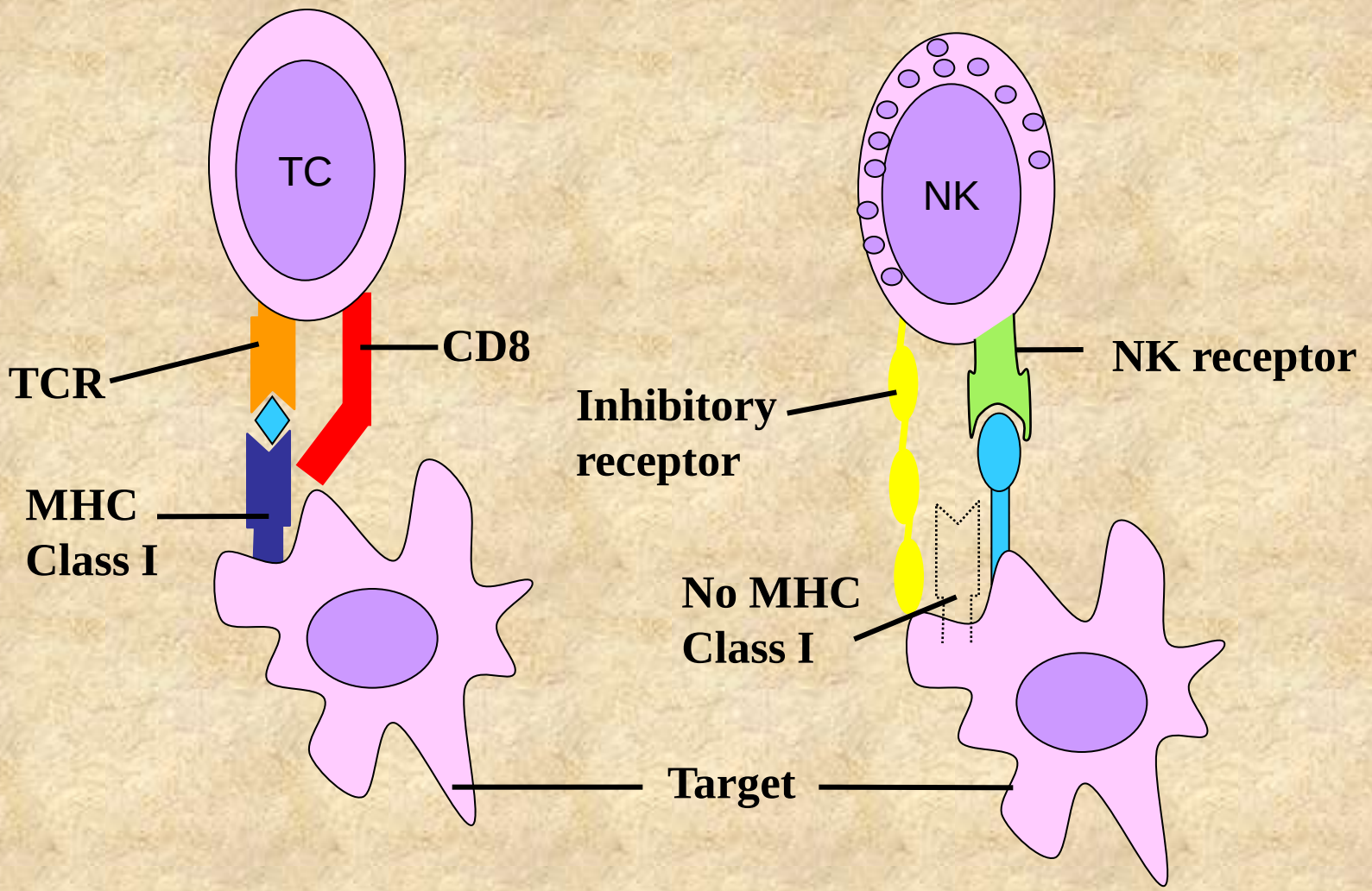
- Bind to infected cells
- Induce cell death
- Punch holes in cell membrane

Cytotoxic T-cells



Natural Killer

- destroy virus-infected cells
- do not express antigen specific receptors
- cells with low levels of MHC I
- induce cells to undergo apoptosis


TC
NK
TCR
CD8
MHC
Class I
Inhibitory
receptor
NK receptor
No MHC
Class I
Target