

Hypersensitivity •

Lecture (11) •

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Disorders of the immune response

Exaggerated
Hypersensitivity

Deficient
Immundeficiency

Misdirected
Autoimmune

Hypersensitivity

In immunity focus of attention is antigen (Killing , neutralization of toxin).

in hypersensitivity focus of attention is what happens to host as a result of immune reaction.

Some forms of' immune reaction can produce sever and occasionally Fatal results. This are known hypersensitivity.



Mechanism: •

The mechanism of hypersensitivity is that • reactions that appear within minutes are mediated by freely diffusible antibody molecules (immediate type).

The other type is slow evolving responses that • are mediated by sensitized T- lymphocytes. This cell mediated Hypersensitivity(delayed type)

Coombs and Gell Classification (1969) They • are classified hypersensitivity reaction into (4) types on the basis of pathogenesis .It is widely used:



Hypersensitivity reactions

Humoral

Type I

Type II

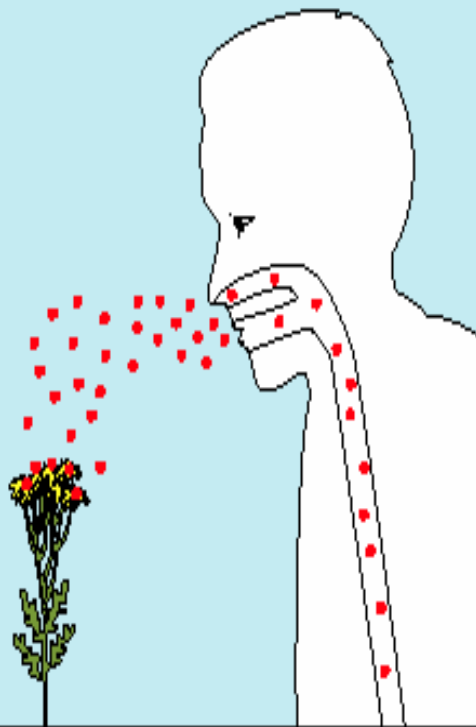
Type III

Cell mediated
Type IV

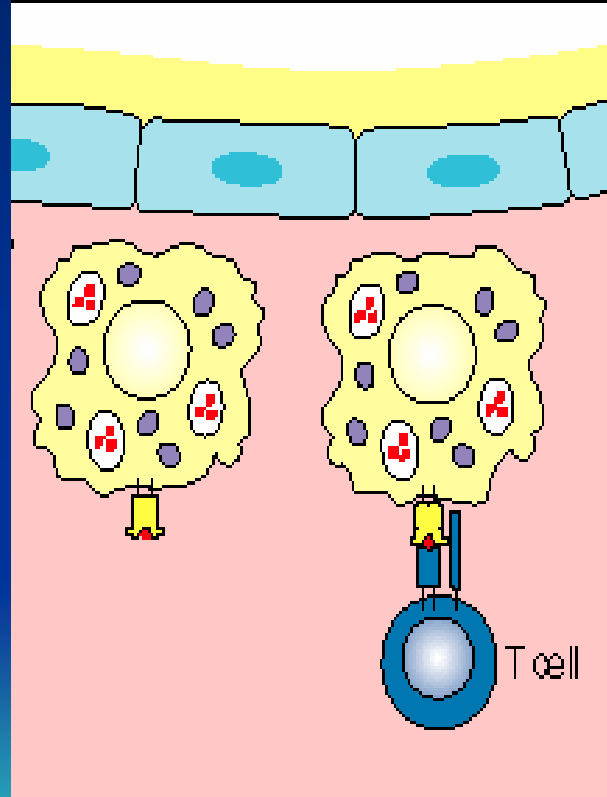


Type I hypersensitivity – sensitization to an inhaled allergen or bee sting (Atopy, Anaphylactic)

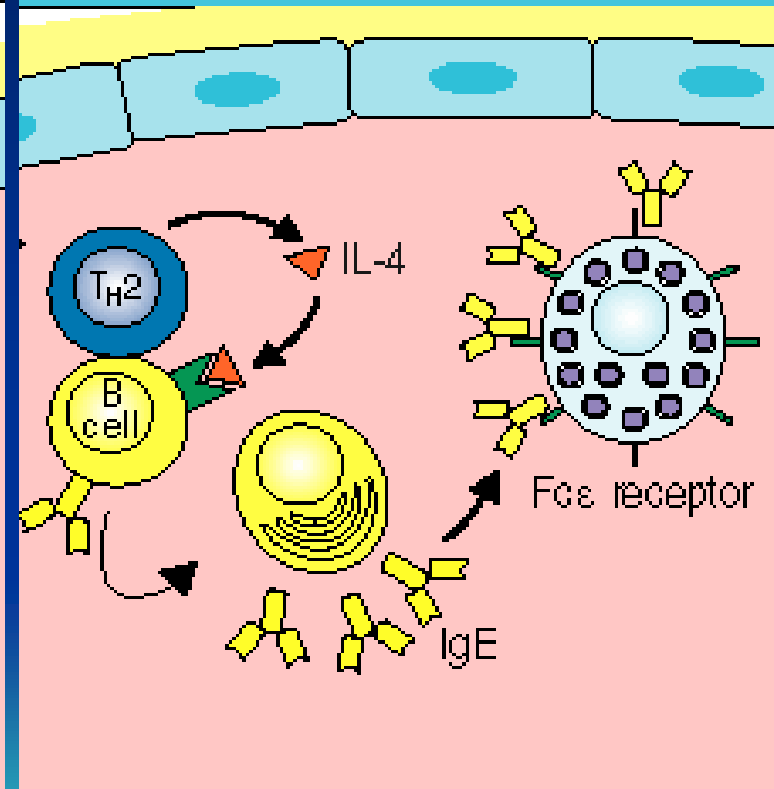
First exposure to pollen



Activation of antigen-specific T cells

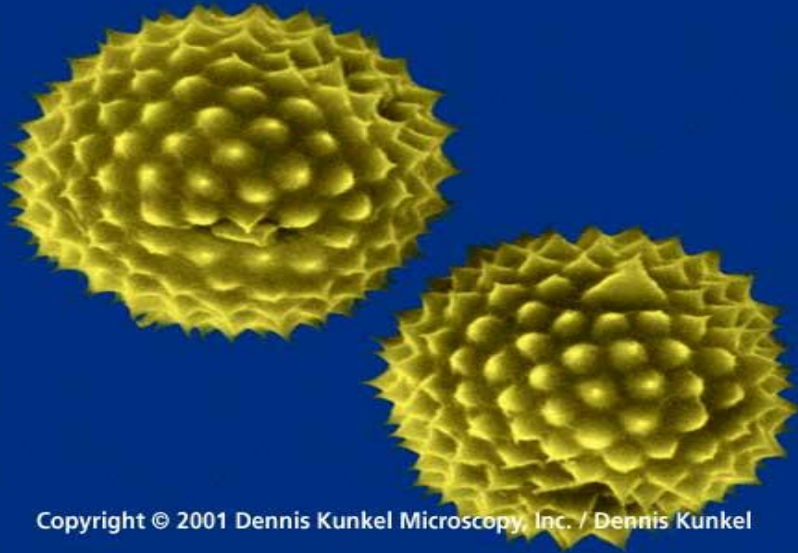


Production of IgE and binding to mast cells

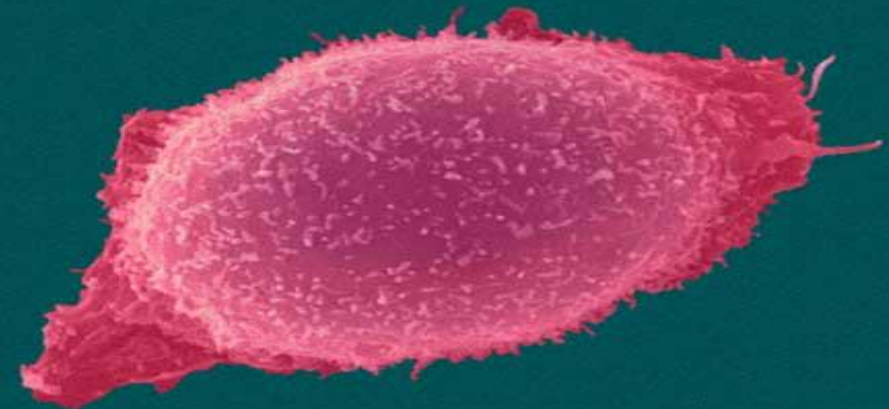


- Allergens(food, dust particles, medicines ,insect venom, mold spores, pollen)

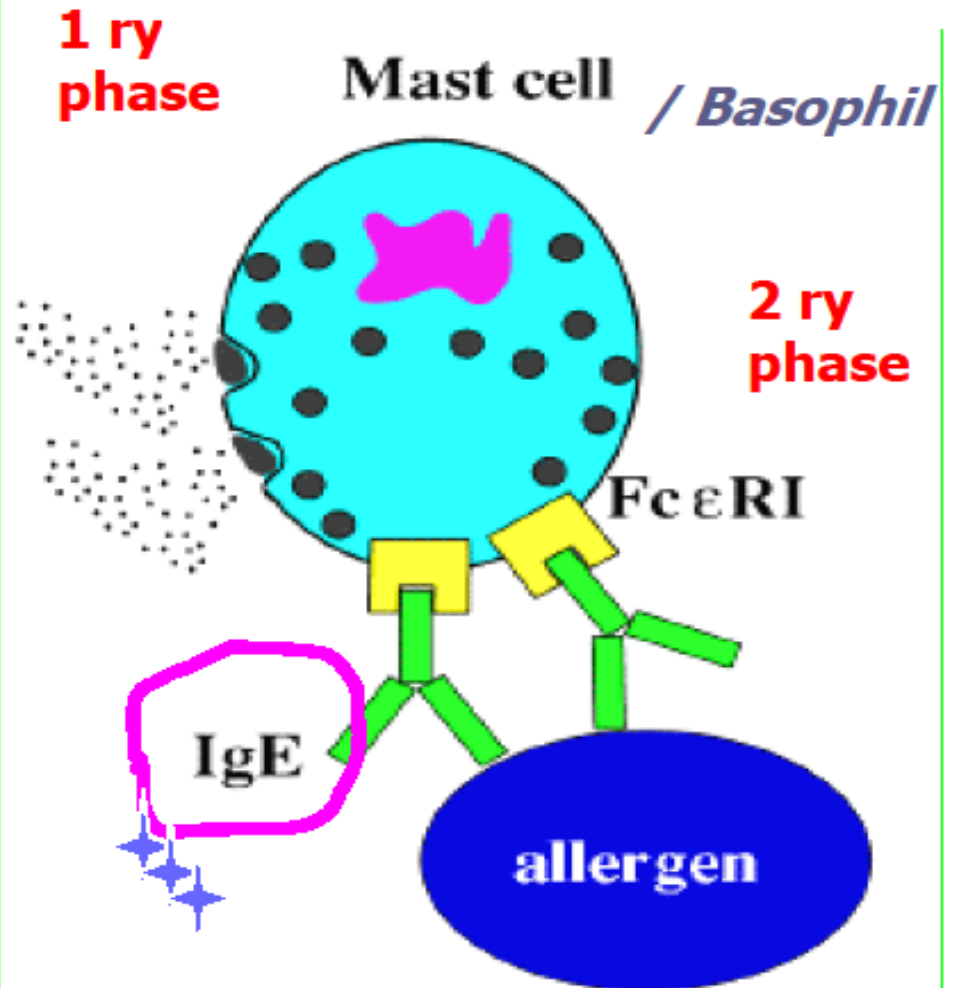
Pollen grains



Mast cell

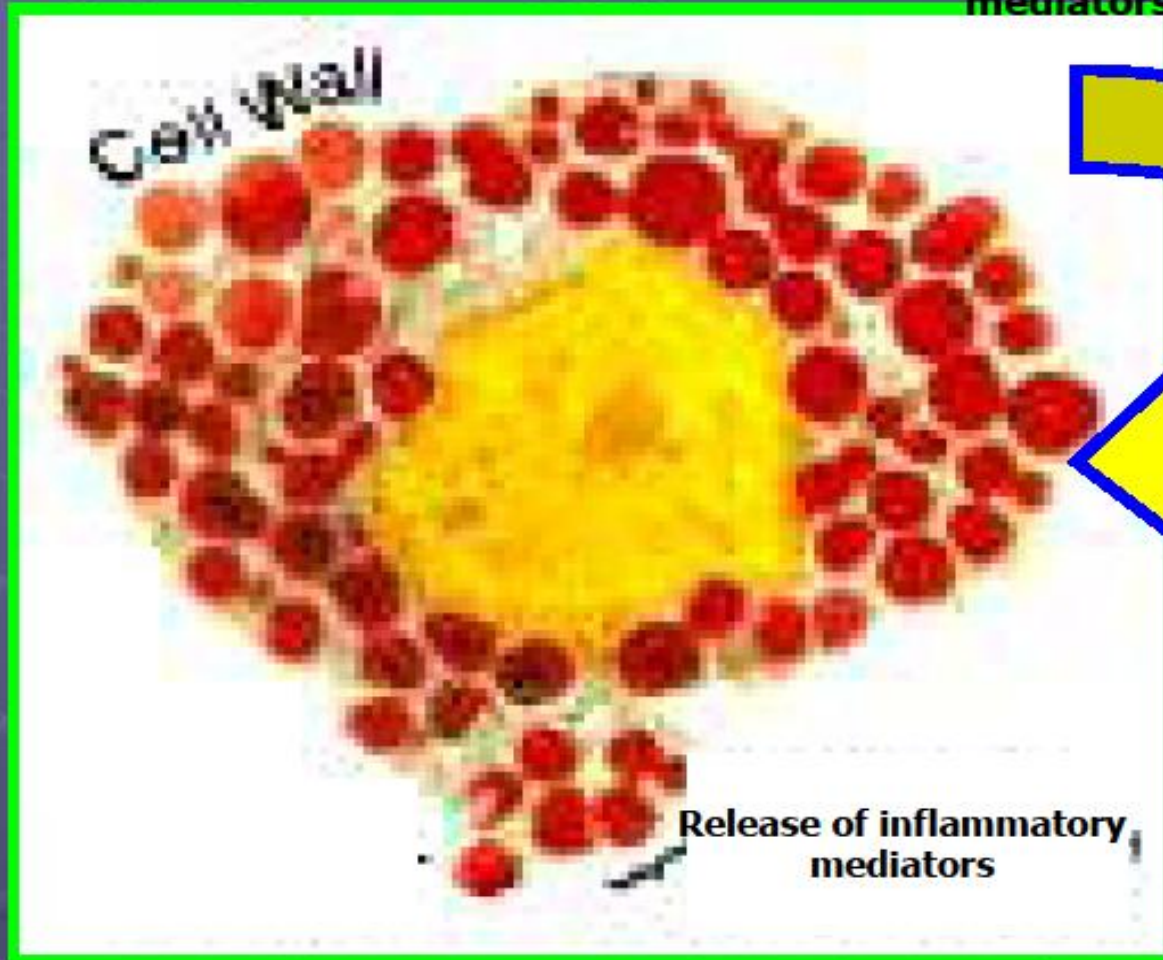


- **Type I hypersensitivity reaction**
- **Anaphylactic response**
- **(1st & 2nd exposures)**



Atopy (allergy)

Intracellular granules
containing
mediators



ALLERGIC REACTIONS

Skin Contact



poison
plants



animal
scratches



pollen



latex

Injection



bee sting

Penicillin

Ingestion



medication



nuts &
shellfish

Inhalation



pollen



dust



mold &
mildew

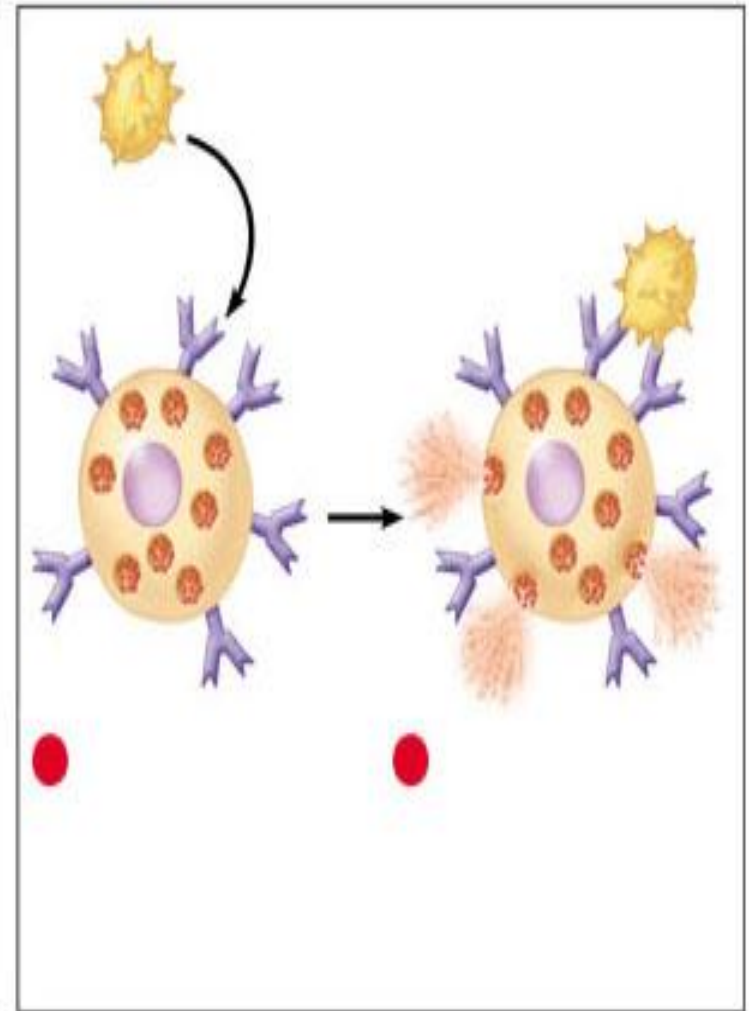
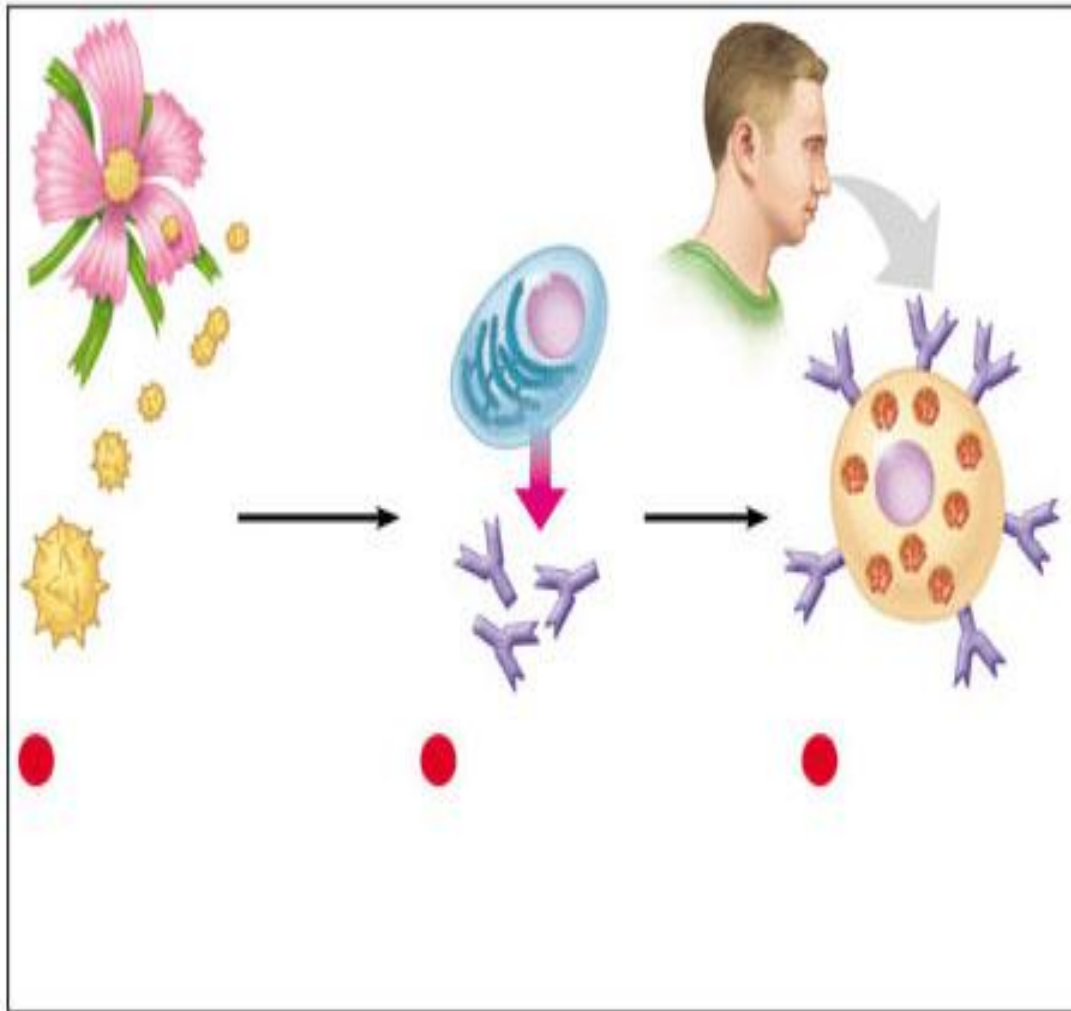


animal
dander

ADAM.

Antigens which consist of foreign peptide involves the activation of mast cell (in tissue)& basophil (in circulation) leading to the production of IgE, upon binding of allergen to cell-associated IgE release of histamine from mast cell, basophil which is responsible for allergy symptoms. Once the body reexposed these occur in Atopic disease like Asthma, eczema





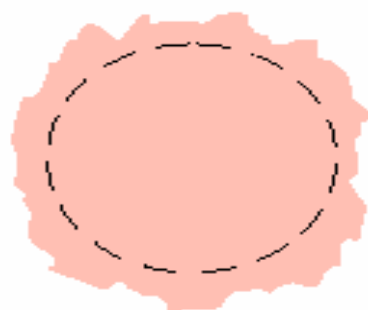
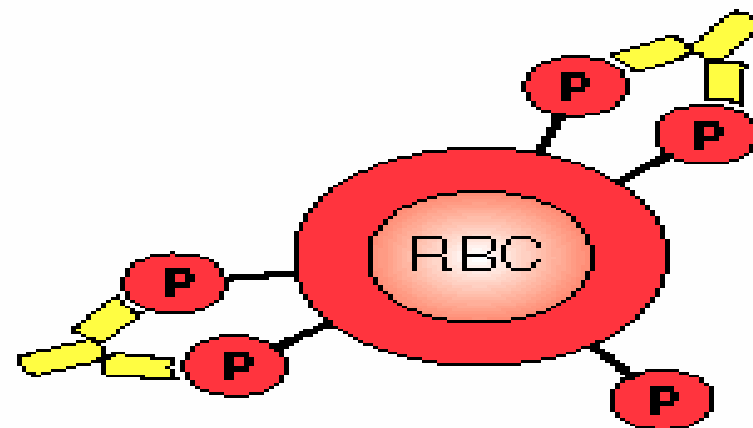
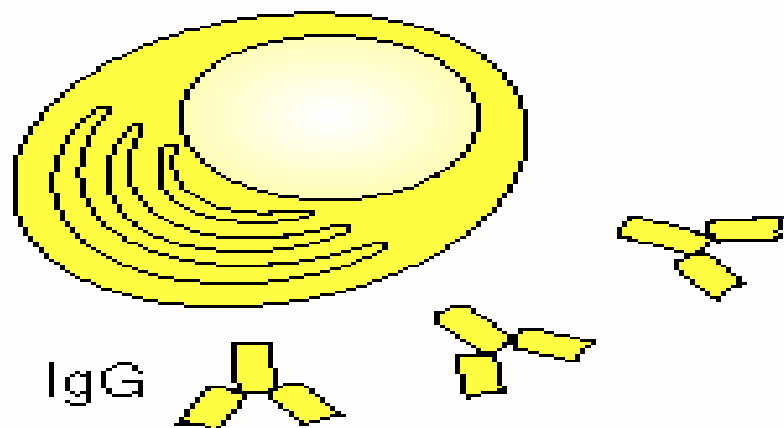
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**Antibodies
attach to
mast cell**

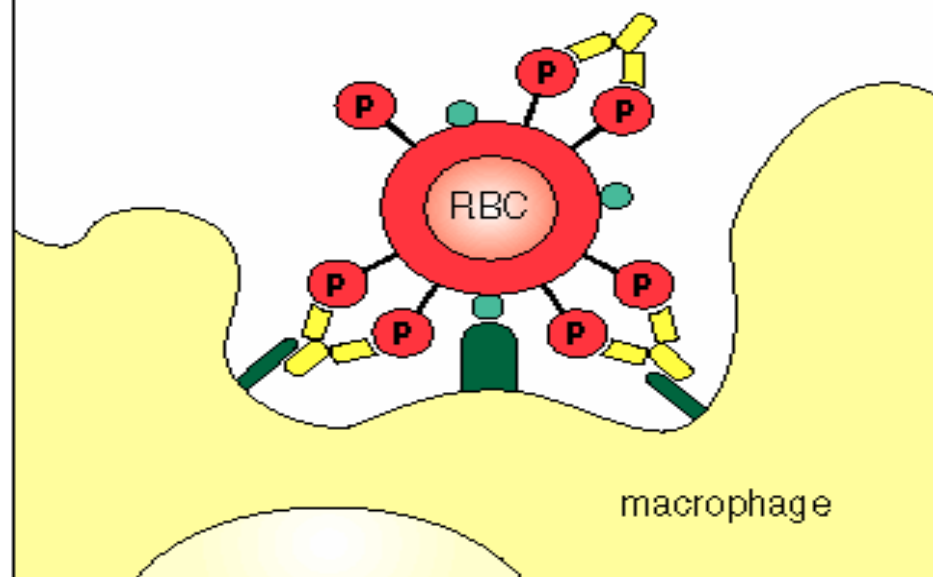
Type II hypersensitivity –(cytotoxic) immune-mediated destruction of red blood cells

Drug (penicillin) modified red blood cells induce the production of antibodies, because the bound drug (as Haptin) makes them look foreign to the immune system. When these antibodies are bound to them, the red blood cells are more susceptible to lysis or phagocytosis. Onset is dependent on the presence of specific antibodies.





Lysis



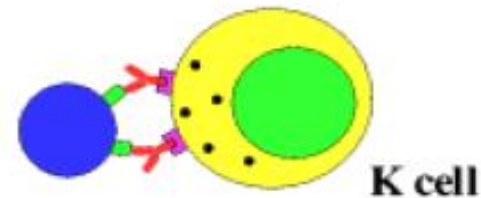
Phagocytosis

Type II hypersensitivity reaction

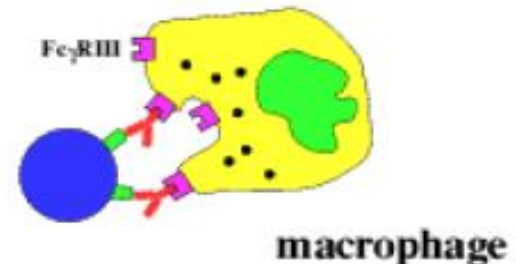
Mechanism

- Requirements:
- Ag on the surface of the target cell
- Ab formation
- Ag-Ab complex (on surface)
- Fixation of C
- Release of inflammatory mediators
- Killing (destruction) of target cell
- Phagocytosis

Type II Hypersensitivity



Antibody dependent cell cytotoxicity



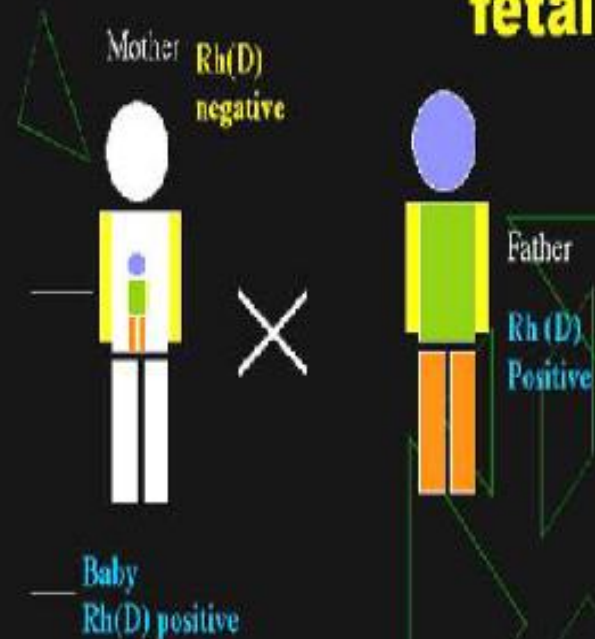
Type II hypersensitivity reaction

Example: Erythroblastosis fetalis

Rh(D) Immune globulin

- ◆ Antibody to RhD+ erythrocytes
- ◆ Rh(D) negative mothers carrying Rh(D)+ baby.
- ◆ First pregnancy OK. But sensitizes the mother
- ◆ Second pregnancy - high risk.
- ◆ Antibodies given < 48 hrs after delivery to prevent maternal sensitization

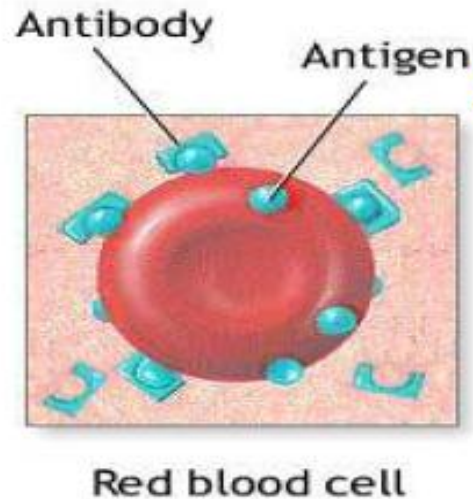
Erythroblastosis fetalis



Type II hypersensitivity reaction

Example: Transfusion reactions

(ABO incompatibility)



Ag-Ab reaction at surface
of donor RBC



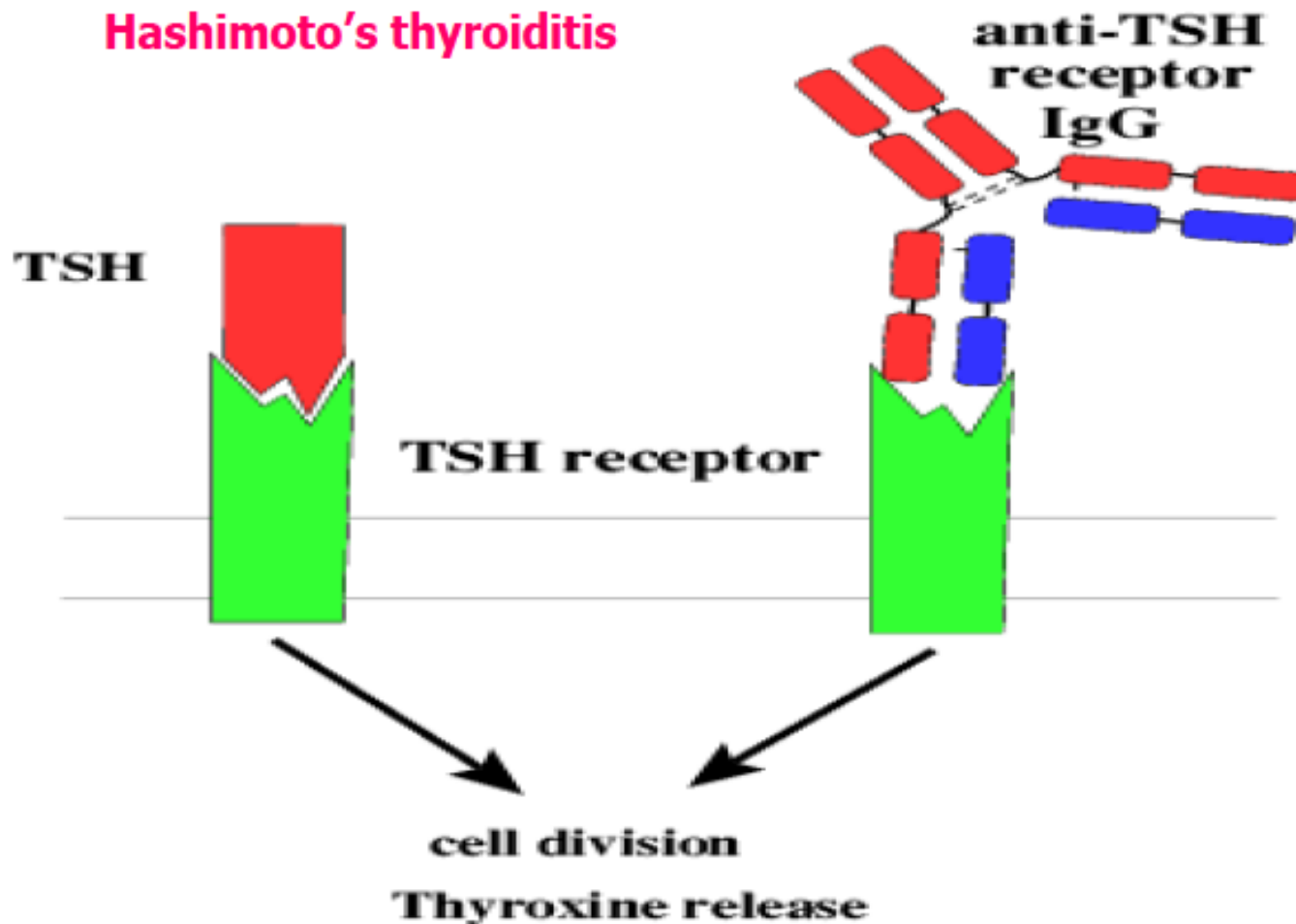
hemolysis

Type II hypersensitivity reaction

Mechanism-Ab –mediated cellular dysfunction



Hashimoto's thyroiditis



**Antibody directed at cell surface •
antigens activates the Complement
to damage the cell cause destruction •
of cell in mismatched blood transfusion
or transplanted tissues or hemolytic
disease under rhesus incompatibility
drug (as Haptin) penicillin ,Quinine •
attach to surface of Red cell and initiate
antibody formation such antibodies
(IgG) may then combine with resulting
hemolysis.**

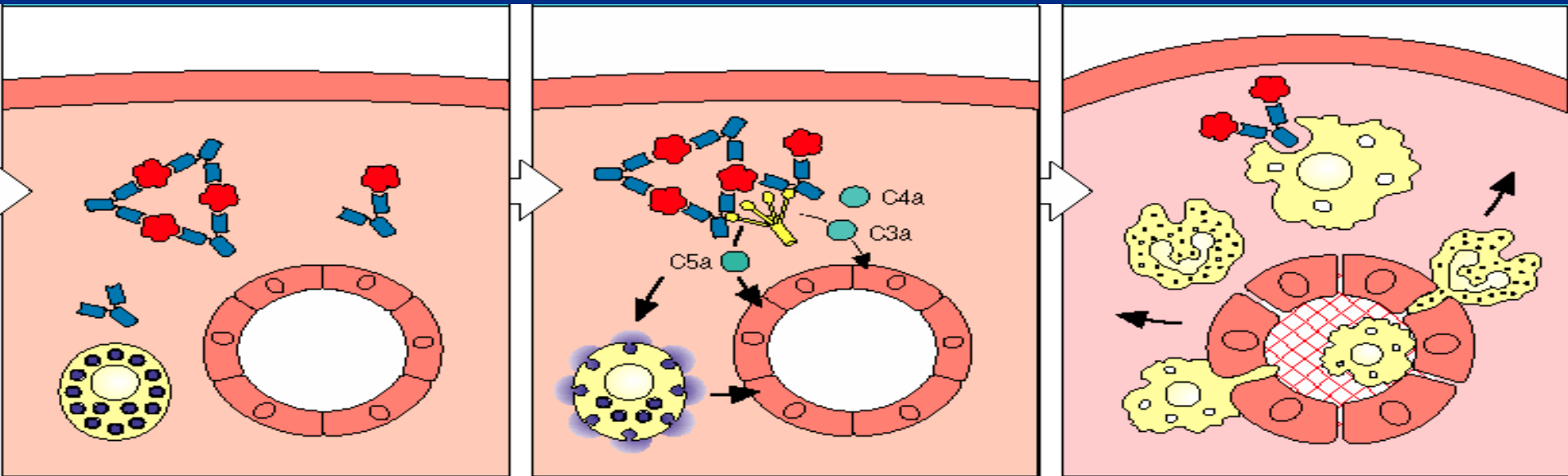


Type III hypersensitivity – immune complex formation and deposition

Immune complexes of antigen (red dots) and antibody form in target organ

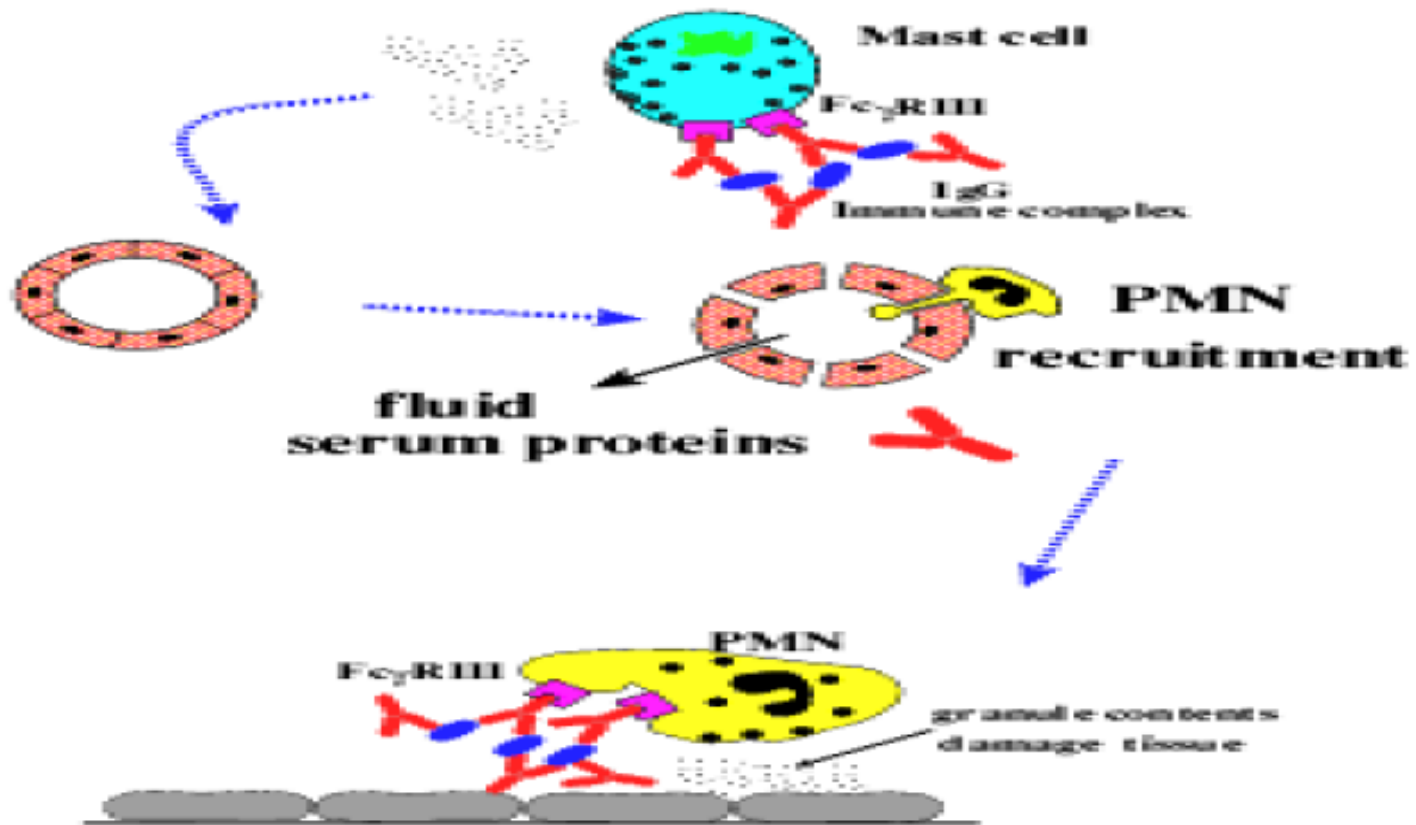
Immune complexes activate complement (green dots- C3a, C4a, and C5a), and mast cells (yellow cell) degranulate.

Inflammation and edema occur, and organ is damaged



Type III hypersensitivity reaction

Mechanism-Immune (Ag-Ab) complex



Type III hypersensitivity reaction

Immune (Ag-Ab) complex mediated

Systemic form: Acute serum sickness

- Ag –Ab complexes

- (Small + medium sized)



RES dysfunction

- Circulating complexes



Fixation of C

- Acute necrotizing vasculitis (PMNLs)

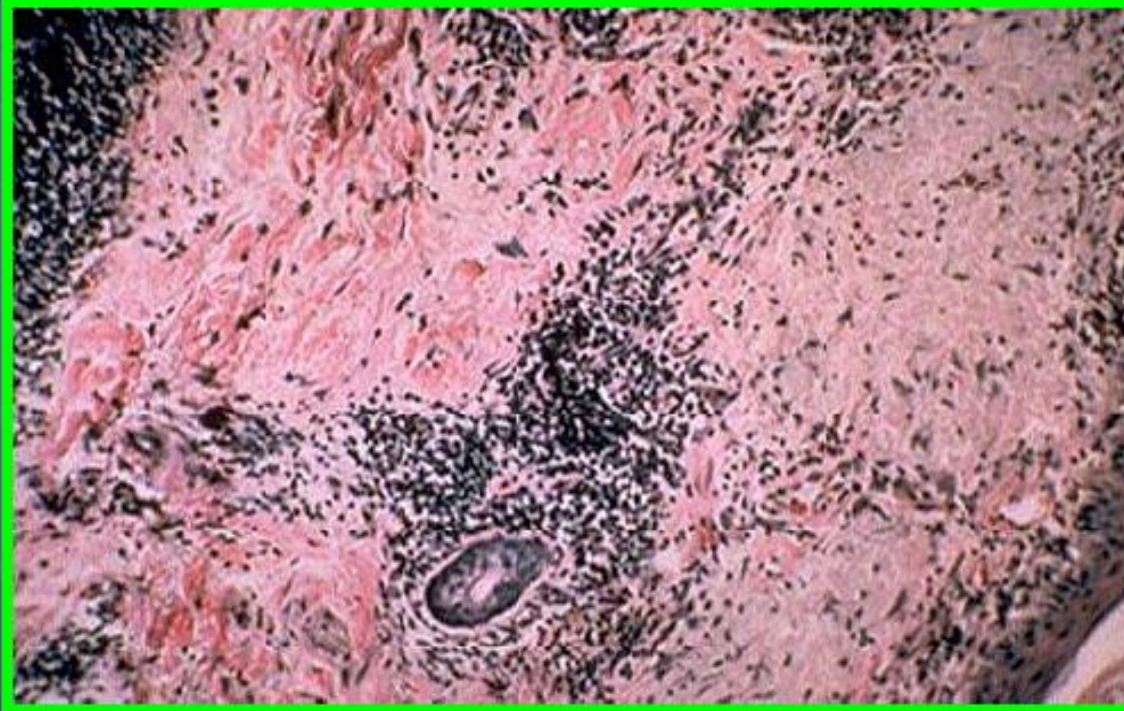
- Thrombosis + ischemic necrosis

- (Heart / Joints / bv / kidney/skin)

Type III hypersensitivity reaction

Immune (Ag-Ab) complex mediated

Local form: Arthus type reaction



*Acute necrotizing
vasculitis*

Immune complex or toxic complex e.g. •
Arthus reaction, serum sickness ..etc. In •
this reaction IgG & IgM and
Complement take part, it is known as •
immune complex- mediated
hypersensitivity Involve immediate
Antibody-mediated (IgG & IgM) response
soluble proteins, occurs in response to
persistent exposure to weakly imm
unogenic antigens.

Antigens may be self components, •
leading to autoimmune diseases

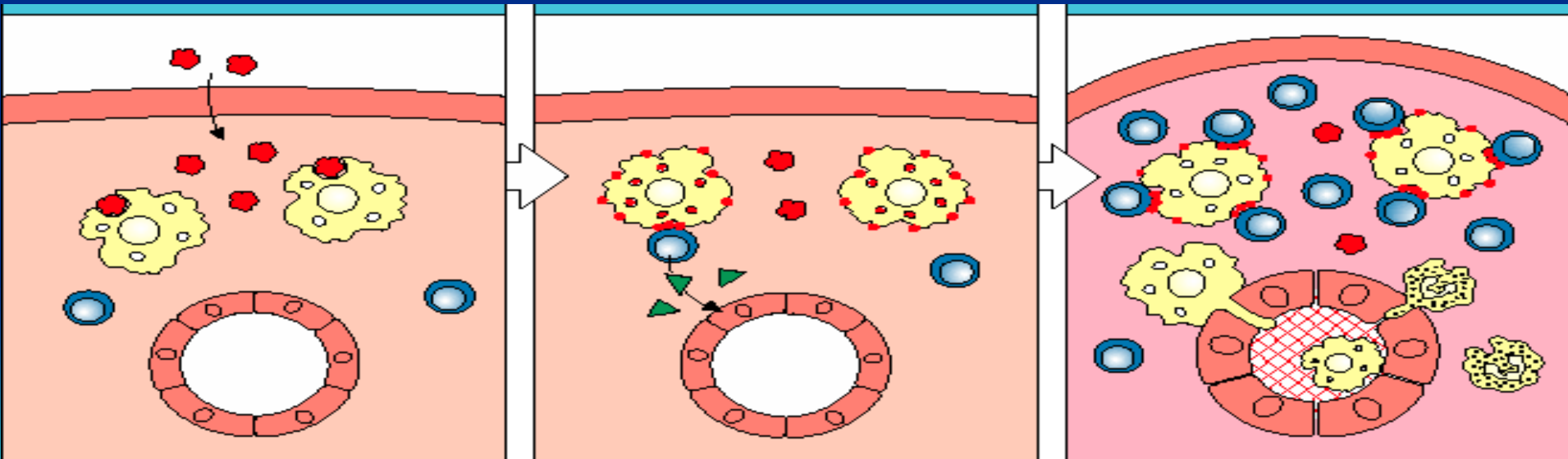


Type IV hypersensitivity – delayed-type or contact

Antigen (red dots) are processed by local APCs

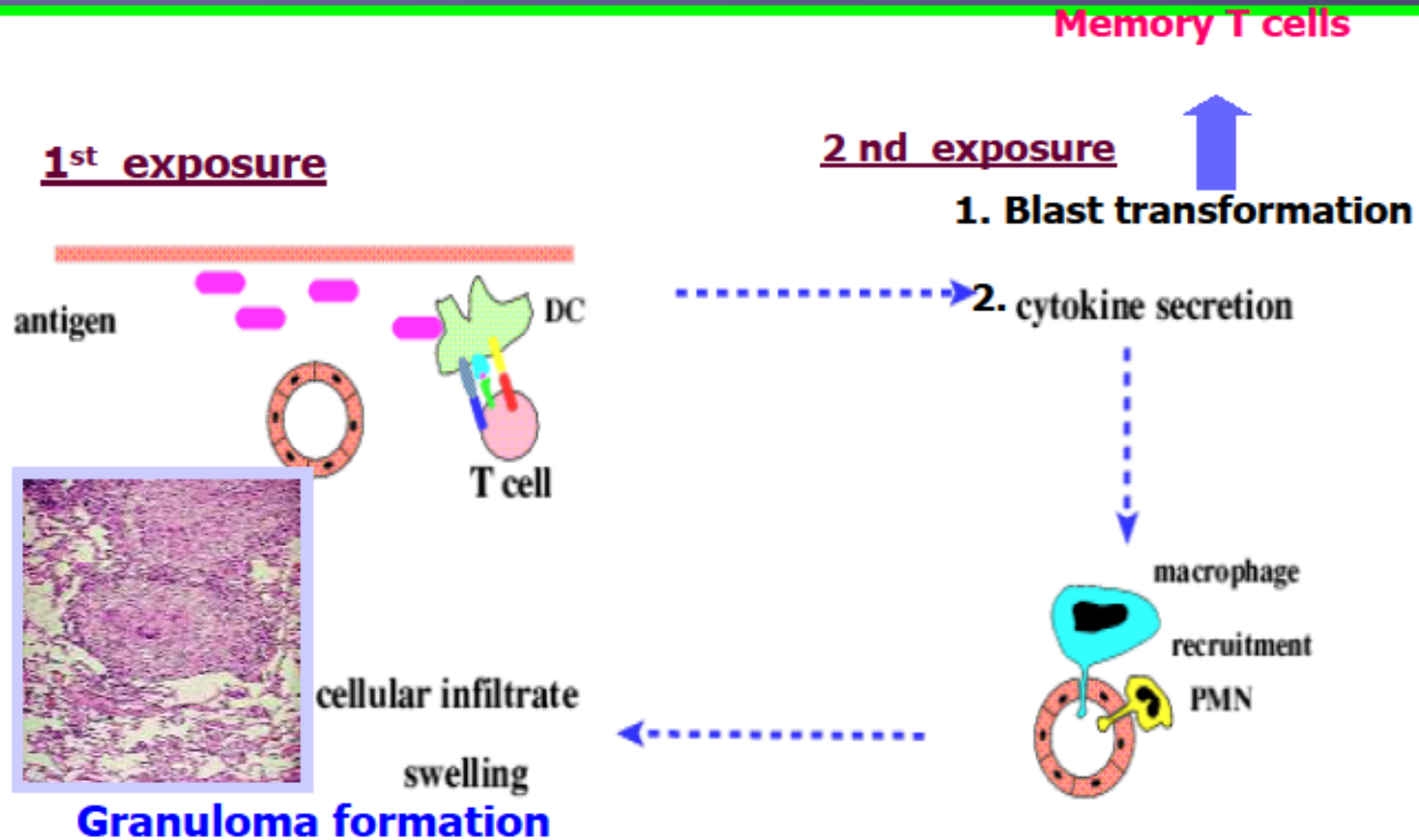
T cells (blue cells) that recognize antigen are activated and release cytokines

Inflammatory response causes tissue injury



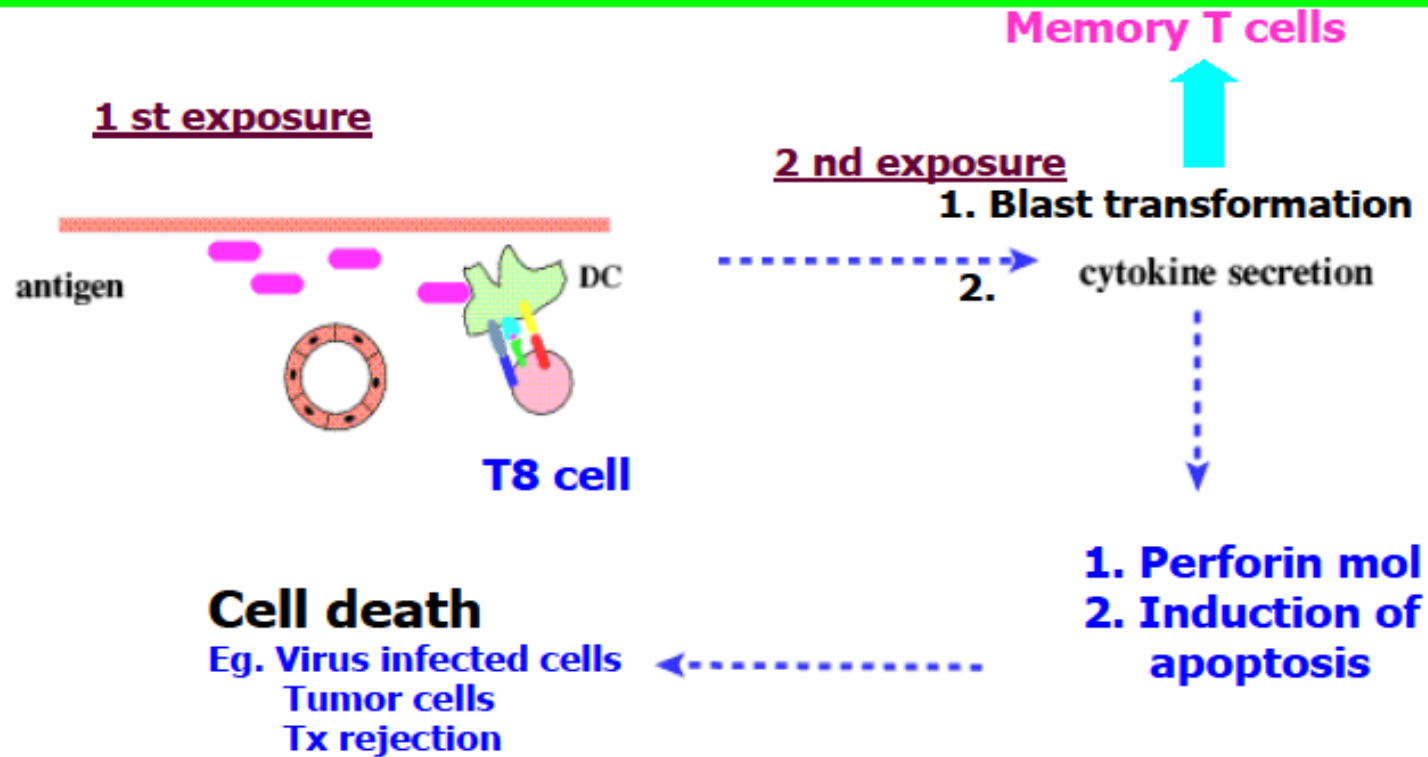
Type IV hypersensitivity reaction

Delayed type reaction-Mechanism (CD4+)



Type IV hypersensitivity reaction

II- T cell mediated cytotoxicity (CD8+)



Type IV hypersensitivity reaction
Mechanism-T lymphocyte mediated

● Delayed type

● T cell mediated cytotoxicity

● CD4 +

● CD8+

Antigen is presented by APCs to antigen-specific memory T cells that become activated and produce chemicals that cause inflammatory cells to move into the area, leading to tissue injury. Inflammation by 2-6 hours; peaks by 24-48 hours.



it is delayed type of hypersensitivity in which T- •
cells, lymphokine and macrophages take part
e.g. tuberculin type and contact dermatitis, It
is one of aspect cell mediated immunity .The
antigen activates specifically macrophages
& sensitized T-Cell leading to secretion of
lymphokines. Locally the reaction is manifested
by infiltration with mononuclear cell these
reactions have the following
characters, •



Antigen stimulus is necessary. Induction •
period 7-days a sensitive subject reaction
occurs on exposure to specific antigen .e.g.
tuberculin reaction.

Delayed hypersensitivity is transferred by •
cells from lymphoid tissue, peritoneal
exudates or blood lymphocytes. Two type
delayed

Classical or tuberculin type •

Granulomatous reactions. •



THE END—

