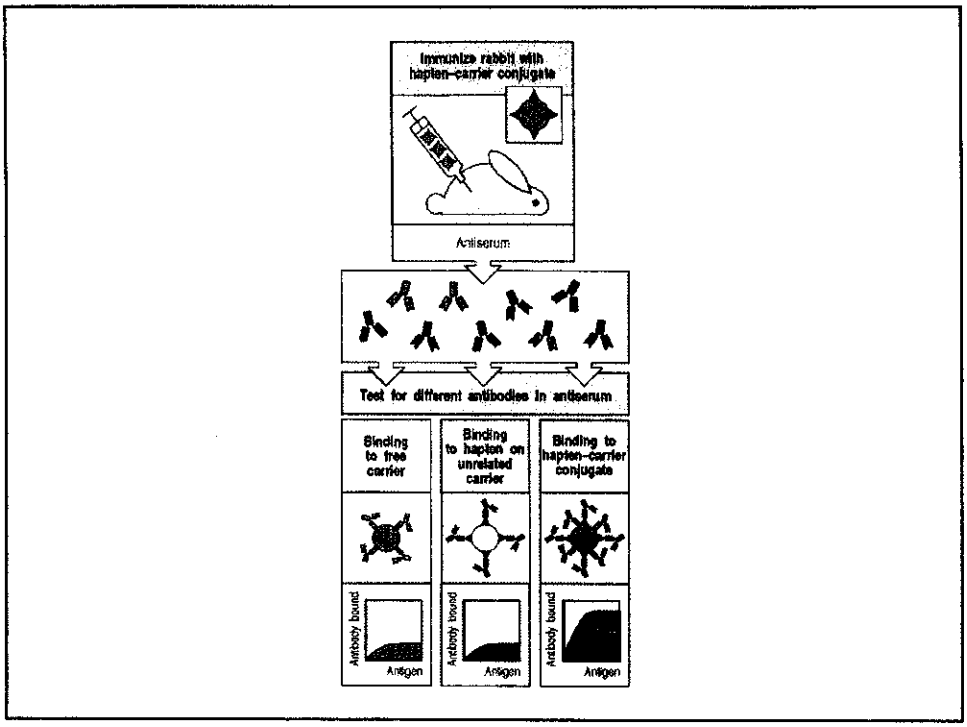
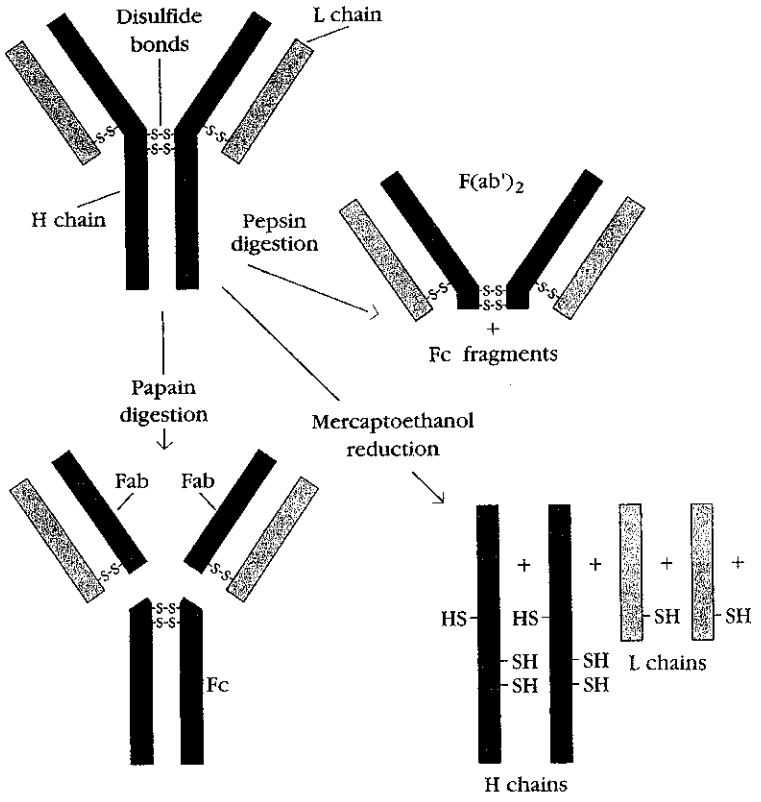
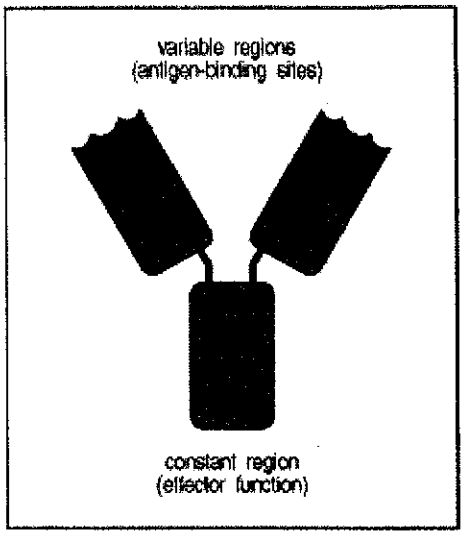

Immunize rabbit with hapten–carrier conjugate
Antiserum
Test for different antibodies in antiserum
Binding to free carrier
Binding to hapten on unrelated carrier
Binding to hapten–carrier conjugate
Antibody bound
Antigen
Antibody bound
Antigen
Antibody bound
Antigen

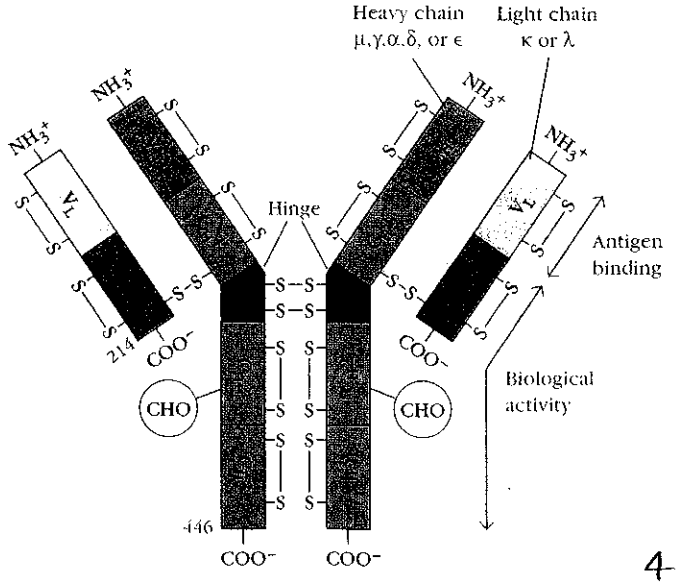
1


Disulfide bonds
L chain
H chain
Pepsin digestion
F(ab')2
+
Fc fragments
Papain digestion
Mercaptoethanol reduction
Fab
Fab
Fc
HS
HS
SH
SH
SH
SH
SH
SH
L chains
H chains

2


variable regions
(antigen-binding sites)
constant region
(effector function)

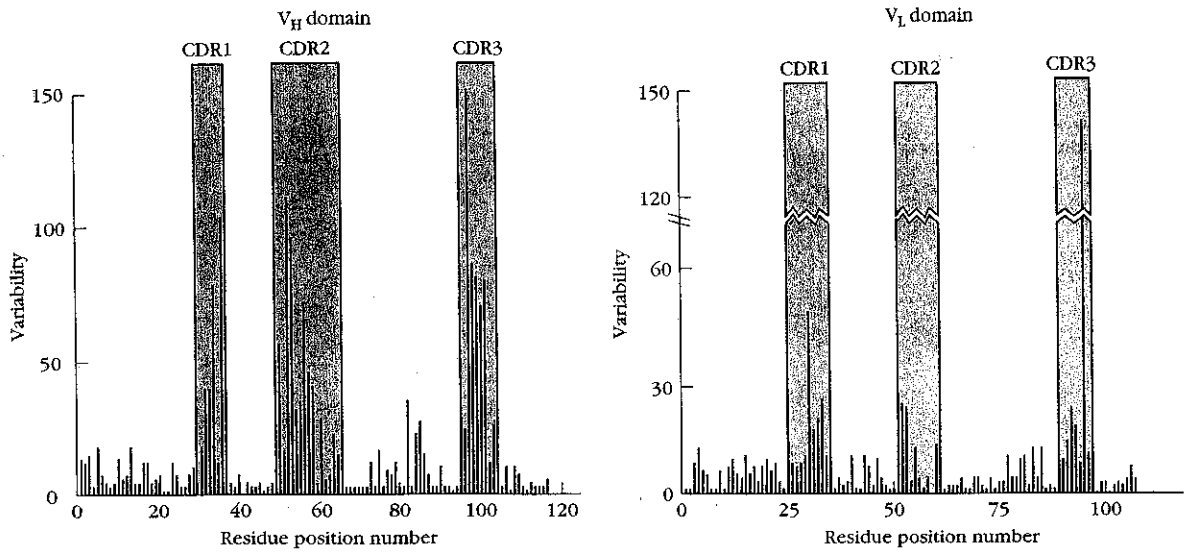
3

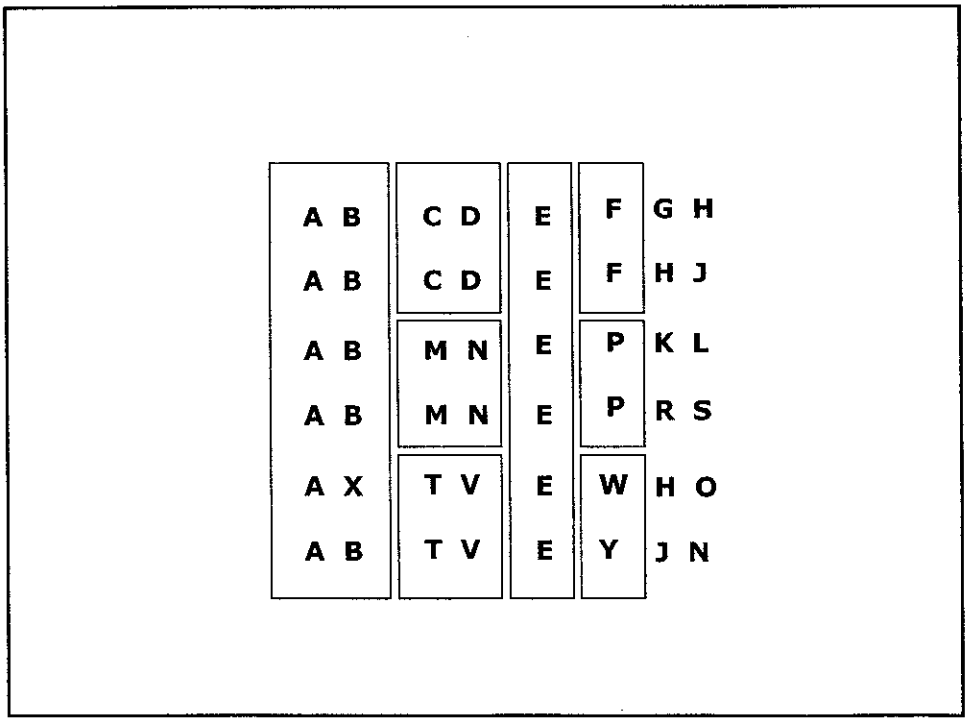

Heavy chain
μ,γ,α,δ, or ε
Light chain
κ or λ
Hinge
Antigen
binding
Biological
activity
CHO
CHO
214
446
COO⁻

4

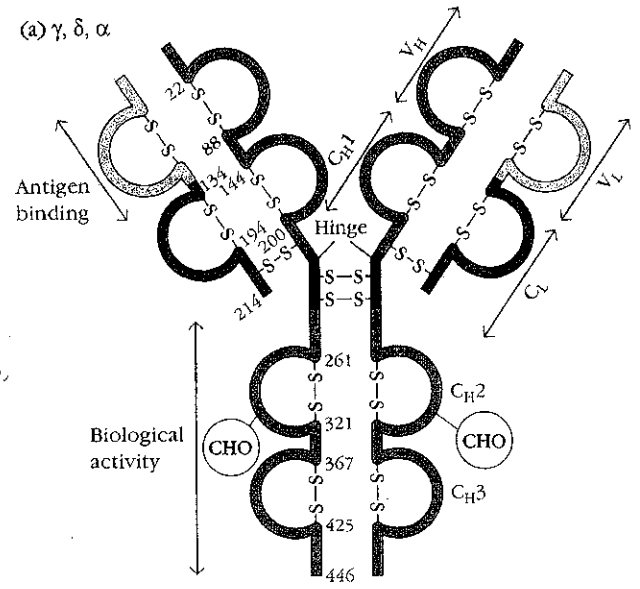
CDR = HV

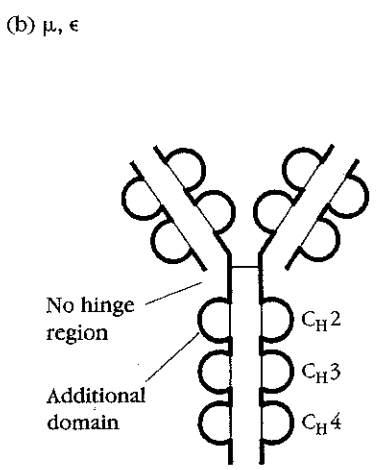
5


V_H domain
CDR1
CDR2
CDR3
150
100
50
0
Variability
0
20
40
60
80
100
120
Residue position number
V_L domain
CDR1
CDR2
CDR3
150
120
60
30
0
Variability
0
25
50
75
100
Residue position number


A B
A B
A B
A B
A X
A B
C D
C D
M N
M N
T V
T V
E
E
E
E
E
E
F
F
P
P
W
Y
G H
H J
K L
R S
H O
J N

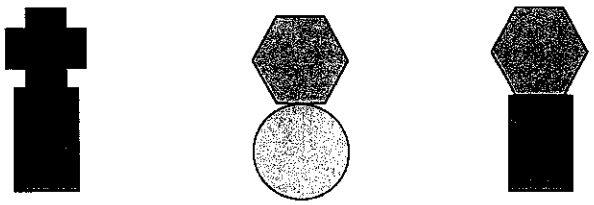
6





7

fonction spécifique = fonction anticorps



fonction non spécifique = fonction effectrice

8

TABLE 4-1 Chain composition of the five immunoglobulin classes in humans

Class	Heavy chain	Subclasses	Light chain	Molecular formula
IgG	γ	$\gamma1$, $\gamma2$, $\gamma3$, $\gamma4$	κ or λ	$\gamma_2\kappa_2$ $\gamma_2\lambda_2$
IgM	μ	None	κ or λ	$(\mu_2\kappa_2)_n$ $(\mu_2\lambda_2)_n$ $n = 1$ or 5
IgA	α	$\alpha1$, $\alpha2$	κ or λ	$(\alpha_2\kappa_2)_n$ $(\alpha_2\lambda_2)_n$ $n = 1, 2, 3$, or 4
IgE	ϵ	None	κ or λ	$\epsilon_2\kappa_2$ $\epsilon_2\lambda_2$
IgD	δ	None	κ or λ	$\delta_2\kappa_2$ $\delta_2\lambda_2$

9

TABLE 4-2 Properties and biological activities* of classes and subclasses of human serum immunoglobulins

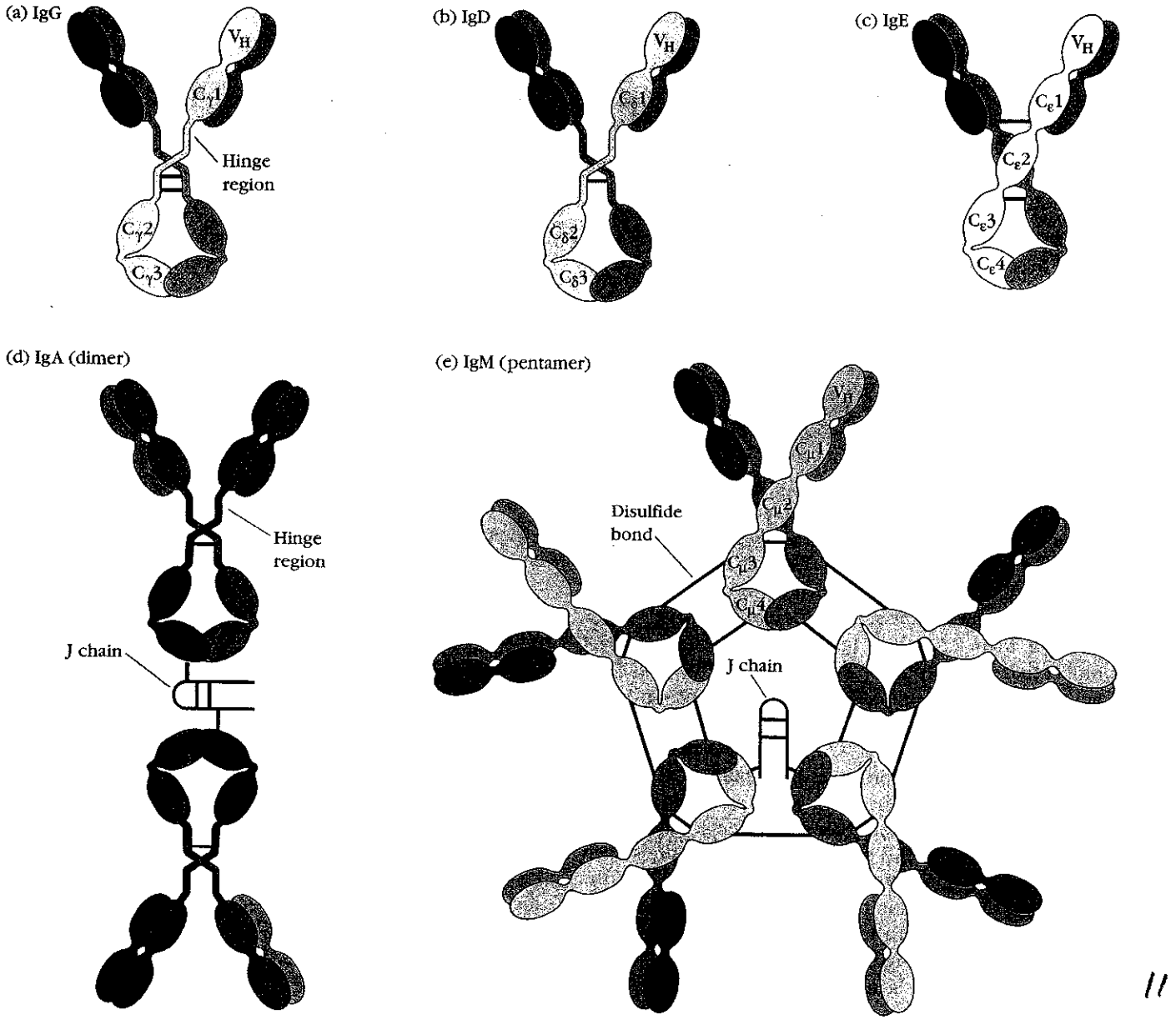
Property/Activity	IgG1	IgG2	IgG3	IgG4	IgA1	IgA2	IgM‡	IgE	IgD
Molecular weight†	150,000	150,000	150,000	150,000	150,000–600,000	150,000–600,000	900,000	190,000	150,000
Heavy-chain component	$\gamma1$	$\gamma2$	$\gamma3$	$\gamma4$	$\alpha1$	$\alpha2$	μ	ϵ	δ
Normal serum level (mg/ml)	9	3	1	0.5	3.0	0.5	1.5	0.0003	0.03
In vivo serum half life (days)	23	23	8	23	6	6	5	2.5	3
Activates classical complement pathway	+	+/−	++	−	−	−	+++	−	−
Crosses placenta	+	+/−	+	+	−	−	−	−	−
Present on membrane of mature B cells	−	−	−	−	−	−	+	−	+
Binds to Fc receptors of phagocytes	++	+/−	++	+	−	−	?	−	−
Mucosal transport	−	−	−	−	++	++	+	−	−
Induces mast-cell degranulation	−	−	−	−	−	−	−	+	−

*Activity levels indicated as follows: ++ = high; + = moderate; +/− = minimal; − = none; ? = questionable.

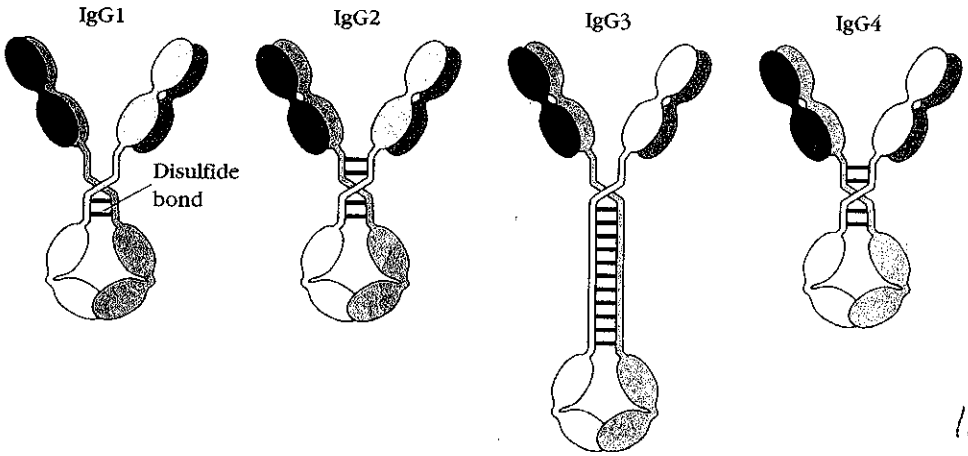
†IgG, IgE, and IgD always exist as monomers; IgA can exist as a monomer, dimer, trimer, or tetramer. Membrane-bound IgM is a monomer, but secreted IgM in serum is a pentamer.

‡IgM is the first isotype produced by the neonate and during a primary immune response.

10

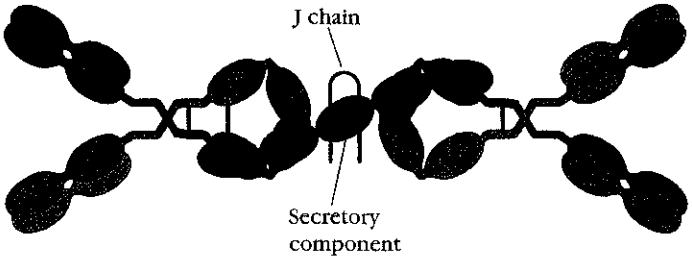

(a) IgG
V_H
$C_\gamma 1$
Hinge region
$C_\gamma 2$
$C_\gamma 3$
(b) IgD
V_H
$C_\delta 1$
$C_\delta 2$
$C_\delta 3$
(c) IgE
V_H
$C_\varepsilon 1$
$C_\varepsilon 2$
$C_\varepsilon 3$
$C_\varepsilon 4$
(d) IgA (dimer)
Hinge region
J chain
(e) IgM (pentamer)
V_H
$C_\mu 1$
$C_\mu 2$
Disulfide bond
$C_\mu 3$
$C_\mu 4$
J chain

11

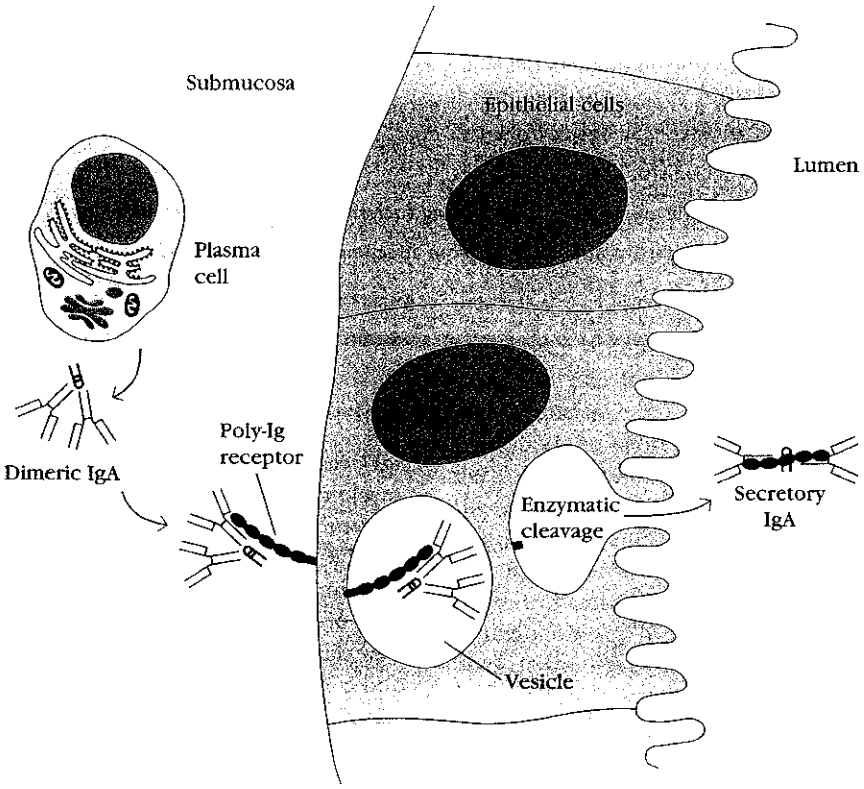

IgG1
IgG2
IgG3
IgG4
Disulfide bond

12

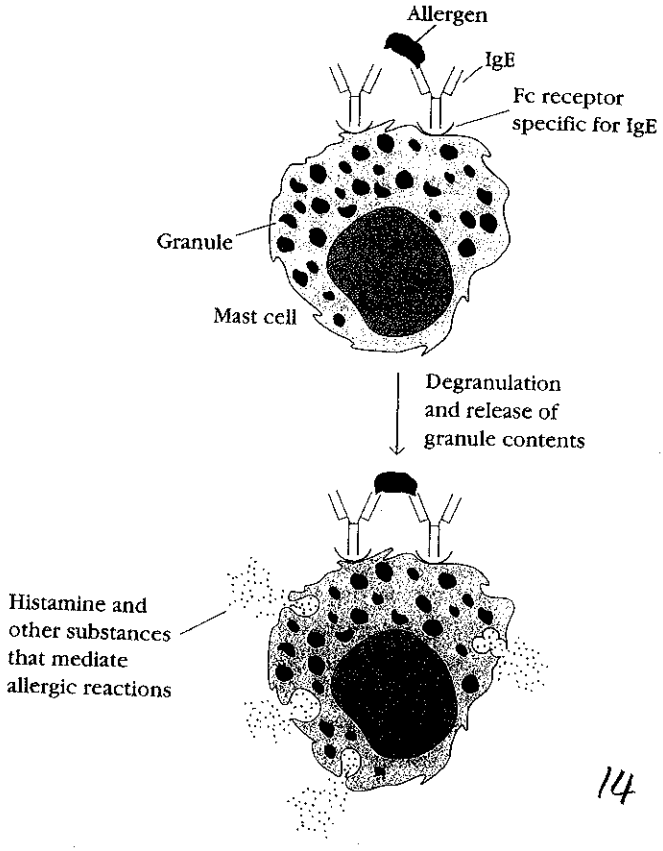
(a) Structure of secretory IgA



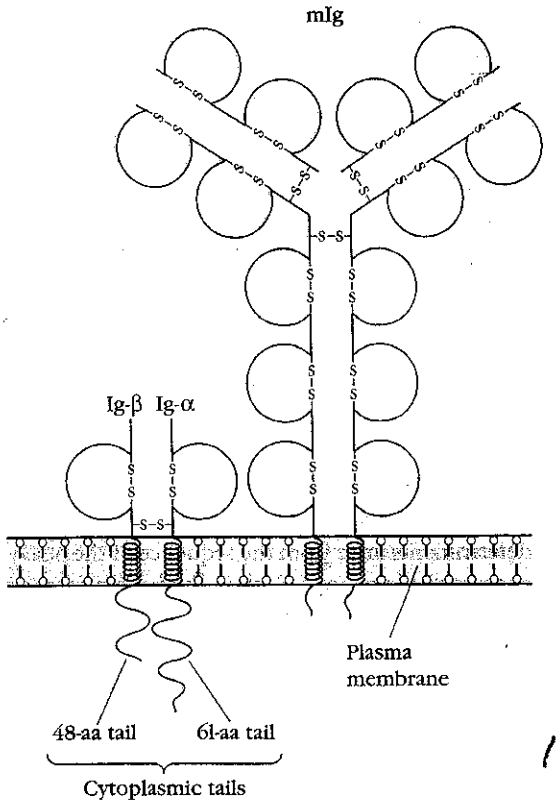
(b) Formation of secretory IgA



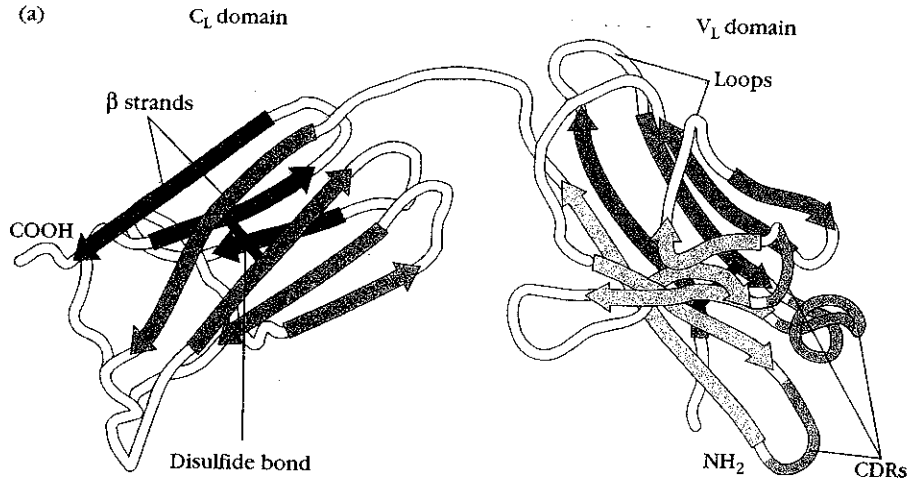
13

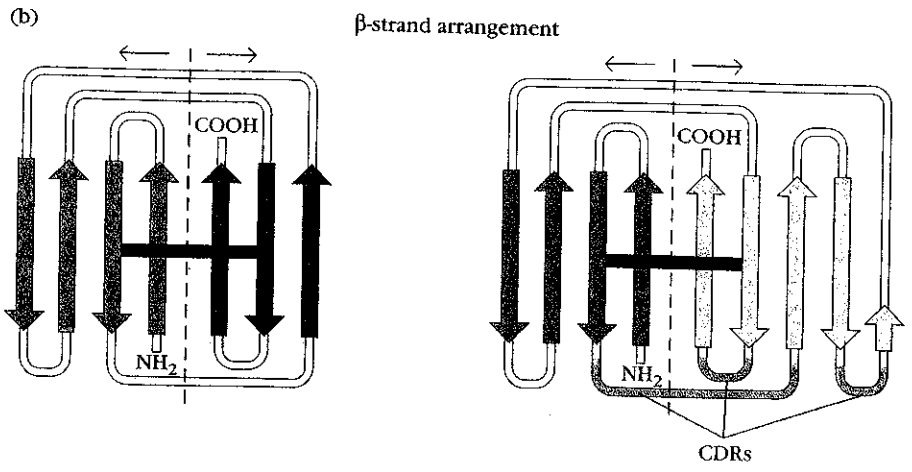


14


mIg
Ig-β
Ig-α
Plasma membrane
48-aa tail
61-aa tail
Cytoplasmic tails

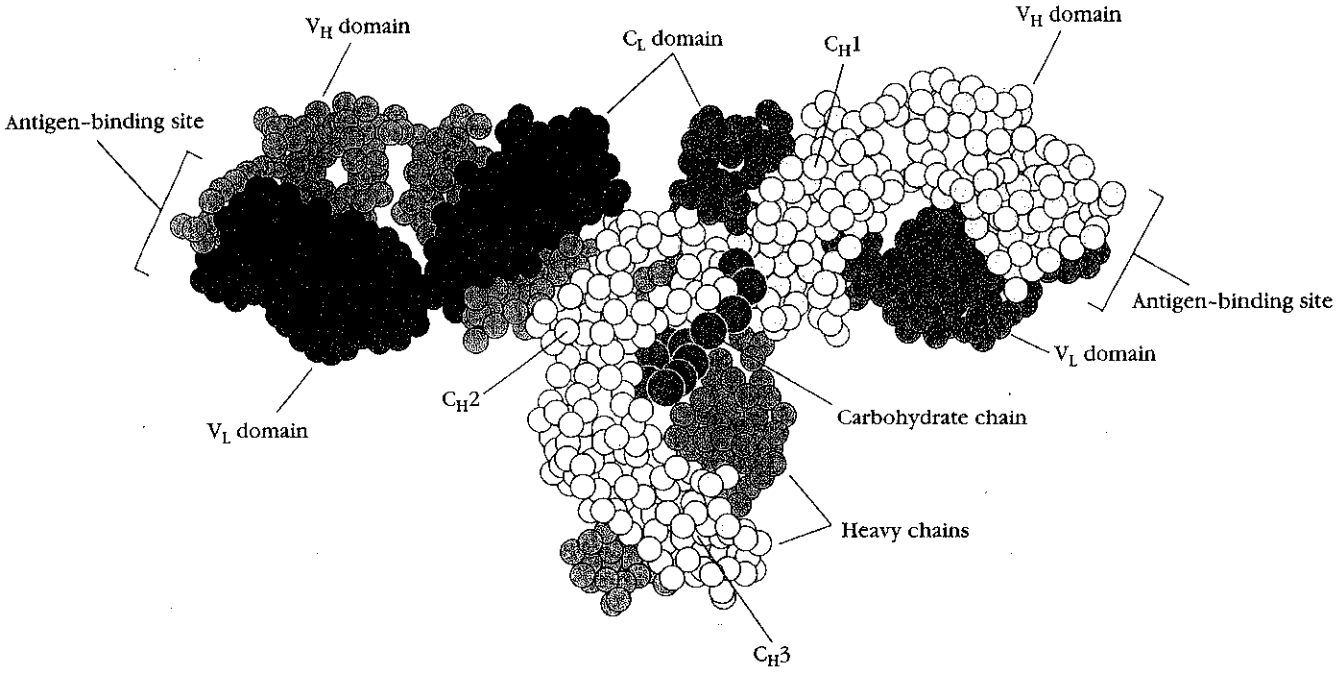
15


(a)
C_L domain
V_L domain
β strands
Loops
COOH
Disulfide bond
NH_2
CDRs

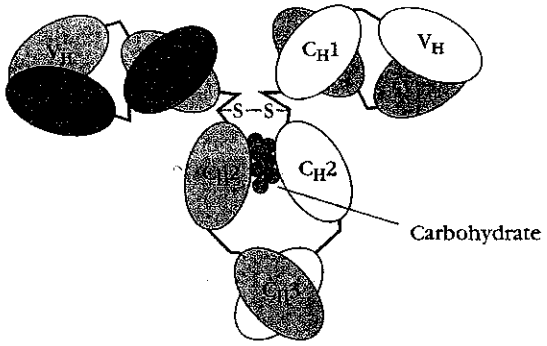

(b)
β-strand arrangement
COOH
NH_2
COOH
NH_2
CDRs

16

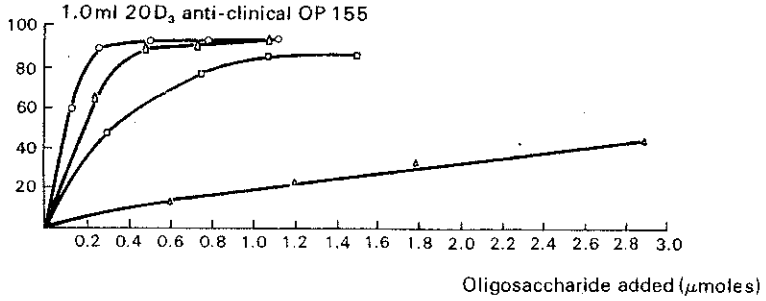
(a)


V_H domain
C_L domain
C_H1
V_H domain
Antigen-binding site
Antigen-binding site
V_L domain
C_H2
Carbohydrate chain
V_L domain
Heavy chains
C_H3

(b)

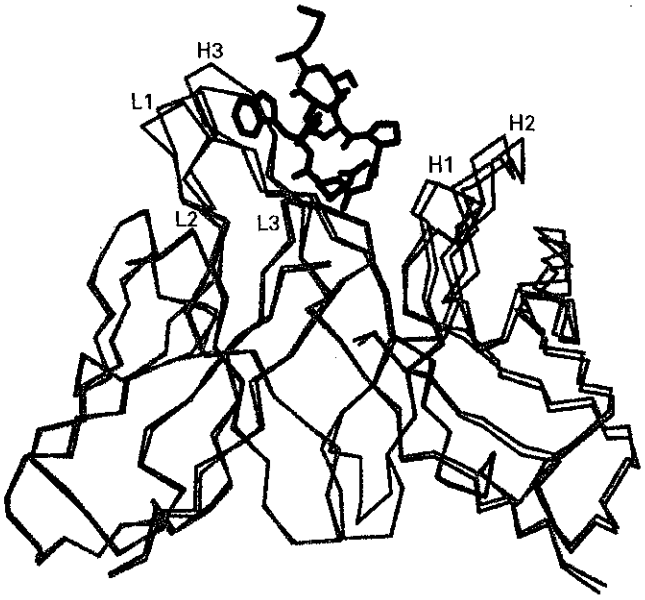

C_H1
V_H
S—S
C_H2
Carbohydrate
C_H3

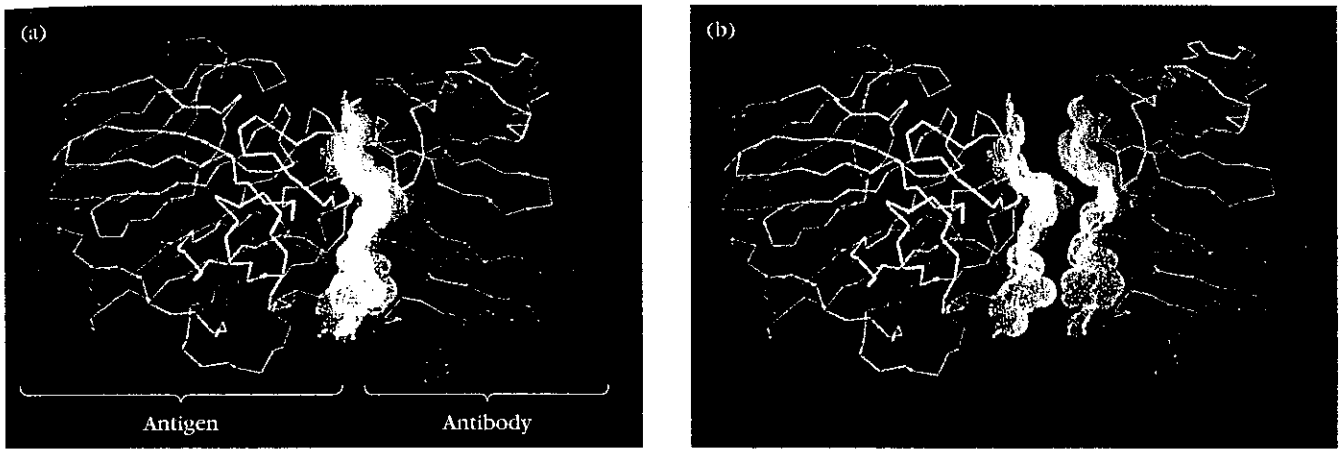
17


1.0ml 20D$_3$ anti-clinical OP 155
100
80
60
40
20
0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
Oligosaccharide added (μmoles)
Isomaltohexaose
Isomaltopentaose
Isomaltotetraose
Isomaltotriose

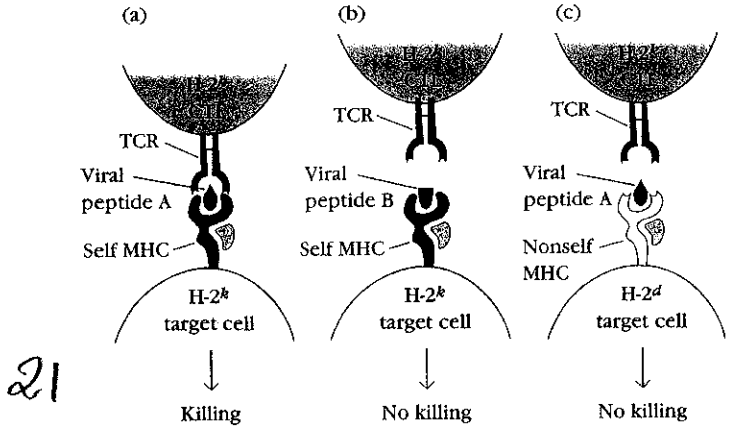
18

19

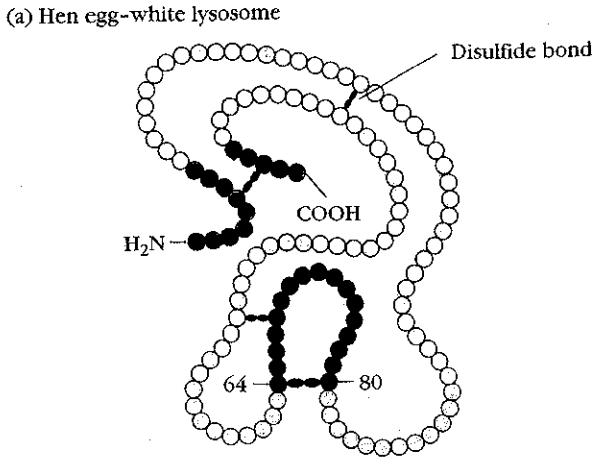

H3
L1
H2
H1
L2
L3


(a)
(b)
Antigen
Antibody

20

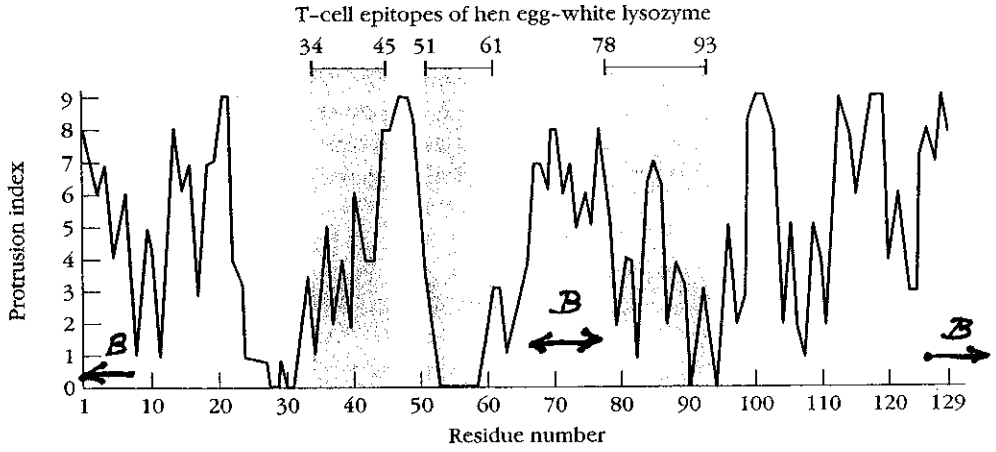

(a)
(b)
(c)
TCR
Viral peptide A
Self MHC
H-2k target cell
Killing
TCR
Viral peptide B
Self MHC
H-2k target cell
No killing
TCR
Viral peptide A
Nonself MHC
H-2d target cell
No killing

21

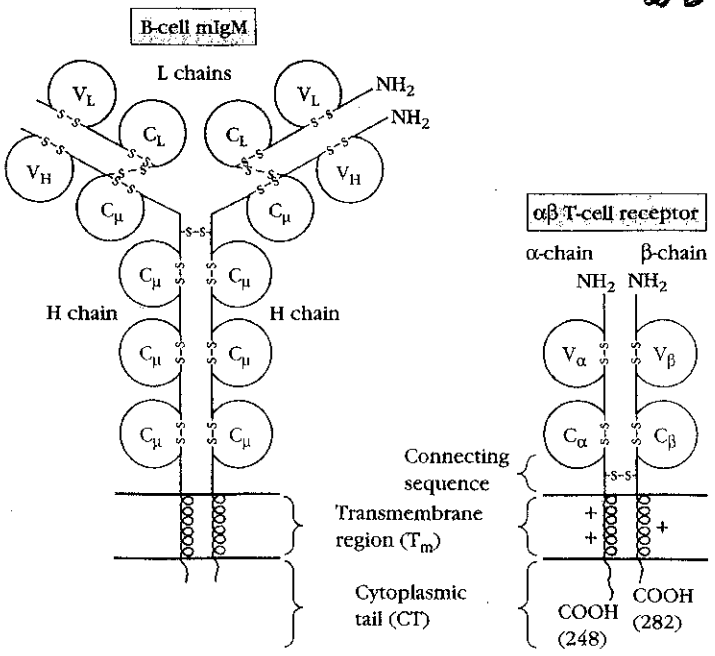

(a) Hen egg-white lysosome
Disulfide bond
COOH
H_2N
64
80

22a

22b


T-cell epitopes of hen egg-white lysozyme
34
45
51
61
78
93
Protrusion index
Residue number
B
B
B

23


B-cell mIgM
L chains
V_L
C_L
V_H
C_μ
NH_2
H chain
αβ T-cell receptor
α-chain
β-chain
V_α
V_β
C_α
C_β
Connecting sequence
Transmembrane region (T_m)
Cytoplasmic tail (CT)
COOH (248)
COOH (282)

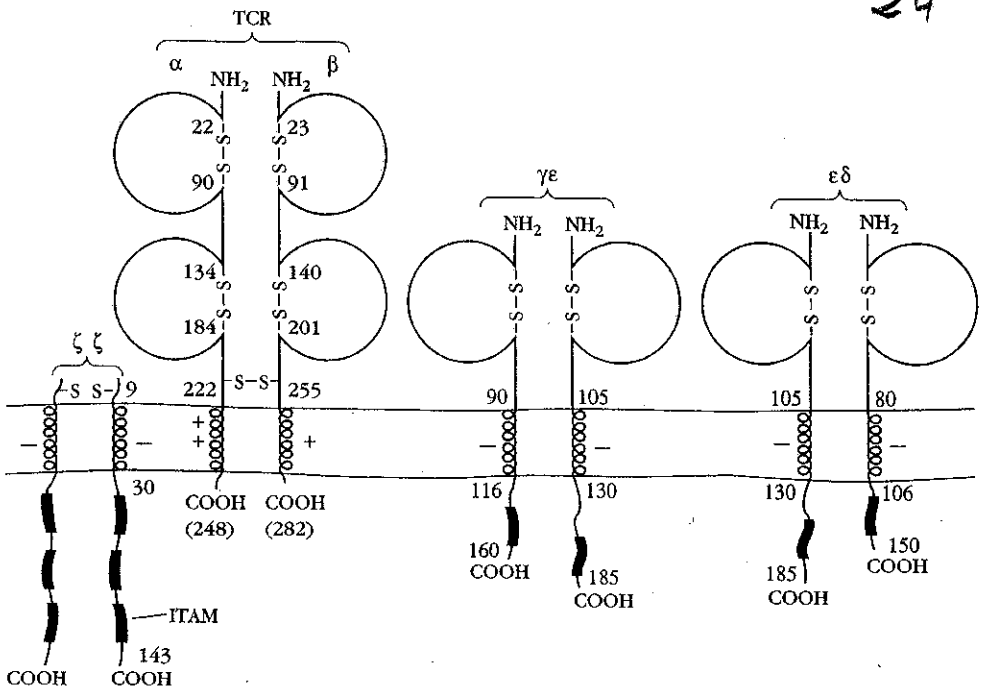
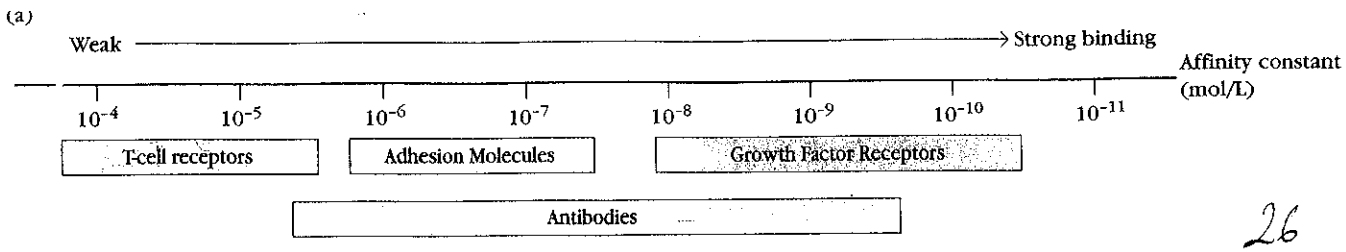


TABLE 9-1 Comparison of αβ and γδ T cells

Feature	αβ T cells	γδ T cells
Proportion of $CD3^+$ cells	90–99%	1–10%
TCR V gene germ-line repertoire	Large	Small
CD4/CD8 phenotype		
$CD4^+$	~60%	<1%
$CD8^+$	~30%	~30%
$CD4^+CD8^+$	<1%	<1%
$CD4^-CD8^-$	<1%	~60%
MHC restriction	$CD4^+$: MHC class II	No MHC restriction
	$CD8^+$: MHC class I	
Ligands	Peptide + MHC	Phospholipid antigen

SOURCE: D. Kabelitz et al., 1999, *Springer Seminars in Immunopathology* 21:55, p. 36.

25



26

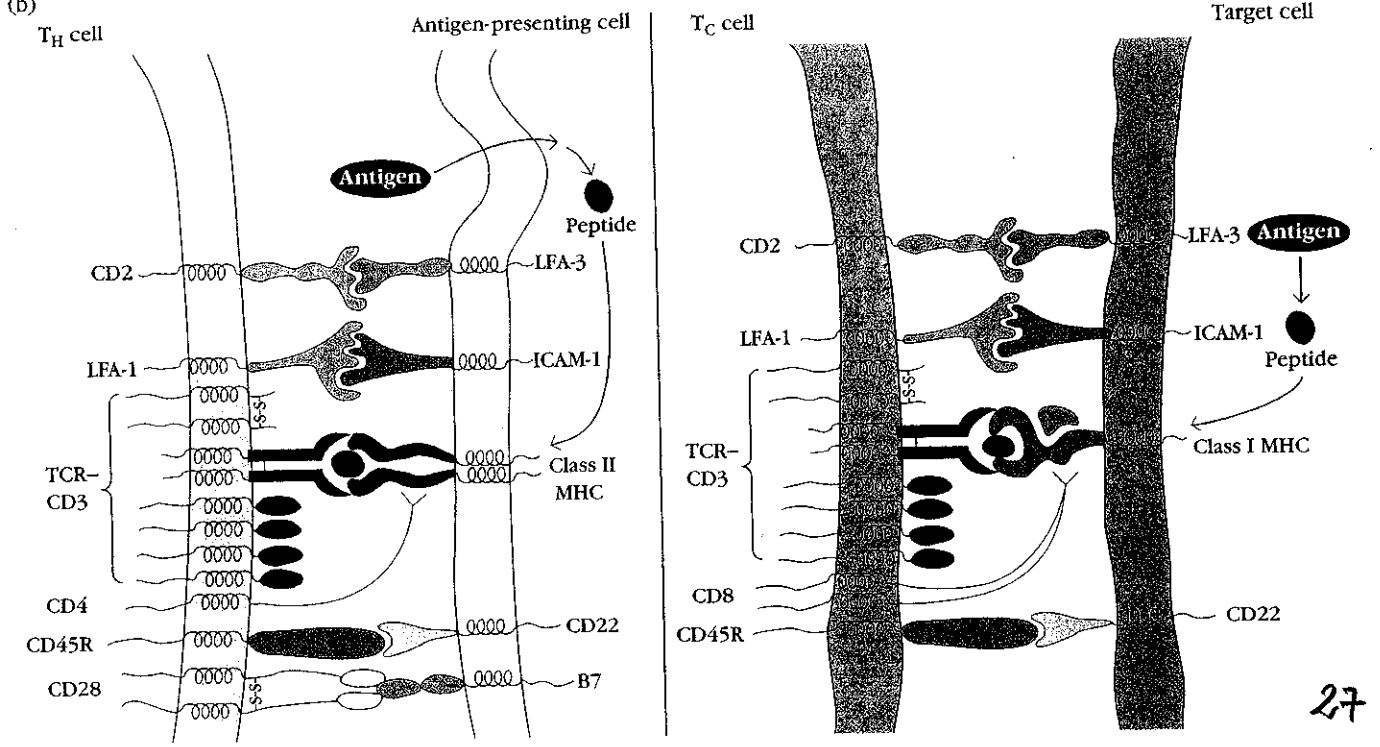


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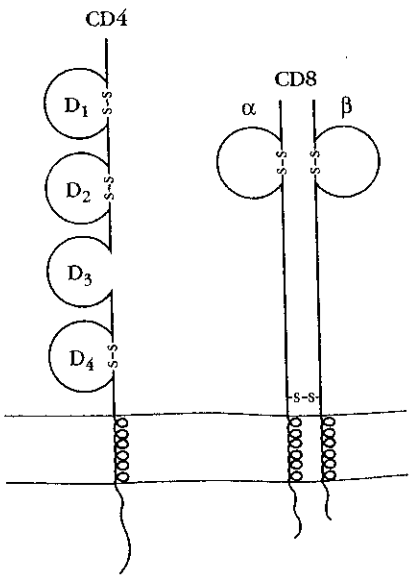
TABLE 9-4 Selected T-cell accessory molecules

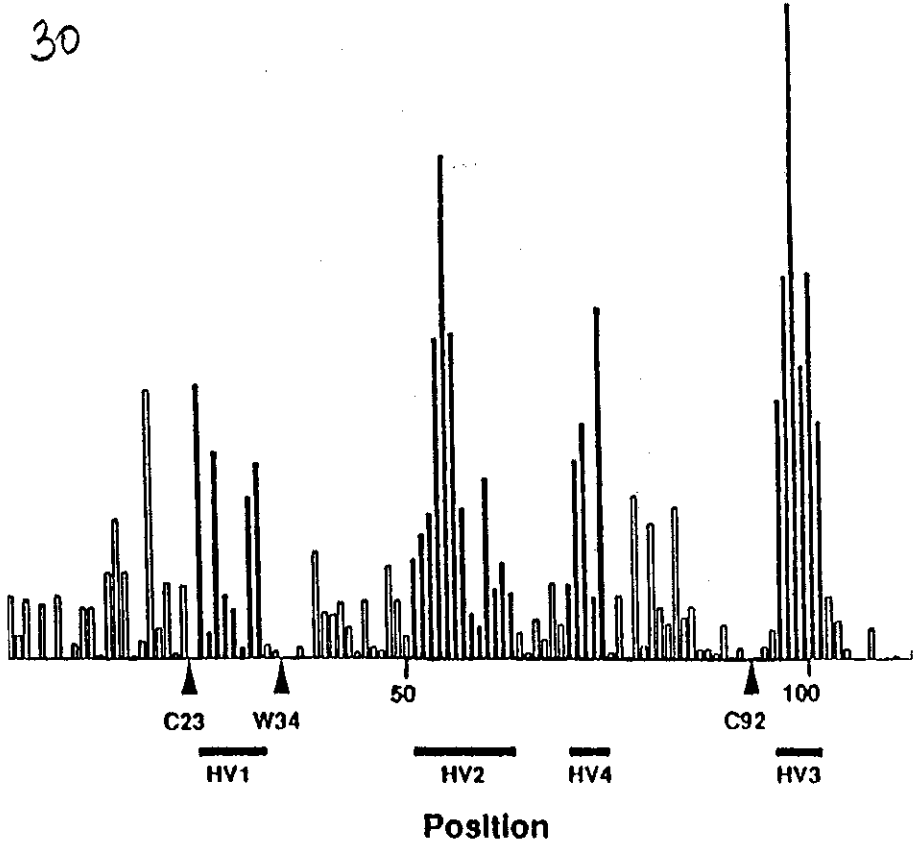
Name	Ligand	FUNCTION: Adhesion	FUNCTION: Signal transduction	Member of Ig superfamily
CD4	Class II MHC	+	+	+
CD8	Class I MHC	+	+	+
CD2 (LFA-2)	CD58 (LFA-3)	+	+	+
LFA-1 (CD11a/CD18)	ICAM-1 (CD54)	+	?	+/(−)
CD28	B7	?	+	+
CTLA-4	B7	?	+	−
CD45R	CD22	+	+	+
CD5	CD72	?	+	−

28

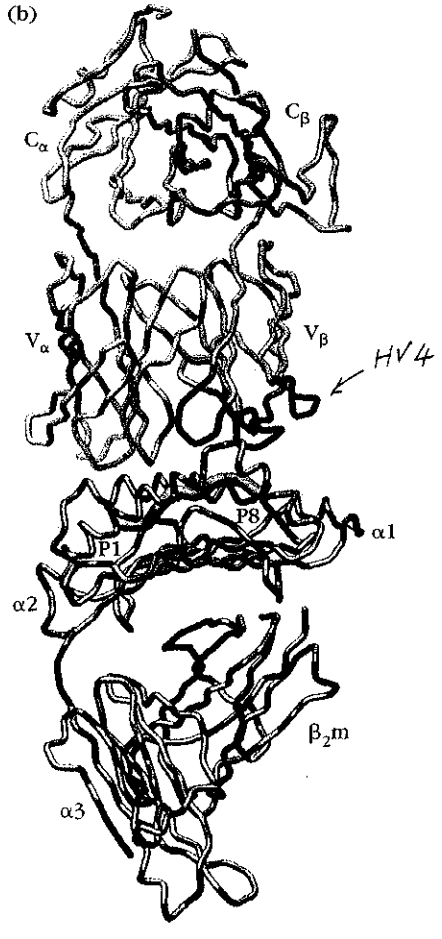


29

30


C23
W34
50
C92
100
HV1
HV2
HV4
HV3
Position

31


(b)
C_β
C_α
V_α
V_β
HV4
P8
P1
α1
α2
β_2m
α3