

NUTR*4320: Metabolic Control of Disease Practice Final Exam

1. Which of the following is true about mucus production?

- (a) The primary mucin produced in the intestines is Muc1
- (b) Muc1 is bound to the epithelial cell and is both "O" and "N-glycosylated"**
- (c) Muc2 is secreted into the intestines and is only "N-glycosylated"
- (d) The inner stratified mucus layer has a loose structure and is thicker than the outer layer

Answer: (b)

- (a) is incorrect because the primary mucin produced in the intestines is Muc2.
- (c) is incorrect because Muc2 is only "O-glycosylated".
- (d) is incorrect because the outer mucus layer has a loose structure and is thicker than the inner stratified layer.

2. Which of the following is a characteristic of malignant tumors?

- a. They do not metastasize
- b. Encapsulated- cells are usually fully differentiated
- c. Anaplastic- lose the morphological characteristics of the cell and the orientation.**
- d. First signs that a malignant tumor has spread is swelling of nearby tissues.

ANSWER C

- a. Malignant tumors metastasize
- b. Encapsulation is a characteristic of benign tumors
- d. First signs that a malignant tumor has spread is swelling of nearby lymph nodes.

3. Which of the following is a characteristic of lean adipose tissue?

- A. M2-like macrophage polarization**
- B. M1-like macrophage polarization
- C. Secretion of chemokines (MCP-1, IL-6)
- D. Increased TLR ligands

Answer: A

- B is incorrect because M1 macrophages are pro-inflammatory and increase in obese adipose tissue.
- C is incorrect, because MCP-1 and IL-6 are pro-inflammatory. Lean adipose tissue should secrete anti-inflammatory adipokines such as adiponectin and IL-10.
- D is incorrect because an increase in TLR ligands would be due to an increase in the local inflammatory microenvironment as is the case with obese adipose tissue.

4. Which of the following is false regarding eukaryotes?

- a) the genetic material is stored on chromosomes in the nucleus
- b) eukaryotes have no cell wall
- c) they are usually unicellular**
- d) cell division is through mitosis and meiosis

Answer: C - Eukaryotes are multicellular, whereas prokaryotes are unicellular.

Answer A is correct, as genetic material is stored on linear chromosomes that are usually paired within the nucleus. Prokaryotes genetic material is stored on plasmids within the cytoplasm.

Answer B is correct, as eukaryotes do not have a cell wall. However, prokaryotes do have cell walls, they can be gram positive or gram negative (LPS).

Answer D is correct. Eukaryotes divide through mitosis and meiosis, whereas prokaryotes divide through asexual reproduction by binary fission.

5. Which of the following is true regarding macrophage polarization in obesity?

- a) M2 macrophages are associated with obesity.
- b) M1 macrophages function to dampen the inflammatory response and promote repair.
- c) M2 macrophages are primarily used for tissue remodelling.**
- d) M1 macrophages promote insulin sensitivity.

Answer: c) M2 macrophages are primarily used for tissue remodelling.

-a) is incorrect because M2 macrophages are associated with lean tissue. M1 Macrophages are associated with obesity.

-b) is incorrect because M2 macrophages function to dampen the inflammatory response and promote repair.

-d) M1 macrophages promote insulin resistance.

6. A bacterial cell wall consists of peptidoglycan, which is made up of what?

- A) NAG
- B) NAM
- C) Short chains of amino acids
- D) All of the above.**

Correct answer: D

A, B, and C are incorrect because peptidoglycan is a polymer consisting of NAG, NAM and short chains of amino acids.

7. Which statement is correct regarding lipopolysaccharides (LPS)?

- a) LPS is a component of the inner layer of gram positive cell walls
- b) LPS can only bind to TLR2 to activate the eventual release of inflammatory cytokines.
- c) Lipid A is a component of LPS and is an endotoxin that can cause fever and shock in the host.**
- d) O polysaccharides, a fat, is a component of LPS that functions as an antigen

ANSWER: C

A is incorrect because LPS is part of the outer layer of gram negative cell walls.

B is incorrect because LPS can also bind to TLR4 to activate the eventual release of inflammatory cytokines.

D is incorrect because O polysaccharides are sugars not fats.

8. Which of the following is true regarding the microbiota composition in obesity?

- a) There are an increased number of Bacteroidetes in obese people.
- b) There are an increased number of Firmicutes in obese people.**
- c) The bacteria are not responsive to caloric intake.
- d) There was no effect when the microbiota from a lean donor was transferred to an obese recipient.

Answer: b) There are an increased number of Firmicutes in obese people.

-a) is incorrect because there are a decreased number of Bacteroidetes in obese people.

-c) is incorrect because the bacteria are responsive to caloric intake.

-d) is incorrect because there was a reduction in obesity-associated insulin resistance when the microbiota from a lean donor was transferred to an obese recipient.

9. Which of the following is NOT a beneficial function of the SCFA butyrate?

- A) Stimulation of GLP-1 and GLP-2
- B) Decreases in intestinal junction permeability
- C) Inhibition of NF κ B signalling cascade
- D) Raise in colonic pH to support health microbiota**

A. is incorrect - GLP-1 and GLP-2 stimulation is a beneficial function of butyrate

B. is incorrect - decreased intestinal permeability is a beneficial function of butyrate

C. is incorrect - inhibition of NF κ B signalling is a beneficial function of butyrate

D. is correct - butyrate lowers colonic pH (not raise) and healthy microbiota prefer lower colonic pH whereas pathogenic bacteria prefer higher pH

10. When studying the microbiota, bacteria are commonly classified based on taxonomy. Which of the following is the correct classification order from largest to smallest?

A) Kingdom, Class, Phylum, Family, Order, Genus, Species

[False, order is incorrect.]

B) Species, Genus, Family, Order, Class, Phylum, Kingdom

[False, order goes from smallest to largest.]

C) Kingdom, Species, Phylum, Genus, Class, Family, Order

[False, order is incorrect.]

D) Kingdom, Phylum, Class, Order, Family, Genus, Species

TRUE

11. Resveratrol supplementation on a high fat diet does NOT induce the following in rodents:

- a) Decrease body weight
- b) Decrease adipose tissue accumulation
- c) Decrease GLP-1**
- d) Improve glucose tolerance

Answer:C

A) is correct because in the 2006 Lagouge study, rodents saw a decrease in body weight following 9 week supplementation of 400mg/Kg BW of resveratrol.

B) Is correct because the study also showed a decrease in adipose accumulation.

C) is correct as we see faster glucose uptake and better response to the OGTT.

12. Which of the following is NOT a characteristic of eukaryotic cells?

- a) Genetic material is stored on chromosomes within the nucleus
- b) Contains membrane-bound organelles
- c) Cell division occurs via binary fission**
- d) 80S ribosome

Solution: The correct answer is (c). The question is asking for which one is not a characteristic of eukaryotic cells and (a), (b) and (d) are all typical characteristics of a eukaryotic cell. Option (c) states that cell division occurs via binary fission which is incorrect. This is a characteristic of a prokaryotic cell. Eukaryotic cells undergo mitosis and meiosis as methods for cell division.

13. Which of the following is INCORRECT about n-3 PUFAs?

- a) n-3 PUFAs can bind to GPR120 receptors on adipocytes to stimulate GLUT4 expression, which results in increased glucose uptake into the cell
- b) n-3 PUFAs can bind to GPR120 receptors on macrophages and prevent expression of pro-inflammatory cytokines via TAK1 and TBK1 suppression
- c) Like free fatty acids (free FAs), n-3 PUFAs are known for their pro-inflammatory properties**
- d) n-3 PUFAs include DHA and EPA

CORRECT ANSWER: c)

Explanation of incorrect answers –

- a) “n-3 PUFAs can bind to GPR120 receptors on adipocytes to stimulate GLUT4 expression, which results in increased glucose uptake into the cell” is incorrect (correct statement) because n-3 PUFAs are able to bind to this unique receptor and drive this response.
- b) “n-3 PUFAs can bind to GPR120 receptors on macrophages and prevent expression of pro-inflammatory cytokines via TAK1 and TBK1 suppression” is incorrect (correct statement) because this is one of the ways in which n-3 PUFAs reduce inflammation.
- c) “Like free fatty acids, n-3 PUFAs are known for their pro-inflammatory properties” is the correct answer.
- d) “n-3 PUFAs include DHA and EPA” is incorrect (correct statement) because these are the two such compounds that are known for their anti-inflammatory properties.

14. Which of the following is true about peptidoglycan?

- a) Made up of short chains of amino acids and subunits NAG and NAM**
- b) Penicillin is required for the last step of synthesis
- c) Polypeptide crossbridges always have a tetrapeptide sidechain that is connected to NAGs
- d) Peptidoglycan is the defining feature of gram-negative bacterial cell walls

Answer: A

B – Incorrect- penicillin inhibits the last step of synthesis by binding to PBPs and preventing cross linkage reactions

C – Incorrect – the crossbridge tetrapeptide sidechain is connected to NAMs

D – Incorrect – Peptidoglycan is the defining feature of gram positive bacterial cell wall

15. What is the name of a bacteria with known health promoting functions?

- A. Commensal
- B. Dysbiosis
- C. Symbiont**
- D. Pathobionts

- A. Incorrect – commensal refers to permanent residents of the microbiota.
- B. Incorrect – dysbiosis refers to an unnatural shift in the composition of the microbiota.
- C. Correct.
- D. Incorrect – pathobionts refers to permanent residents of the microbiota that have the potential to induce pathologies.

16. Which of the following is not an effect of insulin?

- A) Insulin acts in the liver to stimulate glycogen synthesis
- B) Insulin acts at the skeletal muscle to stimulate glucose uptake
- C) Insulin acts at the adipose tissue to inhibit glucose uptake**
- D) Insulin acts to promote anabolic processes and inhibit catabolic processes

A is incorrect: This statement is true; insulin does act at the liver to stimulate glycogen synthesis

B is incorrect: This statement is true; insulin does act at the skeletal muscle to stimulate glucose uptake

C is correct: Insulin acts at the adipose tissue to stimulate glucose uptake

D is incorrect: This statement is true; insulin acts to promote anabolic processes and to inhibit catabolic processes

17. Which of the following is a characteristic of lean adipose tissue

- a) M2 like macrophages**
- b) Insufficient blood supply to adipocytes
- c) M1 like macrophages
- d) Crown like Structures (CLS)

A is correct

B is incorrect. Insufficient blood supply to adipocytes is a characteristic of obese adipose tissue

C is incorrect. M1 like macrophages is a characteristic of obese adipose tissue

D is incorrect. Crown like Structures (CLS) is a characteristic of obese adipose tissue

18. Which of the following is NOT a mechanism by which n-3 PUFAs help the obesity phenotype?

- A. Increased GLUT4 expression and translocation to the cell surface of the adipocyte
- B. Suppression of TAK1 and TBK1
- C. Decreased adiponectin expression**
- D. Increased M2 macrophages

Answer: C

A is incorrect because the increase in GLUT4 expression and translocation to the adipocyte cell surface (by the binding of DHA to GPR120) improves glucose uptake and tolerance.

B is incorrect because the suppression of TAK1 and TBK1 by the activation of TAB1 decreases inflammatory cytokine production.

D is incorrect because n-3 PUFAs help improve adipose tissue macrophage polarization status, increasing M2 macrophages and decreasing M1 macrophages, which reduce the inflammatory response.

19. An abnormal increase in the number of cells is called:

- A. Metaplasia
- B. Dysplasia
- C. Hyperplasia**
- D. Atypia

Answer: C

A is incorrect because metaplasia is when cells are not the type normally found in that tissue or area.

B is incorrect because dysplasia is when cells develop abnormally, in both appearance and organization.

D is incorrect because atypia is when cells look slightly abnormal under the microscope.

20. Short chain fatty acids have been found to enhance the epithelial defense mechanisms by stimulating the secretion of _____, an anti-microbial that promotes the integrity of the mucous layers and promotes barrier integrity by epithelial restitution.

- a. Muc1
- b. IgA
- c. Muc2
- d. Tree-foil factor 3 (TFF3)**

ANSWER: D

- a. Is incorrect because Muc1 is not stimulated by SCFA to be secreted, and does not promote the physiological mechanisms listed
- b. Is incorrect because it does not promote the integrity of the mucous layer, although it has anti-microbial effects
- c. is incorrect because although it is secreted by SCFA and enhances the mucous layer, it is not considered an 'anti-microbial' but is a 'mucin'
- d. is correct

21. Dysbiosis refers to:

A. Residents of the microbiota that have the potential to induce pathologies.

B. An equilibrium in the amount of symbionts and pathobionts in the microbiota.

C. Microbiota that have no detrimental or beneficial effects to the host.

D. A disequilibrium (loss of balance), where an unnatural shift in the composition of the microbiota occurs.

Answer: D

A is incorrect because that choice is referring to pathobionts.

B is incorrect because dysbiosis is a loss of balance in the microbiota, where you get a reduction in the number of symbionts, and/or an increase in the number of pathobionts.

C is incorrect because that choice is referring to commensal bacteria.

22. Which of the following statements regarding teichoic acid is false?
- a. Prevents cell wall breakdown and lysis during cell growth
 - b. Binds and regulates cation movements into and out of the cell
 - c. Able to trigger an immune response
 - d.** Found in both gram-positive and gram-negative bacterial cell walls

Answer: **D) is the correct answer** because teichoic acid is only present in gram-positive bacterial cell walls, and therefore this option is false. Answers A-C are all true according to the Gut Microbiota Lecture 1 (slide 8).

23. Which of the following is not a class of proteins associated with maintaining epithelial membrane barrier integrity?

- A. Claudins
- B.** Cathelicidins
- C. Cadherins
- D. Junction associated molecules

Answer: B

A is incorrect as claudins are a class of tight junction proteins which acts to seal neighboring cells together.

C is incorrect because cadherins are a family of adherens junction proteins that join the actin bundle in one cell to the one beside it.

D is also incorrect because JAM proteins are a class of tight junction proteins that acts to seal neighboring cells together.

24. In obesity, which of the following is correct about adipokine influence on inflammation:

- a) There is an increase in TNF- α , IL-6 and adiponectin, but a decrease in MCP-1 and leptin
- b) There is an increase in TNF- α , IL6, MCP-1 and leptin, and a decrease in adiponectin
- c)** There is an increase in IL-10, Adiponectin and MCP-1, and a decrease in TNF- α and IL-6
- d) There is a decrease in TNF- α , leptin, Adiponectin, MCP-1 and IL-6

Adiponectin is an anti-inflammatory and insulin-sensitizing adipokine that stimulates fatty acid oxidation in the muscle.

MCP-1, IL-6 and TNF- α promote inflammation and induce insulin resistance in obese adipose tissue

25. What area of the human body has the highest content of microflora?

- A) Stomach
- B) Duodenum
- C) Jejunum
- D)** Colon

Answer: D

- A) Stomach only has 10^2 to 10^3
- B) Duodenum has less than 10^4 to 10^5
- C) Jejunum has less than 10^4 to 10^5
- D) Colon has 10^9 to 10^{12} bacterial cells. Intestinal microflora increases as you move proximal to distal through the digestive tract

26. What is the role of adherens junctions?

- a. Joins the actin bundle in one cell to the next cell
- b. Seals neighboring cells together - prevents leakage between epithelial cells
- c. Allows passage of small water-soluble ions and molecules
- d. Single cell barrier between the microbiota and all host tissues

Correct Answer: A

- a. correct – adherens junctions joins the actin bundle in one cell to the next cell
- b. This is incorrect because it explains what tight junction molecules role is in epithelial membrane barrier integrity
- c. This is incorrect because it explains the role of gap junctions in the epithelial membrane barrier integrity
- d. incorrect – this is the role of epithelial barrier, but adherens junctions are important to help with the epithelial barrier

27. Which of the following is false regarding the colonic epithelium?

- a) There are no long villi in the colon
- b) Cells are pushed up the crypts as they mature
- c) Goblet cells are found only in the crypts
- d) Dividing cells are found at the bottom of the crypts

Answer is C) False. While goblet cells are found mainly in the crypts, they can be found elsewhere as well.

28. Which of the following is not an antimicrobial peptide commonly found and discussed?

- a. Occludins
- b. Cathelicidins
- c. Lipopolysaccharide binding protein
- d. Defensins

Correct Answer: A

[A] is correct because occludins are a type of tight junction proteins and not antimicrobial proteins.

[B], [C], and [D] are incorrect because they are types of antimicrobial proteins and the question is looking for proteins that are not antimicrobial proteins. Defensins exist as α -defensins or β -defensins. In humans, LL-37 serves as a cathelicidin. The lipopolysaccharide binding protein acts as an antimicrobial peptide by blocking the binding of lipopolysaccharide (LPS) to Toll-like receptors (TLRs).

29. What happens in the obese phenotype?

- A.) Generally there is enough angiogenesis to support the growth of adipocytes in obesity. This is done through the help of Treg cells which increase in the obese phenotype.
- B.) Due to death or necrotic tissue, an infiltration of immune cells occur (there are some present in the fat already though), mainly see an increase in M2- like macrophages.
- C.)** Treg cells try and dampen the immune response in obesity, however they are usually overwhelmed. Also, they are seen to decrease in the obese phenotype, making the situation worse.
- D.) There are increase in adiponectin and IL-10 in the adipose tissue of a person who has an obese phenotype. Obese Adipose tissue also tends to push monocytes to differentiate into pro-inflammatory M1-like macrophages.

- A.) Is wrong, there is generally NOT enough angiogenesis to support the growth of adipocytes in obesity, also Treg cells do not increase in the obese phenotype.
- B.) Is wrong, there is an infiltration of immune cells, however they are classically activated macrophages which are M1 macrophages.
- C.) Is True, Treg cells do try and dampen increased pro-inflammatory cytokines and they are down regulated in obesity.
- D.) Is false because adiponectin and IL-10 are actually down regulated in obesity and are not pro-inflammatory cytokines.

30. Which of the following is NOT a component of lipopolysaccharide (LPS)?

- a) Lipid A
- b) Core polysaccharide
- c) Techoic acid**
- d) O polysaccharides

ANSWER: C

- a) TRUE- Lipid A is the endotoxin component of LPS
- b) TRUE- The core polysaccharide binds sugars to Lipid A
- c) FALSE- Techoic acid is not a component of LPS and is found in gram positive bacteria only
- d) TRUE- O polysaccharides are the antigenic component of LPS and they stimulate a host immune response

31. Which of the following is correct regarding adipokine function and adipose tissue?

- A) MCP-1 is an anti-inflammatory chemokine which down-regulates the recruitment of macrophages and monocytes to the site of inflammation
- B) IL-6 is down-regulated in obese adipose tissue
- C) Leptin inhibits hunger and provides a feeling of satiety**
- D) Obese adipose tissue is insulin sensitive

Answer: C

- A) MCP-1 is a pro-inflammatory chemokine which recruits monocytes and macrophages
- B) IL-6 is an inflammatory mediator and is increased in obese adipose tissue
- D) Obese adipose tissue is insulin resistant

32. Which of the following is incorrect about the metabolites secreted by many pathogens that can diffuse through the mucus barrier?

- a) They can disrupt mucus production
- b) They can block epithelial cell growth
- c) They can disrupt epithelial cell tight junctions
- d) They decrease the number of pathogens that reach the cell surface**

- a) This is true
- b) This is true
- c) This is true

CORRECT: the metabolites secreted by pathogens that disrupt mucus production reduce the amount of mucus, causing an increase in pathogens that can get through to the cell surface

33. Which of these is not a characteristic of obese adipose tissue

- A) Hypertrophic adipocytes
- B) Hyperplasia of the adipocytes
- C) Insulin sensitive**
- D) Insufficient angiogenesis

Correct answer: C – lean adipose tissue is metabolically healthy and insulin sensitive, but obese adipose tissue is insulin resistant

A, B, and D are incorrect because these are all features of obese adipose tissue. When in positive energy balance, adipose start to change and undergoes hyperplasia (increasing number of fat cells) than hypertrophic (increase size) when it cannot make any more cells. Growth of the fat tissue leads to poor angiogenesis and the adipose becomes hypoxic.

34. Which of the following is not one of the three major steps in the development of cancer?

- A) Initiation
- B) Promotion
- C) Carcinoma**
- D) Progression

Answer: C

A is incorrect because initiation is the first step in the development of cancer

B is incorrect because promotion is the second step in the development of cancer

D is incorrect because progression is the third step in the development of cancer

35. Which of the following molecules is not a part of the TLR-2 signalling?

- a) RAK-1**
- b) Mal
- c) TBK-1
- d) IRAK-1

Answer: C This is an incorrect statement! TBK-1 is a kinase that is a part of the TLR4 signalling pathway. It is recruited by the adaptor protein Trif. TBK-1 functions by activating transcription factors such as NF-kB and IRF3.

a) This is a correct statement! RAK-1 is a kinase that is a part of the TLR-2 signalling pathway. It is recruited by MyD88.

b) This is a correct statement! Mal is an adaptor protein that is activated by TLR2. It is essential for recruiting MyD88 (adaptor protein) to the membrane.

d) This is a correct statement! Like RAK-1 this is a kinase that is a part of the TLR-2 signalling pathway. It is recruited by MyD88. Both RAK-1 and IRAK-1 function by activating transcription factors NF-kB and IRF5, which then promote the production of pro-inflammatory cytokines like TNF and ILs.

36. Which of the following is not a characteristic of a prokaryote?

- a) No nucleus
- b) Genetic material stored on chromosomes**
- c) Cell wall
- d) Usually unicellular

Answer: B

a) Incorrect (i.e. is a characteristic of prokaryotes) Prokaryotes lack a nucleus. Genetic material is found in the cytoplasm in a plasmid.

b) Correct (i.e. is not a characteristic of prokaryotes) Genetic material in a prokaryote is stored in plasmids in the cytoplasm, not on chromosomes in the nucleus.

c) Incorrect (i.e. is a characteristic of prokaryotes) Prokaryotes have a cell wall that surrounds the plasma membrane and protects the organism. The cell wall structure differs between gram + and gram – bacteria.

d) Incorrect (i.e. is a characteristic of prokaryotes) Prokaryotes are generally unicellular (e.g. bacteria), whereas eukaryotes are multicellular.

37. Which is the correct signalling order of the TLR 2 receptor to initiate an inflammatory response:

a. TLR2 -> Mal -> MyD88 -> TBK1 -> NF-kB -> TNF

b. TLR2 -> TRAM -> Trif -> TBK1 -> NF-kB -> ILs

c. TLR2 -> Trif -> TRAM -> TBK1 -> IRF5 -> ILs

d. TLR2 -> Mal -> MyD88 -> IRAK1 -> NF-kB -> ILs

a. False – see D for correct order

b. False – see D for correct order (this is the pathway of TLR4 not TLR2)

c. False – see D for correct order

d. Correct

38. Gut microbiota Composition change in response to High Fat diet. Changes include

a) Decreased number of Firmicutes

b) Increased Bacteroidetes

c) Decreased Gram-positive bacteria

d) Increased Firmicutes

Answer: D

A is incorrect because Firmicutes numbers increase after being fed a HFD

B is incorrect because Bacteroidetes decreases after being fed a HFD
C is incorrect because gram-positive bacteria (like Firmicutes) increases after HFD

39. Which of the following bacterial components are responsible for the antigenicity of gram positive and gram negative bacteria respectively ?
- a) Peptidoglycans and teichoic acids
 - b) Teichoic acids and NAG
 - c) Teichoic acids and O polysaccharides
 - d) Peptidoglycans and Lipid A

Correct Answer: C)

Reasons

- a) Incorrect: bacteria cell wall consists of peptidoglycan component (NAG & NAM polymers), but contribute to cell wall structure and not antigenicity. Teichoic acids provide antigenicity for gram positive cells not gram negative cells
- b) Incorrect: the first part is correct, however NAG is one of the molecules that forms the carbohydrate backbone of the peptidoglycan structure.
- c) CORRECT
- d) Incorrect: see note about peptidoglycans above. Lipid A is part of the LPS component of the outer-membrane on gram negative bacteria, but it does not contribute to antigenicity. Lipid A binds to TLR4/2. It is the O polysaccharide component of LPS that functions as an antigen.

40. Which of the following statements is correct:

- A. n-3 PUFA in the diet has been shown to increase M1 macrophages and decrease M2 macrophages.
- B. Regulatory T cells (Tregs) are a type of CD4+ T cells which stimulate auto-reactive, inflammatory T cell responses
- C.** In obesity, there is a phenotypic shift from M2 macrophages to M1 macrophages.
- D. n-3 PUFA activates TAB1 which stimulates TBK1 and TAK1

Answer: C

- A is incorrect as n-3 PUFA has been shown to be beneficial by decreasing M1 macrophages and increasing M2 macrophages.
- B is incorrect as Tregs have suppressor activity against excessive auto-reactive, inflammatory T cell responses.
- D is incorrect as n-3 PUFA activates TAB1 which suppresses TBK1 and TAK1.

41. An obese person will have decreased levels of which cytokine?

- a. IL-6
- b. MCP-1
- c.** Adiponectin
- d. Leptin

- A is incorrect. IL-6 levels do increase obesity.
- B is incorrect. MCP-1 levels increase in obesity.
- C is correct. Adiponectin levels decrease in obesity.
- D is incorrect. Leptin levels increase in obesity.

42. Which of the following is true?

- a. There are more prokaryotes than eukaryotes overall in the whole human body
- b. The ideal microflora profile involves a very high amount of symbionts and a small amount of both commensal and pathobiont bacteria
- c. Bacteria in the lumen of the colon are at a concentration of 10^{14} cells/mL of colonic content
- d. The ileum has the highest concentration of bacteria of the GI tract

ANSWER:

- a. Correct
- b. There is no ideal microflora profile for everyone; we all have many non-modifiable factors contributing to our microflora, including different genetic and environmental factors
- c. Lumen bacteria concentration is 10^{11} cells/mL of colonic content
- d. The distal portion of the large intestine has the largest concentration of bacteria according to our notes

43. What change is seen in microbiota composition in obesity?

- a. An increase in *Faecalibacterium prausnitzii*
- b. The Firmicutes, gram-negative bacteria, exerts anti-inflammatory effects and decreases in obesity
- c. A reduced number of *Bifidobacterium*
- d. An increased number of Bacteroidetes, gram-positive bacteria

Correct answer: C

A is incorrect because we see a reduction in *Faecalibacterium prausnitzii* (which exert anti-inflammatory effects)

B is incorrect because Firmicutes are gram-positive bacteria that increase in obesity

D is incorrect because we see a decrease in Bacteroidetes, the gram-negative bacteria.

44. Which of the following proteins is an example of an adherens junction?

- A. Claudins
- B. Occludins
- C. Catenins
- D. Cathelicidins

Answer: C

A is false. Claudins are an example of tight junctions

B is also false for the same reason mentioned above. Occludins are associated with tight junctions

D is false. Cathelicidins are anti-microbial peptides. LL-37 is an example of a cathelicidin that promotes wound healing and modulates the adaptive immune response.

45. Which of the following is NOT a mechanism by which n-3 PUFAs can inhibit inflammation?

- A. By altering adipose tissue macrophage polarization to increase M1 macrophages and decrease M2 macrophages.

- B. Binds GPR120 receptor on macrophage to suppress TBK1 and TAK1 downstream signalling; thus, it prevents inflammatory transcription factor activation (NFkB).
- C. By increasing expression of anti-inflammatory mediators: IL-10 and adiponectin which help to inhibit inflammation.
- D. By directly blocking NFkB activity.

Answer: A, because n-3 PUFAs do alter adipose tissue macrophage polarization but act to increase M2 macrophages which are less inflammatory, and to decrease M1 macrophages which are more pro-inflammatory.

B, C and D are all incorrect because they are all mechanisms through which n-3 PUFAs can inhibit inflammation.

46. Which of the following functions of SCFAs (specifically Butyrate) is true?

- a. SCFAs inhibit GLP-1 and GLP-2 production.
- b. SCFAs increase the colonic pH, thereby decreasing the growth of pathogenic bacteria.
- c.** SCFAs stimulate the production of Muc2, which enhances the epithelial barrier.
- d. SCFAs stimulate NFkB signaling and inhibit downstream inflammatory mediator production.

Answer: C

- a. Incorrect because SCFAs stimulate GLP-1 and GLP-2 production.
- b. Incorrect because SCFAs decrease the colonic pH, thereby decreasing the growth of pathogenic bacteria.
- d. Incorrect because SCFAs inhibit NFkB signaling and downstream inflammatory mediator production.

47. The diversity and size of the bacterial population _____ as you move _____ to _____ in the digestive tract.

- A. Increases; distally; proximally
- B.** Increases; proximally; distally
- C. Stays the same; proximally; distally
- D. Decreases; proximally; distally
- E.

Answer: B

A is incorrect because as you move distally to proximally, the diversity and size of the bacterial population gets less.

B is correct.

C is incorrect because there is an increase in bacterial diversity and size as you move proximally to distally in the digestive tract, so size and diversity do not stay the same.

D incorrect because there is an increase, not decrease, in bacterial diversity and size as you move proximally to distally in the digestive tract.

48. Which of the following is NOT an example of an anti-microbial protein/peptide?

- a) alpha-defensins
- b) Cathelicidins
- c) Lysozymes
- d) Muc1**

-a is incorrect because alpha-defensins are an example of an anti-microbial protein/peptide
-b is incorrect because cathelicidins are also an example of an anti-microbial protein/peptide
-c is incorrect because lysozymes are also an example of an antimicrobial protein/peptide
-d is the correct response because although Muc1 is a barrier defence mechanism, it is not an anti-microbial protein/peptide

49. Mal (MyD88 adaptor-like protein) and MyD88 (myeloid differentiation primary-response gene 88) are key adaptor proteins in the downstream recruitment of what?

- A. IRAK1 and IRAK4
- B. TBK1
- C. TAK1 and TBK1
- D. PKC

Answer: A

B is incorrect because TBK1 is activated by key adaptor proteins TRAM(Trif-related adaptor molecule) and Trif (interferon-beta (IFN-beta)-mediated transcription-factor)

C is incorrect because they are the downstream activation of TLR4 and TNFR

D is incorrect because it is the downstream activation of the calcium pathway

50. What is not one of the components of lipopolysaccharide (LPS)?

- A. O – polysaccharides
- B. N – polysaccharides
- C. Lipid A
- D. Core polysaccharides

Answer: B

A → incorrect because O-polysaccharides are the sugars that function as the antigens which stimulate the host immune response

C → incorrect because lipid A is the endotoxin component of the lipopolysaccharides

D → incorrect because this is the component that binds the sugars to Lipid A