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Indian Institute of Technology Guwahati
BT304 Immunology

Name: Mangadliya Dhruv G.

Mid-Sem Exam

Roll No: 210106032

Marks: 40

Date: 19/09/2023

Duration: 2 hrs

SECTION A
(Questions 1 to 4)

Instructions: Answer questions 1-4 in the space provided in the question paper

1. Fill in the blanks with a suitable word. (0.5 × 10 marks)

- a. The five cardinal signs of inflammation are heat, pain, swelling, Redness and loss of function.
- b. Substances that cannot induce antibody formation by themselves but can react specifically with antibodies are called Incomplete Ag.
- c. IgA antibodies are called secretory antibodies due to their two remarkable properties of having J chain and Secretory component.
- d. Highly variable zones in an antibody that make contact with the epitope of an antigen are called as complimentarity determining Region (CDR).
- e. An antibody digested by Papain enzyme yields three fragments: two 50 kDa Fab fragments and one 50 kDa Fc fragment.

2. Match the words in Column A with Column B in the provided space. (0.5 × 10 marks)

Column A	Match	Column B
Type I interferon	G	A. IgE
Humoral innate immunity	B	B. Coagulation system
Langerhan cells	F	C. Helper lymphocytes
Plasma cells	I	D. Cytotoxic lymphocytes
Neutrophils	H	E. Alternate pathway of complement activation
Human Blood group	J	F. Skin
Basophils receptor	A	G. Antiviral response
Factor B	E	H. Granular leucocytes
CD4 T cells	C	I. Source of immunoglobulins
CD8 T cells	D	J. Alloantigen

O O
m p

3. Write True (T) or False (F) in the provided space.

(0.5 × 12 Marks)

- a. TLR can be present on the surface of the plasma membrane or in the endosomal membrane of the cellular component of the innate immune system. (T) ✓
- b. LPS and Flagellin are examples of pattern recognition receptors. (T) ✗
- c. Azurophilic granules are characteristic of neutrophils. (T) ✓
- d. Tissue remodeling is one of the effector functions of Macrophages. (T) ✓
- e. NK cells activate macrophages to kill phagocytosed microbes by releasing type I interferon. (T) ✓
- f. B cells can function as antigen-presenting cells. (F) ✗
- g. A protein of molecular weight less than 5 kDa is usually less antigenic. (T) ✓
- h. IgM can be transported from a healthy mother to a fetus by the placenta during pregnancy. (F) ✓
- i. MHC genes are polymorphic and co-dominantly expressed. (T) ✓
- j. The peptide binding cleft of MHC I can accommodate a maximum of 18-21 amino acids for presentation to T Cells. (F) ✓
- k. MHC is self-restricted to CD4 and CD8 T cells. (T) ✓
- l. T cell-independent antigen does not produce immunological memory. (T) ✓

4. Encircle the correct option based on the given statement.

(1×12 marks)

- i. Tissue damage caused by a wound or invading pathogenic organisms includes a complex sequence of events collectively known as
a. Opsonization
b. Phagocytosis
 c. Inflammation
d. None of these
- ii. Kupffer cells are macrophages found in
a. Liver
b. Lung
 c. Kidney
d. Bone
- iii. Innate immunity involves all except
a. Anatomic barriers ✓
b. Phagocytic ✓
c. Inflammatory mechanisms ✓
 d. Antibody production ✗
- iv. The immunoglobulins involved in host defence against parasitic infection (Helminths)
a. IgM ✗
b. IgG ✗
c. IgA ✗
 d. IgE
- v. The immunoglobulins present in secretions like tears, saliva, colostrums, etc
a. IgM
b. IgG
 c. IgA
d. IgE

- vi. Any agents that may stimulate the immune system and enhance the response without having any specific antigenic effect by itself.
- a. Antigen
 - b. Allergen
 - c. Adjuvant
 - d. Carriers
- vii. Any molecule that induces or elicits an immune response are
- a. Antigen
 - b. Immunogen
 - c. Antibodies
 - d. Epitope
- viii. Generally, antibodies present against a pathogen is
- a. Monoclonal
 - b. Polyclonal
 - c. Homogenous
 - d. All of the same specificity
- ix. Antibodies clear out antigens by
- a. Neutralization
 - b. Agglutination
 - c. Precipitation
 - d. all of these
- x. Any substances that promote phagocytosis of antigens by binding to them are called as
- a. Opsonins ✗
 - b. Phagocytosis ✗
 - c. Macrophages
 - d. Interleukins
- xi. Immunologic memory is provided by
- a. B cells
 - b. T cells
 - c. Both B and T cells
 - d. Phagocytes
- xii. The characteristic of passive immunity includes
- a. immediate relief ✓
 - b. no immunologic memory ✓
 - c. resistance for a short period only ✓
 - d. all of these

(4)

SECTION B
(Answer questions 5 to 10 in response sheets)

5. Describe the cytosolic and endocytic antigen presentation pathway to T cells. (2 marks)
6. Draw the classical pathway of complement activation and discuss the function of the complement system. (2 marks)
7. Compare and contrast the four types of antigen-binding molecules used by the immune system- antibodies, T-cell receptors, class I MHC molecules, and class II MHC molecules- in terms of the following characteristics.
 a. Specificity for antigen
 b. Cellular expression
 c. Types of antigen recognized (2 marks)

8. Compare the features of the T cell epitope with the B cell epitope in terms of structure, receptor, nature, size, and presentation. **(2 marks)**

9. Describe the following words from an immunological perspective. **(0.5 × 4 marks)**

a. Phagocytosis

b. Superantigen

c. Diapedesis

d. Acute phase proteins

10. Describe transcytosis with an example in the immune system. **(2 marks)**

Or

Draw the schematic structure of MHC I and MHC II molecules with proper labeling.

*****The END*****



Indian Institute of Technology Guwahati

MID/END SEMESTER EXAMINATION

NAME: Mangsholiya Dhruv ROLL NO.: 210106032

COURSE NO. & TITLE: BT304: Immunology

NO. OF SUPPLEMENTARY SHEETS ATTACHED: 0 DATE: 19.10.23

INSTRUCTIONS TO CANDIDATES

1. Please read carefully the examination related instructions overleaf.
2. Please write on both sides of a leaf.
3. Index all pages (excluding the cover page as well as overleaf instructions page) with page numbers 1, 2, 3, etc. and continue this numbering order across the Supplementary Sheets as well.
4. Pages used for rough calculations must also be attached to the answer book before submission.
5. Signature put by the student should match with the one on his/her Identity Card.

"I pledge my honour that, while writing this examination, I have neither taken assistance from others nor given assistance to others; and that I have not violated any of the 'Examination Related Instructions to Students' as stated on back-side of the page and those notified for this examination.

I also understand that if I am found to have done anything contrary to my pledge as expressed above, I shall be liable to be penalized by the Institute for the same."

Student's Signature:

Invigilator's Signature:

Examiner's Signature:

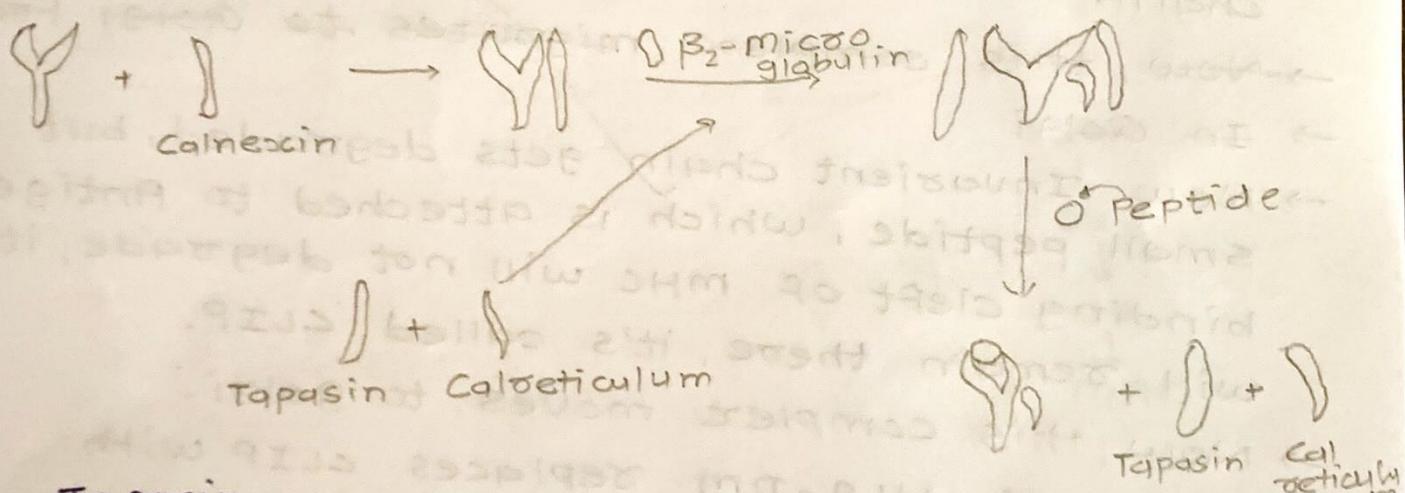
Q. No.	Answer Page No.	Marks
1		4.5 + 0.5
2		5
3		4.5
4		8
5		2
6		2
7		1.5
8		0
9		2
10		2
Total		30.5 + 0.5

Checked by - M.L.S

* Section: B *

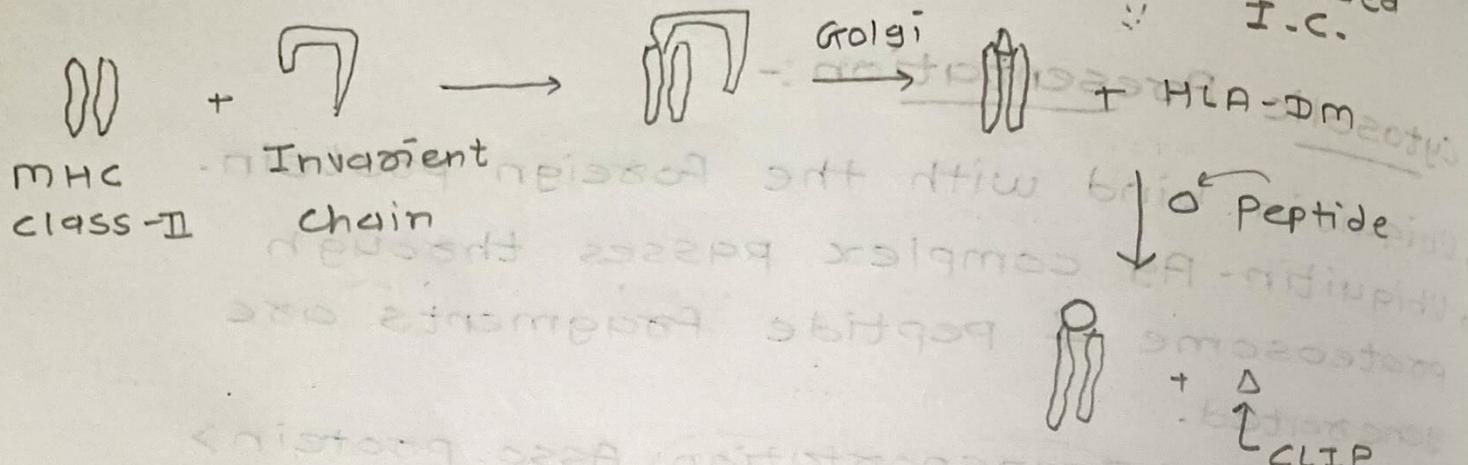
5) Cytosolic Presentation:-

- Ubiquitin bind with the foreign protein.
- Ubiquitin-Ag complex passes through proteasome & peptide fragments are generated.
- Now, TAP < Translocation Asso. Protein > uses ATP to send peptide fragment from ER to Golgi. into ER.



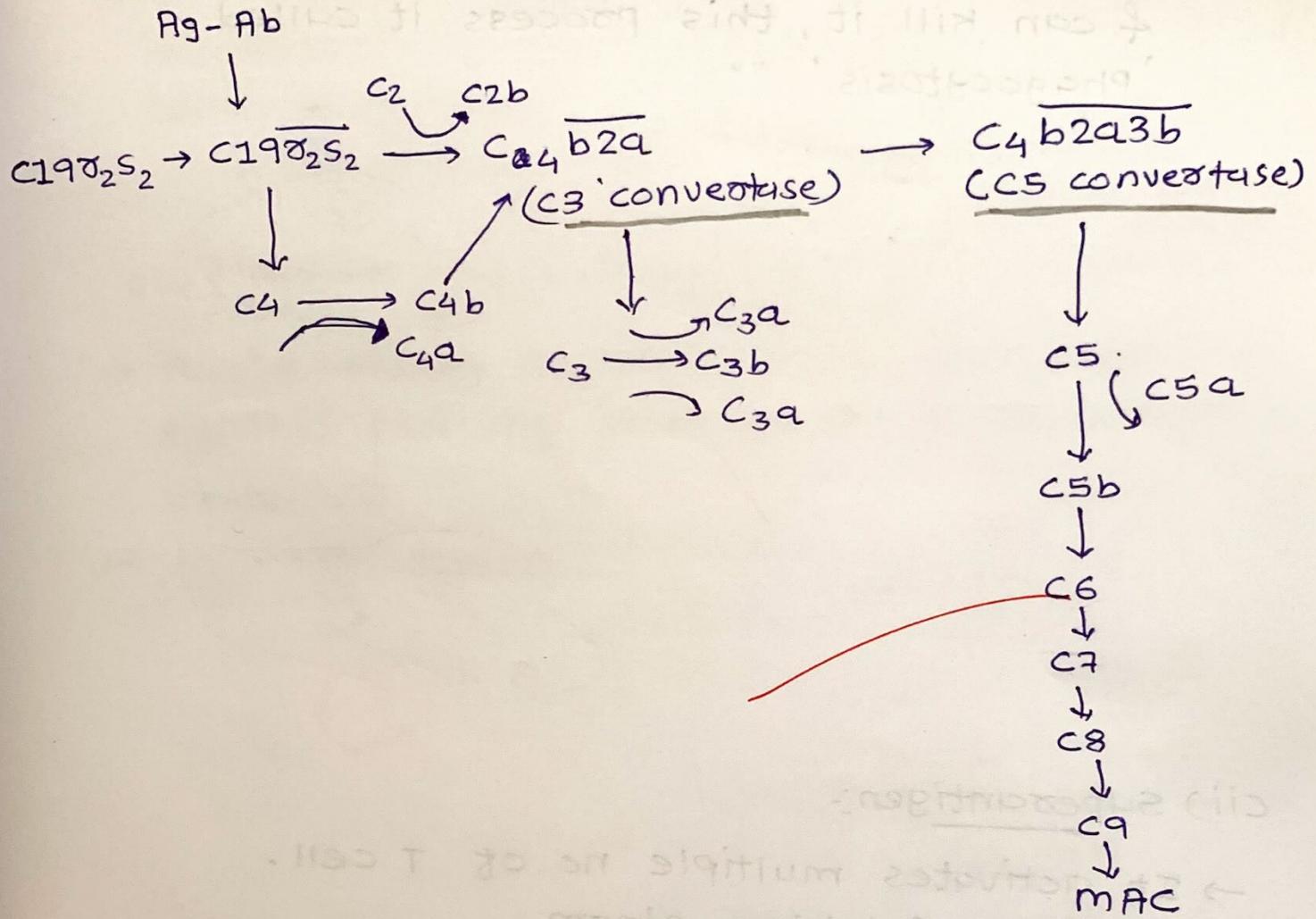
- ~~Calmexin~~ help MHC-I molecule & peptide to come closer.
- Tapasin Calnexin makes sure that MHC-I is in correct conformation.
- Calreticulum helps B₂-Microglobulin to bind to MHC-class-I molecule.
- Now, Peptide gets attached & Tapasin & calreticulum gets dissociated. (In Golgi)
- MHC-Ag complex is ready for presentation to T cell, so it migrates to T-cell via Golgi.

• Endocytic Ag Presentation:-



- In ER, MHC class-II gets attached to invariant chain.
- Now, this complex migrates to Golgi from ER.
- In Golgi
- Now, Invariant chain gets degraded, but small peptide, which is attached to Antigen binding cleft of MHC will not degrade, it will remain there, it's called CLIP.
- Now, this complex moves to Golgi.
- In Golgi, HLA-DM replaces CLIP with Antigen peptide.
- Now, MHC class-II molecule will migrate to T-cell.

6) • Pathway:-

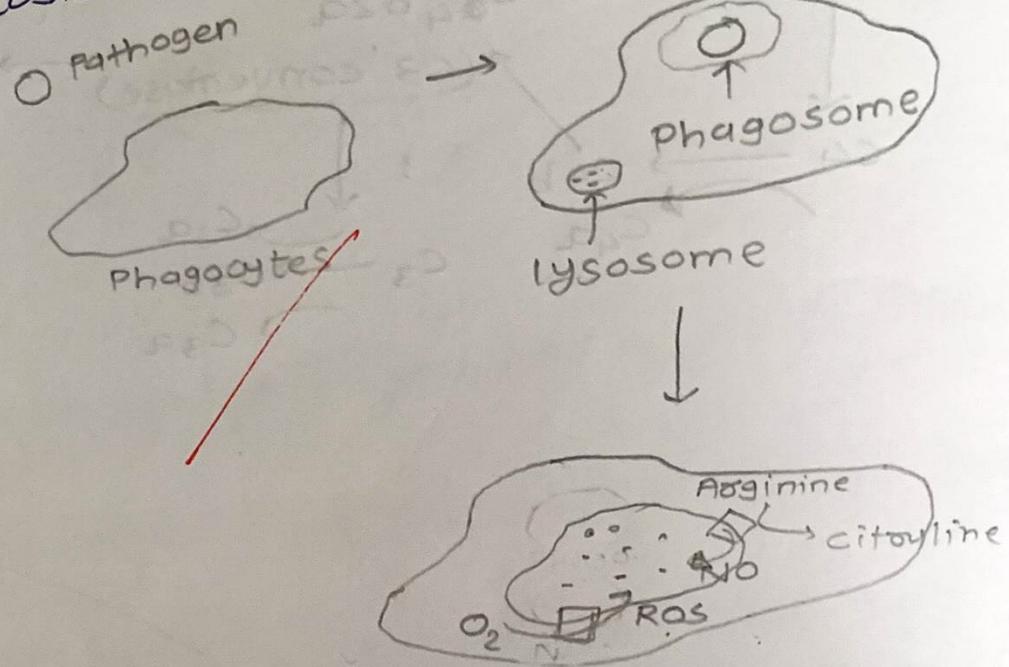


- ⇒ Function:-
- i > opsonization
 - ii > lysis
 - iii > Acti. of inflammatory response.
 - iv > clear imm. components.

②

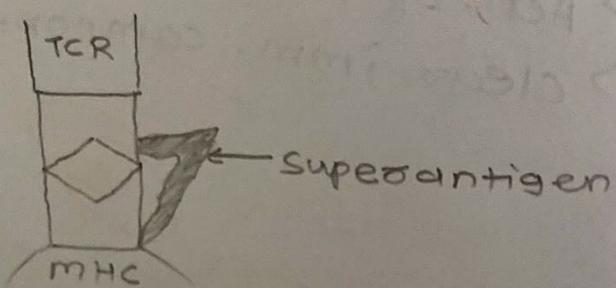
8. Compare the features of ~~micro~~ nature, size, and
Describe ~~micro~~

Q) (ii) Phagocytosis:-
→ Phagocytes can engulf ~~micro~~ Antigen & can kill it, this process is called 'Phagocytosis.'



(iii) Superantigen:-

- It activates multiple no. of T cell.
- Creates Cytokine storm.
- Cause T-Cell deletion.
- Normal antigen: Activates $0.000001\text{-}1$ T-cell
- Superantigen : Activates $\checkmark 2\text{-}1$ T-cell



ciii) Diapedesis :-

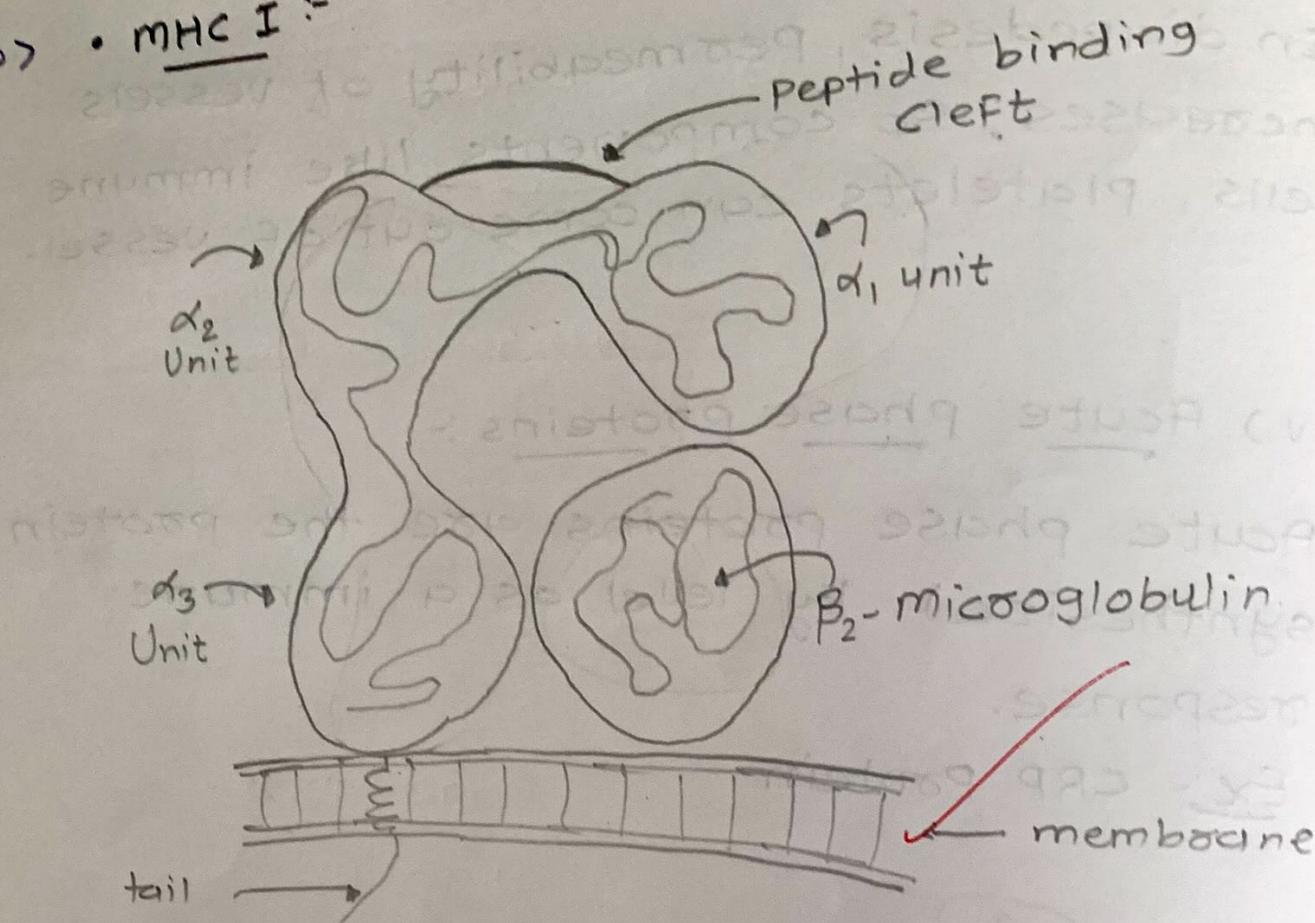
→ In diapedesis, permeability of vessels increases. So components like immune cells, platelets can come ~~out of~~ vessel.

civ) Acute phase proteins :-

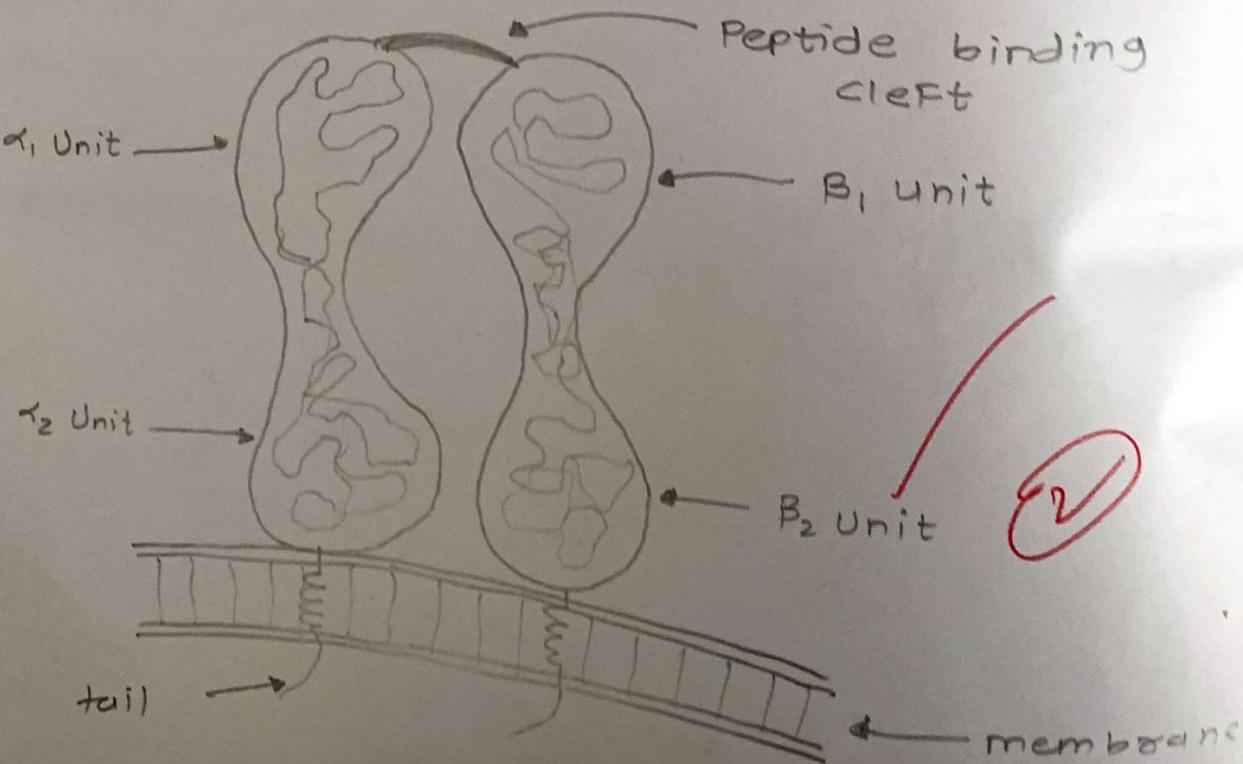
- Acute phase proteins are the protein synthesized by liver as a immune response.
- Ex:- CRP Protein

(2)

107 • MHC I :-



• MHC II :-



7) (a) specificity for antigen:-

→ A antibody can bind to multiple Antigen.

→ class-I & class-II molecules can also bind to multiple type of Ag.

→ TCR is very specific, for antigen.

(c) Type of antigen recognised:-

→ Antibody can recognize both exogenous or endogenous antigen.

→ class-I: Endogenous Ag only.

→ class-II: Exogenous Ag only.

→ TCR: Endogenous Ag only.

(b) cellular Expression:-(which cell each molecules are expressed?)

→ Antibodies binds with the antigen & present it to imm. cells.

→ MHC class-I mole. binds with endogenous Ag & present it to T-cell.

→ MHC class-II mole. binds with exogenous Ag & present it to B-cell, ~~or other~~

→ TCR recognise class-I MHC molecules & shows immune response.

(1.3)

8) B cell epitope :-

- Smaller than T cell epitope C8 ~~X~~ 10 aa
- Binds with the MHC class-II molecules Antigen.
- Short in length. ~~X~~

T cell epitope :-

- 13-18 aa long.
- Binds with MHC C-I molecules
- long in length. ~~X~~

(10)