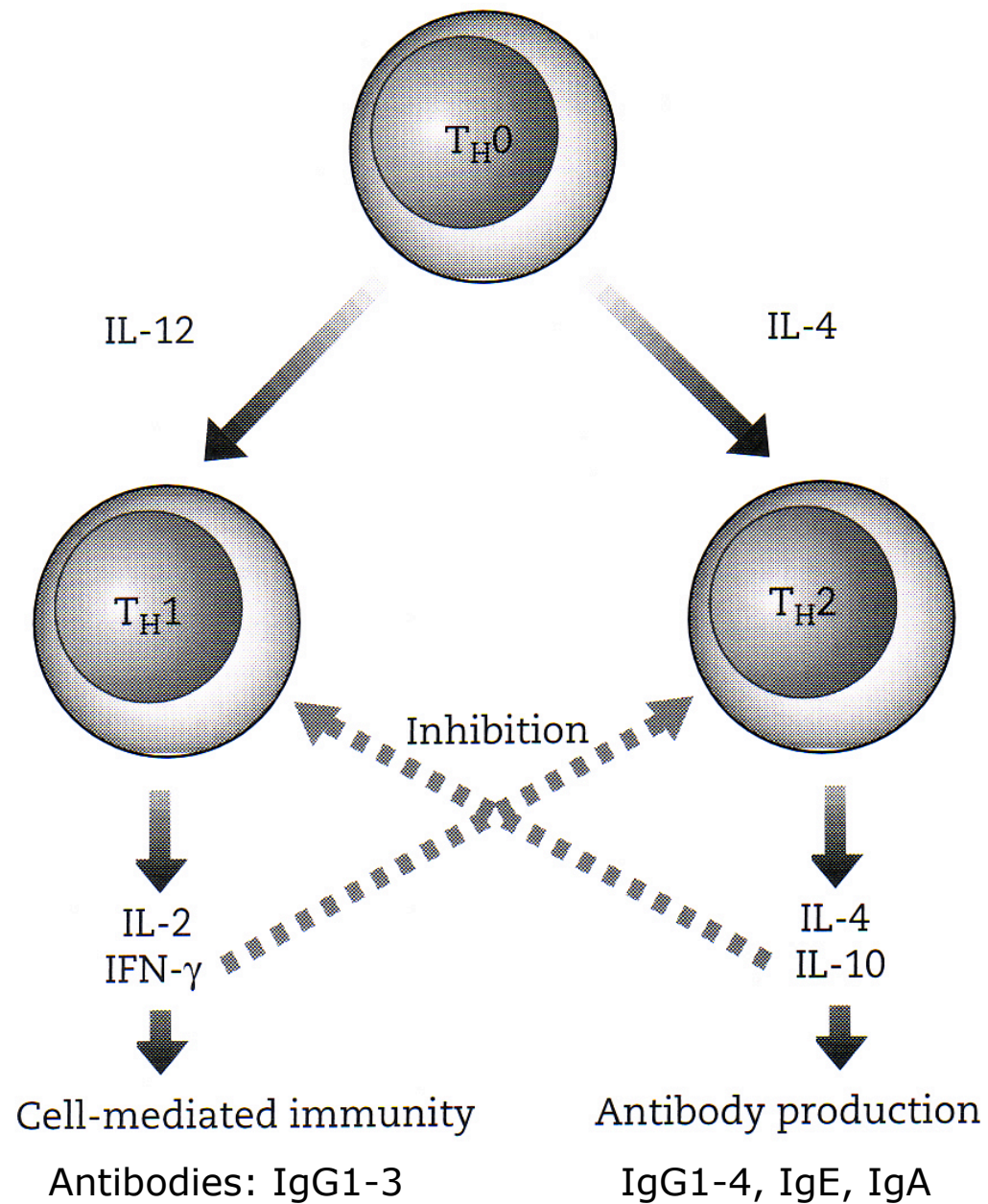


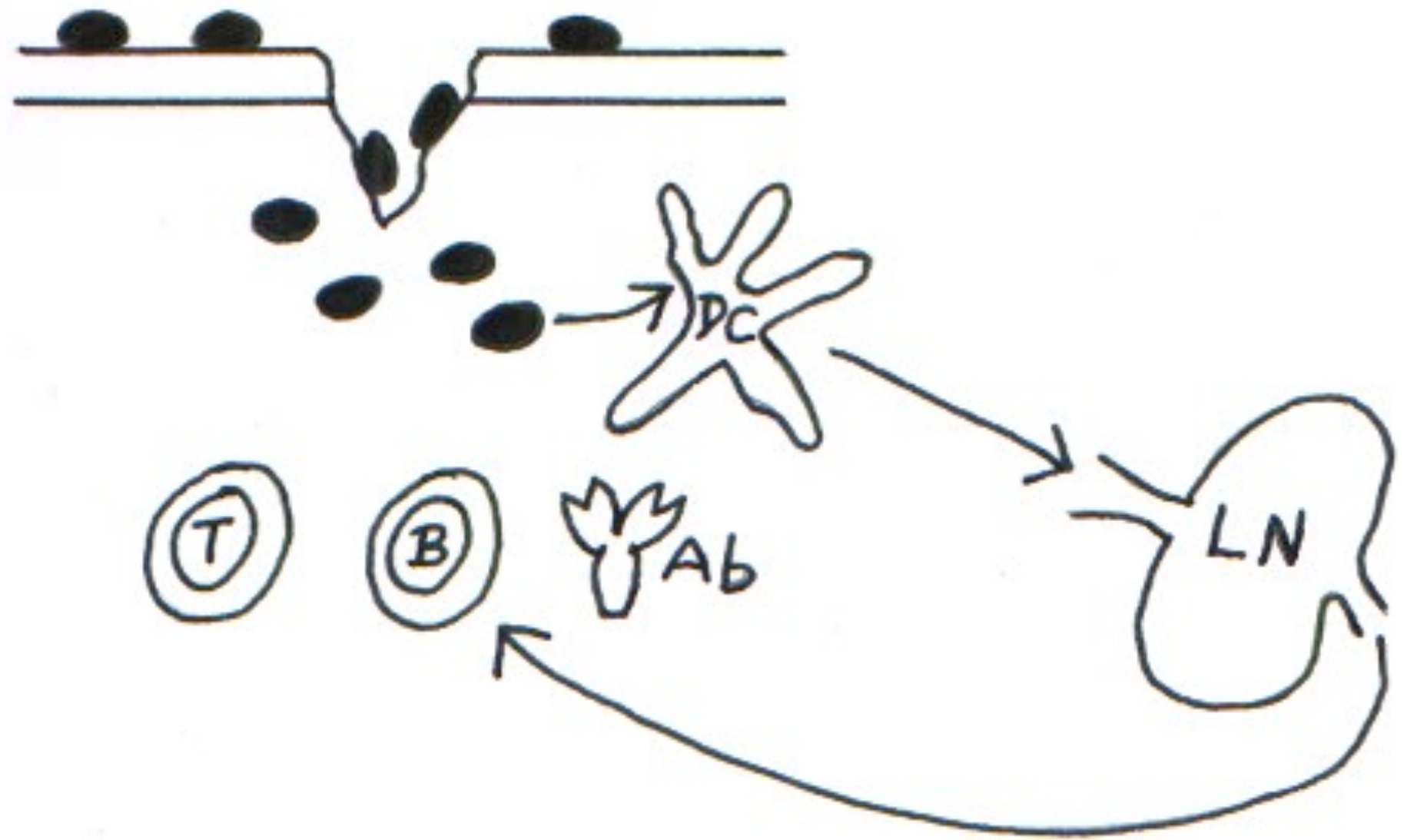
Helper T cells and cytokines

Cytokines

- Secreted proteins that regulate cellular activities
- Bind to cell surface receptors and trigger intra-cellular signalling pathways
- Cytokines include:
 - interleukins (IL-1, IL-2, IL-3, etc.)
 - tumour necrosis factors (TNF- α , TNF- β)
 - interferons (IFN- α , IFN- β , IFN- γ)
 - colony-stimulating factors (G-CSF, M-CSF, GM-CSF)
 - chemokines
- Many cell types produce cytokines and respond to them
- Cytokines produced by T cells are particularly important in regulating immune responses

T_H1 & T_H2 CELLS





DISSEMINATION OF THE IMMUNE RESPONSE

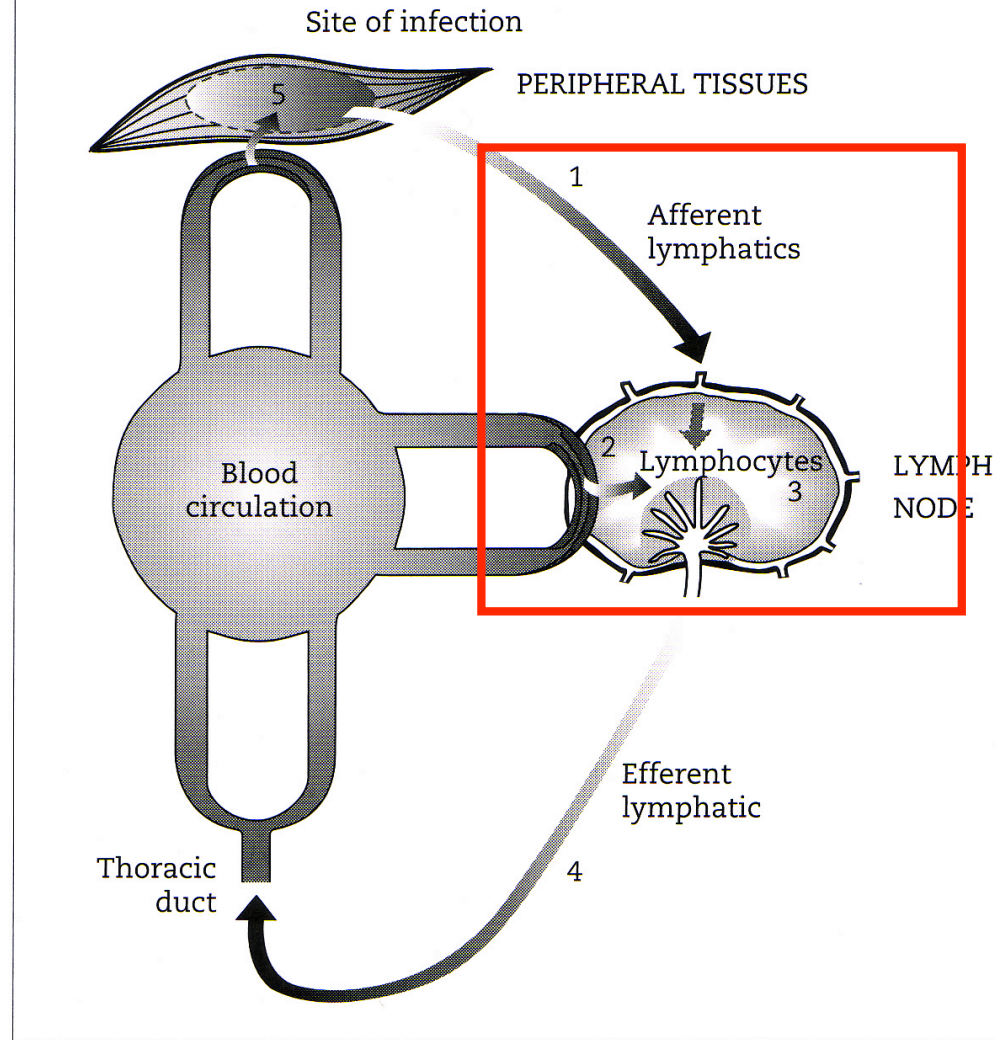
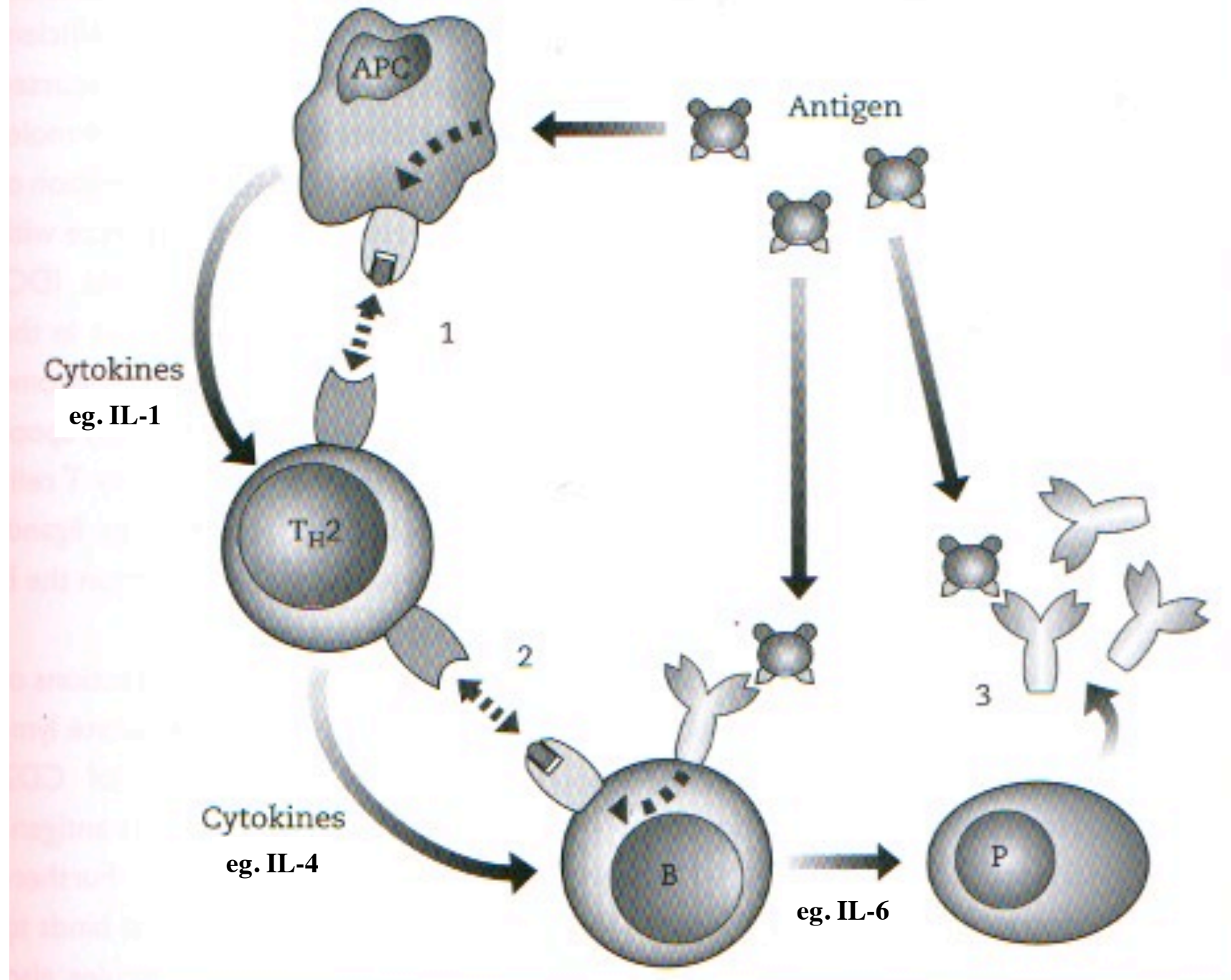
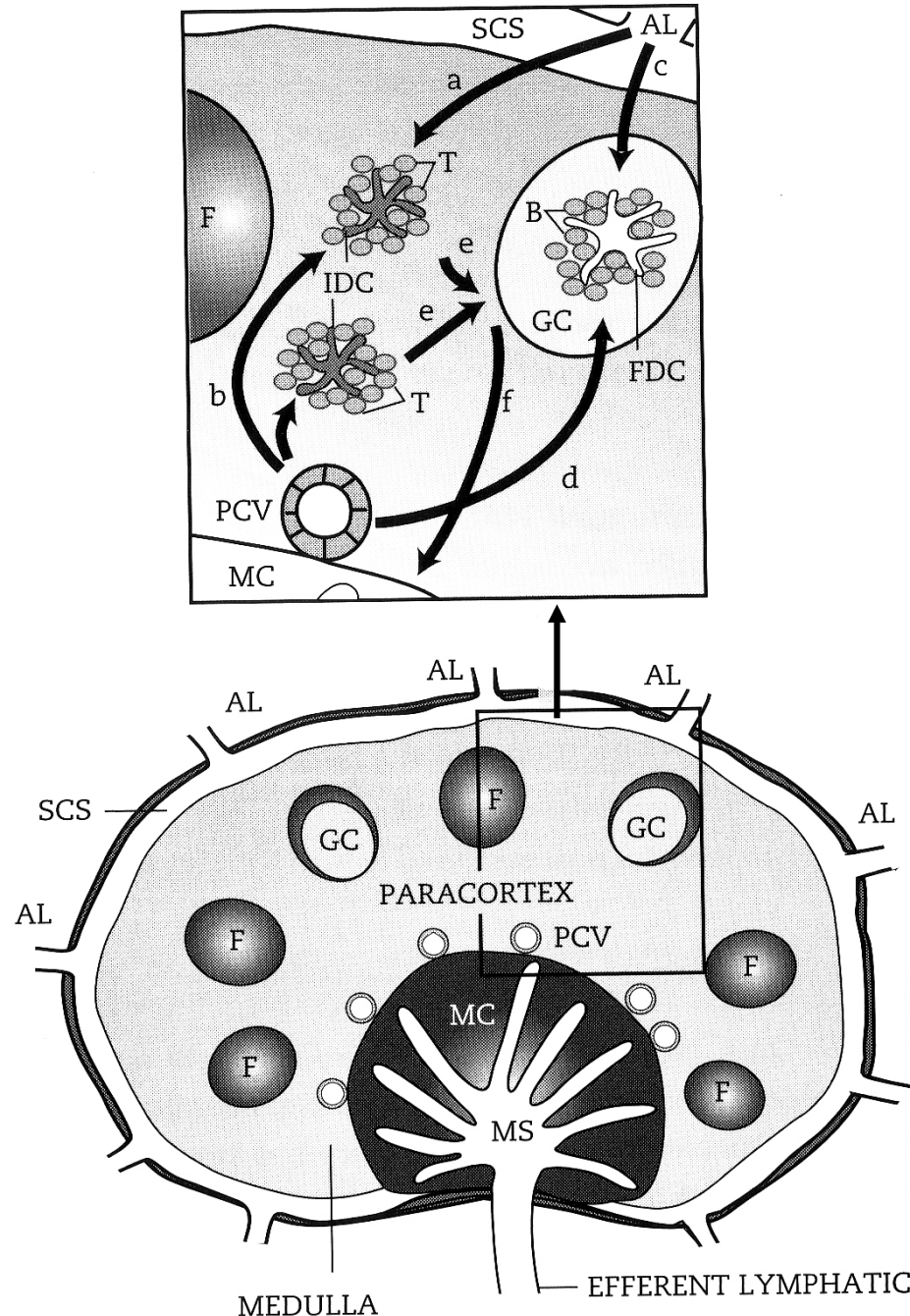


Fig. 10.3 The steps involved in mounting a specific immune response. (1) Antigen (both free and on antigen-presenting cells) is transported from the site of infection to the draining lymph node; (2) lymphocytes enter the node from the blood across high endothelial venules; (3) activation of antigen-specific lymphocytes; (4) activated lymphocytes enter the circulation; (5) cells and mediators (e.g. lymphocytes, macrophages, granulocytes, antibodies and complement) pass across the activated endothelium into the site of infection.

T_H & B CELL ACTIVATION



LYMPH NODE STRUCTURE



Paracortex - activation of specific T and B cells

- Activation of antigen-specific T cells by dendritic cells
- Activation of antigen-specific B cells by T cells

Germinal centre - maturation of activated B cells

- Division - increases size of response
- Antigenic selection - increases affinity of the response
- Class switching - increases defence effector functions
- Formation of plasma cells and memory cells

Tissue homing of activated lymphocytes is determined by their expression of particular adhesion molecules (eg. integrins) and chemokine receptors.

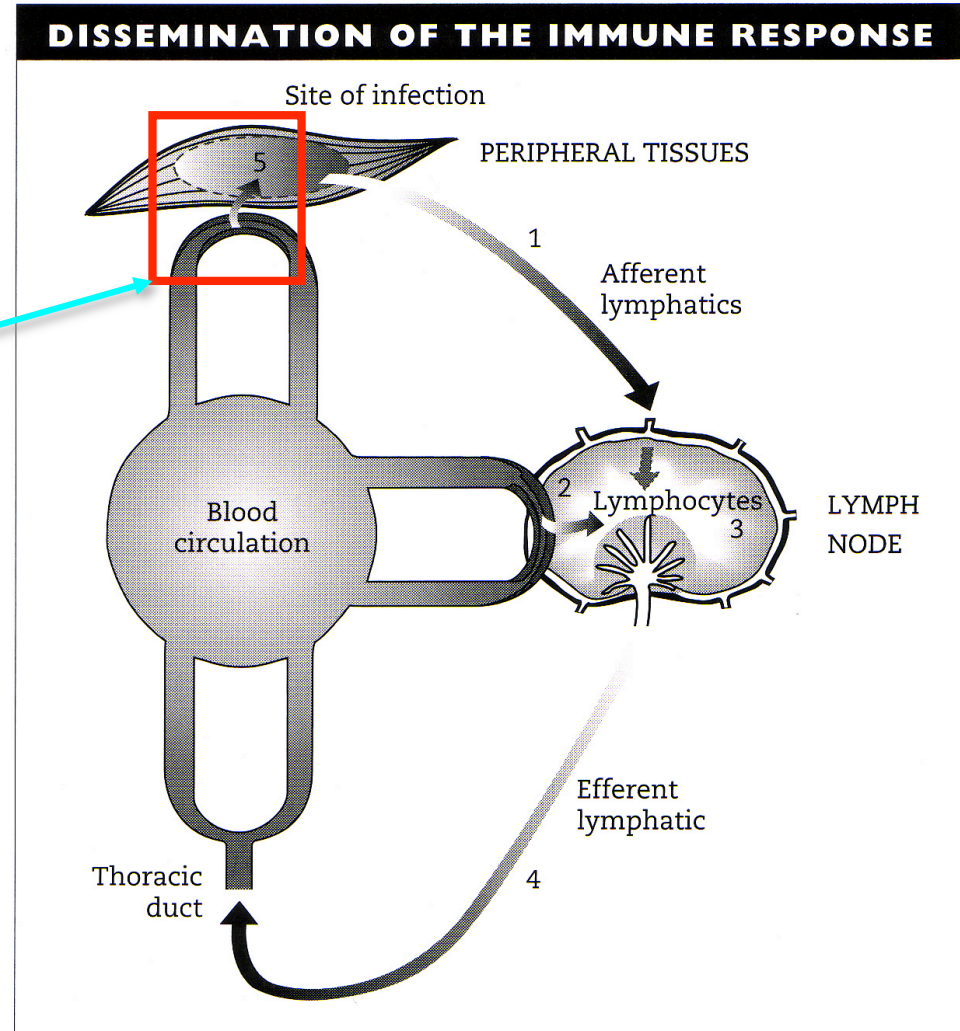
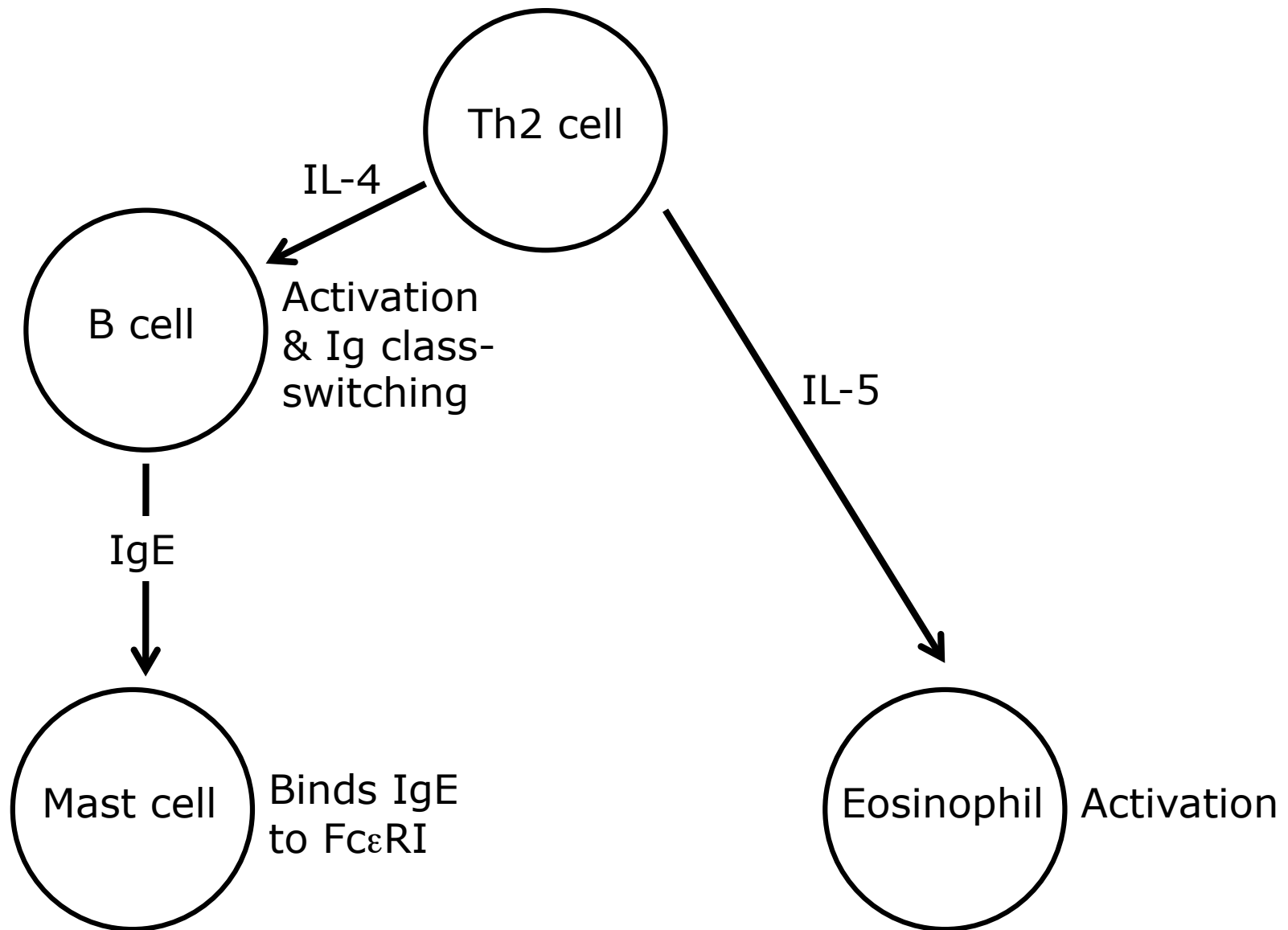


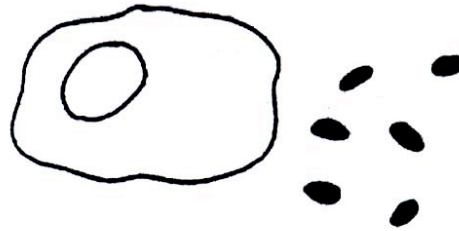
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Th2 cells can promote atopic (type 1 allergic) responses



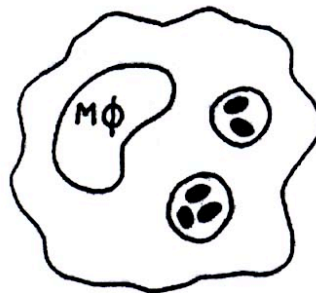
Immunity
strategies
for
different
categories
of
infections

Extra-cellular infection



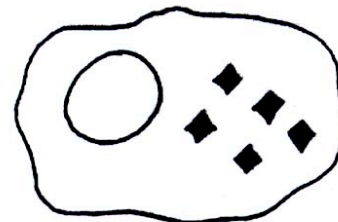
- Complement proteins
- Phagocytes
- Antibodies

Intra-cellular vesicular infection



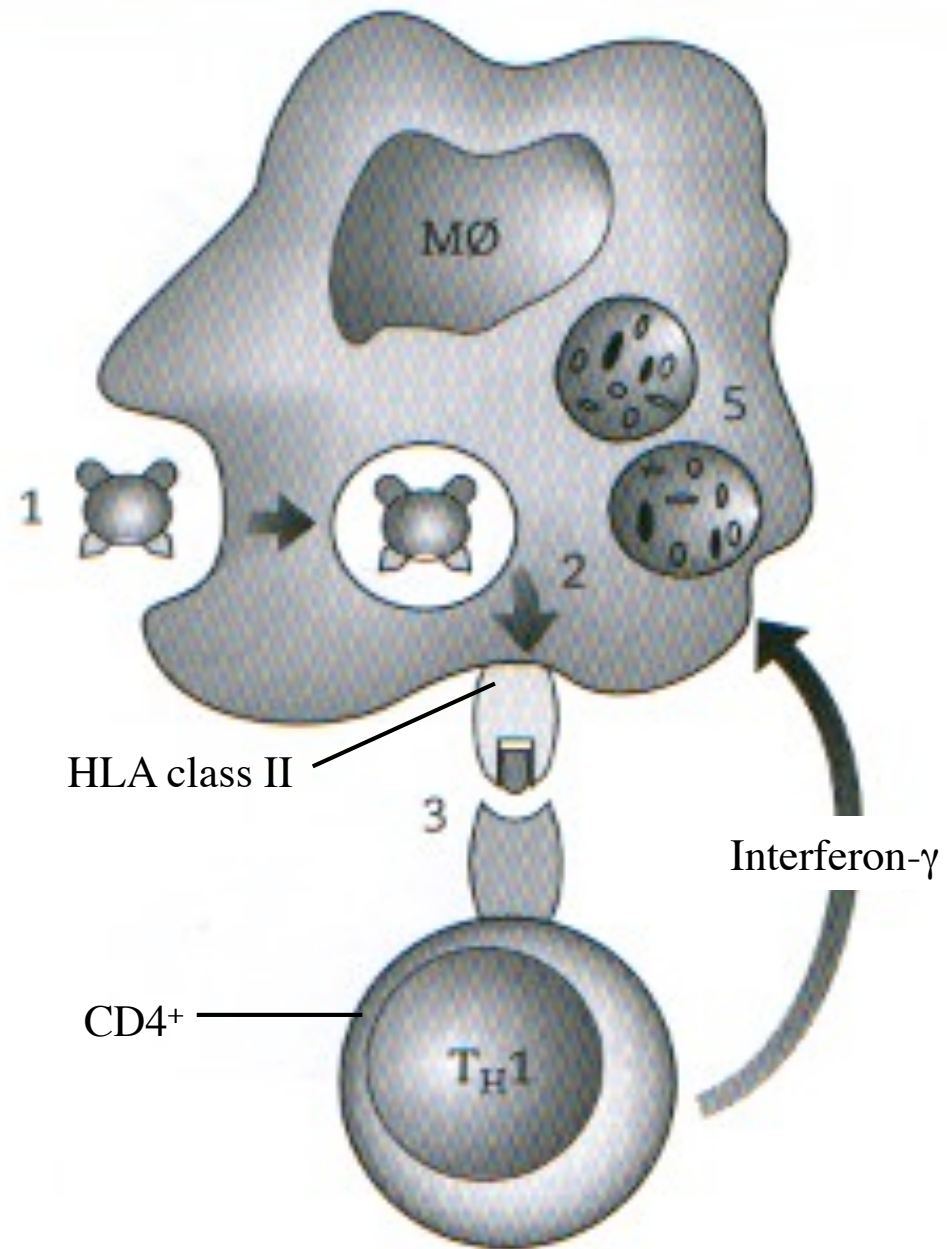
- Helper T cells

Intra-cellular cytosolic infection



- Interferon proteins
- Natural killer cells
- Cytotoxic T cells

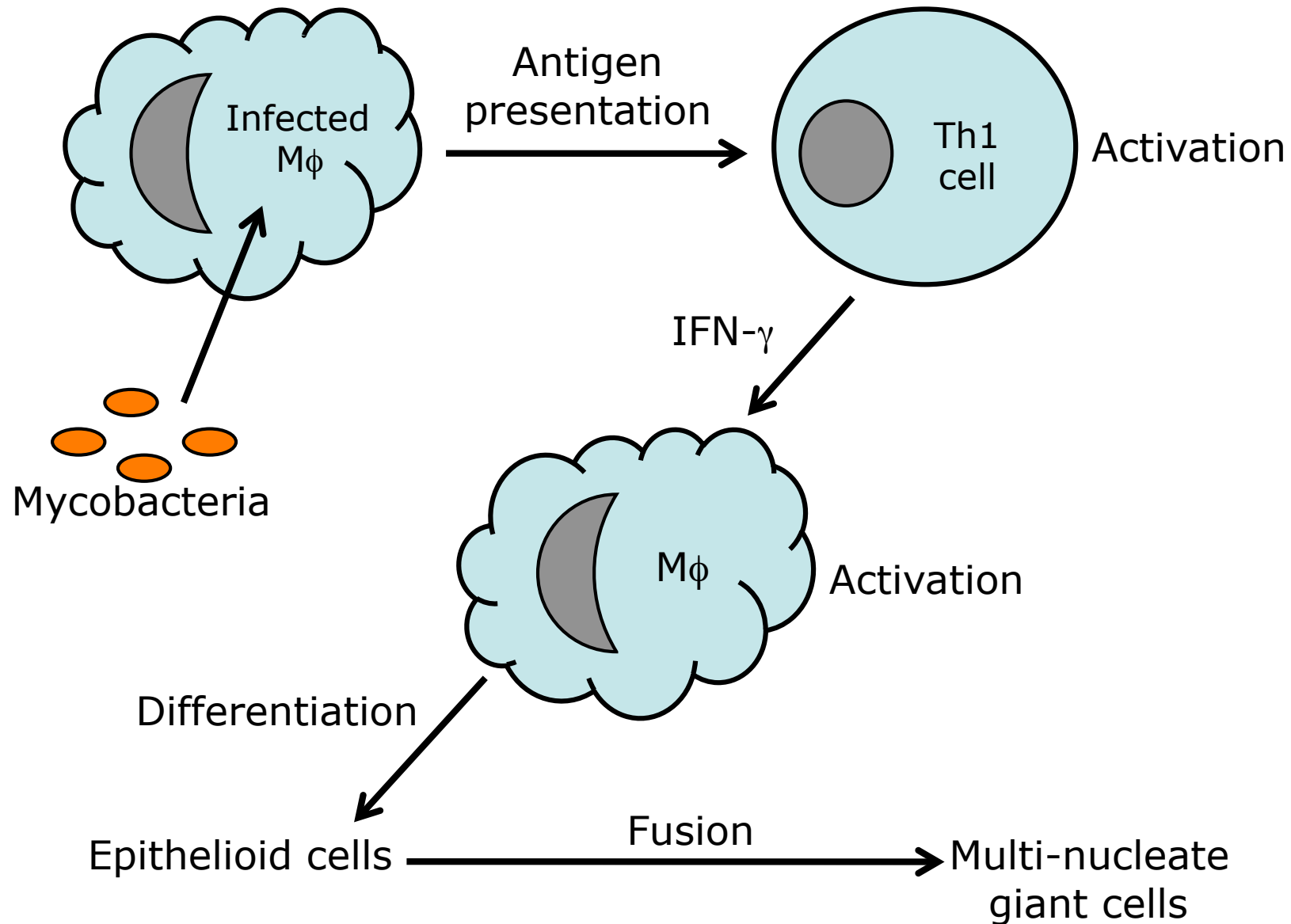
T_H & MACROPHAGE ACTIVATION



Evasion mechanisms used by mycobacteria include:

- Resistance to the digestive enzymes of phagocytes
- Escape from the phagosome into the cytosol

Th1 cells can promote granulomatous inflammation



Example of TB chest X-ray available in Wikipedia

URL - http://en.wikipedia.org/wiki/Tuberculosis_radiology

Example of lung histology in TB available on YouTube

Title – Histopathology Lung-Tuberculosis

URL - http://www.youtube.com/watch?v=uxKoLtL_n3w

Tuberculoid leprosy →

- **pronounced lymphocytic infiltrate**
- **inflammatory damage**
- **killing of mycobacteria**

Lepromatous leprosy →

- **limited lymphocytic infiltrate**
- **uncontrolled growth of mycobacteria**

CYTOKINES & DISEASE

Event	Development of tuberculoid leprosy	Development of lepromatous leprosy
T _H activation: cytokine production	Activation of T _H 1: production of IFN- γ	Activation of T _H 2: production of IL-4
Effector cell stimulation: effects on mycobacteria	Activation of macrophages: intracellular digestion of mycobacteria in cytoplasmic vesicles	Activation of B cells: antibodies have no access to intracellular mycobacteria
Resulting pathology	Some inflammatory tissue damage, but destruction of mycobacteria	Growth of mycobacteria and severe tissue damage

Table 3.3 The influence of cytokine production on disease pathogenesis following infection of macrophages by *Mycobacterium leprae*.