Chapter 16: Tolerance, Autoimmunity, and Transplantation

1. Central tolerance

A) is the first step of tolerance mechanisms.
B) affects both T cells and B cells.
C) deletes cells that are autoreactive.
D) occurs in the bone marrow and thymus.
E) All of the answers are correct.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Autoreactivity can involve both T cells and B cells.
Source: Test Bank
Sequence: 16001

2. Which of the following statements does NOT describe tolerogens accurately?

A) They can be the same molecules as immunogens.
B) They lead cells to become unresponsive.
C) They are part of peripheral tolerance.
D) They only affect B cells.
E) All of the answers describe tolerogens.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Understanding

Level of Difficulty: Moderate
Hint: Tolerogens are equivalent to immunogens, but in different context.
Source: Test Bank
Sequence: 16002

3. The tolerogenic response

A) is not antigen specific.
B) leads to apoptosis but not anergy.
C) results in cells becoming nonresponsive.
D) depends on the presentation context.
E) affects T cells only.

Answer: C
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Anergy and apoptosis are both mechanisms of tolerance.
Source: Test Bank
Sequence: 16003

4. Tolerance is promoted by all of the following circumstances EXCEPT

A) high doses of antigen.
B) persistent antigen.
C) oral introduction of antigen.
D) presence of adjuvant.
E) low levels of costimulation.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Oral polio vaccine is unusual in its effectiveness.

Source: Test Bank
Sequence: 16004

5. Tolerance is promoted by

A) induction of anergy.
B) induction of apoptosis.
C) regulation of activity of cells.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Autoreactivity is such a large potential problem that multiple systems to control it are used.
Source: Test Bank
Sequence: 16005

6. Apoptosis is

A) similar to necrosis.
B) important in peripheral but not central tolerance.
C) important in central but not peripheral tolerance.
D) impaired in Fas-deficient systems.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Apoptosis is widely used.
Source: Test Bank
Sequence: 16006

7. Maintaining immunologically protected sites, such as the eye,

A) allows sequestration of antigens.
B) reduces central tolerance.
C) can lead to autoreactivity secondary to injury.
D) can reduce background reactivity.
E) All of the answers are correct.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Keeping self-antigens away from immune cells reduces interactions, both during development and afterwards.
Source: Test Bank
Sequence: 16007

8. Central tolerance employs all but which of the following mechanisms?

A) Apoptosis
B) Receptor editing
C) Positive selection
D) Negative selection
E) Clonal deletion

Answer: C
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Removal of autoreactive cells is a major mechanism.
Source: Test Bank
Sequence: 16008

9. Peripheral tolerance

A) is caused by costimulation without TcR-MHC$^+$ peptide interaction.
B) is caused by TcR-MHC$^+$ peptide interaction without costimulation.
C) leads to anergy.
D) both leads to anergy and is caused by costimulation without TcR-MHC$^+$ peptide interaction.
E) both leads to anergy and is caused by TcR-MHC$^+$ peptide interaction without costimulation.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: It is antigen specific.
Source: Test Bank
Sequence: 16009

10. Which molecule is MOST closely associated with inhibitory responses to antigen?

A) TCR
B) MHCI
C) CTLA-4
D) CD80
E) All of the answers are equally associated with inhibitory responses to antigen.

Answer: C
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: The correct answer can be involved in activation and suppression.
Source: Test Bank
Sequence: 16010

11. $CD8^+$ T_{REG} cells can counteract autoimmune diseases in mice deficient in

A) AIRE.
B) $CD4^+$ T_{REG}s.
C) IL-10.
D) plasma cells.
E) lymphocytes.

Answer: A
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: AIRE is vital for central tolerance.
Source: Test Bank
Sequence: 16011

12. Which of the following events PRIMARILY drives the need for tolerance?

A) Organ transplants
B) V(D)J recombination in lymphocyte development
C) HLA polymorphisms
D) All of the answers are correct.
E) None of the answers are correct.

Answer: B
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: From where do autoreactive immune cells come?
Source: Test Bank
Sequence: 16012

13. What are the three main methods through which our body prevents immune responses against itself?

Answer:
Feedback: The three main routes to tolerance are evasion, elimination, and engagement. Evasion refers to tissues such as the eyes and CNS being inaccessible to most immune cells; elimination is the programmed cell death of cells reactive to auto-antigens; engagement occurs when inhibitory responses to the self are cultivated.
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Analyzing
Level of Difficulty: Moderate
Hint: One of the methods involves partial partitioning of antigens away from immune circulation.
Source: Test Bank
Sequence: 16013

14. Speculate as to why regulatory T cells may have evolved, despite us having negative selection of lymphocytes during development. Explain your answer.

Answer:
Feedback: B and T cells go through extensive negative selection during development, and this should theoretically be enough to prevent autoimmunity. However, we know from the existence of T_{REG} cells and cases where autoimmunity does develop that this system, despite being impressive, is not foolproof. A "backup system" that can turn some autoreactive T cells into negative regulators of the immune system – via tolerance and inhibition, rather than apoptosis and deletion – then becomes very valuable.
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Evaluating
Level of Difficulty: Difficult
Hint: See Figure 16-1.
Source: Test Bank
Sequence: 16014

15. What is the PRIMARY difference between how central and peripheral tolerance are developed?

Answer:
Feedback: The primary difference is temporal: central tolerance arises during lymphocyte, whereas peripheral tolerance occurs after development in circulation and tissues. There are other differences, such as the fate of these lymphocytes (more deletion in central tolerance and more development of T_{REG}s in the periphery), but temporality is the main difference.
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.1
Cognitive Level: HOC
Blooms Level: Analyzing
Level of Difficulty: Moderate
Hint: See Figure 16-1.
Source: Test Bank
Sequence: 16015

16. Autoimmune diseases

A) involve a failure of central tolerance.
B) involve a failure of peripheral tolerance.
C) lead to tissue destruction.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Multiple failures must take place for autoimmunity to develop.
Source: Test Bank
Sequence: 16016

17. Hashimoto's thyroiditis targets the thyroid and

A) is more common in men than in women.

B) shows juvenile onset.
C) is primarily T-cell mediated.
D) leads to hypothyroidism.
E) All of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: It reduces thyroid function.
Source: Test Bank
Sequence: 16017

18. Insulin-dependent diabetes

A) usually shows juvenile onset.
B) is more common in men that in women.
C) interferes with fat metabolism.
D) seems to be triggered by antibodies.
E) None of the answers are correct.

Answer: A
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: It is also known as juvenile-onset diabetes.
Source: Test Bank
Sequence: 16018

19. Myasthenia gravis is an autoimmune disease that

A) is triggered by antibodies.
B) targets the neuromuscular junction.
C) leads to destruction of muscle cells.

D) All of the answers are correct.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Acetylcholine receptors are on muscle cells.
Source: Test Bank
Sequence: 16019

20. Systemic lupus erythematosus

A) is more common in women than in men.
B) is antibody mediated.
C) targets multiple organs.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: “Systemic” means spread throughout.
Source: Test Bank
Sequence: 16020

21. Multiple sclerosis

A) does not seem to have an environmental component.
B) seems to have some genetic component.
C) is more common in Europe than North America.
D) seems to be primarily mediated by antibodies.
E) All of the answers are correct.

Answer: B
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: If one sibling has it, others are more likely to have it as well.
Source: Test Bank
Sequence: 16021

22. Rheumatoid arthritis

A) seems to be T-cell mediated, with cytotoxic T cells being primarily responsible.
B) is more common in men than in women.
C) targets the joint capsules.
D) is characterized by juvenile onset.
E) All of the answers are correct.

Answer: C
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: The etiology includes activation of the complement cascade at the joints.
Source: Test Bank
Sequence: 16022

23. Individuals who express *HLA-B27* are 90 times more likely to develop the autoimmune disorder ankylosing spondylitis than individuals with a different HLA allele at this locus. This leads to the conclusion that

A) *HLA-B27* causes ankylosing spondylitis.
B) individuals with *HLA-B27* will develop ankylosing spondylitis.
C) autoimmune disorders must have genetic components.
D) patients with ankylosing spondylitis express *HLA-B27*.
E) None of the answers are correct.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: Likelihood does not equal causation.
Source: Test Bank
Sequence: 16023

24. Many autoimmune disorders are treated with immunosuppressive drugs, which produce other problems. Antigen-specific immunotherapy would be much better because

A) they would target only the autoreactive cells.
B) they would not induce general suppression of the immune system.
C) they would produce a general reduction in inflammation.
D) they would both target only the autoreactive cells and not induce general suppression of the immune system.
E) they would target only the autoreactive cells and produce a general reduction in inflammation.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: The key to effective immune function is the ability to mount specific responses.
Source: Test Bank
Sequence: 16024

25. What is the MOST important gene (or group of genes) for the development of autoimmunity? Explain.

Answer:
Feedback: There are a wide variety of genes that can leave a person at risk for developing autoimmune diseases, but the most important are those that encode for MHC molecules. These

genes (known as “HLA” in humans) are critical because they are responsible for which antigens are presented to all T cells. For example, the HLA allele B-27 is responsible for a substantial increase in the risk of developing ankylosing spondylitis.
Question Type: Essay
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Analyzing
Level of Difficulty: Difficult
Hint: Consider the role of genes in autoimmunity.
Source: Test Bank
Sequence: 16025

26. What causes the diseases APS-1 and IPEX? Explain why the conditions are grouped together despite being caused by different mutations.

Answer:
Feedback: APS-1 is caused by mutations in the AIRE gene, whereas IPEX occurs when FoxP3 is mutated. However, because these two mutations control the beginning and the end stages of tolerance they are grouped together. With either mutation the ability to generate tolerance and prevent autoimmunity is greatly impacted, so both APS-1 and IPEX are associated with the development of many different autoreactive diseases.
Question Type: Essay
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Evaluating
Level of Difficulty: Difficult
Hint: Systemic autoimmunity due to disrupted immune regulation.
Source: Test Bank
Sequence: 16026

27. In immunotherapy, there has been a great deal of success through the use of tailored approaches and gene therapy — for example, engineering T cells that target a patient’s unique cancer cells. With this in mind, what might a similar approach look like for autoimmune diseases?

Answer:
Feedback:

Option 1: CAR therapy that recognizes the specific TCRs or BCRs causing the autoimmune response; these are then targeted for apoptosis and/or anergy.
Option 2: Rationally designed T_{REG} cells that bind the target autoantigen and induce tolerance/anergy in other nearby reactive immune cells.
Question Type: Essay
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Evaluating
Level of Difficulty: Difficult
Hint: Consider what, in treatments, causes a general suppressing effect on immunity.
Source: Test Bank
Sequence: 16027

28. Small animal models (for example, drosophila) have afforded profound insights into both biology and genetics. Your classmate wants to propose an inexpensive lab studying autoimmunity by using this insect. Predict what will happen next. Will the funding be received?

Answer:
Feedback: Small animal model systems can be excellent tools for studying immunology, but the classmate's proposal does not have a strong case. Human immunity is caused by the random recombination of antigen-binding genes in our lymphocytes — this process is unique to the adaptive immunity of vertebrates. Drosophila will not experience autoimmunity in the same way that a human being will.
Question Type: Essay
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Evaluating
Level of Difficulty: Difficult
Hint: Consider how autoimmunity is experienced.
Source: Test Bank
Sequence: 16028

29. Why is type 1 diabetes considered an autoimmune disorder despite being caused by a lack of insulin in the body? Explain.

Answer:
Feedback: Insulin is produced by beta cells in the pancreas. A common cause of type 1 diabetes is these cells being destroyed by autoreactive T cells produced by the host's own immune

system. These CTLs recruit macrophages, which leads to a DTH response that destroys the body's source of insulin.
Question Type: Essay
Chapter Name: 16
Section: 16.2
Cognitive Level: HOC
Blooms Level: Analyzing
Level of Difficulty: Moderate
Hint: See Table 16-1.
Source: Test Bank
Sequence: 16029

30. Autografts will be rejected only rarely because of all but which of the following?

A) They are from the same individual.
B) They are MHC matched.
C) They do not trigger an immune response.
D) They have T_H17 cells.
E) All of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: "Auto" means self.
Source: Test Bank
Sequence: 16030

31. Isografts are NOT usually rejected because

A) they are between genetically identical individuals.
B) they are MHC matched.
C) they do not trigger an immune response.
D) they are syngeneic.
E) All of the answers are correct.

Answer: E

Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: “Syngeneic” means shared genes.
Source: Test Bank
Sequence: 16031

32. Rejection of allografts

A) does not depend on MHC mismatching.
B) demonstrates immunological specificity.
C) demonstrates immunological memory.
D) both demonstrates immunological specificity and does not depend on MHC mismatching.
E) both demonstrates immunological specificity and immunological memory.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Rejection does depend on mismatches of MHC.
Source: Test Bank
Sequence: 16032

31. Because T cells are essential in graft rejection, nude mice, which lack a thymus

A) will reject grafts the same as wild-type mice.
B) will reject grafts more vigorously than wild-type mice.
C) will not reject grafts as they lack T cells.
D) will not reject grafts as they lack B cells.
E) will not reject grafts because of peripheral tolerance.

Answer: C
Question Type: Multiple Choice
Chapter Name: 16

Section: 16.3
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Without a thymus, T-cell development does not occur.
Source: Test Bank
Sequence: 16033

34. Kidney transplant infiltrates show both $CD4^+$ and $CD8^+$ T cells. This suggests that to reduce graft rejection

A) $CD4^+$ T cells should be depleted.
B) $CD8^+$ T cells should be depleted.
C) Both $CD4^+$ and $CD8^+$ cells should be depleted.
D) Inflammatory cells should be depleted.
E) None of the answers are viable treatments.

Answer: E
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: HOC
Blooms Level: Applying
Level of Difficulty: Difficult
Hint: What effect will T-cell depletion have on immune function?
Source: Test Bank
Sequence: 16034

35. Although MHC matching is important for transplantation, ABO blood group matching is also critical because

A) ABO antigens are expressed on nervous tissue.
B) ABO antigens are expressed on muscle cells.
C) complement will cause rapid lysis of ABO mismatched cells.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: C
Question Type: Multiple Choice
Chapter Name: 16

Section: 16.3
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: ABO is expressed on connective tissues.
Source: Test Bank
Sequence: 16035

36. Minor histocompatibility locus genes can cause tissue rejection

A) only if major histocompatibility genes also cause rejection.
B) even if major histocompatibility genes match properly.
C) more quickly than MHC-mediated rejection.
D) at the same rate as MHC rejection.
E) None of the answers are correct.

Answer: B
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Major is major, and minor is minor.
Source: Test Bank
Sequence: 16036

37. Allografts can be accepted without use of immunosuppressive drugs if

A) they lack alloantigens, such as cartilage.
B) cells are grafted to a site that is immunologically privileged.
C) tolerance has been induced previously, such as nonidentical twins.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC

Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: Lack of antigens leads to a lack of immune response.
Source: Test Bank
Sequence: 16037

38. Graft rejection consists of

A) sensitization, when T cells are stimulated, and effector, when they attack the graft.
B) sensitization, when B cells are stimulated, and effector, when they attack the graft.
C) recognition, when T cells are stimulated, and effector, when they attack the graft.
D) recognition, when B cells are stimulated, and effector, when they attack the graft.
E) None of the answers are correct.

Answer: A
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Remembering
Level of Difficulty: Easy
Hint: Sensitization of T cells is essential.
Source: Test Bank
Sequence: 16038

39. Transplantation of organs and tissues is challenging (even between relatives) for all of the following reasons EXCEPT

A) HLA alleles must be completely nonoverlapping.
B) HLA alleles must be all or nearly matched.
C) ABO blood groups must be matched.
D) Immunosuppression is needed.
E) All of the answers are correct.

Answer: A
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: HOC
Blooms Level: Applying

Level of Difficulty: Difficult
Hint: The mixed lymphocyte reaction is instructive here.
Source: Test Bank
Sequence: 16039

40. In transplantation, CsA, rapamycin, and FK506 are all used to

A) decrease the odds of rejection.
B) inhibit the activation of resting T cells.
C) improve the survival odds for the patient.
D) All of the answers are correct.
E) None of the answers are correct.

Answer: D
Question Type: Multiple Choice
Chapter Name: 16
Section: 16.3
Cognitive Level: LOC
Blooms Level: Understanding
Level of Difficulty: Moderate
Hint: How did more specific immune suppression become possible?
Source: Test Bank
Sequence: 16040

41. What are three different ways to prevent rejection following organ transplantation?

Answer:
Feedback: Answers will vary, but possible responses include transplanting an autograft (self-tissue), using immunosuppressive drugs, transplanting a tissue that does not contain alloantigens (such as cartilage), transplanting in a privileged site, or enclosing the transplanted cells in a protective barrier.
Question Type: Essay
Chapter Name: 16
Section: 16.3
Cognitive Level: HOC
Blooms Level: Analyzing
Level of Difficulty: Moderate
Hint: Some methods for preventing rejection after organ transplantation may only be available for certain types of transplants.
Source: Test Bank

Sequence: 16041

42. A transplantation doctor is observing her notes for an upcoming surgery. She sees the following information about the donor and recipient of a heart transplantation:

HLA: 11/12 [genes matched]
Donor blood type: A+
Recipient blood type: B-

What are the chances of success for this operation? Provide your prognosis.

Answer:
Feedback: Finding a donor organ that has 11/12 HLA genes matched up is rare (and quite exciting). However, the lack of a blood type match is concerning. There is a high chance that this patient will experience hyperacute rejection of the new organ due to complement deposition and damage incurred from mismatched blood type antigens. This surgery should not proceed as planned.
Question Type: Essay
Chapter Name: 16
Section: 16.3
Cognitive Level: HOC
Blooms Level: Evaluating
Level of Difficulty: Difficult
Hint: What does partial HLA matching ensure?
Source: Test Bank
Sequence: 16042