MCQs on Lymphocytes, Antigen-Presenting Cells, and Lymphoid Tissues – Medical Immunology

Antigen-Presenting Cells (APCs)

1. Which of the following is NOT a professional antigen-presenting cell?

A) Dendritic cell

B) Macrophage

C) B lymphocyte

D) Neutrophil

E) Langerhans cell

2. The main function of dendritic cells in the immune system is:

A) Phagocytosis of microbes

B) Killing of infected cells

C) Activation of naïve T lymphocytes

D) Secretion of antibodies

E) Production of histamine

3. The MHC class II molecules present peptides derived from:

A) Cytoplasmic proteins

B) Nuclear proteins

C) Extracellular antigens

D) Endogenous viral peptides

E) Mitochondrial proteins

4. Which of the following cytokines enhances MHC class II expression on macrophages?

A) IL-2

B) IL-4

C) IFN-γ

D) TNF-α

E) IL-10

5. The costimulatory molecules CD80 and CD86 on APCs interact with which receptor on T cells?

A) CD3

B) CD4

C) CD28

D) CD40

E) CTLA-4

Natural Killer (NK) Cells

1. NK cells primarily recognize and kill target cells that:

A) Overexpress MHC class I

B) Express self-peptides normally

C) Lack or have reduced expression of MHC class I

D) Express foreign MHC molecules

E) Are coated with IgE

2. Which cytokine is most critical for the activation and proliferation of NK cells?

A) IL-1

B) IL-2

C) IL-10

D) IL-12

E) IL-15

3. Antibody-dependent cellular cytotoxicity (ADCC) by NK cells is mediated through which receptor?

A) FcγRIII (CD16)

B) FcεRI

C) CD28

D) CD56

E) CD40L

4. NK cells kill their targets primarily through:

A) Opsonization

B) Complement activation

C) Release of perforin and granzymes

D) Production of nitric oxide

E) Phagocytosis

5. Which inhibitory receptor on NK cells recognizes self-MHC class I molecules?

A) NKG2D

B) CD16

C) KIR

D) CD94/NKG2C

E) CD28

B Lymphocytes

1. The surface immunoglobulin of mature naïve B cells is composed mainly of:

A) IgM and IgD

B) IgA

C) IgG

D) IgE

E) IgM only

2. Upon activation, B cells can differentiate into:

A) Neutrophils

B) Cytotoxic T cells

C) Plasma cells and memory B cells

D) NK cells

E) Dendritic cells

3. Which molecule on B cells interacts with CD40L on activated helper T cells?

A) CD19

B) CD21

C) CD40

D) MHC class I

E) Igα/Igβ

4. Class switching of B cells is driven mainly by:

A) IL-1

B) IFN-γ

C) T-cell cytokines and CD40-CD40L signaling

D) Toll-like receptor ligation

E) Complement activation

5. Which immunoglobulin class is first produced during a primary immune response?

A) IgA

B) IgE

C) IgM

D) IgG

E) IgD

T Lymphocytes

1. Cytotoxic T lymphocytes recognize antigens presented by which MHC class?

A) Class I

B) Class II

C) Both classes

D) CD1

E) None

2. Helper T cells recognize antigen in association with:

A) MHC class I

B) MHC class II

C) Antibody

D) CD40

E) Complement

3. Th1 cells are primarily responsible for promoting:

A) Antibody production

B) Activation of eosinophils

C) Cell-mediated immunity and macrophage activation

D) IgE-mediated hypersensitivity

E) Regulatory suppression

4. Regulatory T cells (Tregs) suppress immune responses mainly via:

A) IL-2 secretion

B) IL-10 and TGF-β production

C) Complement activation

D) Histamine release

E) IFN-γ secretion

Lymphoid Tissues

1. Primary lymphoid organs are the sites of:

A) Antigen trapping

B) Lymphocyte activation

C) Lymphocyte maturation

D) Antibody secretion

E) Inflammation

2. The main secondary lymphoid organs include:

A) Bone marrow and thymus

B) Liver and spleen

C) Lymph nodes, spleen, and MALT

D) Brain and spinal cord

E) Kidney and pancreas

3. In the lymph node, B cells are primarily located in the:

A) Paracortex

B) Medulla

C) Cortex (follicles)

D) Germinal center only

E) Capsule

4. The white pulp of the spleen is mainly responsible for:

A) Filtration of red blood cells

B) Antigen presentation and immune responses

C) Storage of iron

D) Production of platelets

E) Phagocytosis of dead cells

Answers and Explanations

Antigen-Presenting Cells (APCs)

1. Answer: D

Explanation: Neutrophils are not professional APCs; they lack MHC class II and costimulatory molecules necessary for T-cell activation.

2. Answer: C

Explanation: Dendritic cells capture antigens and migrate to lymph nodes to present them to naïve T cells, initiating adaptive responses.

3. Answer: C

Explanation: MHC class II presents peptides derived from extracellular proteins that are endocytosed and degraded in lysosomes.

4. Answer: C

Explanation: IFN-γ upregulates MHC class II and promotes activation of macrophages for improved antigen presentation.

5. Answer: C

Explanation: CD80 and CD86 on APCs bind to CD28 on T cells, providing the second signal for full T-cell activation.

Natural Killer (NK) Cells

1. Answer: C

Explanation: NK cells detect the absence of self-MHC class I molecules, a common feature of virally infected or tumor cells.

2. Answer: E

Explanation: IL-15 is essential for NK cell development, survival, and activation.

3. Answer: A

Explanation: CD16 (FcγRIII) binds the Fc region of IgG-coated target cells, triggering NK-mediated killing.

4. Answer: C

Explanation: NK cells induce apoptosis in target cells via perforin and granzymes, similar to cytotoxic T lymphocytes.

5. Answer: C

Explanation: Killer-cell immunoglobulin-like receptors (KIRs) recognize self-MHC class I, preventing NK activation against normal cells.

B Lymphocytes

1. Answer: A

Explanation: Naïve B cells coexpress surface IgM and IgD as their antigen receptors.

2. Answer: C

Explanation: Activated B cells differentiate into antibody-secreting plasma cells or long-lived memory B cells.

3. Answer: C

Explanation: CD40-CD40L interaction is crucial for B-cell activation, isotype switching, and germinal center formation.

4. Answer: C

Explanation: Cytokines from helper T cells and CD40-CD40L signaling induce recombination to produce different antibody isotypes.

5. Answer: C

Explanation: IgM is the first antibody produced upon antigen exposure and is later replaced by other isotypes after class switching.

T Lymphocytes

1. Answer: A

Explanation: CD8+ cytotoxic T cells recognize peptides presented on MHC class I molecules.

2. Answer: B

Explanation: CD4+ helper T cells interact with peptides bound to MHC class II on APCs.

3. Answer: C

Explanation: Th1 cells secrete IFN-γ and support macrophage activation and cytotoxic responses.

4. Answer: B

Explanation: Tregs secrete IL-10 and TGF-β, inhibiting effector T-cell and APC functions to maintain tolerance.

Lymphoid Tissues

1. Answer: C

Explanation: Primary lymphoid organs (bone marrow and thymus) are responsible for lymphocyte development and maturation.

2. Answer: C

Explanation: Secondary lymphoid organs are sites where mature lymphocytes encounter antigens and become activated.

3. Answer: C

Explanation: B cells reside in follicles within the cortex, where germinal centers form after activation.

4. Answer: B

Explanation: White pulp contains lymphocytes and functions as the immunologic compartment of the spleen.