



## PAST PAPER QUESTIONS

Solved by: Abdelhadi Okasha

### Chapter (1)

1) Which of the following characteristic is a basic property of cells?

- a) Cells are highly complexed and organized.
- b) Cells possesses a genetic program and the mean to use it.
- c) Cells are capable of producing more of themselves.
- d) Cells acquire and utilize energy.
- e) All of these are correct.

answer: e

Source : Concept 1.2

2) The genetic material of a prokaryotic cell is present in a ..... region of a cell.

- a) Genome
- b) Nucleoid
- c) Nucleus
- d) Pharmacopeia
- e) Chromatic region

Answer: b

Source: Concept 1.3

3) What characteristic distinguish prokaryotic and eukaryotic cells?

- a) Eukaryotes have membrane-bound organelles, prokaryotes don't.
- b) Prokaryotes have relatively little DNA, Eukaryotes have much more.
- c) Eukaryotic chromosomes are linear, Prokaryotic chromosomes are circular.
- d) Prokaryotic DNA is naked or nearly naked, Eukaryotic DNA is usually heavily associated with proteins.
- e) All of these are correct

Answer: e

Source: Concept 1.3

4) Which of the following is not a model organism?

- a) Escherichia coli
- b) Drosophila melanogaster
- c) Caenorhabditis elegans
- d) Saccharomyces
- e) Homo sapiens

Answer: e

source: Concept 1.5

5) bacteria will often pass a piece of DNA from a donor bacterial cell to a recipient bacterial cell presumably through pilus, this process is called.....

- a) confirmation
- b) transduction
- c) transformation
- d) conjugation
- e) fission

**Answer: d**

**Source: concept 1.3**

### Summary for chapter (1)

→ Cell theory is formed of 3 items:

- 1) All organisms are composed of one or more cells.
- 2) The cell is the structural unit of life.
- 3) Cells arise only by division from a pre-existing cell.

→ Basic properties of cells:

1. Cells are highly complex and organized
2. Cells Possess a Genetic Program and the Means to Use It
3. Cells Are Capable of Producing More of Themselves
4. Cells Acquire and Utilize Energy
5. Cells Carry Out a Variety of Chemical Reactions
6. Cells Engage in Mechanical Activities
7. Cells Are Able to Respond to Stimuli
8. Cells Are Capable of Self-Regulation (Feedback circuit)

→ We have two types of cells

- 1) prokaryotes (very diverse)
- 2) eukaryotes

#### Features of eukaryotic cells not found in prokaryotes:

- o Division of cells into nucleus and cytoplasm, separated by a nuclear envelope containing complex pore structures
- o Complex chromosomes composed of DNA and associated proteins that are capable of compacting into mitotic structures
- o Complex membranous cytoplasmic organelles (includes endoplasmic reticulum, Golgi complex, lysosomes, endosomes, peroxisomes, and glyoxisomes)
- o Specialized cytoplasmic organelles for aerobic respiration (mitochondria) and photosynthesis (chloroplasts)
- o Complex cytoskeletal system (including actin filaments, intermediate filaments, and microtubules) and associated motor proteins
- o Complex flagella and cilia
- o Ability to ingest particulate material by enclosure within plasma membrane vesicles (phagocytosis)
- o Cellulose-containing cell walls (in plants)
- o Cell division using a microtubule-containing mitotic spindle that separates chromosomes
- o Presence of two copies of genes per cell (diploidy), one from each parent
- o Presence of three different RNA synthesizing enzymes (RNA polymerases)
- o Sexual reproduction requiring meiosis and fertilization

1) prokaryotes: contain a) archaea and b) bacteria

→ The best known Archaea are species that live in extremely inhospitable environments, often referred to as extremophiles.

Methanogens: Convert CO<sub>2</sub> and H<sub>2</sub> gases into methane

Halophiles: Live in extremely salty environments

Acidophiles: Acid-loving prokaryotes

Thermophiles: Live at very high temperatures.

Hyperthermophiles: Live in very high temperatures more than 100 C.

→ Bacteria are many families, and live everywhere

best known family is cyanobacteria, which 1) make nitrogen fixation, 2) it was the first bacteria to make photosynthesis and rise oxygen, 3) it lives in the coat of polar bear

2) eukaryotes: more complicated, almost multicellular, most complex is protist

→ Model organisms:

*Escherichia coli* (bacterium)

*Caenorhabditis elegans* (nematode)

*Saccharomyces* (yeast)

*Drosophila* (fruit fly)

*Arabidopsis* (mustard plant)

*Mus musculus* (mouse)

→ The cell size is limited:

- 1) By the volume of cytoplasm that can be supported by genes in the nucleus.
- 2) By the volume of cytoplasm that can be supported by exchange of nutrients.
- 3) By the distance over which substances can efficiently travel through cytoplasm by diffusion.

---

## Chapter (8)

1) Which of the following is a function of membranes?

- a) Compartmentalization
- b) All of these are correct
- c) Mediate Intracellular interaction
- d) Helps cell to respond to external signals
- e) Selectively permeable barrier

**Answer: b**

**Source: 8.1**

2) What are building blocks of a phosphoglyceride, specifically phosphatidic acid?

- a) Glycerol + 3 fatty acids
- b) Glycerol + 1 phosphate group + 3 fatty acids
- c) Glycerol + 1 phosphate group + 2 fatty acids
- d) Glycerol + 1 phosphate group
- e) Glycerol + 2 phosphate group + 1 fatty acid

**Answer: c**                      **source: concept 8.2**

3) People who have the AB blood type possess .....

- a) An enzyme that adds glucose to the end of the oligosaccharide chain on RBC membrane glycolipids.
- b) An enzyme that adds N-acetylgalactosamine the end of the oligosaccharide chain on RBC membrane glycolipids.
- c) An enzyme that adds galactose to the end of the oligosaccharide chain on RBC membrane glycolipids.
- d) No enzyme that adds anything to the end of the oligosaccharide chain on RBC membrane glycolipids.
- e) B + C

**Answer: e**      **source: 8.3**

4) People who have the A blood type possess .....

- a) An enzyme that adds glucose to the end of the oligosaccharide chain on RBC membrane glycolipids.
- b) An enzyme that adds N-acetylgalactosamine the end of the oligosaccharide chain on RBC membrane glycolipids.
- c) An enzyme that adds galactose to the end of the oligosaccharide chain on RBC membrane glycolipids.
- d) No enzyme that adds anything to the end of the oligosaccharide chain on RBC membrane glycolipids.
- e) B + C

**Answer: b**      **source: 8.3**

5) What kind of membrane protein penetrates into the hydrophobic part of the lipid bilayer?

- a) Galactocerebroside
- b) Integral protein
- c) lipid-anchored protein
- d) Peripheral proteins
- e) Phosphatidylcholine

**Answer: b**      **source 8.4**

6) What kind of membrane protein is found entirely outside the bilayer on either the extracellular or cytoplasmic surface? These proteins are covalently linked to a membrane lipid situated within the bilayer?

- a) Integral protein
- b) Lipid- anchored protein
- c) Peripheral protein
- d) Carbohydrate- anchored protein
- e) Transmembrane protein

**Answer: b**      **source 8.4**

**7)** The temperature at which a lipid bilayer shifts from a fluid state to a crystalline gel is called the .....

- a) pH optimum
- b) Gelation temperature
- c) Temperature optimum
- d) Transition series
- e) Transition temperature

**Answer: e**      **source: 8.6**

**8)** What directly or indirectly determines the temperature at which a lipid bilayer shifts from a fluid state to a crystalline gel?

- a) Whether the fatty acid chains of the lipids are saturated or unsaturated
- b) The length of the fatty acid chains
- c) The extent to which the fatty acid chains of the lipids contain double bonds
- d) The ability of lipid molecules to be packed together
- e) All of these are correct

**Answer: e**      **source: 8.6**

**9-** Which of the following lipids is found concentrated in lipid rafts in animal cell plasma membrane?

- a) Phosphatidylserine
- b) Phosphatidylinositol
- c) Phosphatidylcholine
- d) Cholesterol
- e) Phosphatidylethanolamine

**Answer: d**      **source 8.6**

**10-** They are more gated and highly ordered than the surrounding more fluid regions in artificial membranes that consist primarily of phosphoglycerides. They contain higher concentration of sphingolipids and certain proteins, what are they?

- a) Lipid islands
- b) collections
- c) Lipid rafts
- d) Lipid domains
- e) dense bilayer

**Answer: c**      **source 8.6**

**\*11-** A channel that opens in response to the binding of a specific molecule, which is usually not the solute that passes through the channel is called a .....

- a) Ligand-gated channel
- b) Voltage-gated channel
- c) Charge-gated channel
- e) Mechano-gated channel

**Answer: a**      **source 8.6**

**13-** The movement of water through a semipermeable membrane from a region of lower solute concentration is called .....

- a) Diffusion
- b) Metabolism
- c) Osmosis
- d) Denaturation
- e) Solubility

**Answer: c**            **Concept 8.10**

**14-** Transporting of materials where the diffusing substance binds selectively to a membrane-spanning protein, the process is called .....

- a) Simple diffusion
- b) Facillated diffusion
- c) Active transport
- d) Osmosis
- e) B + C

**Answer: b**            **Concept 8.12**

**15-** The Na<sup>+</sup>/K<sup>+</sup> ATPase pump actively moves

- a) 2 Na<sup>+</sup> out, 3 K<sup>+</sup> in
- b) 3 Na<sup>+</sup> out, 2 K<sup>+</sup> in
- c) 3 Na<sup>+</sup> in, 2 K<sup>+</sup> out
- d) 1 Na<sup>+</sup> out, 1 K<sup>+</sup> in
- e) 2 Na<sup>+</sup> in , 3 K<sup>+</sup> out

**Answer: b**            **Concept 8.13**

**16-** Which of the following is an example of co-transport active transport?

- a) Na<sup>+</sup>/K<sup>+</sup> ATPase
- b) Na<sup>+</sup>/glucose symport
- c) Glucose permease transport
- d) O<sub>2</sub> diffusion across a membrane
- e) Aquaporin water transport

**Answer: b**            **Concept 8.13**

### Summary for chapter (8)

→ Functions of membranes are 7, they're:

- |                                   |  |
|-----------------------------------|--|
| 1) Compartmentalization           | 2) Scaffold for biochemical activities |
| 3) Selectively permeable barrier  | 4) Transporting solutes                |
| 5) Responding to external signals | 6) Intracellular interaction           |
| 7) Energy transduction            |  |

→ Membranes are mainly **lipid bilayers**

→ Components of membranes are: 1) lipids    2) Carbohydrates    3) proteins

→ Membranes are lipid-protein assemblies held together by noncovalent bonds.

→ Ratio of protein lipid varies depending on function (e.g. mitochondria, axon)

1) lipids (amphipathic), they're three main types:

a- phosphoglyceride      b- Sphingolipids      c- Cholesterol

a- phosphoglyceride: diacylglycerides with small functional head groups linked to the glycerol backbone by phosphate ester bonds.

Contains: Glycerol +1 phosphate group(may attach functional group)+ 2 fatty acids

\* if linked to functional group, then named "phosphatidyl(functional group)"

b- Sphingolipids: ceramides formed by attachment of sphingosine to fatty acids.

Contains: Ceramide (sphingosine + 1 fatty acid)

\* may add functional groups on C1.

if functional group is:

phosphorylcholine → sphingomyelin

carbohydrate → glycolipid

if the carbohydrate is single sugar → glycolipid is called cerebroside

if the carbohydrate is cluster of sugars containing sialic acid → glycolipid is called ganglioside

→ Humans unable to synthesize ganglioside suffer from a serious neurological disease characterized by severe seizures and blindness.

→ toxins that cause cholera and botulism both enter their target cell by first binding to cell-surface gangliosides, as does the influenza virus.

c- Cholesterol: a smaller and less amphipathic lipid that is only in animals (50%)

→ Membranes are asymmetric

2) Carbohydrates (always associated with proteins (90% glycoproteins ) or lipids (10% glycolipids))

→ Glycolipid carbohydrates of the red blood cell plasma membrane determine whether a person's blood type (A, B, AB, or O).

A: Enzyme adds N-acetylgalactosamine to the chain terminus.

B: Enzyme adds galactose to the chain terminus.

AB: Both enzymes present.

O: Lack enzymes capable of attaching either terminal sugar.

3) Proteins, they are three types

a- integral proteins: Penetrate and pass through lipid bilayer

b- peripheral proteins: Attached to the membrane by weak non-covalent bonds and are easily solubilized. (outside membrane)

c- lipid-anchored proteins: Attached to the membrane by covalent bonds.

→ Transition state: the temperature at which a lipid bilayer shifts from a fluid state to a crystalline gel.

Factors affecting transition state:

a) Whether the fatty acid chains of the lipids are saturated or unsaturated

b) The length of the fatty acid chains

c) The extent to which the fatty acid chains of the lipids contain double bonds



d) The ability of lipid molecules to be packed together

→ Lipid rafts= (sphingolipids + proteins + cholesterol) floating on phosphoglyceride of outer leaflet of membrane (appears orange)

→ Substances move across membranes by:

1) simple diffusion through the lipid bilayer;

2) simple diffusion through an aqueous, protein-lined channel;

3) diffusion facilitated by a protein transporter;

4) active transport, requires an energy driven protein “pump” to move substances against a concentration gradient

---

## Chapter (9)

**1-** which of the following is not a function of Mitochondria?

a) Synthesis of certain amino acids

b) Uptake of  $\text{Ca}^{2+}$  ions

c) Synthesis of cholesterol

d) Release of  $\text{Ca}^{2+}$  ions

e) Synthesis of heme groups

Answer: c

→ functions of mitochondria:

1) Generate energy by producing ATP

2) synthesis of numerous substances, like certain amino acids and the heme groups.

3) uptake and release of  $\text{Ca}$  ions, (Function) essential triggers for cellular activities

4) Cell death (regulated by events that occur within mitochondria)

**2-** Inner mitochondrial membrane invaginated sheets, make.....

a) Inner boundary membrane

b) Cristae

c) Pseudopodia

d) Outer boundary membrane

e) Matrix

Answer: B

→ Mitochondria have two membranes

1) outer membrane 2) Inner membrane (contains cristae and inner boundary membrane

→ between two membranes = intermembrane space

→ inside inner membrane = matrix



3- What are the two interconnected domains of the inner mitochondrial membrane?

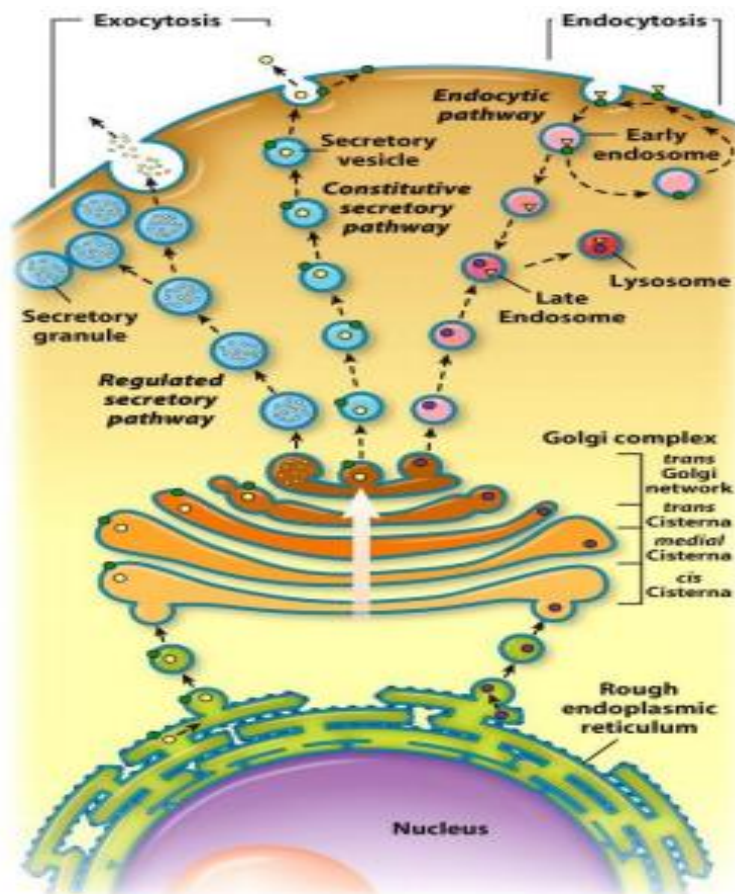
- a) inner boundary membrane, cristae
- b) Central boundary membrane, cristae
- c) Cristae boundary membrane, outer boundary membrane
- d) Inner boundary membrane, matrix
- e) Cristae, matrix

## Chapter (12)

1) Which of the following represent most likely secretory pathway for a protein?

- a) RER → Golgi → secretory vesicle → environment
- b) RER → Golgi → SER → cytoplasm → environment
- c) RER and nucleus → Golgi → secretory vesicle → environment
- d) SER → Golgi → secretory vesicle → environment
- e) RER → secretory vesicle → Golgi → environment

Answer: A      concept 12.1



- 2) Each of the following is a smooth endoplasmic reticulum function except:
- synthesis of steroid hormone
  - synthesis of heme groups
  - detoxification of many organic compounds, such as barbiturates and ethanol
  - sequestration of Calcium ions within the cisternal space
  - release of glucose into bloodstream

**Answer: b Concept 12.3**

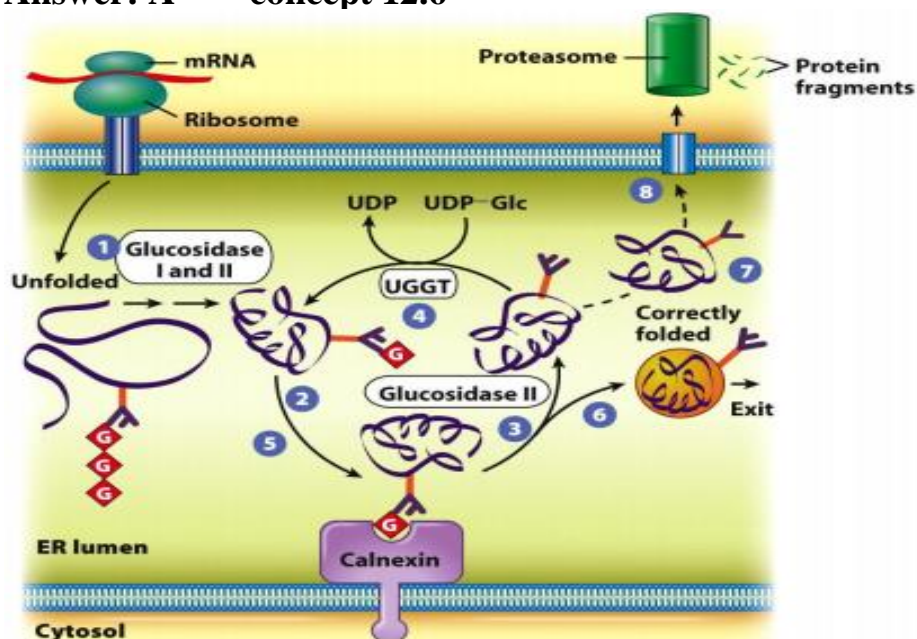
### Functions of SER

- Steroid hormone synthesis in endocrine cells of the gonad and adrenal cortex.
- Detoxification of organic compounds in the liver via oxygenase including the cytochrome P450 family. Hydrophobic compounds are converted into more hydrophilic ones for excretion.
- Sequestering  $Ca^{2+}$  within the cytoplasm; its regulated release in skeletal and cardiac muscle cells from the sarcoplasmic reticulum triggers contraction.
- release of glucose into bloodstream

3) What does appear to be the purpose of molecular chaperons like BIP?

- They recognize and bind to unfolded or misfolded proteins and help them attain their native structures
- They recognize and bind to unfolded or misfolded DNA and help them attain their native structures
- They recognize and bind to unfolded or misfolded RNA and help them attain their native structures
- They recognize and bind to unfolded or misfolded carbohydrates and help them attain their native structures
- They transport secretory proteins into secretory vesicles

**Answer: A concept 12.6**



4) On which of the following intracellular locations does clathrin organize a coat and form vesicles?

- a) lysosomes
- b) trans-Golgi complex
- c) endoplasmic network
- d) inner membrane of mitochondria
- e) regulated secretory vesicle

**Answer: b**      **concept 12.10**

→ COPII-coated vesicles – move materials from the ER “forward” to the ERGIC and Golgi complex.

→ COPI-coated vesicles – move materials from ERGIC and Golgi “backward” to ER, or from the trans Golgi to the cis Golgi cisternae.

→ Clathrin-coated vesicles – move materials from the TGN to endosomes, lysosomes, and plant vacuoles.

5) Which coated vesicle move materials in an anterograde direction from the ER and ERGIC forward toward the Golgi complex?

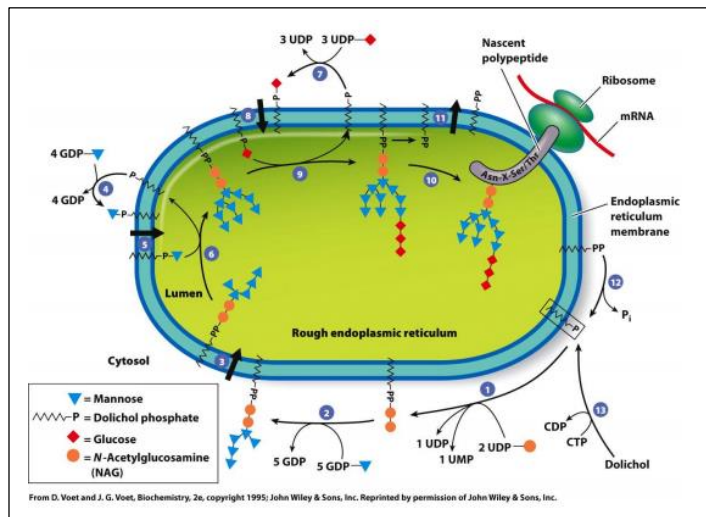
- a) Clathrin-coated vesicle
- b) Calcium coated vesicle
- c) COPI-coated vesicle
- d) COPII-coated vesicle
- e) both COPI-coated vesicle and COPII-coated vesicle

**Answer: c**      **concept 12.10**

6) What is responsible for transferring the oligosaccharide chain from lipid carrier to specific asparagine residue?

- a) membrane- bound glycosyltransferase
- b) membrane- bound oligosaccharide
- c) membrane- bound gangliosides
- d) glycosylsenthase
- e) peptidyltransferase

**Answer: b**      **Concept 12.6**



## Chapter (6)

1) The thin filamentous meshwork which lines inner surface of the nuclear envelope is called .....

- a) basement lamina
- b) basal lamina
- c) nuclear lamina
- d) nucleon
- e) nuclear lamulus

**Answer: c**                                    **concept 6.2**

2) A transport receptor that moves molecules from the nucleus to the cytoplasm is called .....

- a) exhalin
- b) exportin
- c) importin
- d) transportin
- e) receptin

**Answer: b**                                    **concept 6.2**

→ **Exportin:** transport receptor that moves molecules from the nucleus to the cytoplasm, the transported molecule must contain the amino acid sequence NES

**Importin:** transport receptor that moves molecules from the cytoplasm to the nucleus, the transported molecule must contain the amino acid sequence NLS

## Chapter (13)

1) Which type of cytoskeletal element is characterized as a hollow, rigid, cylindrical tube with walls composed of tubulin subunits?

- a) Microfilaments
- b) Microtubules
- c) intermediate filaments
- d) minitubules
- e) all of these are correct

**Answer: b**                                    **concept 13.1 + 13.2**

→ **The cytoskeleton is composed of three main structures**

\***Microtubules:** hollow, rigid, cylindrical tube with walls composed of  $\alpha$  and  $\beta$  tubulin subunits, in addition to GTP

\***Intermediate filaments:** strong, flexible, ropelike fibers that have only been identified in animal cells

\***Actin filaments (Microfilaments):** a flexible, helical filament. 8 nm in diameter and composed of globular subunits of actin

2) Structures that move from the cell body of a neuron down the axon toward the neuron terminals are said to move in ..... direction

- a) retrograde
- b) astronomical
- c) anterograde
- d) radial
- e) intergrade

**Answer: c** concept 13.2

→ Structures traveling from the cell body toward the neuron terminal move in an anterograde direction.

→ Structures that move in the opposite, or retrograde, direction go toward the cell body.

→ Defects in both anterograde and retrograde transport have been linked to neurological diseases like Amyotrophic Lateral Sclerosis (ALS).

3) Which of the following molecular motors is associated with microfilaments?

- a) kinesin
- b) dynein
- c) myosin
- d) kinesin and dynein
- e) Kinesin and myosin

**Answer: c** concept 13.1 + 13.9

→ Cytoskeletal components are sometimes associated with motor proteins

\*Microtubules → Kinesin and dynein

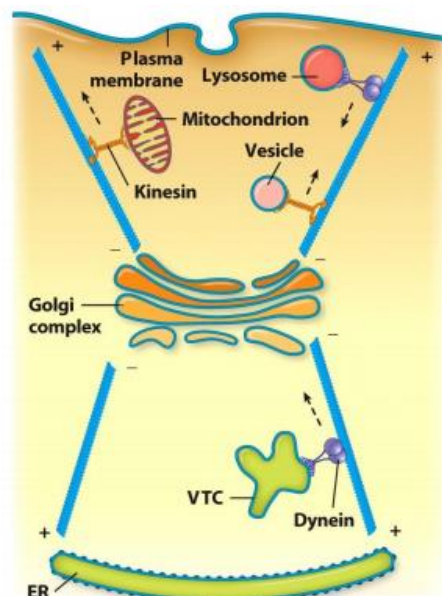
\*Intermediate filaments → Nothing

\*Actin filaments (Microfilaments): Myosin

4) Which of the following molecular motor is known to travel in a retrograde direction along microtubule?

- a) Kinesin
- b) dynein
- c) myosin
- d) kinesin and dynein
- e) Kinesin and myosin

**Answer: b** concept 13.3





5) What type of cytoskeletal element is described as tough, ropelike fibers composed of a variety of related proteins?

- a) Microfilaments
- b) Microtubules
- c) macrofilaments
- d) indeterminate filaments
- e) intermediate filaments

**Answer: e**                      **concept 13.7**

---

## Chapter (11)

1) Which disease is an inherited disease that can occur in patients with genetic alterations in any one of a number of hemidesmosomal proteins, including the  $\alpha 6$  or  $\beta 4$  integrin subunit, collagen VII or laminin-5?

- a) epidermolysis bullosa
- b) bullous pemphigoid
- c) blisterosis
- d) eczema
- e) hemidesmosomosis

**Answer: a**                      **concept 11.6**

→ **bullous pemphigoid: is an autoimmune disease where antibodies are made towards proteins present in these adhesive structures. These auto-antibodies cause the epidermal layer to lose attachment to the underlying basement membrane and result in severe skin blistering.**

→ **Epidermolysis bullosa: a disease results from genetic alterations in hemidesmosomal proteins, including the  $\alpha 6$  or  $\beta 4$  integrin subunit, collagen VII, or laminin-5.**

2) Focal adhesion .....

- a) may act as a type of sensory structure
- b) collect information about the physical properties of extracellular environment
- c) collect information about the physical properties of extracellular environment
- d) transmit information to the cell interior that may lead to changes in cell adhesion, proliferation or survival
- e) all of these are correct

**Answer: e**                      **concept: 11.5 + 11.8**

→ **As focal adhesion are formed mainly by integrins, so they do functions that are mentioned in integrins concept, that are 1)Connect the external environment to the actin cytoskeleton and (2)Provide a pathway for signals to be transmitted from the exterior to the interior**

3) **Selectin** mediate interactions between which of the following?

- a) leukocytes and blood vessel endothelial cells
- b) muscle cells and ECM
- c) nerve cells with other nerve cells
- D) intestinal epithelial cells with neighboring cells
- e) skin cell in different cell layers

**Answer: a**                      **concept 11.7**

→ Three cell-specific selectin types:

E-selectin, endothelial cells;

P-selectin, platelets and endothelial cells;

L-selectin, leukocytes (white blood cells).

4) **The** degradation of the extracellular matrix along with cell surface proteins, is accomplished mostly by a ..... containing enzyme family called .....

- a) copper, matrix metalloproteinase
- b) copper, MMP's
- c) zinc, Matrix metalloproteinase
- e) manganese, MMP's

**Answer: c**                      **concept 11.4**

→ ECM degradation is accomplished by a family of zinc-containing enzymes called matrix metalloproteinases (MMPs) secreted into the extracellular space or anchored to the plasma membrane

5) **Animal** cells communicate through .....

- a) tight junctions
- b) desmosomes
- c) hemidesmosomes
- d) gap junction
- e) plasmodesmata

**Answer: d**                      **concept: 11.11**

6) **A** proteoglycan is composed of:

- a) polypeptide + galactosaminoglycan
- b) polypeptide + glucosaminoglycan
- c) polypeptide + glycosaminoglycan
- d) polypeptide + sucrose
- e) polypeptide + mannose

**Answer: c**                      **concept : 11.3**

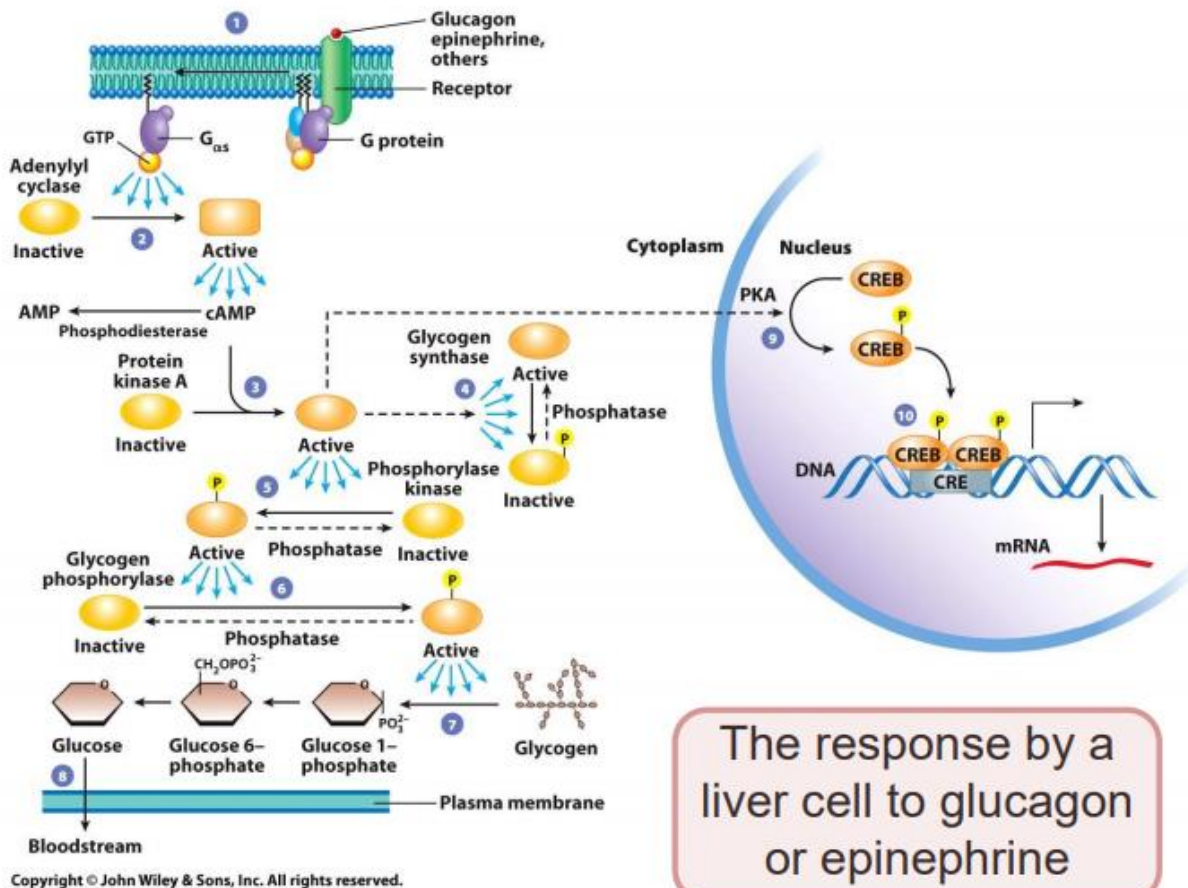


# Chapter (15)

1) The binding of glucagon to its receptor on skeletal muscle cells will cause all of these except:

- a) Increase cAMP
- b) Activate adenylyl cyclase
- c) Increase intracellular  $Ca^{++}$
- d) Activate  $G_{\alpha}$  protein
- e) Activate  $G_{i\alpha}$  protein

Answer: d



The response by a liver cell to glucagon or epinephrine

2) Which intracellular proteins contain SH2 domains ?

- a) RTK
- b) RTK- linked adaptor protein
- c) Sos
- e) Ras protein

Answer: b                      concept 15.8

→ Phosphorylated tyrosines bind effector proteins that have either a Src-homology 2 (SH2) domain or a phosphotyrosine-binding (PTB) domain.

3) Protein kinase A is all of the following except:

- a) activate glycogen synthesis and breakdown
- b) is activated by cAMP
- c) inhibits glycogen synthase
- d) activates glycogen phosphorylase kinase
- e) phosphorylate glycogen kinase

Answer: a            Concept 15.6

4) Which enzyme is inhibited by cAMP?

- a) Glycogen phosphlyrase
- b) Glycogen kinase
- c) Glycogen synthase
- d) Adenylyl cyclase
- e) PKA

Answer: c            Concept 15.6