

# What is the primary role of naive T lymphocytes in lymphoid organs?

- A. To secrete antibodies
- B. To continuously migrate and scan for antigens
- C. To phagocytose microbes
- D. To produce complement proteins

# Answer & Explanation

Correct Answer: B. To continuously migrate and scan for antigens

*Naive T cells circulate through lymphoid tissues, transiently interact with dendritic cells, and stop only when they encounter their specific antigen. This ensures antigen-specific immune responses.*

# Which three signals are required for full T cell activation?

- A. Antigen recognition, costimulation, cytokines
- B. Antigen recognition, antibody secretion, apoptosis
- C. Costimulation, antibody secretion, memory formation
- D. Cytokines, inflammation, antibody binding

# Answer & Explanation

Correct Answer: A. Antigen recognition, costimulation, cytokines

T cell activation requires recognition of peptide-MHC (signal 1), costimulation through receptors like CD28 (signal 2), and cytokines that drive proliferation and differentiation (signal 3).

Which costimulatory receptor on T cells binds to B7 molecules on APCs?

A. CTLA-4

B. CD40L

C. CD28

D. PD-1

# Answer & Explanation

Correct Answer: C. CD28

CD28 is the classic costimulatory receptor on T cells. Its binding to B7-1 (CD80) and B7-2 (CD86) on APCs promotes T cell proliferation, survival, and cytokine production.

Which inhibitory receptor competes with CD28 for B7 binding?

A. ICOS

B. PD-1

C. CTLA-4

D. CD40L

# Answer & Explanation

Correct Answer: C. CTLA-4

CTLA-4 is upregulated after T cell activation and binds B7 with higher affinity than CD28, thereby limiting excessive T cell responses and maintaining tolerance.

Which cytokine is crucial for T cell proliferation after activation?

A. IL-2

B. IL-4

C. IL-6

D. IL-10

# Answer & Explanation

Correct Answer: A. IL-2

IL-2 is rapidly secreted by activated CD4<sup>+</sup> T cells. It promotes clonal expansion and survival of T cells and is essential for both effector and regulatory T cell function.

Which molecule is transiently expressed early on activated T cells and promotes IL-2 responsiveness?

A. CD25

B. CTLA-4

C. CD69

D. CD40L

# Answer & Explanation

Correct Answer: A. CD25

CD25 (IL-2 receptor alpha chain) forms the high-affinity IL-2 receptor complex, allowing activated T cells to respond to IL-2 and proliferate.

# Which cytokines drive differentiation of Th1 cells?

- A. IL-12, IL-18, IFN- $\gamma$
- B. IL-4, IL-25, IL-33
- C. IL-6, IL-1, IL-23
- D. TGF- $\beta$ , IL-10

# Answer & Explanation

Correct Answer: A. IL-12, IL-18, IFN- $\gamma$

IL-12 and IL-18 from APCs, along with IFN- $\gamma$ , promote Th1 differentiation, mediated by transcription factors T-bet, STAT1, and STAT4.

# What is the main effector function of Th1 cells?

- A. Activation of macrophages
- B. Promotion of eosinophils
- C. Neutrophil recruitment
- D. Mucus production

# Answer & Explanation

Correct Answer: A. Activation of macrophages

Th1 cells secrete IFN- $\gamma$ , which strongly activates macrophages to kill intracellular microbes. They also enhance inflammation and antigen presentation.

# Which cytokines promote differentiation of Th2 cells?

A. IL-4, IL-25, IL-33

B. IL-6, IL-1, IL-23

C. IL-12, IFN- $\gamma$

D. TGF- $\beta$ , IL-10

# Answer & Explanation

Correct Answer: A. IL-4, IL-25, IL-33

Th2 differentiation is driven by IL-4, IL-25, and IL-33, acting via STAT6 and GATA3 transcription factors.

# What is a hallmark function of Th2 cells?

- A. Macrophage activation
- B. Eosinophil activation and IgE production
- C. CTL generation
- D. Pro-inflammatory cytokine secretion

# Answer & Explanation

Correct Answer: B. Eosinophil activation and IgE production

Th2 cells produce IL-4, IL-5, and IL-13, leading to IgE-mediated immunity, eosinophil activation, and protection against helminths, but also allergy development.

# Which cytokines drive Th17 differentiation?

- A. IL-6, IL-1, IL-23
- B. IL-4, IL-25, IL-33
- C. IL-12, IFN- $\gamma$
- D. IL-2, IL-15

# Answer & Explanation

Correct Answer: A. IL-6, IL-1, IL-23

Th17 differentiation is induced by pro-inflammatory cytokines IL-6, IL-1, and IL-23, with transcription factor ROR $\gamma$ t driving the program.

# What is the main effector function of Th17 cells?

- A. Recruit neutrophils and maintain epithelial barriers
- B. Activate macrophages
- C. Produce IgE
- D. Induce apoptosis in infected cells

# Answer & Explanation

Correct Answer: A. Recruit neutrophils and maintain epithelial barriers  
Th17 cells produce IL-17 and IL-22, leading to neutrophil-rich inflammation and epithelial barrier reinforcement, crucial for defense against fungi and extracellular bacteria.

Which cytokine secreted by Th17 cells promotes epithelial integrity?

A. IL-17

B. IL-22

C. IL-2

D. TNF- $\alpha$

# Answer & Explanation

Correct Answer: B. IL-22

IL-22 stimulates epithelial cells to produce antimicrobial peptides and supports repair, helping maintain barrier defenses.

Which T cell subset is important in allergic responses?

A. Th1

B. Th2

C. Th17

D. Treg

# Answer & Explanation

Correct Answer: B. Th2

Th2 cells produce IL-4, IL-5, and IL-13, which drive IgE-mediated hypersensitivity and eosinophil recruitment in allergy.

# What defines memory T cells compared to naive T cells?

- A. They are more numerous, respond faster, and require less costimulation
- B. They undergo apoptosis after antigen clearance
- C. They produce antibodies directly
- D. They cannot migrate to tissues

# Answer & Explanation

Correct Answer: A. They are more numerous, respond faster, and require less costimulation

Memory T cells persist long after infection, respond rapidly upon re-exposure, and are less dependent on costimulatory signals.

# Which cytokines maintain memory T cell survival?

- A. IL-7 and IL-15
- B. IL-2 and IL-10
- C. IL-4 and IL-13
- D. TNF- $\alpha$  and IFN- $\gamma$

# Answer & Explanation

Correct Answer: A. IL-7 and IL-15

IL-7 and IL-15 are critical for the long-term maintenance of memory T cells in a quiescent state.

# What characterizes T cell exhaustion?

- A. High effector cytokine production
- B. Increased inhibitory receptor expression
- C. Enhanced proliferation
- D. Complete absence of TCR signaling

# Answer & Explanation

Correct Answer: B. Increased inhibitory receptor expression

Exhausted T cells show reduced proliferation and cytokine production, while expressing inhibitory receptors such as PD-1, CTLA-4, and Tim-3.

# Which molecules mediate cytotoxic T cell killing via granules?

- A. Perforin and granzymes
- B. IL-2 and IL-10
- C. CTLA-4 and PD-1
- D. Fas and FasL only

# Answer & Explanation

Correct Answer: A. Perforin and granzymes

Perforin creates pores in target cells, enabling granzymes to enter and induce apoptosis through caspase activation.

# Which pathway involves FasL binding to Fas to induce apoptosis?

- A. Extrinsic apoptosis pathway
- B. Intrinsic apoptosis pathway
- C. Necrosis
- D. Pyroptosis

# Answer & Explanation

Correct Answer: A. Extrinsic apoptosis pathway

The Fas-FasL interaction activates caspase cascades, leading to apoptosis through the extrinsic pathway.

Which cytokine is critical for CD8+ T cell memory survival?

A. IL-15

B. IL-2

C. IL-4

D. IL-17

# Answer & Explanation

Correct Answer: A. IL-15

IL-15 supports the survival of long-lived memory CD8+ T cells and maintains their pool.

# What is the role of CD40-CD40L interaction in T cell immunity?

- A. It induces B7 expression and cytokines on APCs
- B. It blocks IL-2 signaling
- C. It promotes apoptosis of T cells
- D. It activates inhibitory receptors

# Answer & Explanation

Correct Answer: A. It induces B7 expression and cytokines on APCs  
CD40L expressed on activated T cells binds CD40 on APCs, enhancing their ability to stimulate T cells by upregulating B7 and cytokines.

# Which receptor is targeted by checkpoint blockade therapies in cancer?

- A. CTLA-4 and PD-1
- B. CD28 and ICOS
- C. CD40 and CD40L
- D. IL-2R and IL-7R

# Answer & Explanation

Correct Answer: A. CTLA-4 and PD-1

Immune checkpoint inhibitors block CTLA-4 and PD-1, releasing the brakes on T cells to enhance anti-tumor immunity.

# What is the main effector function of CD8+ cytotoxic T cells?

- A. Direct killing of infected or tumor cells
- B. Activation of B cells
- C. Recruitment of eosinophils
- D. Production of IgE

# Answer & Explanation

Correct Answer: A. Direct killing of infected or tumor cells

CD8+ CTLs kill target cells by delivering perforin and granzymes, eliminating intracellular pathogens and cancer cells.

Which molecule is important for T cell retention in lymphoid organs after activation?

A. CD69

B. CD40L

C. CTLA-4

D. PD-1

# Answer & Explanation

Correct Answer: A. CD69

CD69 expression prevents egress from lymphoid tissues, keeping T cells in place during activation.

# What happens to most effector T cells after antigen clearance?

- A. They die by apoptosis
- B. They all persist as memory cells
- C. They differentiate into B cells
- D. They fuse into giant cells

# Answer & Explanation

Correct Answer: A. They die by apoptosis

Most effector T cells undergo apoptosis during contraction phase, while only a fraction survive as long-lived memory T cells.

# Which cells are the primary producers of IL-2 in immune responses?

- A. Activated CD4+ T cells
- B. Naive CD8+ T cells
- C. Macrophages
- D. B cells

# Answer & Explanation

Correct Answer: A. Activated CD4+ T cells

IL-2 is produced rapidly and transiently by CD4+ T cells after antigen recognition, supporting clonal expansion.

Which subset of T cells is crucial for anti-helminth responses?

A. Th2

B. Th1

C. Th17

D. Treg

# Answer & Explanation

Correct Answer: A. Th2

Th2 cells promote eosinophil activation and IgE production, both of which are key for defense against helminths.

# What is the role of adjuvants in vaccines?

- A. To activate innate immunity and enhance costimulation
- B. To directly kill microbes
- C. To prevent T cell activation
- D. To produce antibodies directly

# Answer & Explanation

Correct Answer: A. To activate innate immunity and enhance costimulation  
Adjuvants mimic microbial products, stimulate innate immunity, and induce APCs to provide stronger costimulatory signals, enhancing T cell priming.