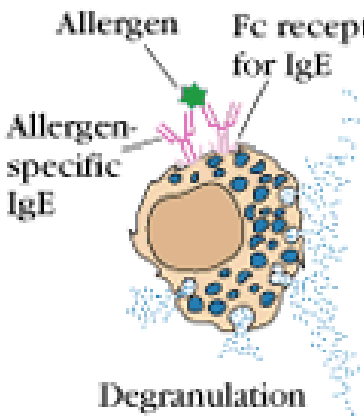
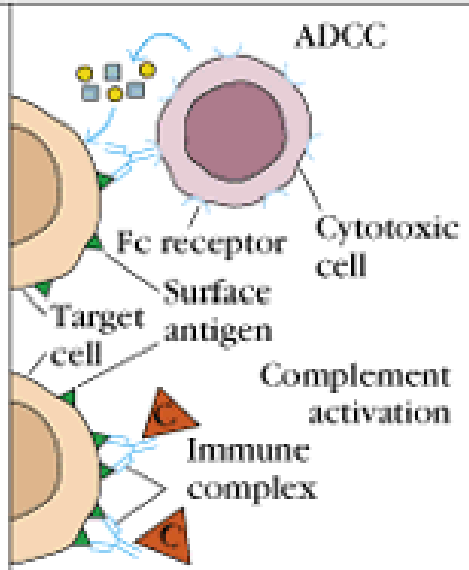
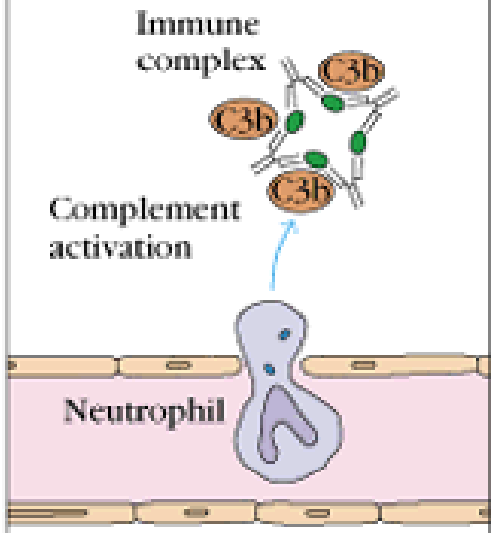
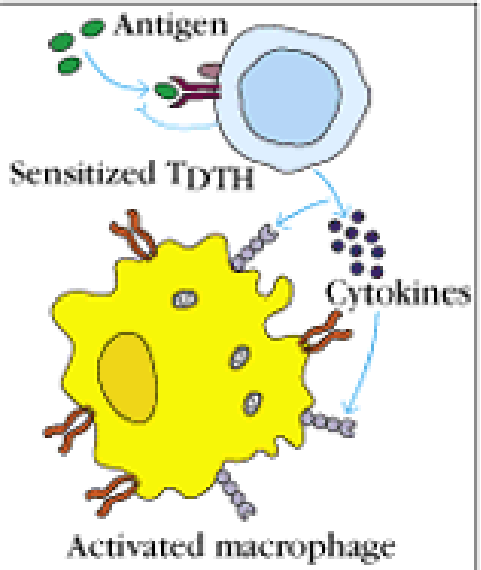
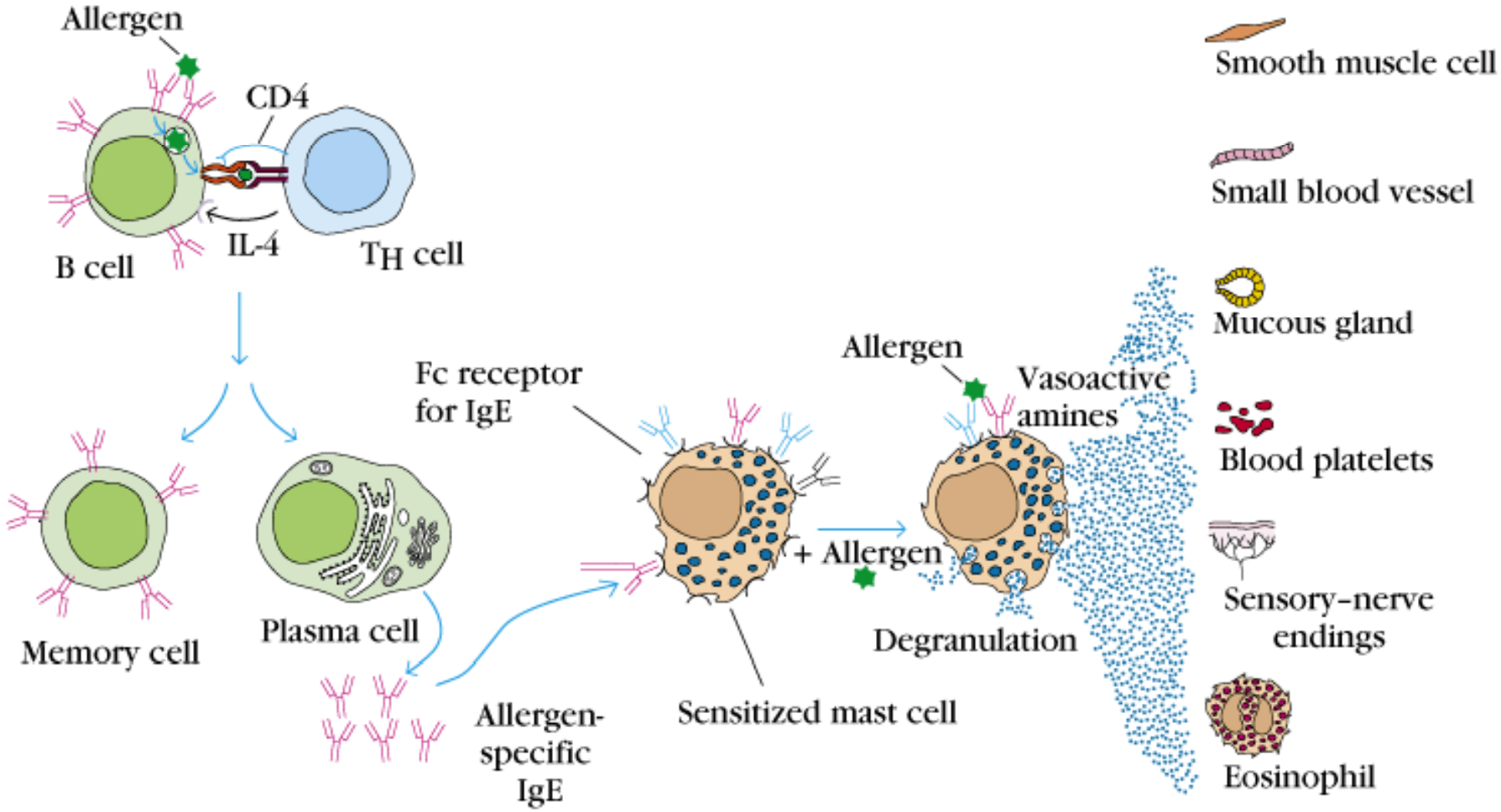
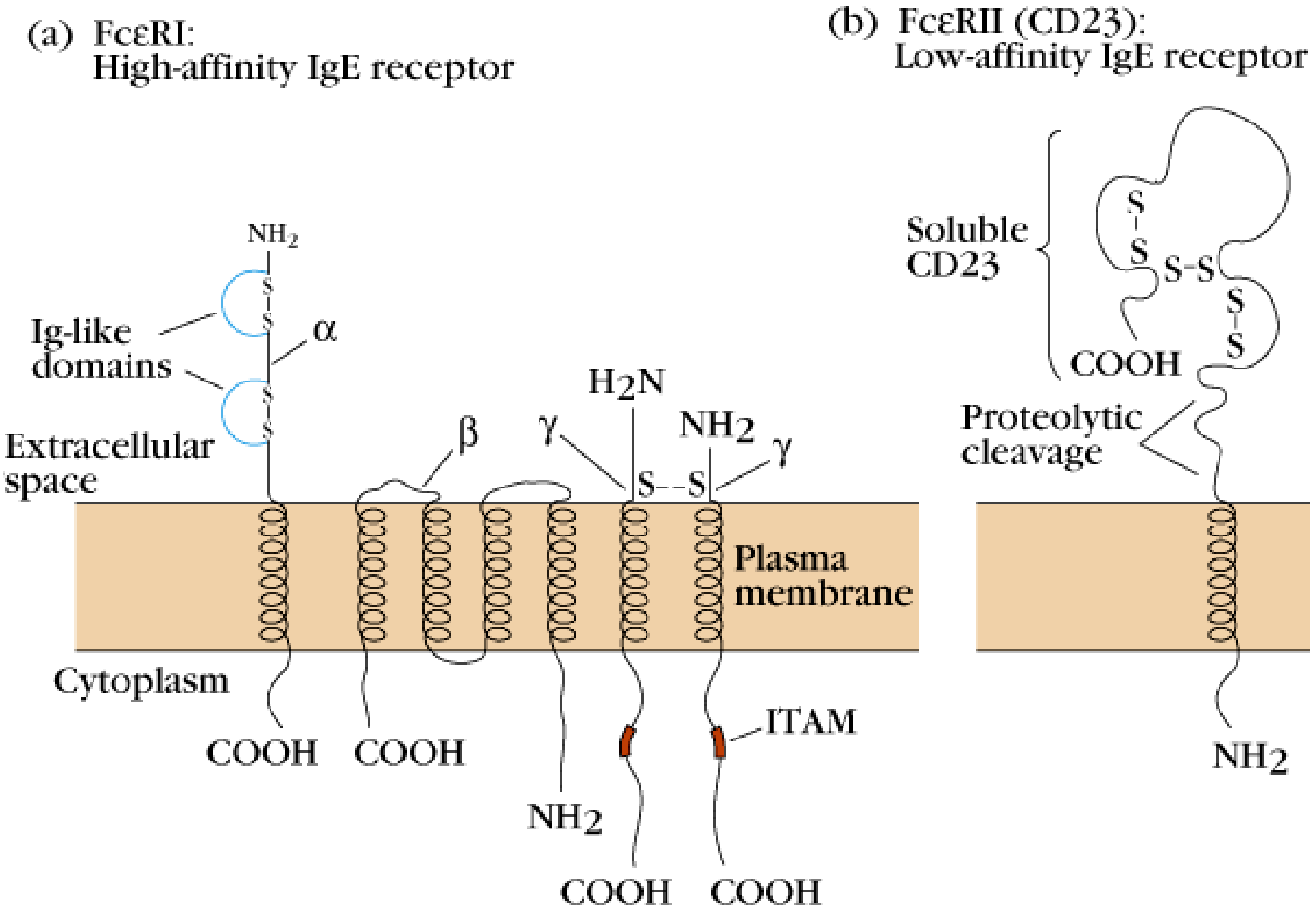
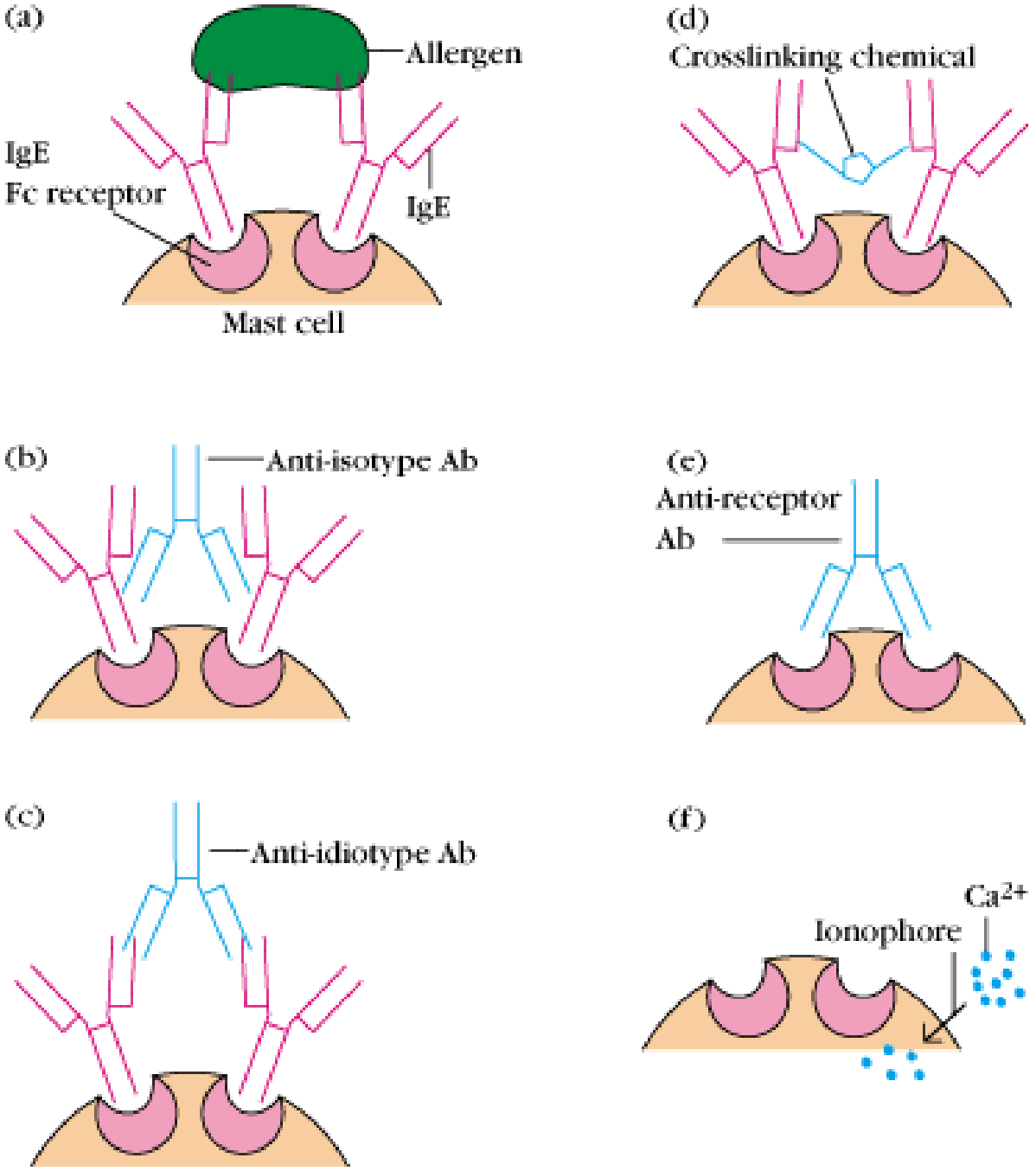
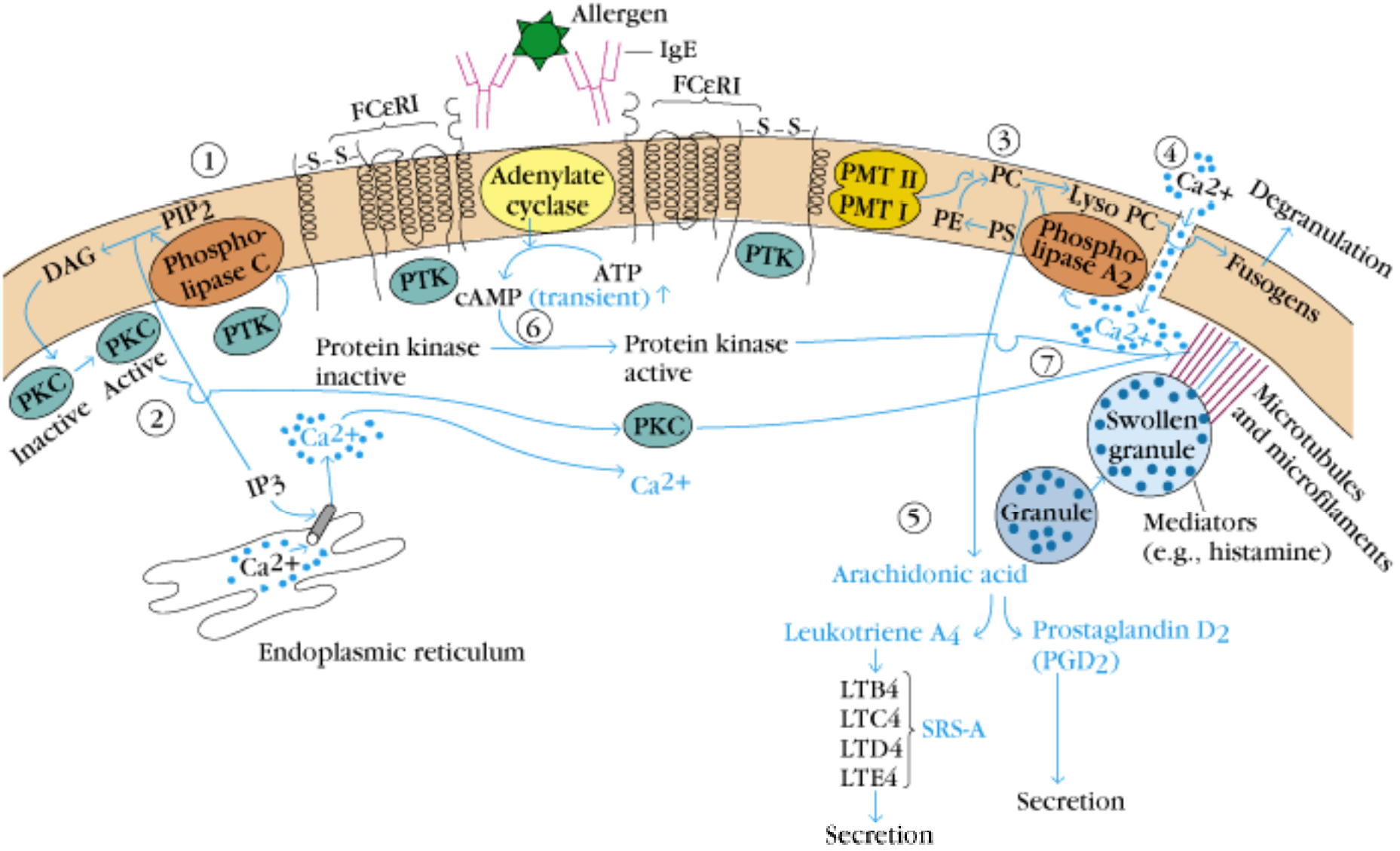
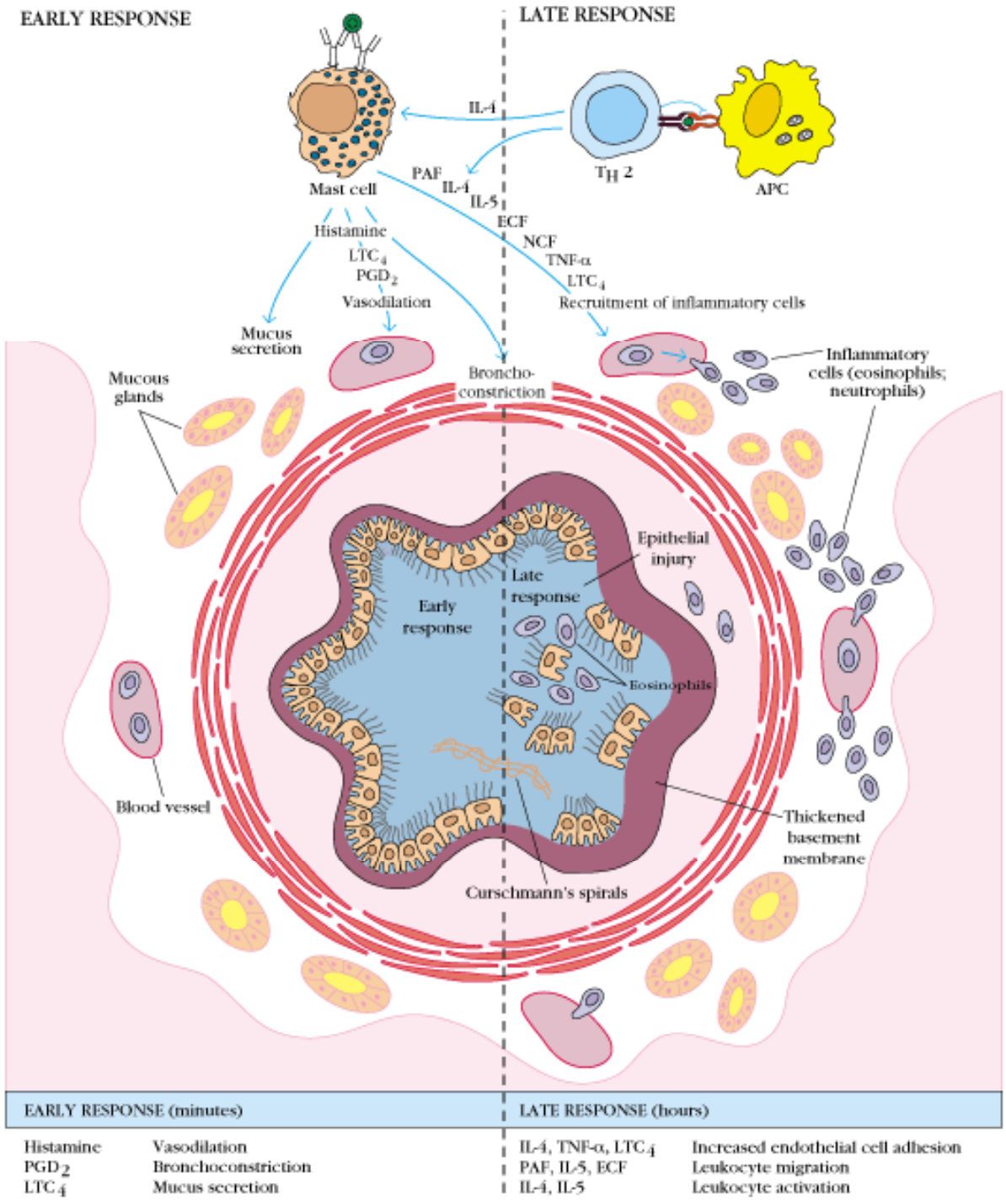
 **Type I**	 **Type II**	 **Type III**	 **Type IV**
IgE-Mediated Hypersensitivity	IgG-Mediated Cytotoxic Hypersensitivity	Immune Complex-Mediated Hypersensitivity	Cell-Mediated Hypersensitivity
Ag induces crosslinking of IgE bound to mast cells and basophils with release of vasoactive mediators	Ab directed against cell surface antigens meditates cell destruction via complement activation or ADCC	Ag-Ab complexes deposited in various tissues induce complement activation and an ensuing inflammatory response mediated by massive infiltration of neutrophils	Sensitized T_{DTH} cells release cytokines that activate macrophages or T_C cells which mediate direct cellular damage
Typical manifestations include systemic anaphylaxis and localized anaphylaxis such as hay fever, asthma, hives, food allergies, and eczema	Typical manifestations include blood transfusion reactions, erythroblastosis fetalis, and autoimmune hemolytic anemia	Typical manifestations include localized Arthus reaction and generalized reactions such as serum sickness, necrotizing vasculitis, glomerulnephritis, rheumatoid arthritis, and systemic lupus erythematosus	Typical manifestations include contact dermatitis, tubercular lesions and graft rejection

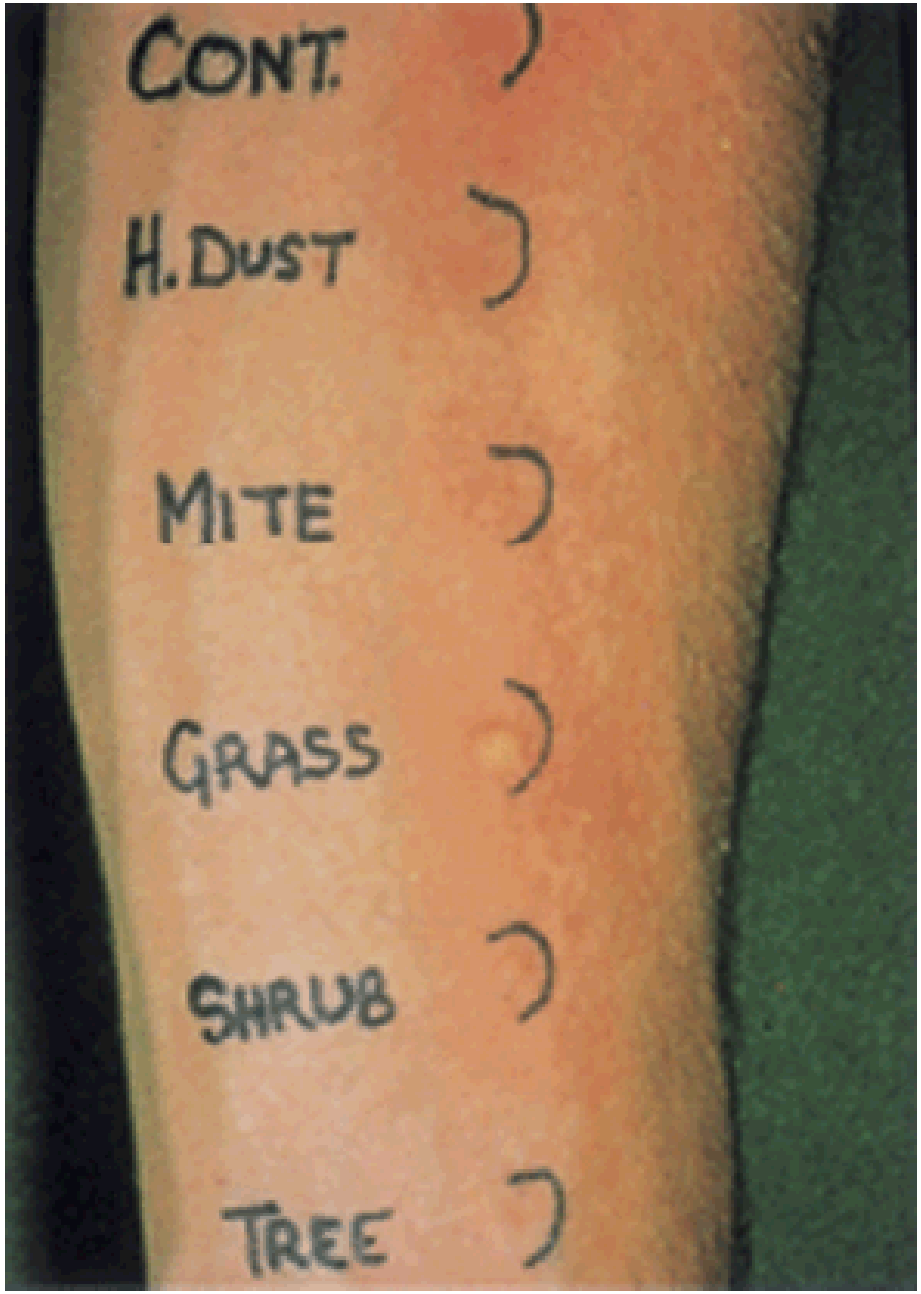

Allergen
CD4
IL-4
B cell
TH cell
Memory cell
Plasma cell
Allergen-specific IgE
Fc receptor for IgE
Sensitized mast cell
+ Allergen
Allergen
Vasoactive amines
Degranulation
Smooth muscle cell
Small blood vessel
Mucous gland
Blood platelets
Sensory-nerve endings
Eosinophil

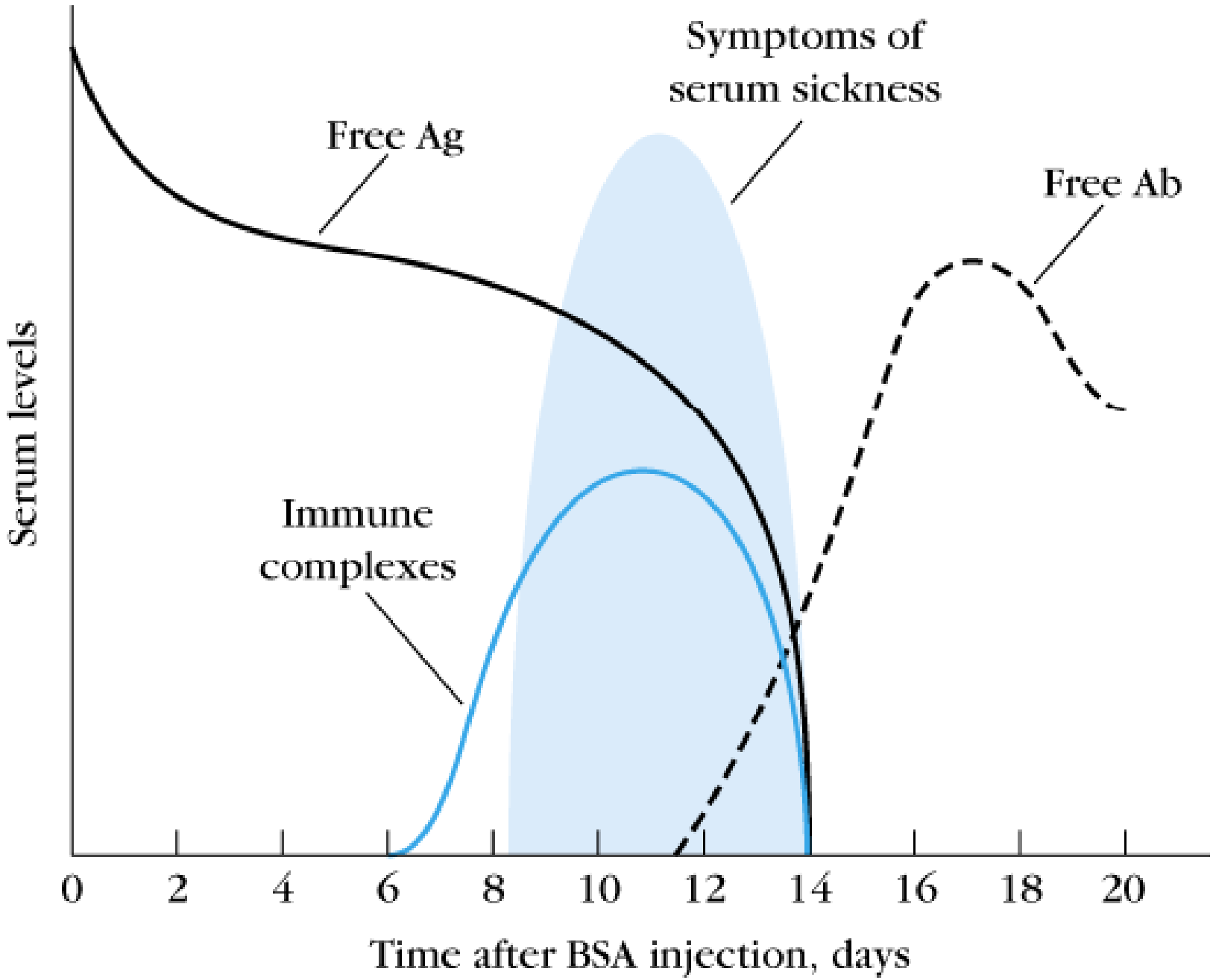

(a) FcεRI:
High-affinity IgE receptor
(b) FcεRII (CD23):
Low-affinity IgE receptor
NH2
Ig-like domains
α
Extracellular space
β
γ
H2N
NH2
γ
S--S
Plasma membrane
Cytoplasm
COOH
COOH
NH2
COOH
COOH
ITAM
Soluble CD23
S-S
COOH
Proteolytic cleavage
NH2


(a)
Allergen
IgE
Fc receptor
IgE
Mast cell
(d)
Crosslinking chemical
(b)
Anti-isotype Ab
(e)
Anti-receptor
Ab
(c)
Anti-idiotype Ab
(f)
Ca^{2+}
Ionophore


Allergen
IgE
FCεRI
FCεRI
S–S
S–S
1
Adenylate cyclase
PMT II
PMT I
3
PC
Lyso PC
PE
PS
Phospho-lipase A2
4
Ca2+
Degranulation
Fusogens
PIP2
DAG
Phospho-lipase C
PTK
PTK
PTK
ATP
cAMP (transient) ↑
6
Protein kinase inactive
Protein kinase active
PKC
Active
PKC
Inactive
2
Ca2+
PKC
Ca2+
IP3
Ca2+
Endoplasmic reticulum
7
Ca2+
Swollen granule
Microtubules and microfilaments
Granule
Mediators (e.g., histamine)
5
Arachidonic acid
Leukotriene A4
Prostaglandin D2 (PGD2)
LTB4
LTC4
LTD4
LTE4
SRS-A
Secretion
Secretion


EARLY RESPONSE
LATE RESPONSE
IL-4
PAF
IL-4
IL-5
Mast cell
TH 2
APC
Histamine
LTC4
PGD2
Vasodilation
ECF
NCF
TNF-α
LTC4
Recruitment of inflammatory cells
Mucus secretion
Broncho-constriction
Mucous glands
Inflammatory cells (eosinophils; neutrophils)
Epithelial injury
Late response
Early response
Eosinophils
Blood vessel
Thickened basement membrane
Curschmann's spirals
EARLY RESPONSE (minutes)
LATE RESPONSE (hours)
Histamine
PGD2
LTC4
Vasodilation
Bronchoconstriction
Mucus secretion
IL-4, TNF-α, LTC4
PAF, IL-5, ECF
IL-4, IL-5
Increased endothelial cell adhesion
Leukocyte migration
Leukocyte activation


CONT.
H. DUST
MITE
GRASS
SHRUB
TREE


Symptoms of
serum sickness
Free Ag
Free Ab
Immune
complexes
Serum levels
0
2
4
6
8
10
12
14
16
18
20
Time after BSA injection, days

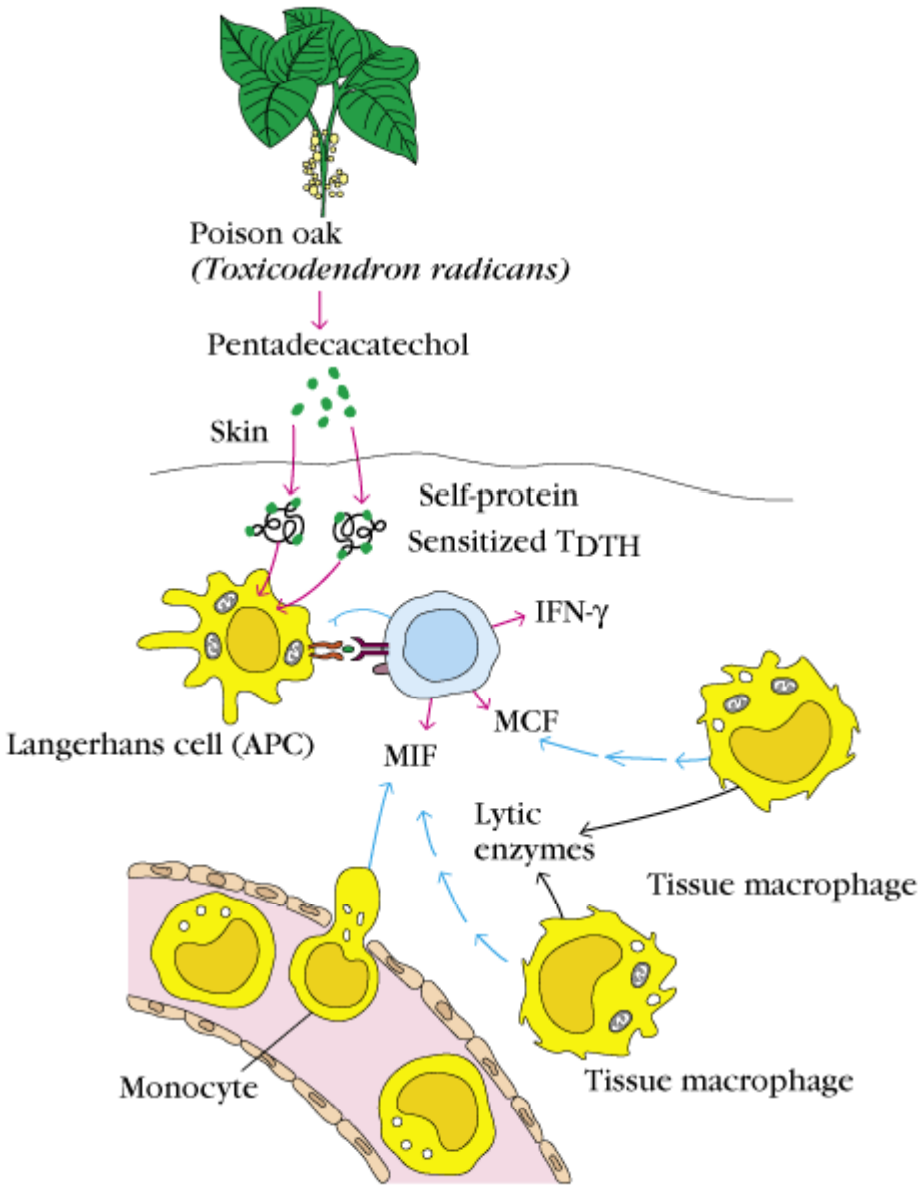

Poison oak
(Toxicodendron radicans)
Pentadecacatechol
Skin
Self-protein
Sensitized TDTH
IFN-γ
MCF
MIF
Langerhans cell (APC)
Lytic
enzymes
Tissue macrophage
Monocyte
Tissue macrophage

TABLE 16-1 COMMON ALLERGENS ASSOCIATED WITH TYPE I HYPERSENSITIVITY

Proteins
- Foreign serum
- Vaccines

Plant pollens
- Rye grass
- Ragweed
- Timothy grass
- Birch trees

Drugs
- Penicillin
- Sulfonamides
- Local anesthetics
- Salicylates

Foods
- Nuts
- Seafood
- Eggs
- Peas, beans
- Milk

Insect products
- Bee venom
- Wasp venom
- Ant venom
- Cockroach calyx
- Dust mites

Mold spores

Animal hair and dander

TABLE 16-3 PRINCIPAL MEDIATORS INVOLVED IN TYPE I HYPERSENSITIVITY

Mediator	Effects
Primary	
Histamine	Increased vascular permeability; smooth-muscle contraction
Serotonin	Increased vascular permeability; smooth-muscle contraction
Eosinophil chemotactic factor (ECF-A)	Eosinophil chemotaxis
Neutrophil chemotactic factor (NCF-A)	Neutrophil chemotaxis
Proteases	Bronchial mucus secretion; degradation of blood-vessel basement membrane; generation of complement split products
Secondary	
Platelet-activating factor	Platelet aggregation and degranulation; contraction of pulmonary smooth muscles
Leukotrienes (slow reactive substance of anaphylaxis, SRS-A)	Increased vascular permeability; contraction of pulmonary smooth muscles
Prostaglandins	Vasodilation; contraction of pulmonary smooth muscles; platelet aggregation
Bradykinin	Increased vascular permeability; smooth-muscle contraction
Cytokines	
IL-1 and TNF-α	Systemic anaphylaxis; increased expression of CAMs on venular endothelial cells
IL-2, IL-3, IL-4, IL-5, IL-6, TGF-β, and GM-CSF	Various effects (see Table 12-1)