

MCAT Immunology



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Med-pathway



Your online MCAT Prep testing center developed
by medical school professors

AAMC MCAT Content Outline: Immunology

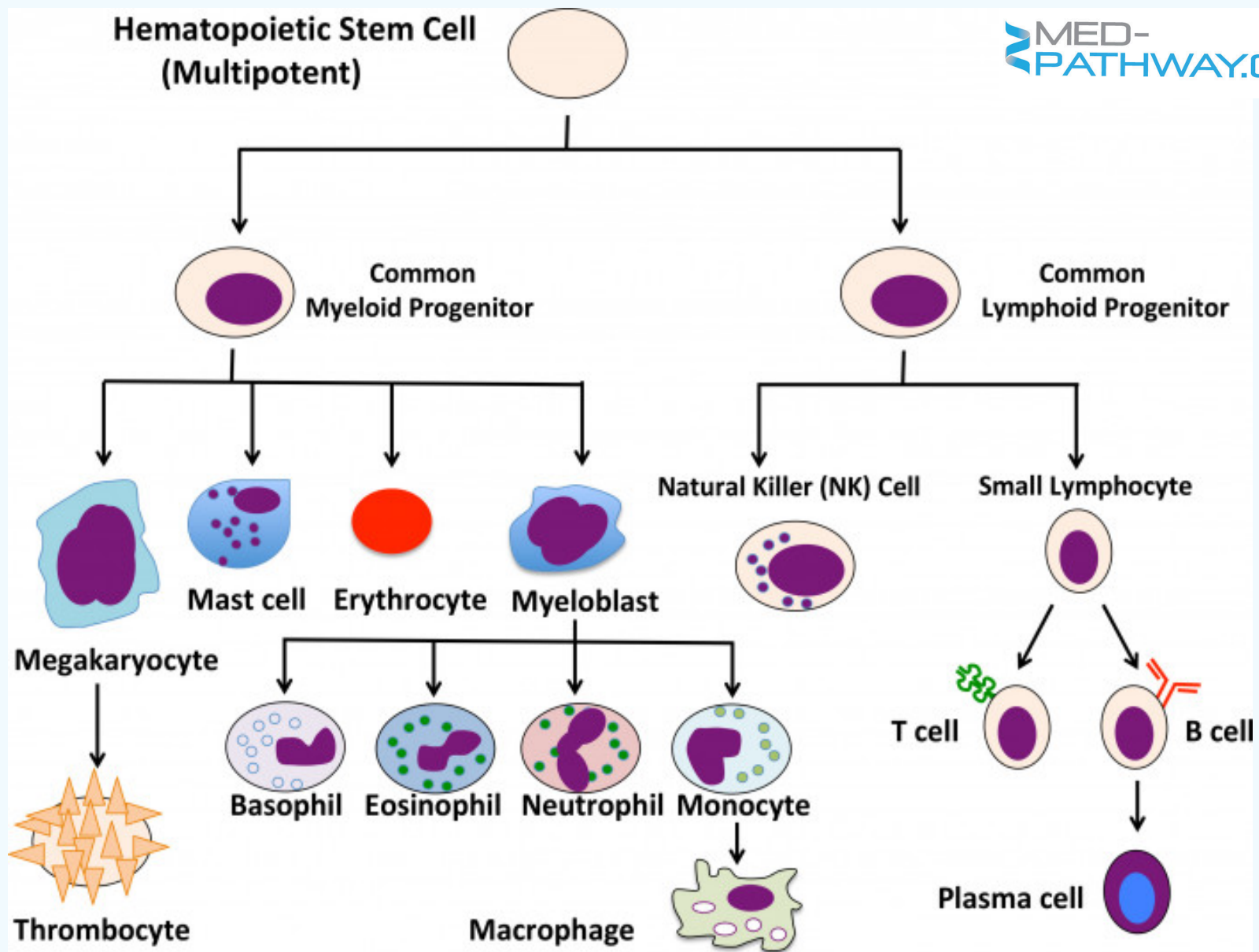
Category 1A: Structure/Function of Proteins/AA

- ☐ Immune System

Category 3B: Organ Systems

- ☐ Innate vs. Adaptive Immunity
- ☐ T and B Lymphocytes
- ☐ Macrophages & Phagocytes
- ☐ Tissue-Bone marrow, Spleen, Thymus, Lymph nodes
- ☐ Antigen and Antibody
- ☐ Antigen Presentation
- ☐ Clonal Selection
- ☐ Antigen-Antibody recognition
- ☐ Structure of antibody molecule
- ☐ Self vs. Non-self, Autoimmune Diseases
- ☐ Major Histocompatibility Complex
- ☐ Lab Techniques: ELISA & Western Blotting

Hematopoiesis Creates Immune Cells



Self vs. Non-self

Innate vs Adaptive

Innate Immunity

Physical Barriers: Skin, mucous membranes, pH

Inflammatory mediators: Complement, Cytokines, Prostaglandins

Cellular Components:

Phagocytes-Neutrophils, Eosinophils, Basophils, Mast Cells

Antigen Presenting Cells-Monocytes, Macrophages, Dendritic Cells

Adaptive (Acquired) Immunity

Composed of B and T lymphocytes: Activated by Innate Immunity

B cells: Express B cell receptor and secrete antibodies as plasma cells

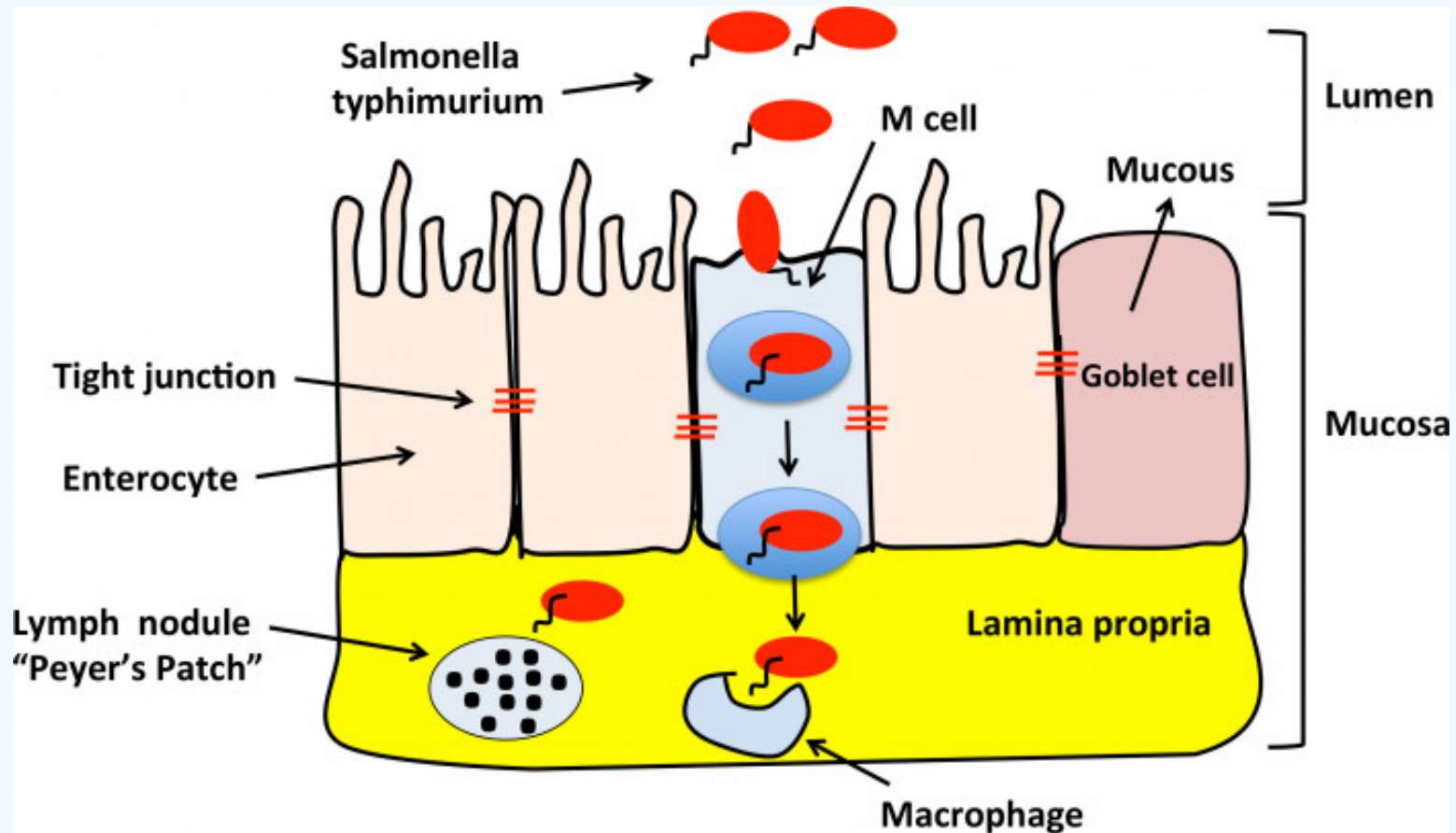
T cells: Mature in thymus, express TCR surface receptor;
Activated by Antigen Presenting Cells (APCs)

Direct Immune response (The Ringleaders of immune system)

Major Lymphoid Organs

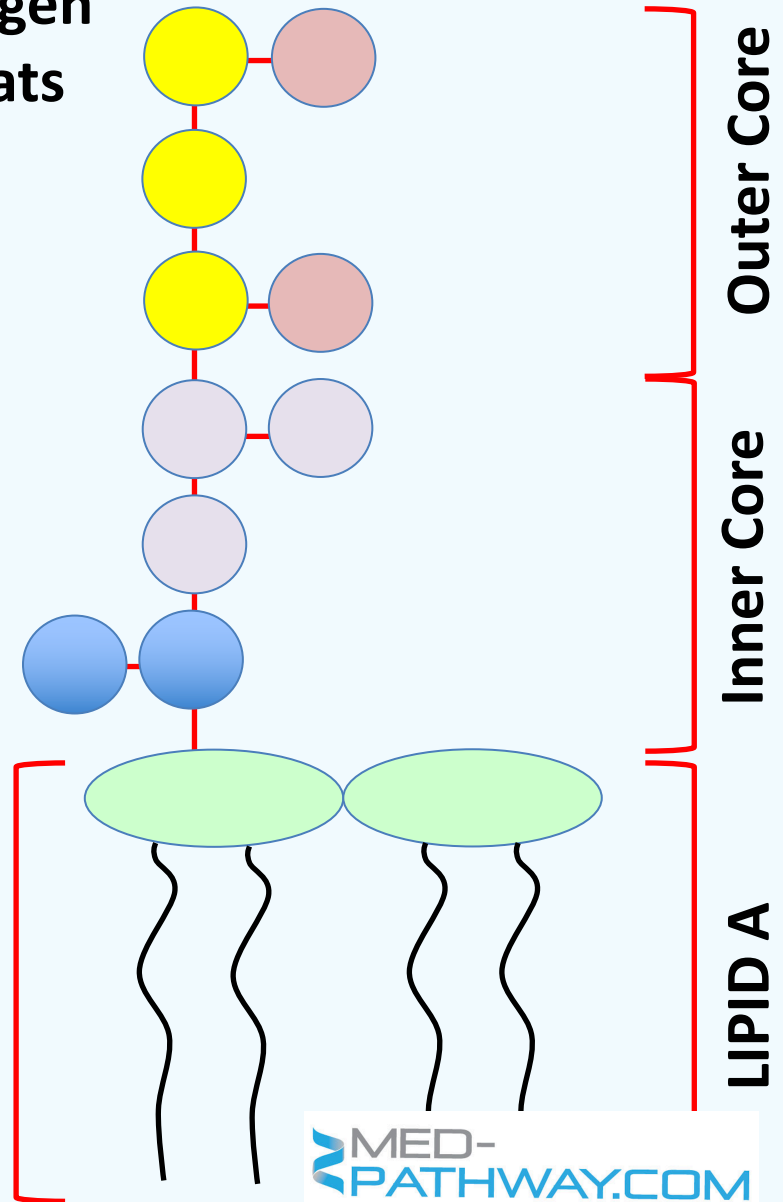
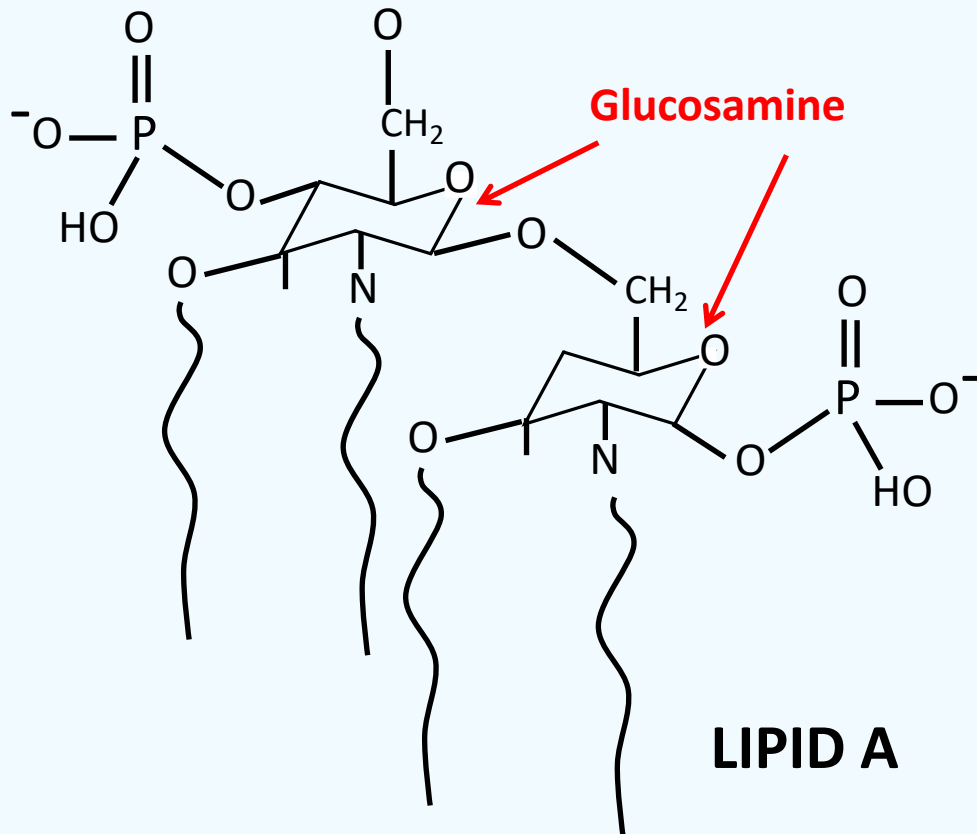
TYPE	SITE	FUNCTION
1°	Liver	Fetal production of lymphoid cells
1°	Bone marrow	Hematopoietic production of myeloid and lymphoid cells
1°	Thymus	Receives bone marrow T cells; site where self is selected from non-self
2°	Lymph nodes Spleen	Sites of antigen activation of lymphocytes; clearance

Macrophages (Sentinel Cells)



LIPOPOLYSACCHARIDE (LPS)

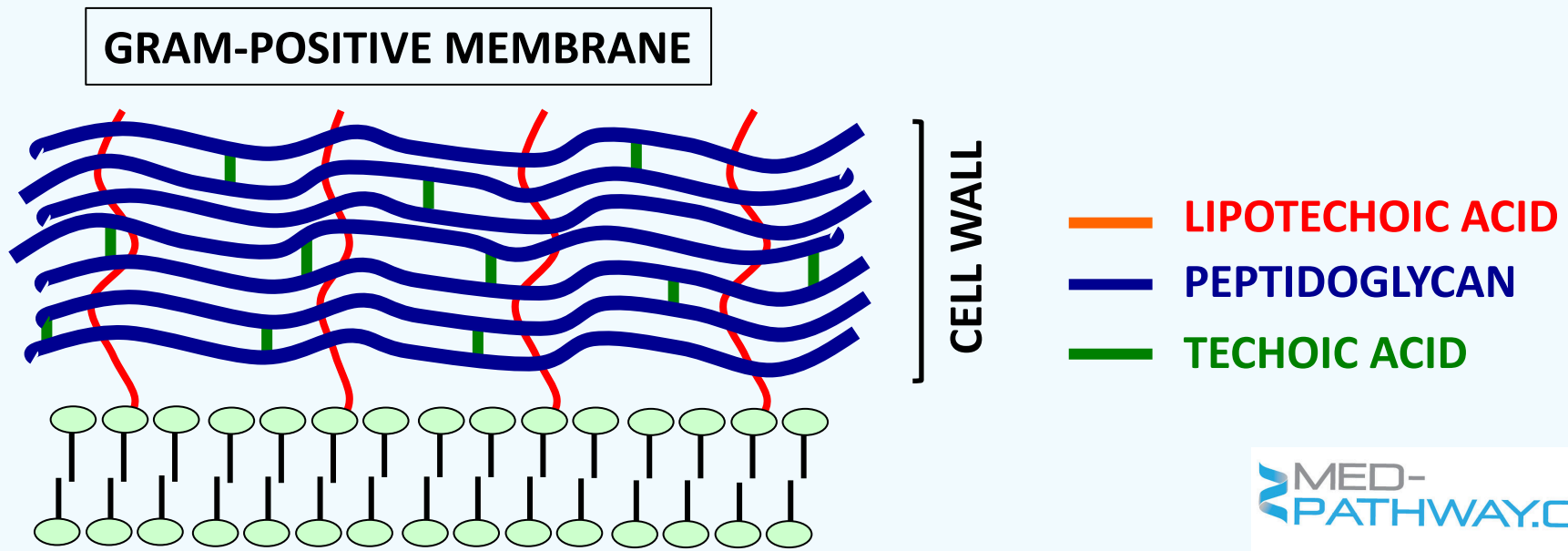
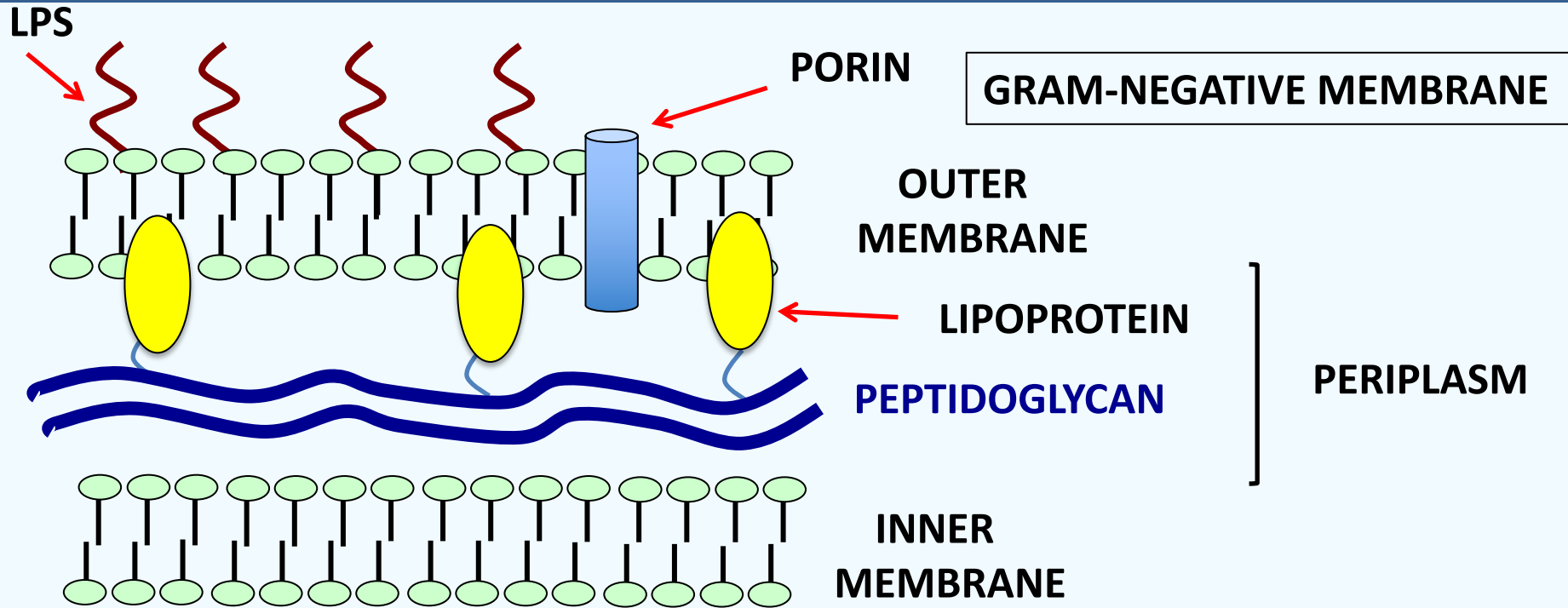
O-Antigen
Repeats



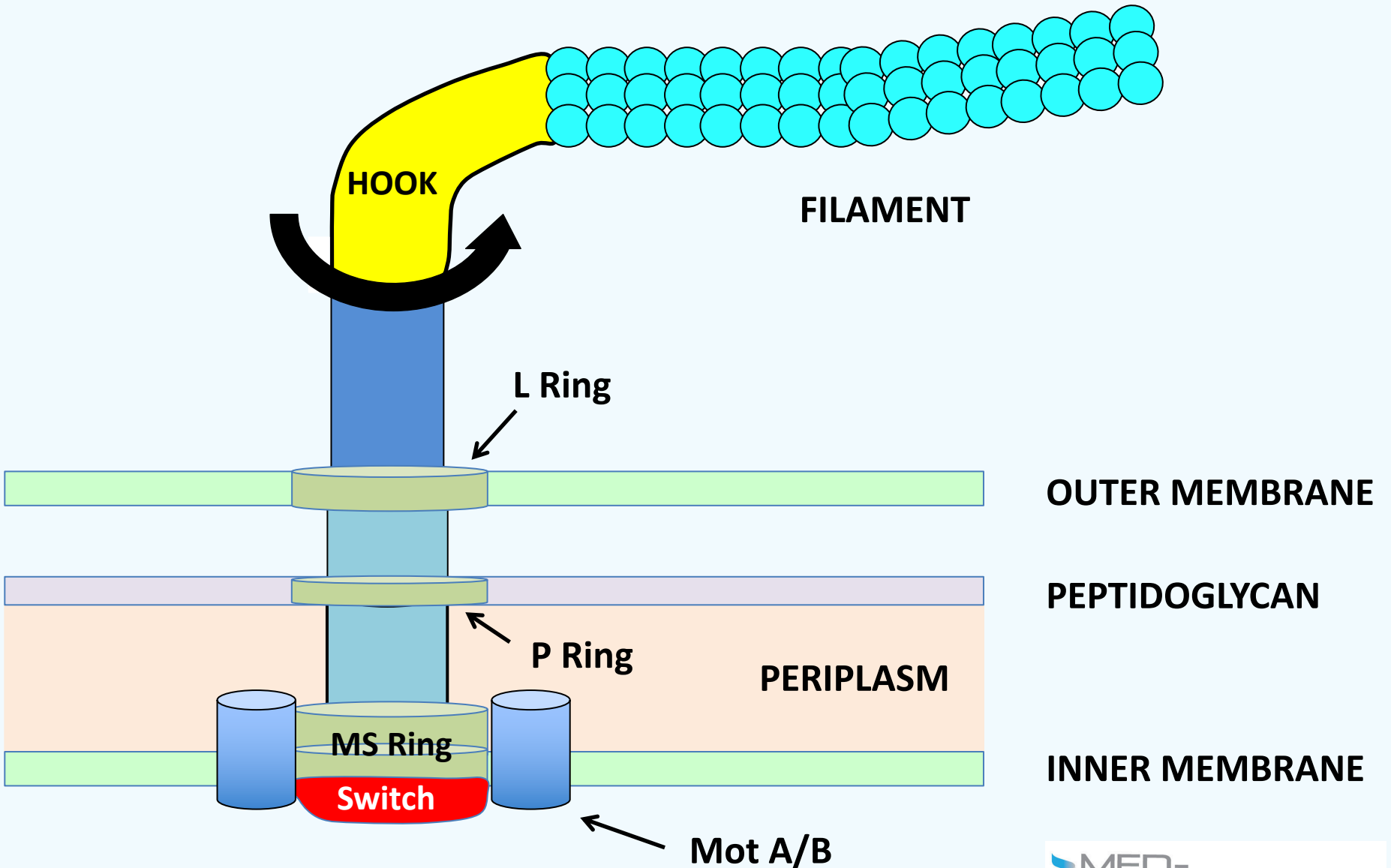
Bacterial Membranes

FEATURE	GRAM-NEGATIVE	GRAM-POSITIVE
CELL WALL	THIN	THICK
OUTER MEMBRANE	YES	NO
Lipopolysaccharide (LPS)	YES	NO

Bacterial Membranes

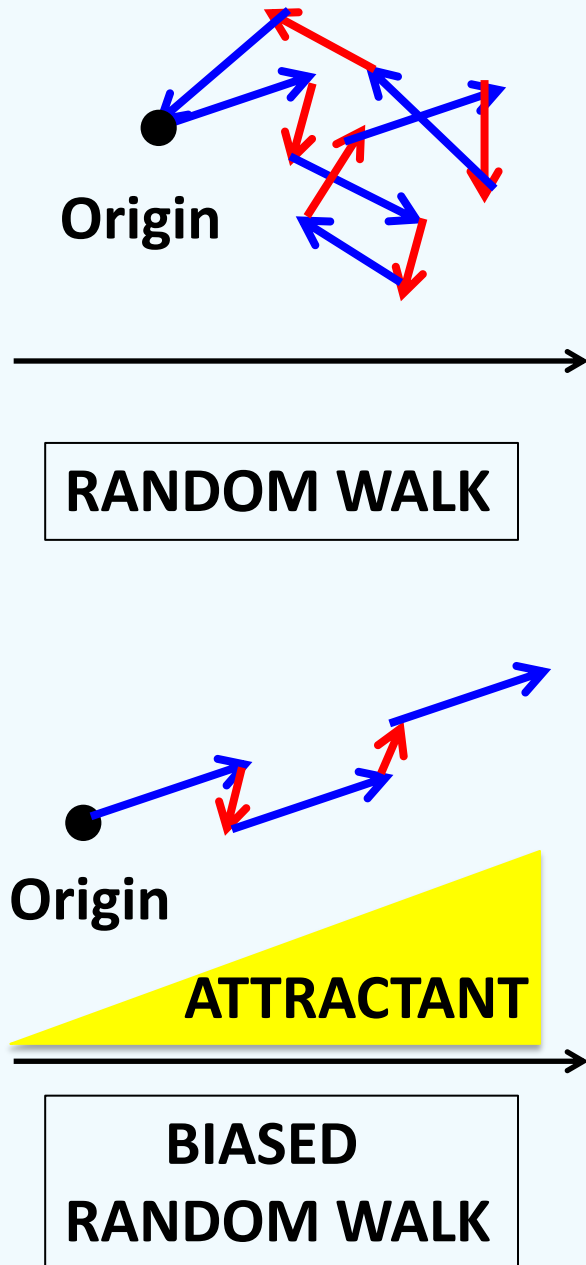


Bacterial Flagella

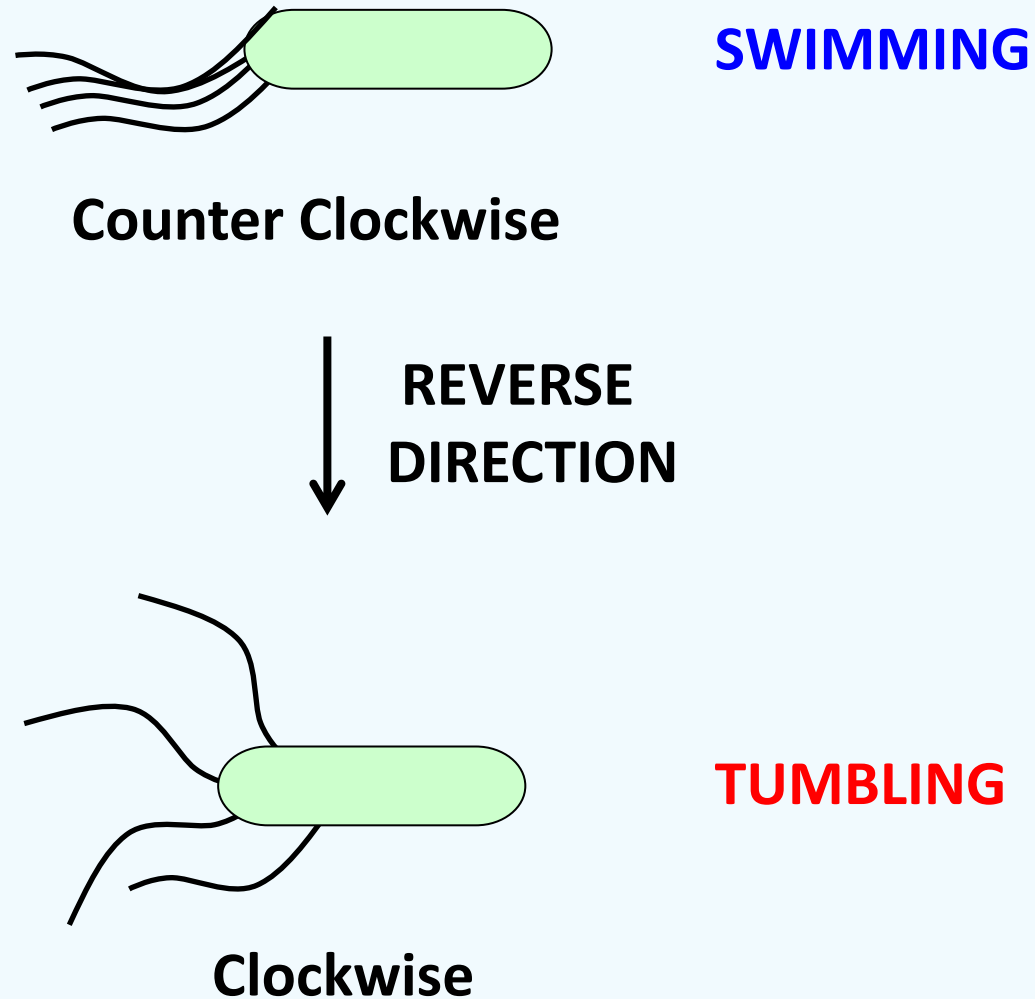


Bacterial Chemotaxis

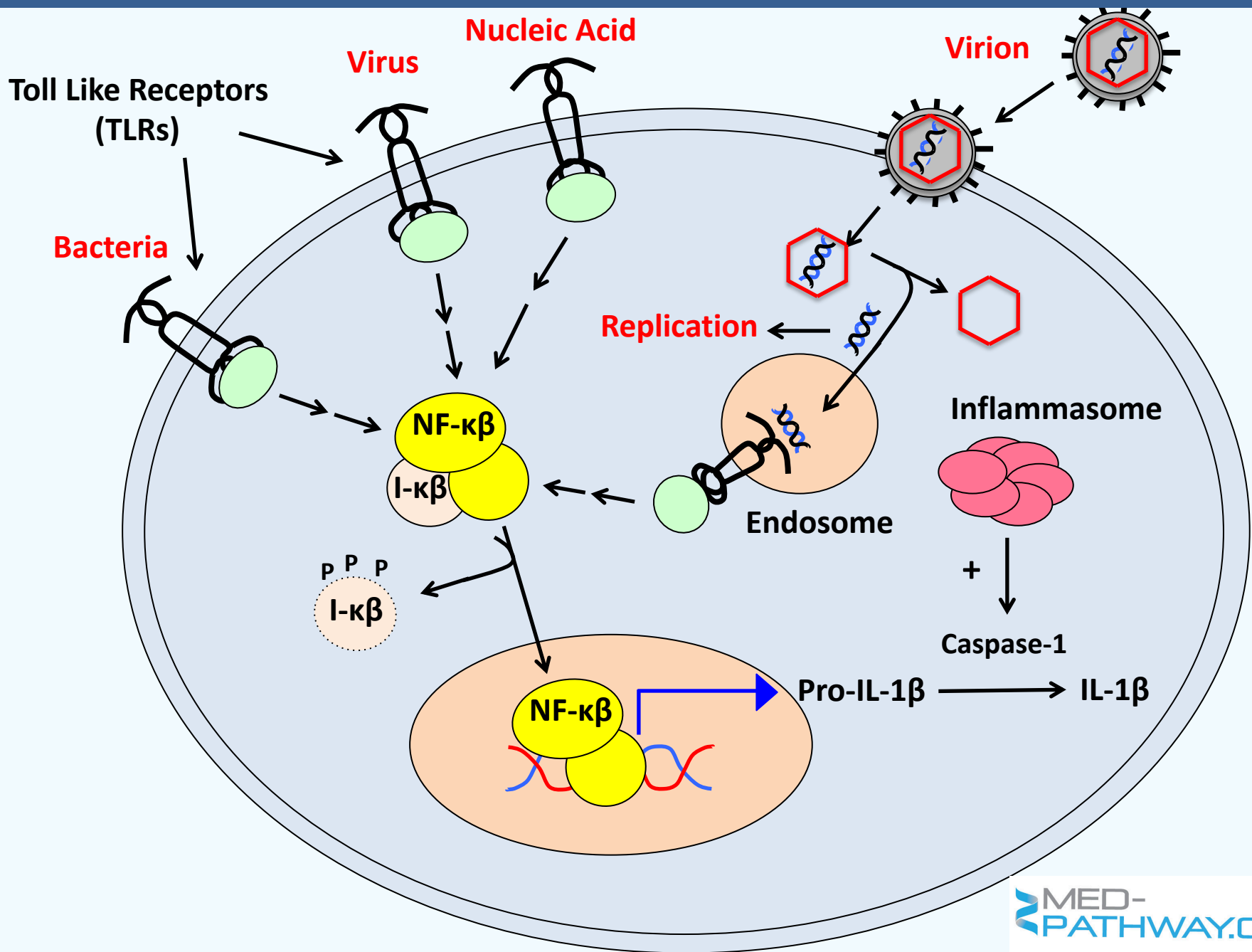
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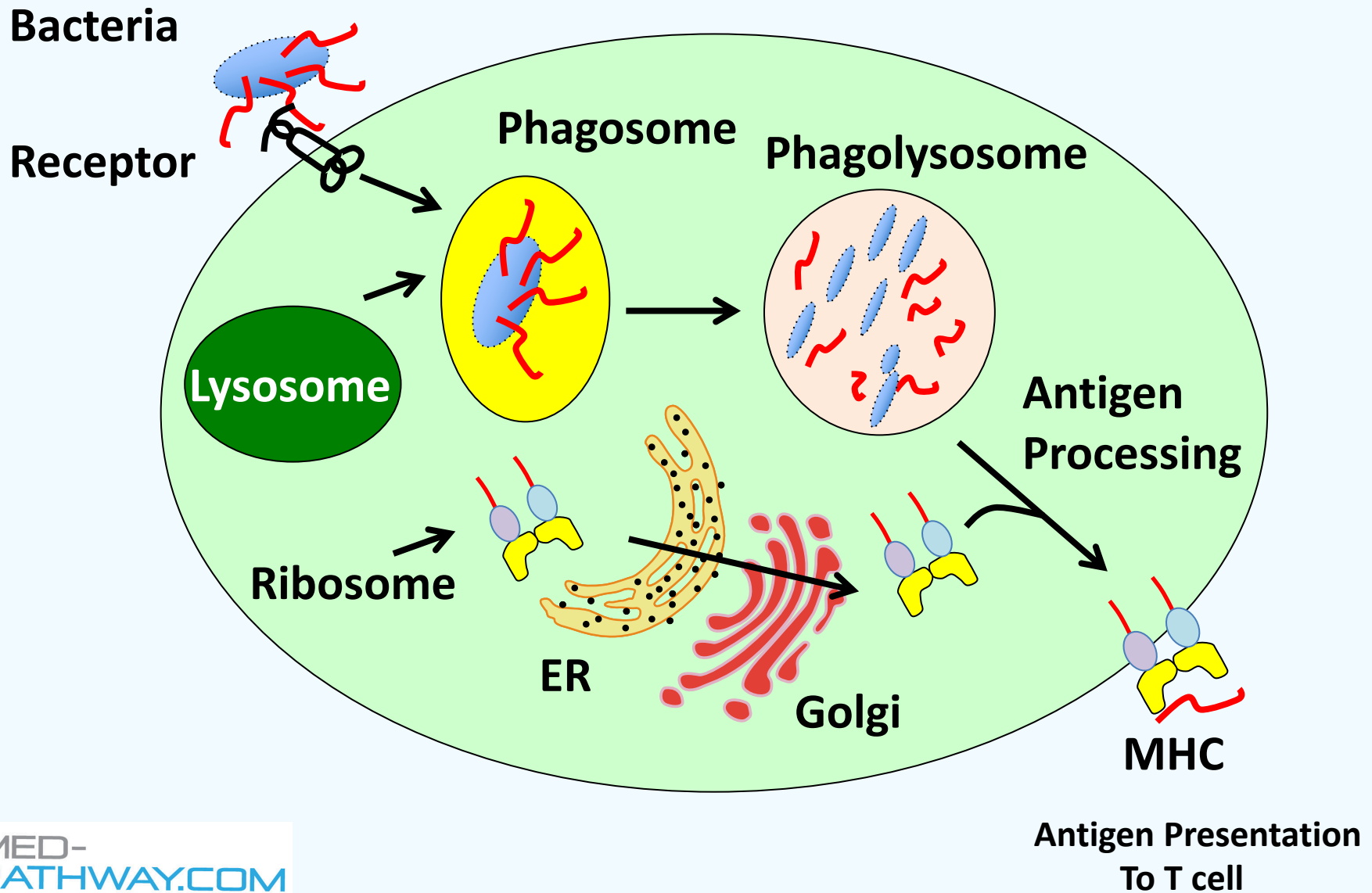
B



Toll Like Receptors



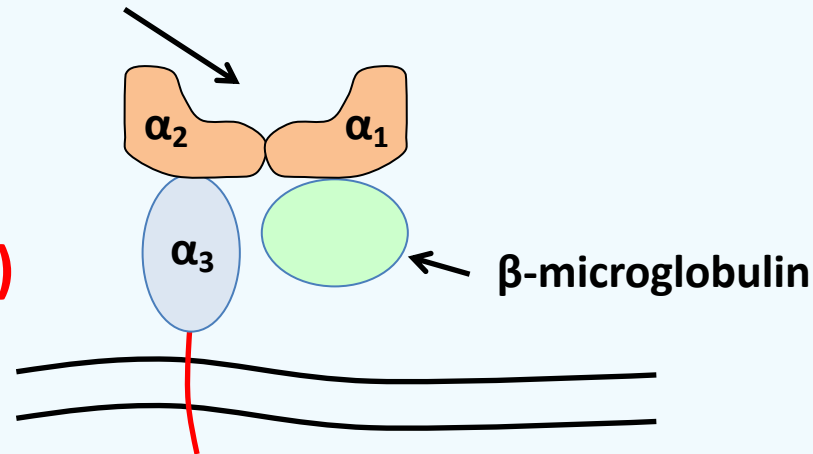
Phagocytosis



Major Histocompatibility Complex

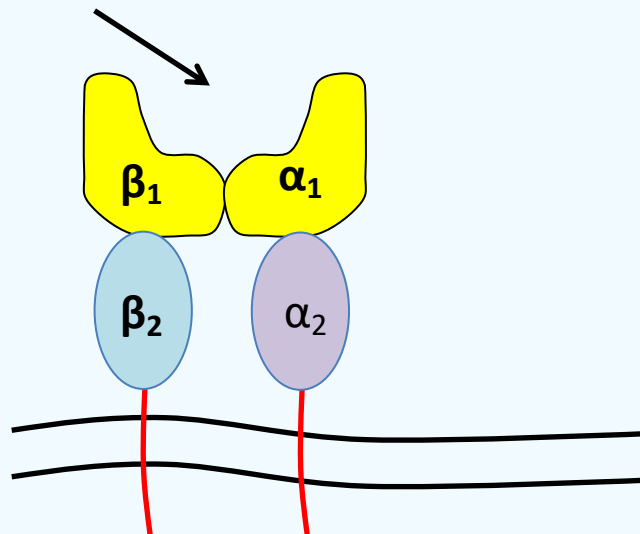
Peptide Binding Groove

Type I
(CD8-co receptors)

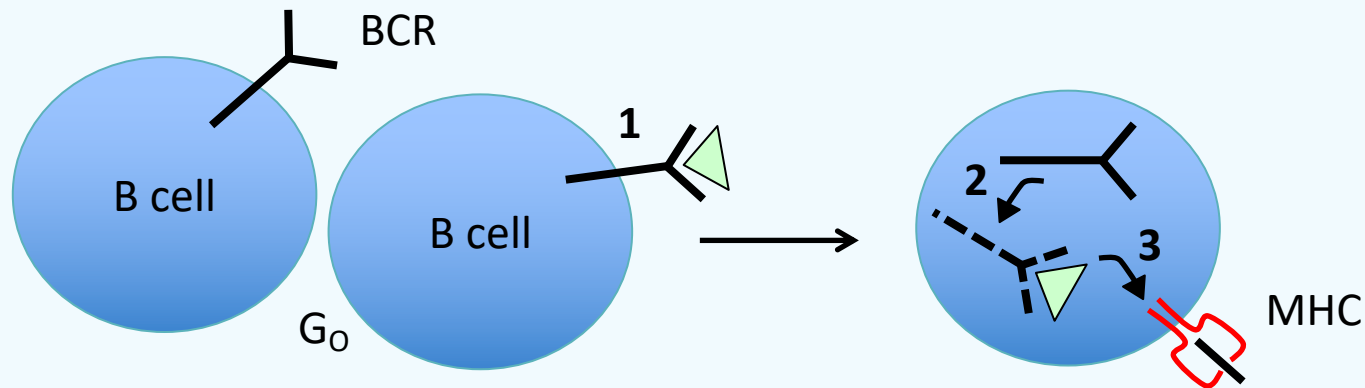


Peptide Binding Groove

Type II
(CD4-co receptors)

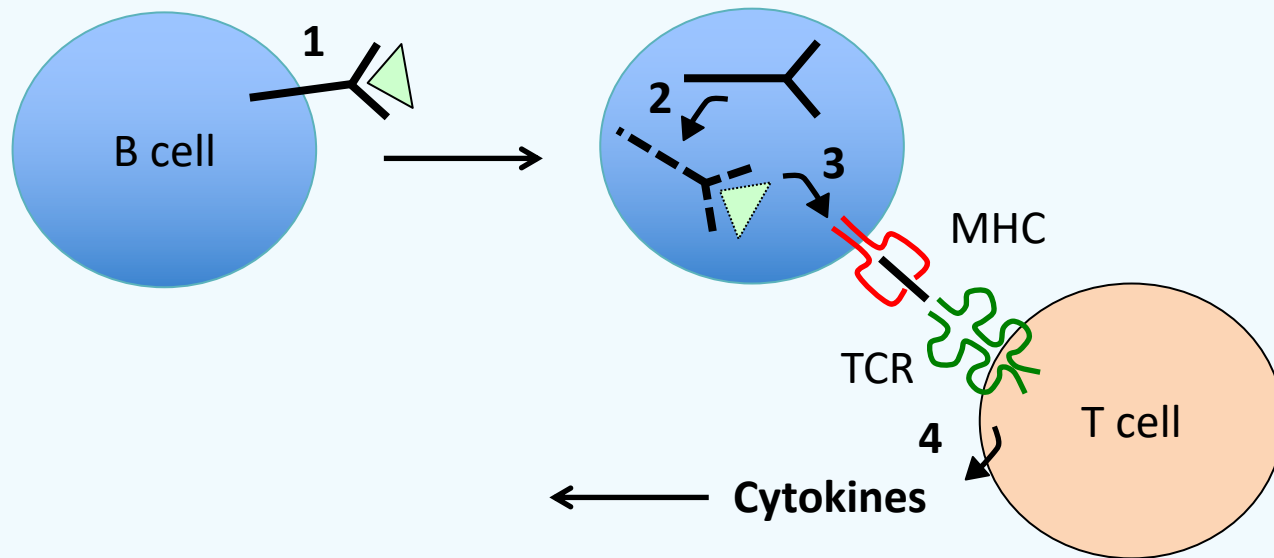


Clonal Selection



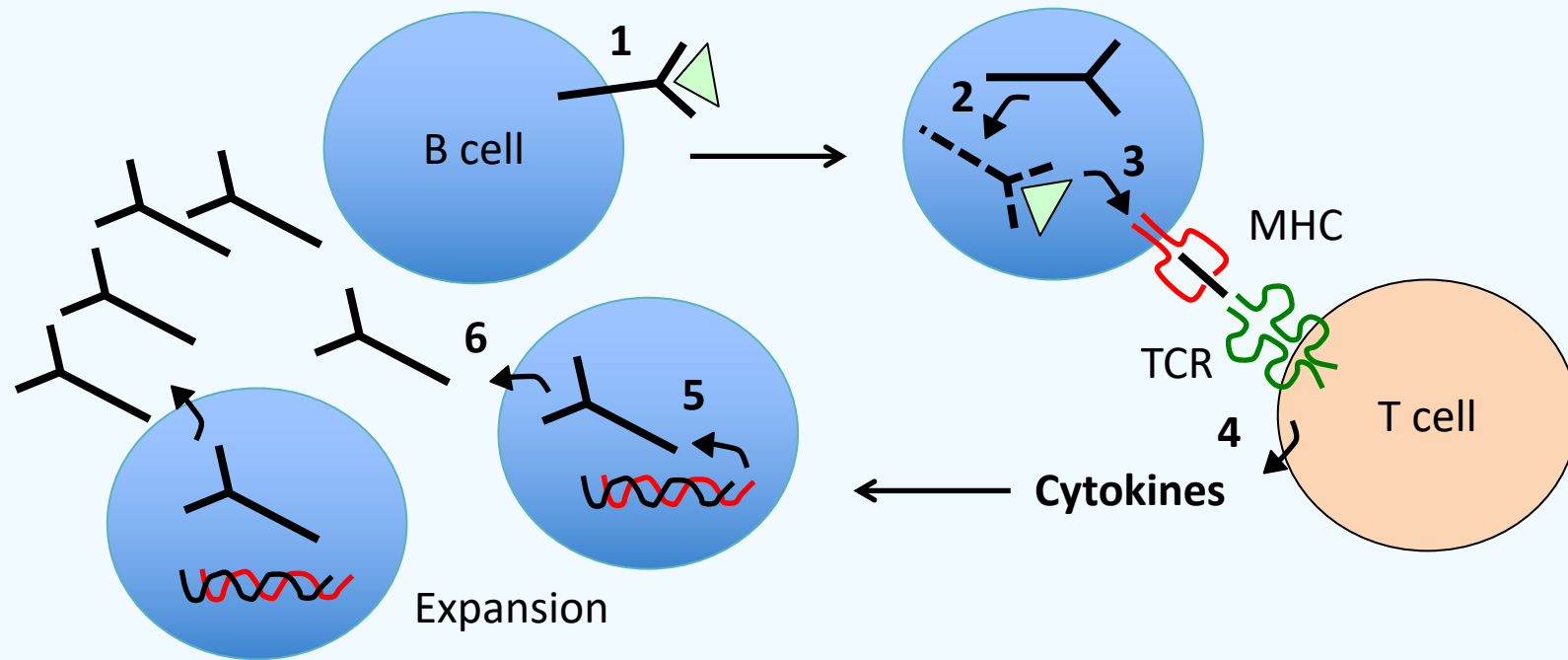
1. Naïve B cell expresses B cell receptor that recognizes cognate antigen.
2. Endocytosis brings the receptor-antigen complex into the cells where it is digested into fragments

Clonal Selection



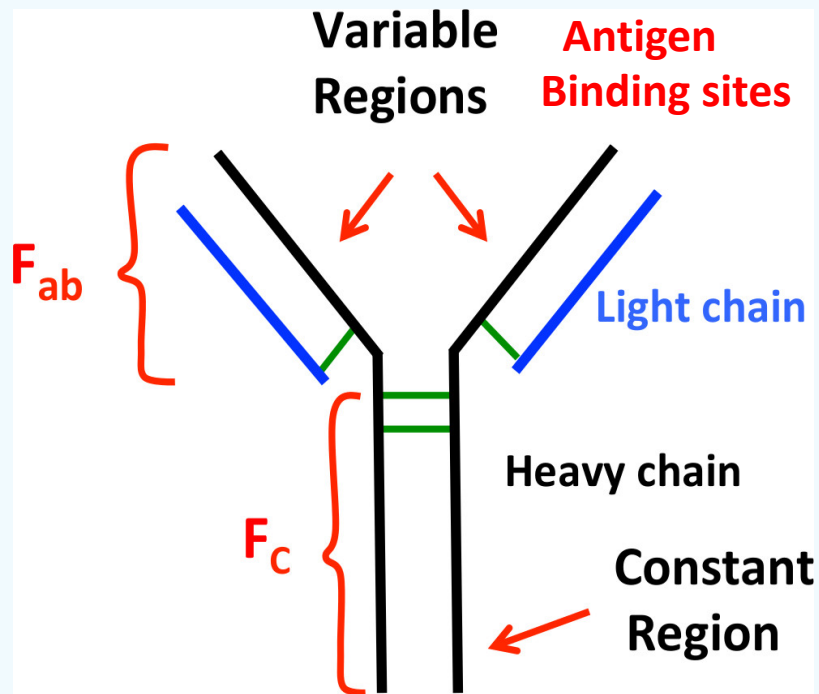
1. Naïve B cell expresses B cell receptor that recognizes cognate antigen.
2. Endocytosis brings the receptor-antigen complex into the cells where it is digested into fragments
3. Peptide fragments are displayed surface from MHC and are recognized by T cells expressing a matching TCR
4. The T cell secretes cytokine signaling molecules.

Clonal Selection



1. Naïve B cell expresses B cell receptor that recognizes cognate antigen.
2. Endocytosis brings the receptor-antigen complex into the cells where it is digested into fragments
3. Peptide fragments are displayed surface from MHC and are recognized by T cells expressing a matching TCR
- 5, 6. Cytokines induce B cells to differentiate and multiply as plasma cells where they secrete the antibody for maximal immune response.

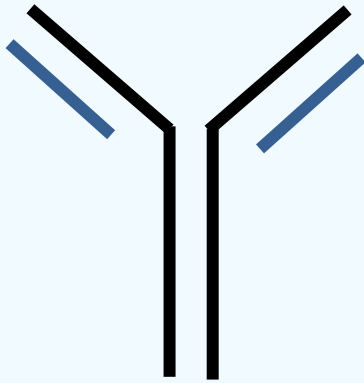
Antibody Structure-Function



Heavy & Light Chain Dissociation



Multiple Myeloma



**Bound Light Chain
(Normal)**

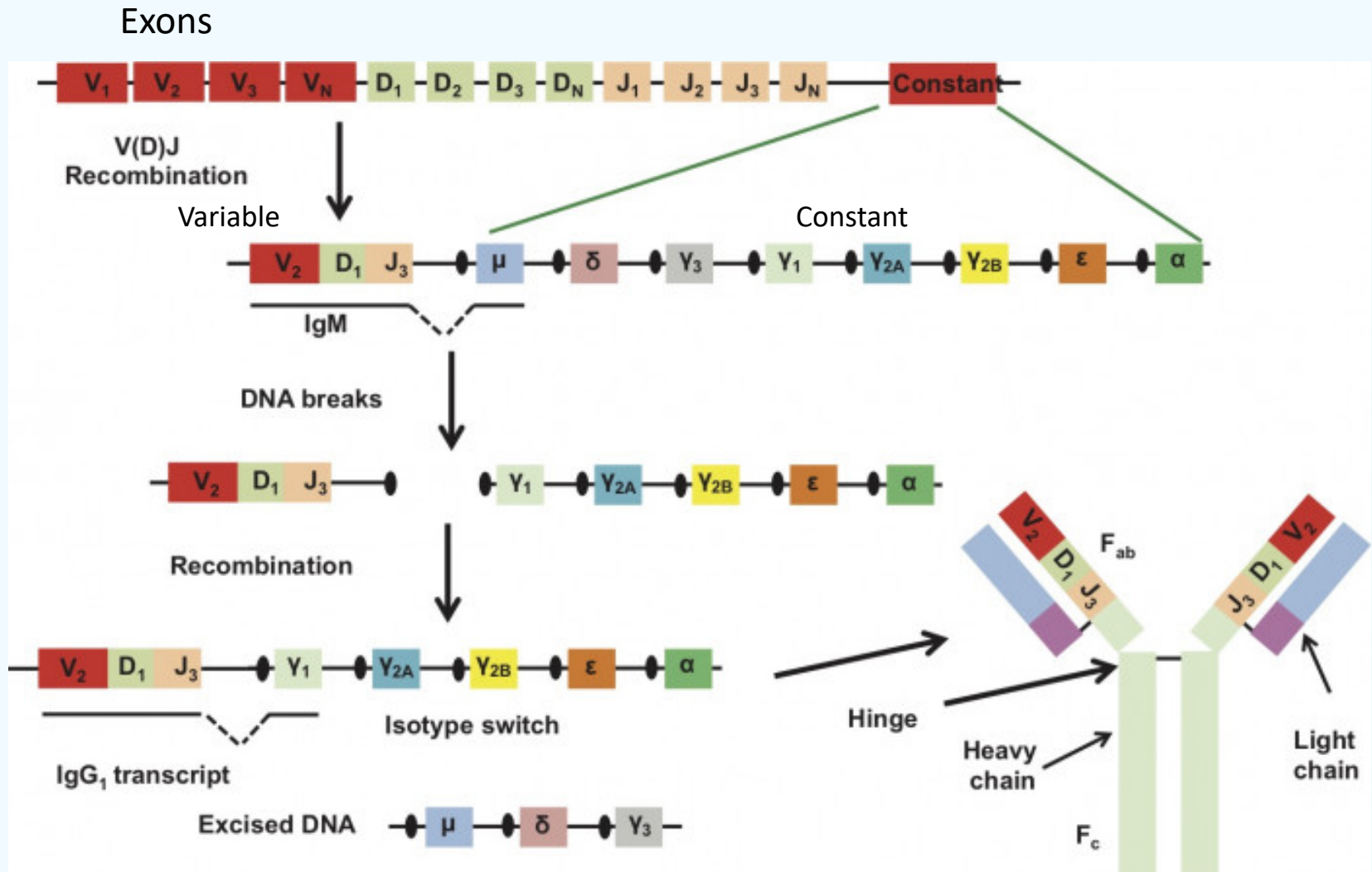


**Free Light Chain
(Diseased)**

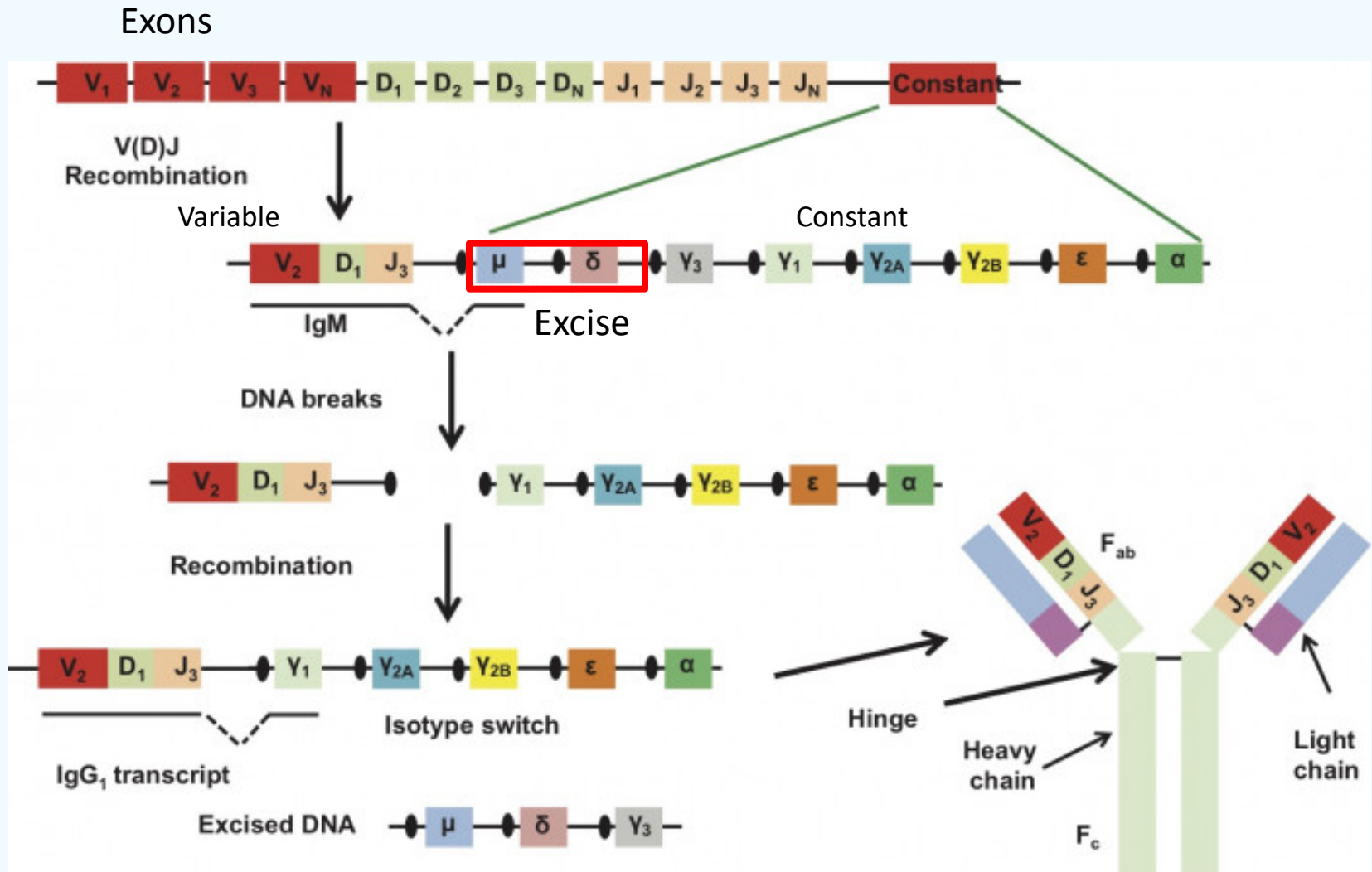
Classes of Antibodies

Class	Cellular Role
IgM	Functions in primary immune response as pentamer; binds B cell receptor
IgG	Major serum immunoglobulin; crosses placenta
IgA	Enriched in mucous membranes
IgE	Binds to mast cells and basophils; mediates allergic response
IgD	Co-expressed with IgM on B cells

V(D)J & Isotype Switching

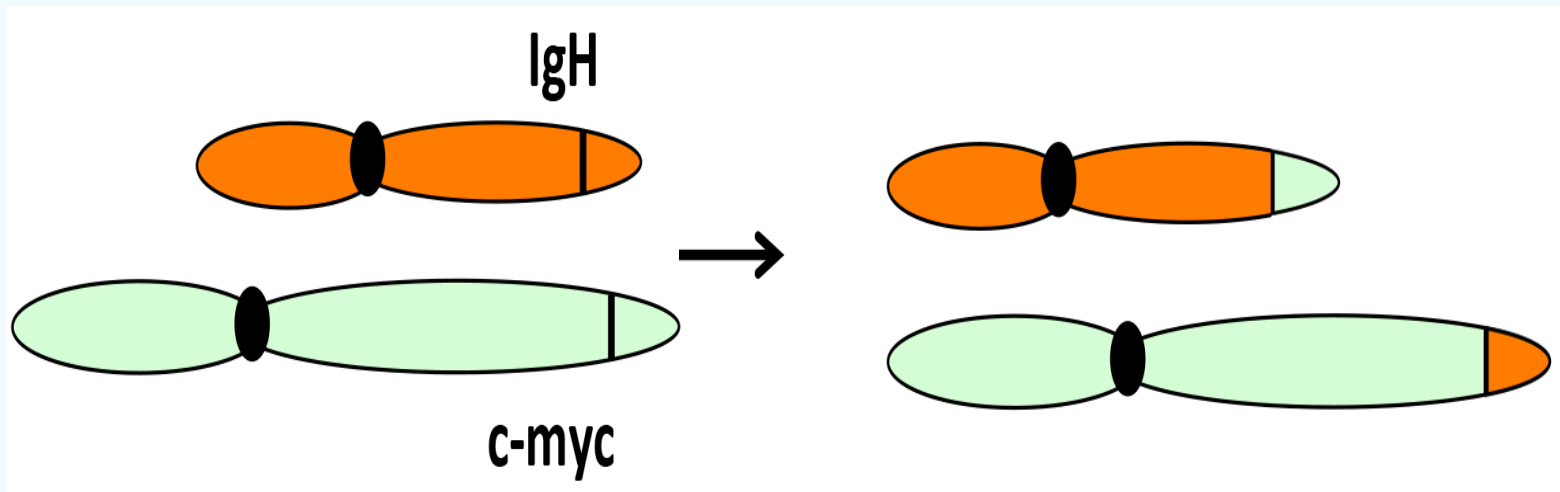


V(D)J & Isotype Switching



IgH Translocations

Burkitt Lymphoma



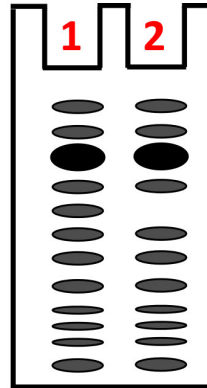
Antibody Techniques

Western Blotting

1. Run PAGE under native or SDS reduced conditions.

Control Experiments:

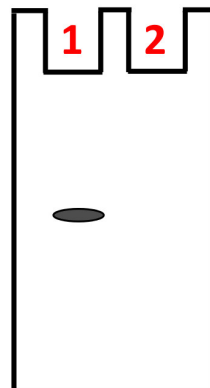
1. Negative
2. Positive
3. Peptide Competition



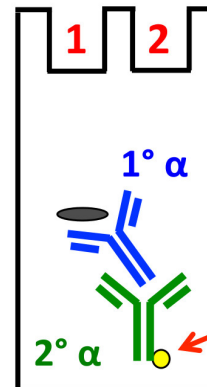
2. Transfer to membrane

3. Block membrane with Non-specific protein

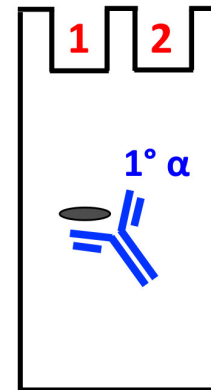
4. Add 1° antibody



6. Wash, Detect



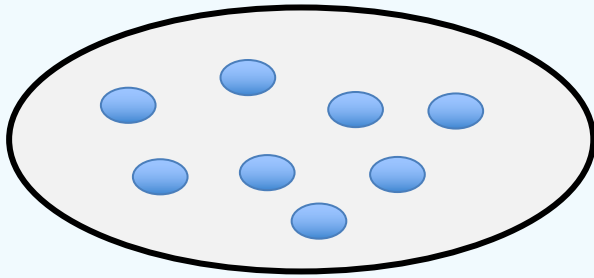
5. Wash; Add 2° α



Indirect ELISA Assays

INDIRECT ELISA

A

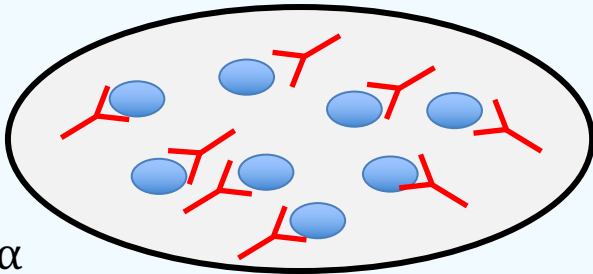


Determines [Ab]
In Solution

Coat with Antigen



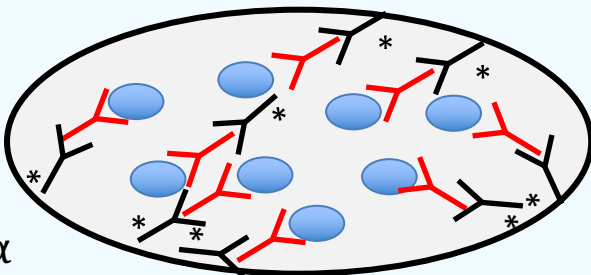
B



Add 1° α



C

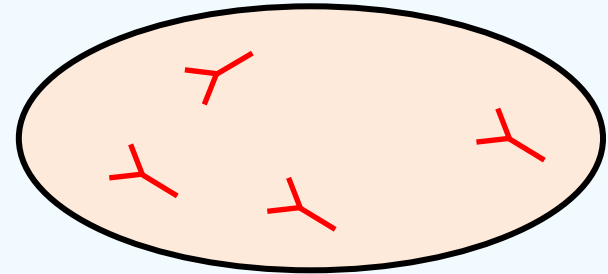


Add 2° α

Sandwich ELISA Assays

Measures [Antigen]
In Sample

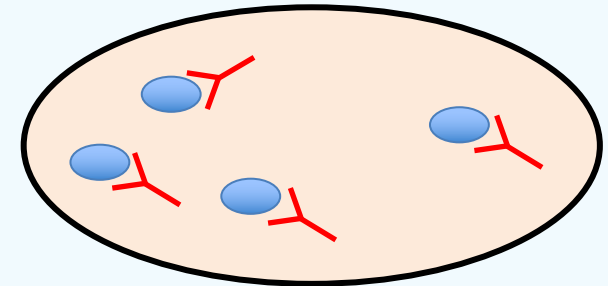
A



Capture α



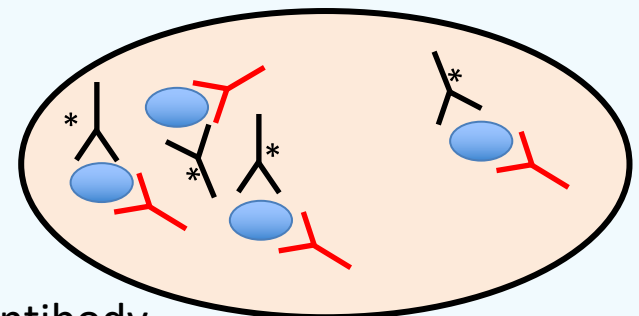
B



Add sample



C

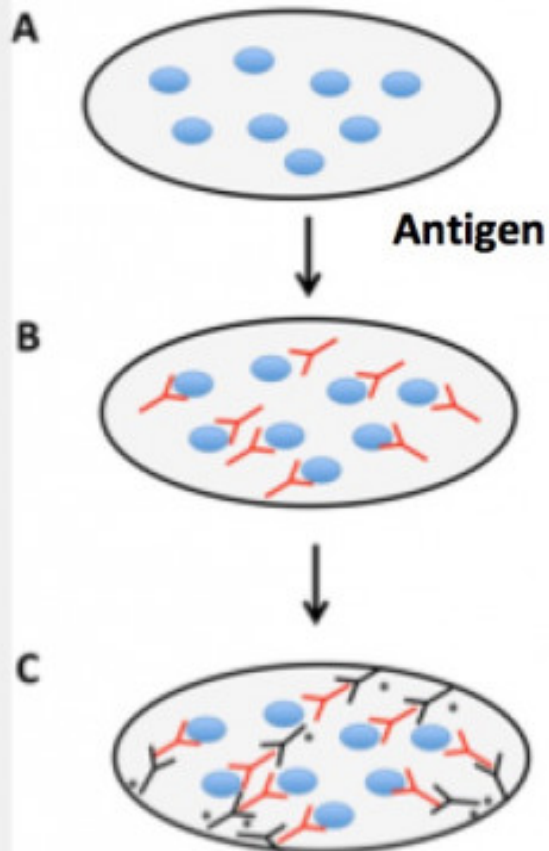


Add 2nd antibody

ELISA Assays

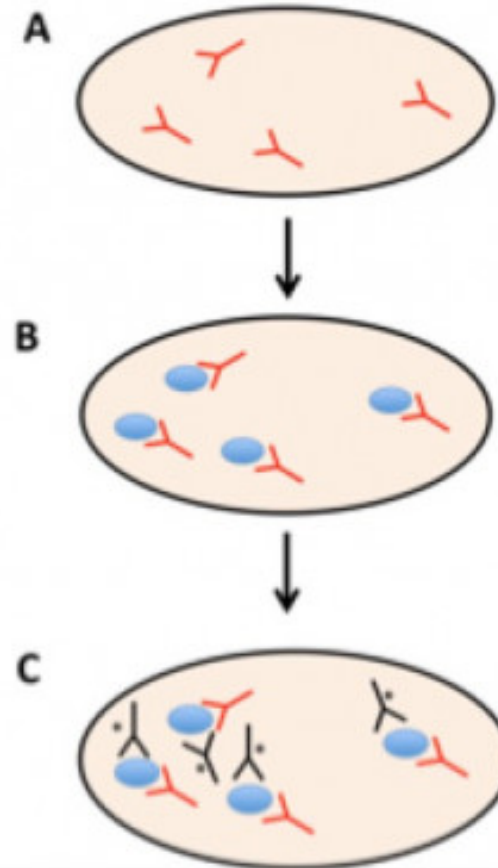
Determines [Ab]
In solution

INDIRECT ELISA



Measures [antigen]
In unknown sample

SANDWICH ELISA



Capture Ab

Workshop Passages

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Register for Med-Pathway

First name *

Last name *

Your email address *

Your password *

Confirm your password *

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