PAZHASSIRAJA COLLEGE
PULPALLY P.O.
WAYANAD

COMPREHENSIVE COURSE PLANNER (CCP)

COURSE	Immunology.
PROGRAMME	M.Sc Microbiology.
ACADEMIC YEAR	2023 - 24

PAZHASSIRAJA COLLEGE, PULPALLY

COMPREHENSIVE COURSE PLANNER (CCP)

Course Details	
Course Code and Title	MBG2C08 ; Immunology.
Semester	II
Academic Year	2023 - 24
Department and Programme	Microbiology PG , M. Sc
Batch and Year of Admission	2023 - 25 admission
Applicable University Regulation	PG regulation , 2020

Faculty Details	
Name	**Email and Mobile Number**
Dr. Sreedevi. R	sreedevisamachandran2007@gmail.com
	sreedevi@prc.ac.in
	8281633299

ICT platforms	
ICT platform used for the Course	**Details (Code/Link etc)**
Google classroom	
Edmodo	
Moodle	
Any other (Specify)	

ASSESSMENT PATTERN

Assessment	Percentage	Marks
Internal	20	5 wt
External	80	30 wt
Total	100	150 wt

Internal Assessment

Criteria	Percentage	Marks
Internal Examination/Test paper/Viva	40	2 wt
Assignment	20	1 wt
Seminar	20	1 wt
Class room participation based on attendance	20	1 wt
Any other (specify)		
Total	100	5 wt

External Assessment

Duration of Examination	3 hours.
Total marks	30 wt. (150 marks)

Question type	No. of Questions	Mark per Question	Total marks
Short Answer/Multiple Choice	4 out of 6	2 wt	8 wt
Paragraph/Problem type	4 out of 6	3 wt	12 wt
Essay type	2 out of 4	5 wt	10 wt
Any other (Specify)			
		Total	30 wt.

Course Objectives

In file (Syllabus)

Course Outcomes

In file (Syllabus)

Action Plan based on University/ College/ Department Calendar	
Date/ Period	**Milestones/Activity**
1.2.2024	Commencement of the Semester
26.6.2024	I Internal Examination
	Publishing of APC in the Notice Board
	Grievance redressal related to APC
	Final Submission of APC and Registration for University Semester Examination
	II Internal Examination
	Publishing of Internal Marks in the Notice Board
	Grievance redressal related to Internal Marks
	Final submission of Internal Marks
	University Semester Examination
	Publishing of Results

Time Table for the Course					
	I	II	III	IV	V
Monday					
Tuesday		MMB1			MMB 1
Wednesday		MMB1			
Thursday	MMB1				
Friday		MMB1	MMB1-P	MMB1-P	MMB1-P

COURSE PLAN

Week	Unit/Contents	Resources	Additional Activities
1	Unit 1	Ananthanarayanan & Paniker - Microbiology Immunology - Kuby.	
2	Unit 1	"	
3	Unit 1	"	
4	Unit 2	"	
5	Unit 2	"	
6	Unit 2	"	

COURSE PLAN

Week	Unit/Contents	Resources	Additional Activities
7	Unit 3	"	
8	Unit 3	"	
9	Unit 3	"	
10	Unit 3	"	
11	Unit 4	"	
12	Unit 4	"	

COURSE PLAN

Week	Unit/Contents	Resources	Additional Activities
13	Unit 4	"	
14	Unit 4	"	
15	Unit 5	"	
16	Unit 5	"	
17	Unit 5	"	
18	Unit 5.	"	

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COURSE DELIVERY AND ASSESSMENT

Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
1/3/24	II	Immunity	Lecturing	
5/3/24	II	Innate and acquired immunity	"	
"	V	Vaccines	"	
6/3/24	II	Antigens	"	
7/3/24	I	Antibodies - Properties & structure	ppt	
12/3/24	II	Antibody types & properties	"	
"	IV	Monoclonal Ab production - Hybridoma technology	"	
13/3/24	II	Overview of lymphoid system	"	
14/3/24	I	Haematopoiesis	"	

Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
2/4/24		T-cells	"	
2/4/24		B-cells	"	
3/4/24		Lymphocyte trafficking	"	
4/4/24		Toll-like receptors	"	
5/4/24		1° lymphoid organ - Thymus	"	
5/4/24		Bone marrow	"	
9/4/24		2° lymphoid organ - lymph node	"	
9/4/24		Spleen	"	
9/4/24		MALT, BALT, GALT, CALT	"	

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Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
11/4/24		Cytokines - biological functions	"	
11/4/24		Cytokines - types	"	
15/4/24		Cell-mediated immune response	"	
15/4/24		Humoral immune response	"	
15/4/24		1° immune response	"	
15/4/24		2° immune response	"	
16/4/24		Intracellular & extracellular antigens	"	
16/4/24		Processing and presentation of intracellular ag.	"	
16/4/24		" " "	"	

Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
		extracellular Ag.		
17/4/24		Theories of immune response	"	
19/4/24		MHC - I	"	
19/4/24		MHC - II	"	
22/4/24		Ag-Ab reac^{n} - Precipelation reac^{n}	"	
		"		
23/4/24		Ag-Ab reac^{n} - Agglutination reac^{n}	"	
24/4/24		Complement system - Classical	"	
		" - Alternate		
		" - Lectin		

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Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
25/4/24		CFT	"	
26/4/24		Hypersensitivity - I	"	
		" - II		
		" - III		
		" - IV		
29/4/24		Autoimmune disease - Systemic	"	
30/4/24		" - Organ specific	"	
2/5/24		Immunodeficiency diseases	"	
3/5/24		Transplantation immunology	"	
6/5/24		GVH & GVH reaction	"	
7/5/24		Immunohaematology	"	

Course Delivery

Date	Hour	Topics	Pedagogy	Additional Activities
8/5/24		Blood transfusion	"	
8/5/24		Rh incompatibility	"	
9/5/24		Haemolytic disease of newborn.	"	
10/5/24		Tumour immunology	"	

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Remedial Activities for Slow Learners

Date	Activity /Topic of Discussion	Beneficiary Students
	Group study	Navyasree Aiswarya mol Anshila
	Exam scoring tips	"
	More comprehensions and important topic notes	"
	QP discussion Imp question discussion	"

Note: if needed attach extra sheets

Additional Activities for Advanced Learners

Date	Activity /Topic of Discussion	Beneficiary Students
	Debating & Critical thinking on Subject topics	Nitha Shimna Balabha Surya
	Peer team learning	"
	QP solving	"
	Extra reading	"

Note: if needed attach extra sheets

Assignment / Seminar details

Name of the student	Seminar Topic	Assignment Topic	Remark by faculty
Usha. C	Precipitation reaction		
Durga Lakshmi	Humoral & cell mediated immune response		
Surya SK	Agglutination reaction		
Vangasree VS	MHC & its types		
Shivana V	Precipitation reactions		Good
Sabalba DS	Hypersensitivity I & II		
Veebasa MP	Hypersensitivity III & IV		
Abessee K	MHC restriction		

Assignment / Seminar details

Name of the student	Seminar Topic	Assignment Topic	Remark by faculty
Aiswarya Mol S	Immunohaematology -	ABO & Rh blood group	Good.
Anshila	Blood transfusion		
Sheesy Sherin PV	Haemolytic disease of incompatibility	newborn & Rh	
Athulya	GVH reac^n & HVG reac^n		
Selja. M	Theories of immune	response	
Divya Prakash S	Autoimmune disease - Systemic		
Ayisha Thabasum	Immunological tolerance		

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Assignment / Seminar details

Name of the student	Seminar Topic	Assignment Topic	Remark by faculty
Aleena Joseph	Agglutination reactions		Good
Febina Sherin	Transplantation immunology graft acceptance & mechanism of graft reject.	- Types of graft,	
Shamila Bithasa M	Autoimmune disease- Local		
Melvin George	Immunodeficiency diseases-		
Sidharth P	Tumour immunology		

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COURSE APPRAISAL

Marks in Internal Examinations (50) C150

No	Name of the Student	Marks in I internal		Marks in II internal		Remarks by the Faculty
1	Neha. C	37	3.7	128	4.27	7.97
2	Arya Lakshmi	26	2.6	Ab	3.5	6.1
3	Surya SK	41	4.1	120	4	8.1
4	Navgassee US	33	3.3	Ab	3.9	7.2
5	Shimna V	39	3.9	129	4.3	8.2
6	Shalalba DS	43	4.3	128	4.27	8.57
7	Neebasa MP	30	3.0	77	2.57	5.57
8	Anusree K	36	3.6	82	2.73	6.33
9	Aiswarya Mol S	23	2.3	56	1.87	4.17
10	Aashiba	30	3.0	105	3.5	6.5
11	Shensy Sherin PV	31	3.1	110	3.67	6.77
12	Athalya	37	3.7	111	3.7	7.4
13	Belja. M	39	3.9	116	3.87	7.77
14	Diya Prakash S	33	3.3	89	2.93	6.23
15	Ayesha Thabasin. K	24	2.4	73	2.43	4.83
16	Meena Joseph	39	3.9	128	4.27	8.17
17	Febina Sherin	30	3.0	Ab	3.8	6.8
18	Shamila Sithara M	31	3.1	88	2.93	6.03
19	Melvin George	32	3.2	86	2.87	6.07
20	Sidharth. P	21	2.1	38	1.27	3.37

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Name of the student	Register Number	Internal Examination*	Assignment*	Seminar*	CRP*	Total*
Neha. C		7.97	5	4.8	5	22.7 4.54
Aryalakshmi		6.1	5	4.5	5	20.6 4.12
Surya. S.K		8.1	5	4.8	5	22.9 4.58
Anusree		~~7 26.33~~	5	4.5	5	21.7 4.3 16
Shinna. V		8.2	5	4.8	5	23 4.6
Salabha DS		8.57	5	4.8	5	23.37 4.67
Neehara MP		5.57	5	4.8	5	20.37 4.07
Aiswarya Mol S		~~6.33~~ 4.17	5	4.7	5	21.03 ~~4.20~~ 3.77
Anshiba		~~4 17~~ 6.5	5	4.7	5	18.87 ~~3.40~~ 4.2
NavyaSree		~~6.5~~ 7.2	5	4.5	5	21 4.3
Sherry Sherin PV		6.77	5	4.7	5	4.29
Athulya		7.4	5	4.87	5	4.45
Selya. M		7.77	5	4.7	5	4.49
Diya Prakash S		6.23	5	4.8	5	4.25
Ayisha Thahasin K		4.83	5	4.7	5	3.9
Aleena Joseph		8.17	5	4.8	5	4.59
Felusia Sherin		6.8	5	4.7	5	4.3
Shamila Sitbara M		6.03	5	4.7	5	4.14
Melvin George		6.07	5	4.7	5	4.15

Internal Assessment Marks

Name of the student	Register Number	Internal Examination*	Assignment*	Seminar*	CRP*	Total*
Sidharth P		3.37	5	4.7	5	3.16

Internal Assessment Marks

Name of the student	Register Number	Internal Examination*	Assignment*	Seminar*	CRP*	Total*

*For courses with 2 or 3 credits the split up will be 6, 3, 3, 3 and total of 15, *For courses with 4 credits the split up will be 8, 4, 4, 4 and total of 20

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Final Marks

Reg. No.	Name of the Student	Marks ( )*	Grade
	Neha C		
	Arya Lakshmi		
	Surya SK		
	Vaigasree VS		
	Bhima V		
	Balabha DS		
	Neehara MP		
	Anusree K		
	Aiswarya Hari S		
	Joshiba		
	Sheney sherin PV		
	Athulya		
	Selja M		
	Divya Prakash. S		
	Ayisha Shabarin. K		
	Meena Joseph		
	Febria Sherin		
	Shamila Sethara M		
	Melvin George		
	Sidharth P		

*Specify total Marks

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Review on Course delivery

Elements of the course that worked well
Well-defined Syllabus.

Student feedback related to Curriculum/Resources/ Study materials
Satisfactory

Modifications based on feedback made to Course materials/Course delivery/Assessment
More class tests on important topics. Stimulatory classes added

Suggestions for Curriculum enrichment, Future Delivery and Timescale for Implementation:
Need to include recent advancements in the subject

Signature of Faculty

Signature of HoD

Name and Signature of the Faculty	Name and Signature of the HoD
Sreedevi Dr. Sreedevi. R.	Vijisha MC Dept

IQAC Coordinator	Principal
Coordinator IQAC Pazhassiraja College Pulpally, Wayanad	ASSISTANT PROFESSOR IN-CHARGE OF PRINCIPAL PAZHASSIRAJA COLLEGE PULPALLY - 673579

PAZHASSI RAJA COLLEGE
Date.....
PULPALLY WAYANAD-673579

Appendix I : *Syllabus*
Appendix II : *Previous years Question papers*
Appendix III : *Attendance of students for the course (from the ERP)*
Appendix IV : *Question Paper of the I and II internal Examination*
Appendix V : *Question paper of the University Semester Examination*

Pazhassiraja College, Pulpally
Department of Microbiology
II M. Sc Microbiology
Internal Examinations, July 2022
MBG2C08 Immunology

Time: 2.5 hrs **Marks: 50**

Section A (Answer any 10 questions)

1. TLR
2. Live and attenuated vaccines
3. Hematopoiesis
4. Memory cells
5. Epitope and paratope
6. MHC
7. CD4 and CD8
8. GALT
9. Di Georges syndrome
10. Functions of T cells
11. Phagocytic cells
12. Enzyme digesion of immunoglobulins

(10x2= 20 marks)

Section B (Answer any 4 questions)

13. Hybridoma technology
14. Vaccines
15. Intracellular and Extracellular antigen presentation
16. Types and Functions of T cells
17. Secondary lymphoid organs
18. Clonal selection theory

(4x5=20 marks)

Section C (Answer any one question)

19. Write a detailed note on structure and classification of Immunoglobulins.
20. Write a detailed note on MHC.

(1x 10= 10 marks)

Name:.....
Register number.....

PAZHASSIRAJA COLLEGE, PULPALLY
Department of Microbiology
Third Semester Internal Exam- December 2023
MBG3C09. Medical Microbiology

Time: 3hrs **Weightage- 30**

Section A
Answer any **FOUR** of the following

1. Ouchterlony's Double immune diffussion
2. HVG reaction
3. Bombay blood group
4. Immuno-deficiency diseases
5. MBL
6. Factor D
7. D and J locus

10 Marks

(4x2=8)

Section B
Answer any **FOUR** of the Following

1. Lectin pathway of complement system
2. Tumour immunology
3. Immunoglobulin Diversity.
4. CFT.
5. Immunodiffusion in gels.
6. Any three immunodeficiency diseases.
7. Immunohaematology.

15 marks

(4x3=12)

Section C
Answer any **TWO** of the Following

1. Precipitation and agglutination reactions.
2. Complement system.
3. Graft acceptance and rejection.
4. Tumour immunology.

25 marks

(2x5=10)

Shimna.V
1st MSc Microbiology.

120/150

Immunology.

Section-C

3. Graft-acceptance and rejection

Transplantation is a transplant or implant a tissue from one individual to other. The transplanted tissue called transplant/ graft

- Who donate the tissue called donor
- Who accept the tissue called recepient.

Transplantation Immunology is the study of immune response in a graft.

- Different type graft

a) Autograft: Self tissue transfer from one body site to other site.

b) Isograft: Syn graft The transplant of tissue from identical individuals in a same species.

c) Allograft: Different individuals in a same species.

d) Xenograft: transplant between 2 different species.

Graft acceptence

The tissue / cells / organs are transplant, take in a genetically identical individuals of same species, the graft transplanted. There is no immune response after the transplantation because the Ag of host and graft having same. So there no problem.

- So it lead to the graft acceptence.
That is graft alive, and healthy in a individual (host)
- And the donor also not infected.

Graft rejection

. The transplantation take place in a two different genetically individu
. There is formation of immune response
. Because Ag of host and graft is different so these immune response occur
. At that time the graft is not healthy and alive. It become decay, and death. It leads to graft rejection.

Graft rejection mainly two types

1) Host versus graft rejection
2) Graft versus host rejection

① Host versus graft rejection (HVG)

Here the after the transplantation the Ag contain graft it produce a immune response in host and leads to the rejection of graft.

Allograft rejection

The distinct genetically individual in a same species undergo transplantation the rejection take place because the Ag of host and graft is different
So the graft is decay and death. So, it rejected.
mainly happens in kidney transplantation.

There are mainly 3 type.

① Acute allograft rejection
② Hyper acute allograft rejection
③ Chronic allograft rejection

① Acute allograft rejection:

- It mainly happens after 1 week of graft transplantation.
- It happens vascular and parenchymal injury due to the cell and antibodies.
- It mainly 2 types.

⇒ Early Acute allograft rejection.

It happens - after months of transplantation

Stimulated by, T lymphocyte and cell mediated immunity.

⇒ Late acute allograft rejection

It happens too later the transplantation

Stimulated by B-lymphocyte and humoral immunity.

② Hyper acute allograft rejection:-

- It happens within minutes to hours.
- Vascularisation against graft. Here rapid degradation of vascularization
- Mainly, affect gastro intestinal, liver, other organ, like kidney, heart

③ chronic allograft rejection:

Mainly affect the solid organs-

- Heart, kidney, liver.

Graft versus Host rejection (GVH)

- It take in 2 different species of transplantation there is a formation of immune response
- become the host and graft Ag are very and the graft is
- rejected by the graft.

graft become death and decay.

This mainly 2 type.

- Acute graft versus Host Rejection - happens months
- chronic graft versus Host Rejection - again too late.

Mechanism of GVHR

Graft lymphocytes aggregated in host lymphoid organs
↓
Graft lymphocytes Stimulated by host lymphocyte
↓
Stimulated graft lymphocyte produce lymphokines
↓
lymphokines Stimulate the B- poly colonal B cell activation
↓
B cells are bind to the self antigen of host produce Ab

Acute graft versus Host Rejection disease

It mainly affect the intestinal tract, liver skin
The symptoms are appeared so fast

Symptoms

~~Fat~~ Skin :- Skin rashes, redness
Intestinal tract : Nausea, vomiting, abdominal pain
liver : Jandice

Prevention

using prednisone, and Ruxolitinib
approved by Food and drug Administration.

- It mainly affect different organ
- Mouth - dry, decay tooth, difficult in swallowing
- Nail - become thick, loss of nail
- Hair (scalp) - loss of hair, premature grey hair loss
- Joint - joint pain, limb rashes
- Skin - itching, light, redness

Prevention

- Prednisone
- Ruxolitinib

Clinal symptoms

- Anemia
- Skin rashes
- Jaundice
- Joint cramps

2. Complement System

- It was 1st discovered by paul Ehlrich
- Complement system having soluble cell and surface proteins induced by Antigen-antibody reaction
- It contain 30 proteins term complement to the immune system
- It contains cell and surface protein
- It mainly involved in innate and adaptive immunity
- And having humoral and cell mediated response

General properties

- In all animal ~~serum~~ contain term. But in maximum concentration present in a guinea pig.
- Also present in the cell surface

- Autolysis - lysis of Bacteria, virus
- Opsonization - enhancing phagocytosis
- Generation of inducers (mediators) in inflammation

It contain 30 serum.

Systems

- complement components:
  components designated as in number (C_1-C_9) and in letter written as eg: Factor B.
- complement requirements:
  - It present cell surface and recognize activation.
- Regulatory proteins in complement
  - It involved in Proteolytic enzyme.
- The proteins are known as pro enzymes there are produced by the lysis / cleavage.

Eg: $C_4 \rightarrow C_4^a$ (small) a- small fragment
$C_4 \rightarrow C_{4b}$ b- large fragment

Exception in C_2 $\rightarrow C_{2a}$ a- large fragment
$\rightarrow C_{2b}$ b- small fragment.

In a complement system it involved 3 steps

① formation of C_3 convertase
② Formation of C_5 convertase
③ Formation of MAC (membrane attack complex).

Complement System has - 3 pathways

① classical pathway

② Alternative pathway

③ Lectin pathway

In these pathway, lectin and alternative pathway is very important that infected by microorganism because that antibody requirne to trigger to classical pathway is not present.

① classical pathway.

* It is Antibody dependent pathway.
* and trigger to formation of soluble antigen-antibody on antibody bind to antigen present on cell surface.

The soluble proteins are C_4, C_1r, C_1s.

· The Substances are bacteria cell wall, fungal envelop

$C_1 - C_9$

$C_1q\ C_1r\ C_1s$

$C_1q r_2 s_2 \longrightarrow \overline{C_1q r_2 s_2} \longrightarrow C_4 \rightarrow C_4a$, $C_4b \rightarrow C_1C_4b \rightarrow C_2 \rightarrow C_2b$, C_2a

(C_1)

C_3 convertase

$C_3a \leftarrow C_3 \leftarrow C_1C_4bC_2a$

$C_5a \leftarrow C_5$ convertase $\leftarrow C_1C_4bC_2aC_3b \leftarrow C_3b$

$C_5 \rightarrow C_5b \rightarrow C_1C_4bC_2aC_3bC_5b \xrightarrow{6,7,8,9} C_1C_4bC_2aC_3bC_5b6,7,8,9$

$100\mathring{A}$ MAC

(Membrane Attack complex)

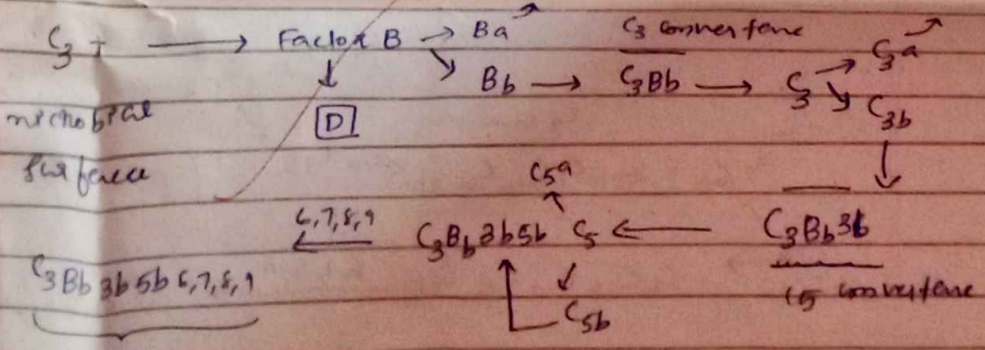
Here C_3b has important role because it having 2 functions formation of C_3 convertase → C_5 convertase leads to the formation MAC.

- It involved in Opsonization
- Here mainly involving IgG and IgM.
- IgM is most common
- IgG has IgG_1, IgG_2 IgG_3 there are involved in classical pathway.
- But IgG_4 not involved
- IgM - also in activated this process
- First, C_1 having other subclass - C_{1q}, C_{1r}, C_{1s}.

C_{1q} → S_2 → C_1

② Alternative pathway

- This is the antibody independent pathway.
- It is the primary pathway when it introduced microorganism
- It contain Factor B (& D)
- It is stabilized C_3 because also contain cell surface.

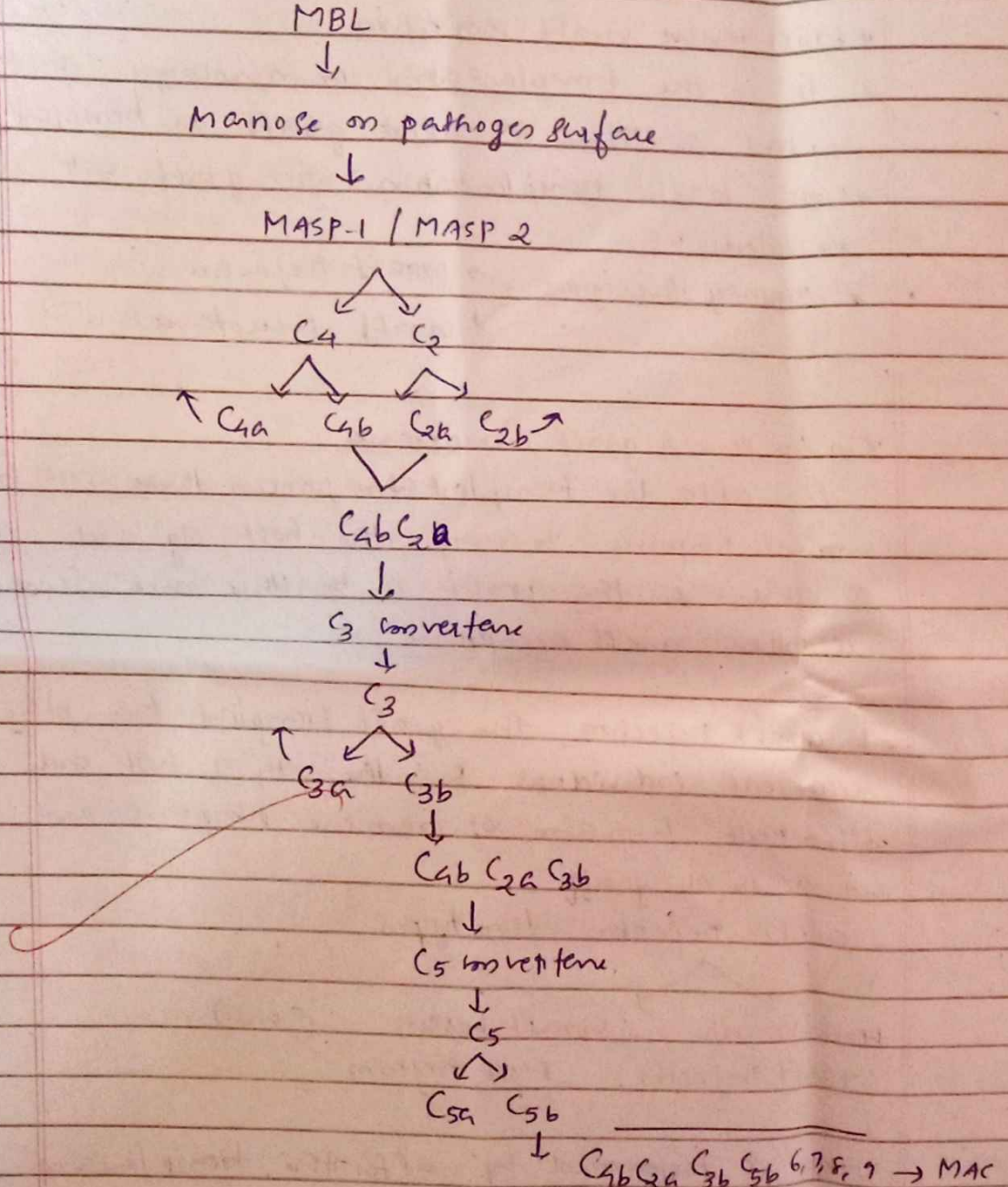


↓

MAC - Membrane attack complex

③ Lectin pathway

* It is antibody independent pathway
* Similar to trigger classical pathway
- It also known as ~~MBP~~ MBL (Mannan-binding Lectin)
- The surface having mannose.
- It contain MASP (~~MBP~~ Mannose association surface protein



The MASP has the ability to break down C_4 and C_2 and bind them to form C_3 convertase and C_5 convertase and MAC

Section - A

2. HVH reaction

* Host versus graft rejection
* It is the transplantation immunology if transfer or implant a tissue is called graft or transplant
* due to the transplantation, the graft will accepted / rejected.
* Mainly two types → graft rejection
  → graft acceptance

* In the case of graft acceptance
  If after the transplantation process there is no formation of immune response because the host Ag and graft Ag is same. so the graft is healthy and alive.
  is called graft acceptance

- In graft rejection, the graft transplant take place in a different individual so the Ag of host and graft is different formation of immune response and decay and death of graft.
- graft rejection two types

Host versus graft rejection graft versus (GVH) Host rejection

GVH is performed by after the transplantation process the the host Ag produce immune response.

In HVN,

After transplantation, the Ag contain graft produce a immune response to recipient and reject the graft

Allograft rejection:

The genetically distinct individual take place transplantation, Ag of host and graft is different lead to immune response and decay and death occur.

3 types -

① Acute allograft :

② Hyper acute allograft

③ chronic allograft

① Acute allograft :-

- It mainly happens after 1 week of graft transplantation.
- It happen vascular and parenchymal injury due to cell and antibody.

2 types → early acute → T lymphocytes & cell mediate immunity

→ later acute → B lympocytes and humoral immunity.

② Hyper acute allograft:

- It happens within minutes to hours
- vascularization against graft. Here rapid degradation of vascularization
- mainly affect gastrointestinal tract, liver, kidney, heart.

③ chronic allograft rejection :-

Mainly affect the solid organ in the body.

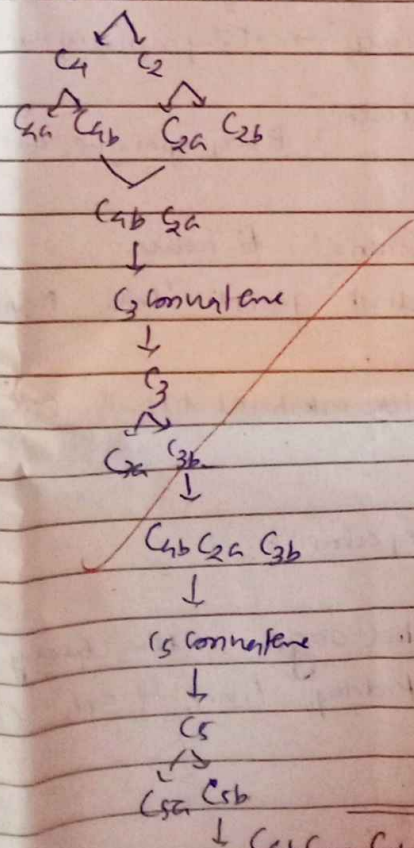
Transplantation take, kidney, liver, Heart, Skin, Bone marrow.

5. MBL

* Mannose Binding Lectin
* It is the protein that involved in the lectin pathway
* It is also known as MBL pathway or mannose-binding lectin
* It is a antibody independent pathway.
* The surface of pathogen having mannose
* involved MASP- (mannose association serine protein)

The pathway similar to clanical pathway

MBL
↓
Mannose on pathogen surface
↓
MASP-1, MASP-2



* lead to MASP it break the C4 and C2.
- to form 2 fragment of each
- and convert C3 convertase C5 convertase and last form membrane attack complex

6. Factor - D

Factor - D is important component in alternative pathway. In regulatory proteins of complement system 3.
- The complement components designated in number $C_1 - C_9$ and letter written as Eg: of Factor B.

* In the case of alternative pathway, it contain Factor (B) D.
* All ready the microbial cell surface having C_3.
- It bind with Factor B.
* Which cleaved and form Ba and Bb.

Ba - small fragment
Bb - large fragment

So, a fragment of B factor that is Ba is diffused and Bb is adding to a sequential cascade. because Bb is a larger fragment.
- Which leads to the formation of C_3 convertase and C_5 convertase finally form MAC.
- That is membrane attack complex
- Factor having important role in alternative pathway.
- Here microorganism have easily infected
- Because there is no presence of Ab.
- It leads to the easy affected on microbes.

7. D & J Locus

In Antibody diversity is the visualized determination of Ig formation, the light chain gene in mouse myeloma cell is comparable with light chain of in embryonic cell DNA of mice.

There are 2 type chain light chain and heavy chain.
The 3 genes are coded Ig.

In human, locus - in heavy chain chrom - 14
κ light chain chromosome - 2
λ light chain chromosome - 22.

The Heavy and light chain having variable and constant region.

The variable having 3 locus.

V (variable) - 60-250 locus
D (diversity) : 30 locus
J (joining) - 6 locus

In light chain variable region having.

V (variable) - 500 } Kappa chain
J (joining) - 4. }

V (variable) - 100 } λ chain.
J (joining) - Several }

In the case of D locus - which affect the antigenic diversity - D- stand for diversity
- The combination of D, V, J segments there is combined and affect the diversity.
- In light chain D - locus is absent
- Only the presence V and J locus.
- D locus is only for heavy chain.
- constant region is constant.
- variable region having the locus became variable region is varying with ~~Ig~~ chain.

8

Section - B

① Lectin pathway in complement system

- The complement system proposed by paul Ehlrich.
- complement system having 30 protein which complement to the immune system.
- Here having soluble and surface protein.

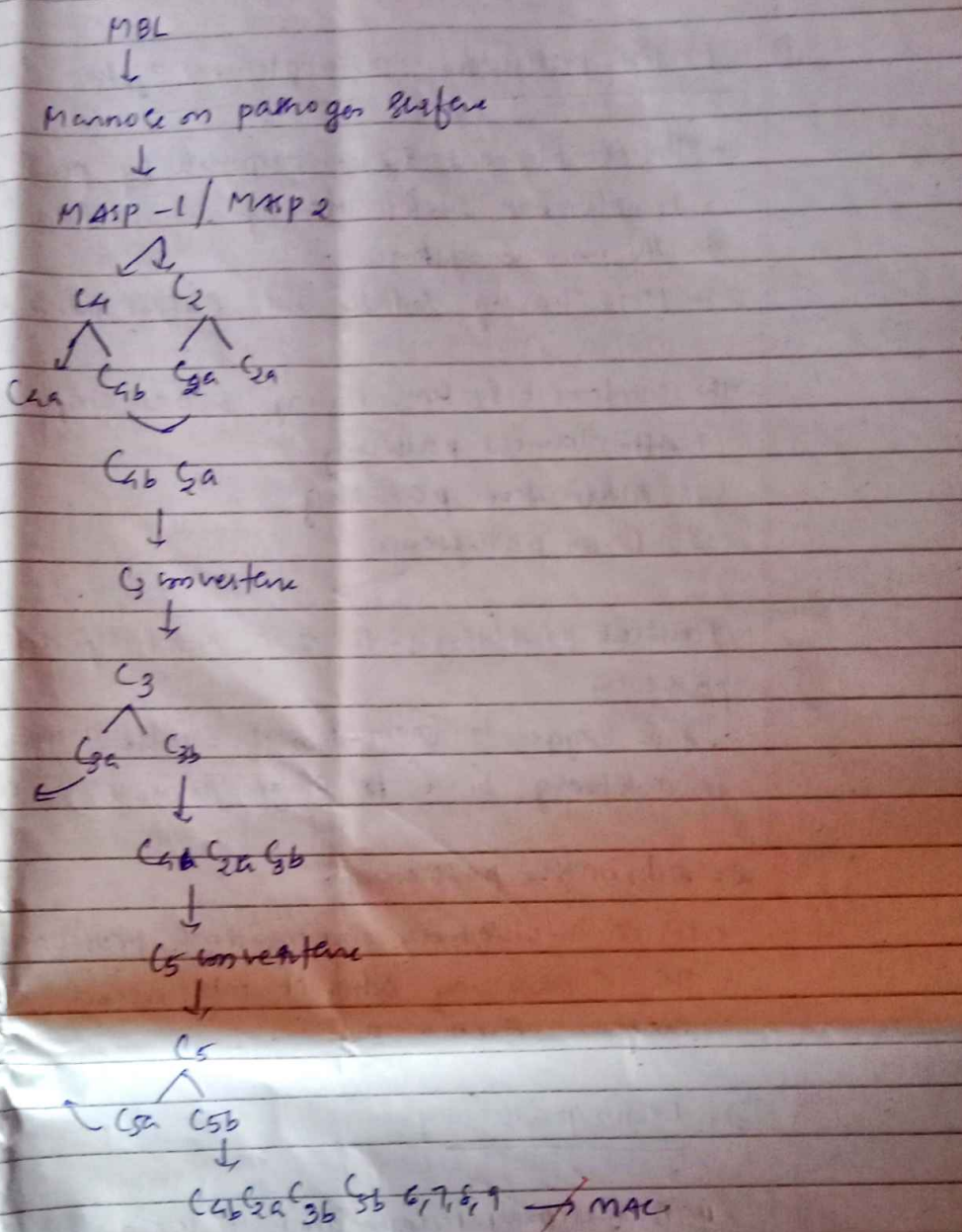
The complement system, having 3 pathway
1. ~~Alt~~ clanical pathway
2. Alternative pathway
3. Lectin pathway

1. Clanical pathway :- It is a Antibody dependent pathway
- And trigger to formation of soluble antigen-antibody or antibody bind to antigen present on cell surface

2. Alternative pathway:
- It is a antibody independent pathway.
- The 1° pathway when it introduced micro organism.
- contain Factor. B.

③. Lectin pathway

- It is antibody independent pathway.
- Trigger clanical pathway.
- Also known as MBL pathway.
MBL - (mannose binding lectin)
- The surface of pathogen having mannose
- Having MASP- (mannose associated surface protein



Here the MASP have the ability to cleavage in C_4, C_2 and they bind together to form C_{4b} C_{2a} leads to the formation of MAC membrane attack complex

3. Immunoglobulin diversity.

* It discovered by, Hozumi, and Tonegawa.
* It is visualisation of analysis of formation of Ig by the light chain of gene in mouse myeloma cell. DNA is comparable with light chain in embryonic cell DNA.

↓

A produce V and J segment and for VJ segment

↓

They concluded that Ig gene undergoes rearrangement B cell development

↓

There is Billions of B cells for the Ag Specific Surface Ig.

Ig in gene

2 gene - Kchain } Light chain
λ chain }

only 1 gene for heavy chain.
Heavy chain segment variable and constant
variable 2 locus - V & J chain.

K - Segment of locus on chromosome - 22
λ Segment of locus on chromosome 2
Heavy chain — 14.
Light chain
variable - 2 locus - V - 500 } K
J - 4 }
heavy - 2 locus - V - 100 } λ
J - Several }

combination of locus.

- During development of B cell randomly pick up V, D, J segment one each segment contain V, D, J on heavy light chain V, & J can contain on light chain.

↓

During development

↓

first randomly pick up V, D, Je

↓

Then adding segment of C locus.

↓

VDJC.

↓

Formation of diversity: The combined of segment difference in diversity. called, ~~the~~ combinational diversity

Transcription of MRNA

During the development of B cell.
The gene are arranged to form ~~DATA~~ gene segment

↓

which leads to the formation of functional MRNA.

↓

Functional MRNA changes to form- transcriptional.

↓

It having RAG1, RAG2 (Recombinement of active gene) of light and heavy chain.
During the joining there is a formation of gap.
The gap filled by using TdT enzyme.
Terminal deoxy ~~G~~ nucleotide transferase

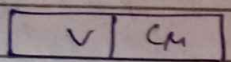
Allelic exclusion

A successful complete rearrangement of gene on light & heavy chain and the homologous chromosome is excluded. called allelic exclusion.

Formation of Surface Ig

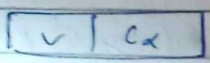
- Here present in the cell
- These are assembled in ER
→ after transcription complete form of Ig
→ PM attaches to the Ag.

classical Switch analysis



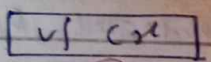
μ chain in IgM

↓ Cμ conversion



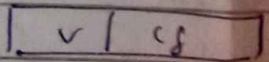
α chain in IgA

↓ or



γ chain of IgG.

↓ or



δ chain of IgD

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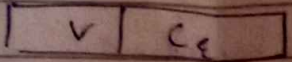


ε chain of IgE

5. Immunodiffusion - in gels

Immunodiffusion in gel is associated with the precipitation reaction of Ag-Ab complex.
- Ab-Ag reaction of is specific
- It is not used to determine the Ab and Ag.
- It can detect the disease, blood grouping and others.

2 types.

1) Precipitation
2) Agglutination.

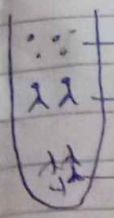
Precipitation

When a soluble Ag is combined with it's antibody in a electrolyte (Nacl) at a suitable temperature the antigen-antibody complex form insolubley

Ag (Soluble) + Ab (Soluble) → Ag-Ab complex (insoluble)
(Precipitinogen) Precipitin (Precipitate)

- It forms Ab-Ag complex to form a precipitate.
- If the not occur precipitation the substance formed between is called flocculation.

Precipitation reaction is mediated by lattice hypothesis



Principle

- Mammack
- Based on the lattice hypothesis.

That is the Ag-Ab formed a complex insoluble

- To form a large lattice. In the zone of equivalence
- But the exact condition of Antigen and Ab - There no formation of lattice. Because exact condition not occur, lattice.

Immunodiffusion ingel.

The gel are mainly agar, Agarose, polyacrylamide It mainly 4 type.

① one single diffusion single dimension
② Single diffusion double dimension
③ double diffusion single dimension
④ double diffusion double dimension

① SS -
- The process diffusion occur 2 D.
Ag to Ab. agar gel antibody
Here the ag attack only one direction
It take in tube.

② Single diffusion double dimension
The antigen attack the two sides.
It take place in a petriplate

③ double diffusion in single diffusion
It present the well contain antigen - add the well reaction take place to form a halo

④ double diffusion in double dimension
The serum contain Ag in a well 3 well & having - same or not
formed of Ab Ag complex.

2nd semester
Immunology

(1) TLR - Toll like receptors

* Toll like receptors is the transmembrane receptors present in macrophages and dentritic cells
* In immune systems foreighn particles can identify by detecting the presence of pathogen associate molecular patter (PAMP)
* This PAMP can recognize pattern recognize receptors (PRR) in present in salvable or phagocytotic cell.
* PAMP recognize PRR and it produce immune response or tolerance.

many PRR present in our body

examples of PRP is

* Toll like receptors
* scavanges
* Non receptors

In toll like receptors 13 recap type of receptor is present to enhance the phagocytotic activity and degrade or lyes foreighn particle.

PAMP pattern bearing pathogens are identify TLR and it involve the process of active immune immunity.

infecting organisms or pathogens by providing by vaccine administrating the pathogens and it produce desired antibodies. It protect our body from specific diseases.

Vaccine is an example of immunisation. It is a active acquired immunity by artificially. vaccine protect from our body to specific disease and long-acting period.

(i) Live vaccines: In this vaccines live particles of microorganisms are used for the preparation of vaccines. The live part as less antigenity and higher immunogenicity.

* The live particle do not cause disease, but it promote the production of antibody against the antigen.
* It doesn't need booster vaccine.
* Its efficiency is high compared to killed vaccine
  eg:- BCG vaccine.

Demerits:

* It cause disease sometimes, when it take in immuno-deficient person
* It store only cold condition

ii) attenuated vaccine.

* In this type of vaccine the part taken in native of killed state
* killed or attenuated micro organisms or its parts are used for the preparations of vaccine.
* Inactive by chemical or physical treatment
* It doesn't need cold storage

Demerits:

* It need booster
* efficiency is less compared to live vaccines

eg:- Rabies vaccine.

(5) EPITOPE & PARATOPE

any substances are foreign particle one body are known antigen. it induce immunological reaction and result immune tolerance or immune response.

Epitope is a lower molecules part present in antigen this reagion is bind with specific antibody and forming antigen-antibody complex and induce immune system.

it have many amino acids are present this reagion only bind antibody.

paratope: the corresponding reagion of antibody bind to antigen is known as paratope. paratope of an antibody bind to the epitope of an antigen result immunological response or tolerance.

(6) MHC

* MHC is the major histocompat cell, it ei a surface protein present in cell membrane of nucleotide cell.
* it is most important in transplantation technique Because a tissue or organ received by a person it is known as allograft and it is considered as foreign to the body of person and it cause rejection of allograft so MHC has high important in transplantation.
* it identify antigenes between self and non self antigen
* MHC complex human mainly 4 types.

MHC I MHC III
MHC II MHC IV

MHC restriction help to detecting antigen presenting cell
prevent cross linking.

CD8 markers bind cytotoxic by T cell by MHC I restriction
CD4 markers help T cells only bind to MHC II restriction.

MHC help transplantation process.
* it identify between self and non self antigen.
* presenting antigen presenting cell.

(7) CD4 and CD8 Markers. (CD- cluster of differentiations)

CD4 and CD8 depend T cell of lymphocytes.
CD4 produce helper T cells and it proliferate to Th1 Th2 Th17 and also T regulated cell.
Th1 for proliferation Th2 for activation of B cell and Th17 for inflation and regulated T for regulation of T cells.

CD8 are involved in cytotoxic release, it lyse the growth of the organism.

Both CD4 & CD8 Markers are used for memory cells.
CD- cluster of differentiation, the surface molecules help to differentiate lymphocytic cell mainly B, T & macrophage.
CD4 and CD8 depend T cells.

(8) GALT (Gut associated lymphocyte T cell)

GALT is the involved in secondary lymphoid organs MALT (mucus associated lymphoid tissue) present on the lining of alimentary respiratory and it found number of several antigens.
GALT is gut associated and it also present M cells

12

10) Functions of T cells.

T cells are lymphocytic cell. It has higher important role in immune system of our body.
T cells are originate Bone marrow and it grow and proliferate in thymus.

Functions are.

-> Heper cells

T helper I : It help to proliferations and secrete cytokines.

T helper II : It active B cells.

T helper III : Involved infection causing.

- cytotonic T cell :

It release cytotoxic substance and lyeis the pathogen by the help of MHC I recognition.

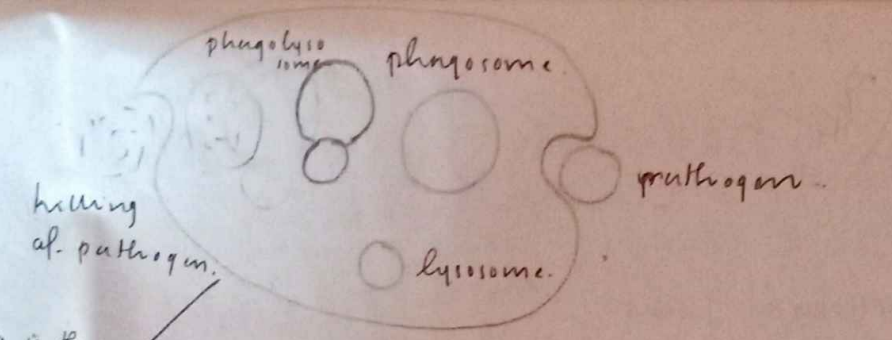
Regulate cell

It regulate immune cyetem.

* T cells are recognize antigen
* antigen specific reaction
* enhance phagocytosis.

(11) phagocytotic cell.

phagocytotic cell is involve in innate immunity
In this cell phagocyte engulf or digest the infected part or pathogen. and killing.



This is the process of phagocytosis. lysosome create phagolysosome with phagosome and it ingest pathogen and killing.

(12) Enzyme digestion of immunoglobulin.

Immunoglobulin is the protein produced by against antigen or foreign particle present our body.
It has structural and functional model
The enzyme digestion is

pepsin: In this the presence of certain digest the immunoglobulin to two
Fc (crystalline region) insoluble
Fab (antigen binding)
Due to this digest 2 chains are form
1 Fc and 2 Fabs.

pepsin
In this digestion immunoglobulin digest to 2(Fab) and Fc.
Fab form cross linking and known as 2(Fab) and it present 3 part.

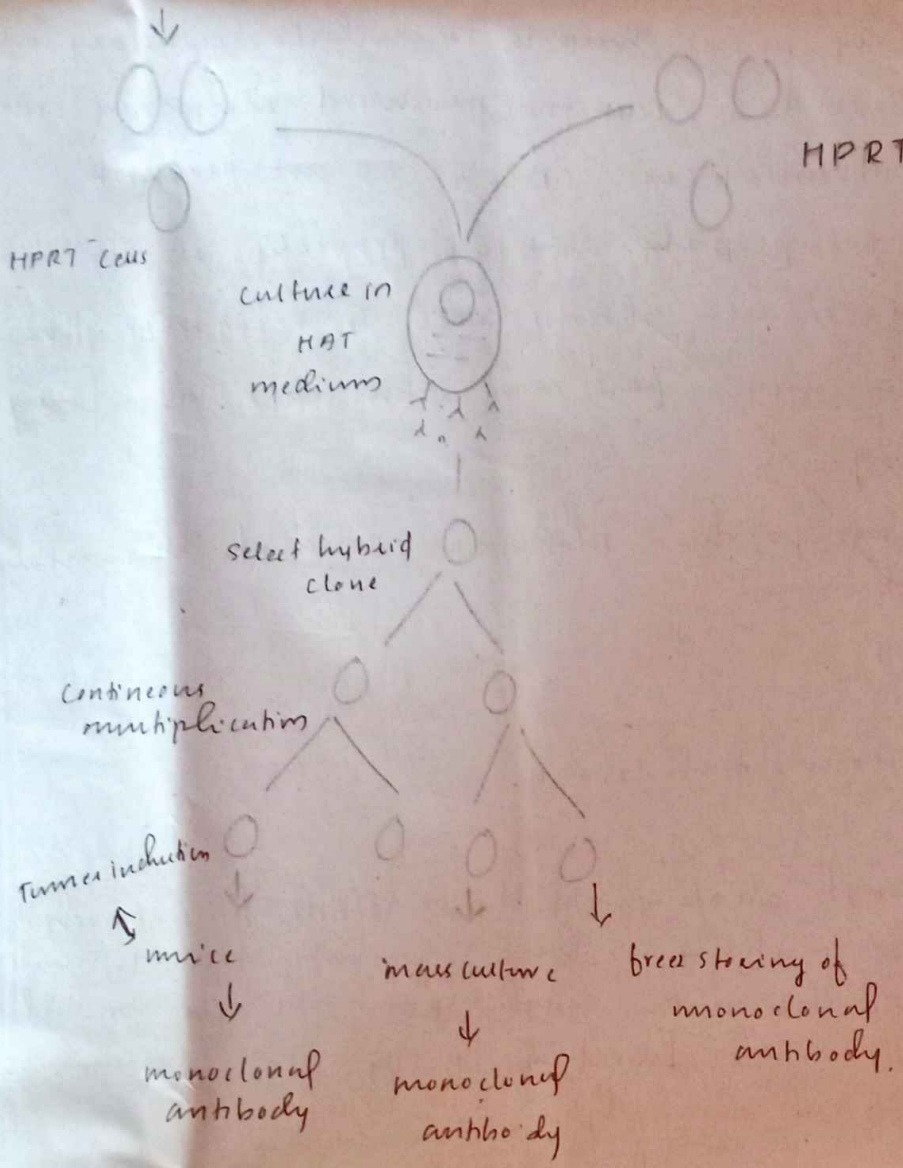
4 Memory cells

Memory cell are help to stimulate secondary immune fast. Both B & T cells are produced Memory cells. in this memory cells CD4 & CD8 are present it fixed the respective antigen properly at the time of prior contact. after it help to recognise the same antigen fast and stimulate secondary immune.

B cells are produce plasma cells and memory cells.

(13) Hybridoma technology.

* a single cell of antibody or clone of antibody have a single specificity of clone against desired antigen. in myeloma with single specificity accumulated multiple single desired specificity this known as monoclonal antibody.
* this monoclonal antibody used this technique development Hybridoma technology.
* it introduce George and Caeser, in 1984 they got nobel prize.
* in this technique hybrid cell are used for the productions of monoclonal antibody.
* Hybridoma technology steps.
  * Fusing
  * combining
  * cloning
  * continuous cultivation
  * mass cultivation or storage of monoclonal antibody



Fusing

lymphocytes of spleen cells of mice with infected desired antigen is selected and it is HPRT+ (Hypoxanthin phospho ribosyl transferase positive) and fuses with myloma cells (HPRT-).

and it culture on a tissue culture medium containing HAT (Hypoxanthine, amminoprotein, thymmine) it only grow HPRT+ cells.

clone selection

Selection of hybrid somatic cells and it allow for continuous multiplication.

aspetic fluid of mice annd prepared monoclonal antibody.

another way is mass culture annd produce monoclonal antibody.

monoclonal antibody store by freezing for future.

applications:

help in therapeutical

help to detect tumors cells by monoclonal antibody. marking, curing therapeutical treatment

(14)

Vaccines

* Vaccine is the artificiaaly acquired immunity.
* It is the method of immunisation.
* immunoprophylaxis is the method of administration killing or living infected pathogen or material to host body annd creat immunity against the desired antigen.
* It is long-acting.
* vaccines are help to prevent or reduces or eliminate many disease.

Type of vaccines is.

1) Live vaccine
2) Inactivated vaccine
3) Toxin vaccine
4) conjugate vaccine
5) Heterogenous vaccine.
6) Homologous vaccine.
7) Heterologous vaccine
8) subunit vaccine
9) mRNA vaccine.
10) DNA vaccine
11) Anti idiotypic vaccine
12) Edible vaccine.

preparations of vaccines.

It is highly efficient and more efficient need to cold storage and damages to immuno deficient person

eg: BCG vaccine.

* Killed vaccine : inactive or killed organisms selected for preparation of vaccine.

Less efficient and safe, doesn't need cold storage.

eg: Rabies, influenza.

* Toxoid vaccine : Take toxins produced by the organisms it is mainly combination of toxoids and adjugant conjugate

DPT (Diphtheria & tetanus combination to pertussis)

* Extracellular material.

Extracellular portion is used for the preparation of vaccine. eg: polysaccharide etc.

Hepatitis vaccines.

* Edible vaccine

In this vaccine transgenic plants are used. gene introduce to plants and it cause production of desired antigen. eg:- ~~Rabies~~

* Subunit vaccine

this is prepared by using recombinant DNA technology. Subunits are used for preparation of vaccine

eg: influenza.

eg- influenza (AH3N2 strain use)

* Heterologous vaccine: use different strain for reduce cross reaction.

* Heterogenous: use acid organism

eg: mycobacterium bovis used for mycobacterium tuberculosis

* mRNA vaccine

mRNA used for vaccine preparation
Virus genes are used for making this so no need of culture growth

influenza

application

It reduce pandemic or epidemic disease
* focus group of people (pregnant women)
* Yellow fever Africa - reduce by vaccine in traveling.

(17) Secondary lymphoid organ.

lymphoid organ has most important in our body immune system.
lymphoid organs and cells are involved in immune response or tolerance.
It is mainly
1) primary lymphoid organ
2) secondary lymphoid organ.

secondary lymph

1) lymph node

2) spleen

3) MALT

lymph node

lymph node present in lymphatic vessel
it has an important role in immunisations.

its functions is

* proliferation and circulation of Both B and T cells.
* enhance phagocytosis and draining capacity
* it enlarge infection causing immune.

This are the major function of lymph node.

spleen

spleen is the largest organ of secondary lymphoid organs. it help immunological process

The function is

* clear the inactive lymphocytic cells
* The white pulp containing portion of spleen help to phagocytosis and antigen presenting.

MALT (mucous associated lymphatic tissue)

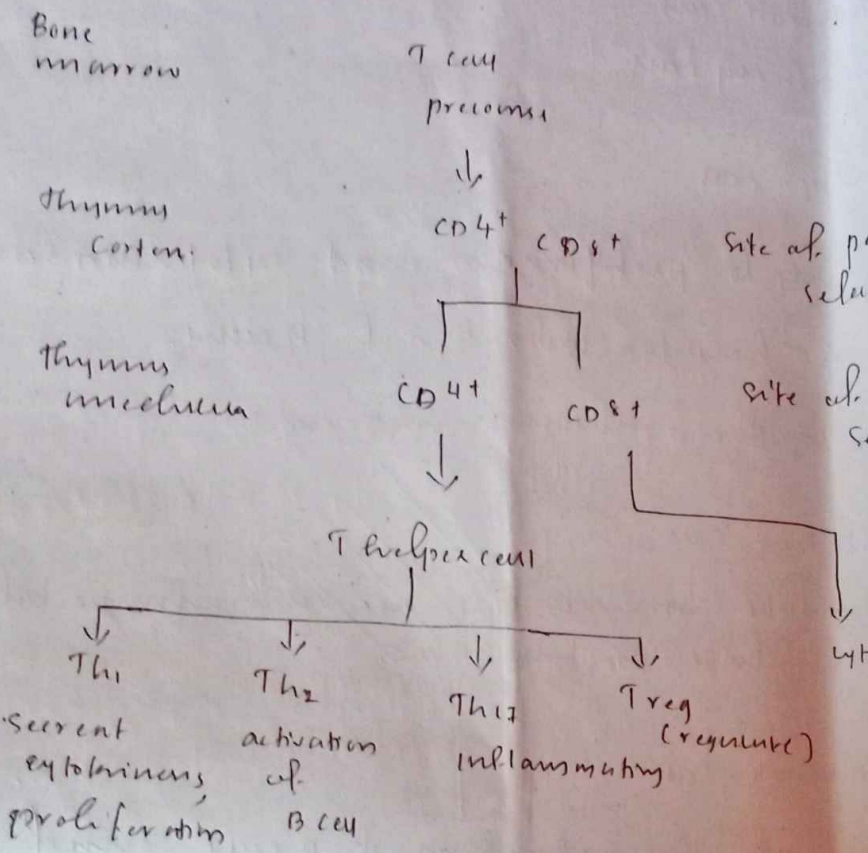
This are mainly found in mucosal wall of alimentary and respiratory tract.

The M cell serve transport antigens to immune process and also present

GALT (Gut associate lymphocyte cell)
BALT (Bronchus associate lymphocyte tissue).

phagocytosis and killing.

(12)



* T cells are lymphocytic cell have most important role in immunity of our body.

→ The function of lymphocytic cell is

1) recognize antigen.
2) store memory
3) reaction of spentic antigen.

CD4 & CD8 associated to T cells.

to proliferate and form cytokinin.

* helper cells
* regulatory cells
* cytokinin cells
* memory cells.

→ In helper cells

TH1 help to proliferation and cytokinin secretion.

TH2 is help to activation of B cells.

TH17 involve inflammations.

→ regulatory cells

It regulate immune response or immune tolerance and regulate the functions.

→ cytokinin cell

It inhibit the activation of B cell and secrete cytokinin, It kyes the pathogen with MHC I complex.

→ Memory cells

Both CD4 & CD8 are involved

It store memory associated with CD57

The Function is mainly

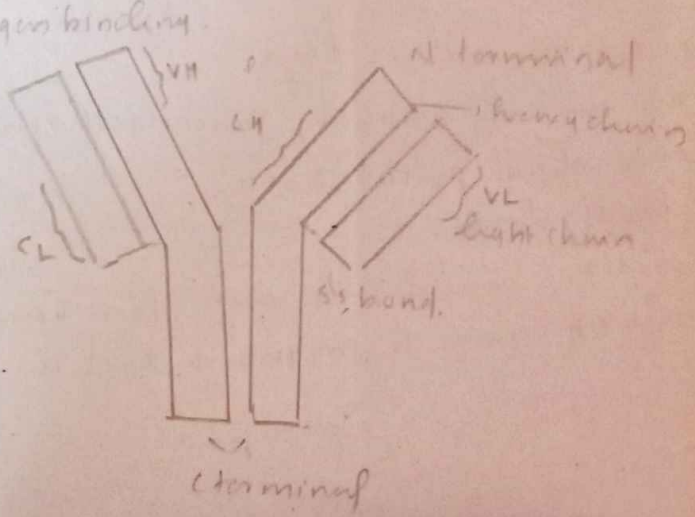
* recognize antigen
* storing memory
* reaction to specific antigen

(19) Structure and classification of immunoglobulin.

immunoglobulin is a protein part created against desired antigen. when a foreign particle enter to our body induce antibody synthesis and create immuno-tolerance or immune response.

Structure of immunoglobulin.

Immunoglobulin has mainly 2 chain of identical heavy chain and light chain.



It has 2 identical chains.

heavy chain, It consist (55,000 DA) molecular weight

α, β, γ, μ, ε this five types are found in heavy chain.

light chain, consist (22,000) DA molecular weight

present only one at a time mostly kappa are present.

the first 110 amino acids are variable known as VL (variable light chain) VH (variable heavy chain)

after it constant. so the part is known as CL (constant light chain) & CH (constant heavy chain)

1) IgG
2) IgA
3) IgM
4) IgD
5) IgE

IgG

* It is more present antibody in one body
* 80% present
* Half life periode 23 days.
* It is the ~~was~~ only antibody passing through placenta mother to child. protect baby.
* It is appears slowly.
* this used to homologous anti feed back used to ~~was~~ anti RH vanine to pregnant ladies.

IgA

* It present 10-13%
* Half life periode is 5-8 days.
* It increase infection stage.
* It mainly found at colostrum, saliva, tears.
* And it is known as antibody' penike. It protect infections
* Colostrum contain high amount of IgA It protect newborn 3 months.
* It has a J chain and secretion piece It doesn't produce on lymphocyte. Secretory piece to help to prevent proteases Enzymes produce microbe organisms.

* present 5-6%
* half life period 3-4 days.
* it increase the infection stage
* it is polymorphonuclear have 5 structure help to small amount for binding.

LgD

* present 2-3%
* half life 2 days.
* help to infection prevent

LgE

it present very small amount.
increase infection stage.
this value indicate infection.

7