BIO*1090
Introduction to Molecular and Cellular Biology
Mock Final Exam

- It is best to write the mock final under exam conditions.
- Do your best to write it without your notes, individually and within 120 minutes.
- Attempt all of the questions.

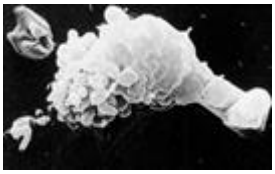
Disclaimer: The content that is used in this mock final is a taste of the subjects we have touched on and the type of questions you can expect to see on the final. This is merely a study tool to test your knowledge and should not be the be all and end all to the studying you should be doing. Good luck on this final and the rest of your finals! :)

This mock final will be taken up at the following times:

Kim	Wednesday December 2nd from 1:30pm – 3:00pm in library room 103
Madeline	Thursday December 3rd from 2:30pm – 5:30pm in library room 103
Lauren	Saturday December 12th from 12:00pm – 3:00pm in library room 384

Section 1: Multiple Choice

1. What characteristic of an apoptotic cell can be clearly seen in this picture?



A. Endocytosis
B. ATP synthesis
C. Blebbing of the plasma membrane
D. Fragmentation of DNA and nucleus
E. None of the above

2. Proton gradients are used by which enzyme to produce ATP?
A. ATP kinase
B. ATP phosphorylase
C. ATP synthase
D. ATP synthetase
E. None of the above

3. The sodium-potassium pump is an important part of all animal cells. It uses energy to move sodium and potassium against their concentration gradients. What kind of movement across the membrane is this?
A. Facilitated diffusion
B. Diffusion through a channel
C. Active transport
D. 2 of the above
E. None of the above

4. The kidney is an important organ for the removal of waste products from the blood. It is divided into a cortex and a medulla which is concentrated with sodium. How can sodium move from the blood and into the medulla?
A. Facilitated diffusion
B. Diffusion through a channel
C. Active transport
D. 2 of the above
E. None of the above

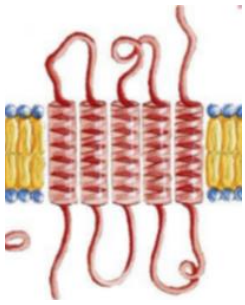
5. Caspases are proteins involved in what function of apoptosis?
A. Production of lamin
B. Lead to the disruption of cell adhesion
C. Deactivates DNAse
D. Builds cytoskeleton
E. ATP synthesis

6. What could occur when a bacterium mutates and increases the proportion of saturated lipids in its plasma membrane?
A. The plasma membrane will become more rigid
B. The plasma membrane will create an opening for molecules to pass
C. The plasma membrane's lipid rafts will break apart
D. The leaflets will separate
E. The plasma membrane will become more fluid

7. In biological membranes, which best describes the transition temperature?
A. The temperature below which a lipid bilayer becomes fluid
B. The temperature at which the rate of diffusion increases
C. The temperature above which a lipid bilayer becomes a crystalline gel
D. The temperature above which a lipid bilayer becomes fluid
E. The temperature at which the lipid bilayer stays rigid

8. How many transmembrane domains are present in this integral protein?

A. 5
B. 2
C. 4
D. 1
E. 10



9. Which of the following best describes biological membranes?
A. It is difficult for lipids to move laterally within a leaflet
B. They are dynamic structures of lipids and proteins
C. They allow many molecules to pass freely
D. Lipids move easily from one leaflet to the other
E. They are fairly rigid structures

10. Which of the following proteins will not contain a signal sequence at its N-terminus when synthesized?
A. Lysosomal hydrolase
B. An ER glycosyltransferase
C. Glucose transporters
D. Mitochondrial proteins
E. Na+/K+ ATPase

11. Tethering of a vesicle on a target membrane is dependent on which protein?
A. The signal sequence
B. SNAREs
C. Rabs
D. COPI
E. COPII

12. If a cell does not synthesize lamin properly, what cellular structure is likely altered?
A. The cytoskeleton
B. The extracellular matrix
C. The endoplasmic reticulum
D. The Golgi complex
E. The nuclear envelope

13. The outer membrane of the nuclear envelope is continuous with this structure:
A. The membrane of the endoplasmic reticulum
B. The membrane of the Golgi complex
C. The lamina
D. The lumen of the endoplasmic reticulum
E. The lumen of the Golgi complex

14. A cell that can no longer destroy and replace its organelles cannot go through:
A. Photosynthesis
B. Oxidative phosphorylation
C. Autophagy
D. DNA replication
E. Cotranslational protein import

15. Plant cell vacuoles are involved in:
A. Stretching of cell wall during growth
B. Intracellular digestion
C. Chemical storage
D. Sequestration of pigments
E. All of the above

16. What is incorrect about microtubules?

A. It is the largest cytoskeletal element
B. Consists of a polymer of proteins alpha-tubulin and beta-tubulin
C. Has structural polarity
D. Contains a slow-growing minus end
E. Contains a slow-growing plus end

18. An assembly of transmembrane proteins with lots of carbohydrates attached on the outside of the plasma membrane is called a(n):
A. Extracellular matrix
B. Epidermis
C. Glycocalyx
D. Proteoglycan
E. Peripheral Carbo Group

20. Which is a polar cytoskeletal element?
A. Kinesin and dynein
B. Intermediate filaments
C. Nuclear lamina
D. Actin filaments
E. All of the above

21. COPI vesicles would move:
A. Rough ER → Cis Golgi Cisterna
B. Trans Golgi Network → Trans Golgi Cisterna
C. Cis Golgi Cisterna → Medial Golgi Cisterna
D. Trans Golgi Cisterna → Lysosomes
E. Two of the above

22. GFP:mucin fusion protein expressed in rat colon cell:
A. Be trapped in the golgi complex
B. Appear only in the nucleus
C. Re-enter the cell through endosomes
D. Eventually show green fluorescence outside the cell
E. Would cause cytochrome c to be leaked from the mitochondria

24. According to endosymbiont theory, the origin of eukaryotic cells can be traced back to when:
A. Ancestral eukaryotic cells formed
B. Anaerobic prokaryotic cell engulfed aerobic bacteria
C. A reducing atmosphere existed
D. H_2O levels began to rise
E. Cyanobacteria consumed O_2

25. Alzheimer's disease is characterized by neurofibrillary tangles. This is caused by a defect in:

A. Motor MAPs
B. Non-motor MAPs
C. Kinesin
D. Dynein
E. MTOC

27. What components can be found in a plant cell wall?
A. Pepsin
B. Pectin
C. Cellulose
D. All of the above
E. Only 2 of the above

28. Which organelle is involved in the sequestration of calcium?
A. Golgi apparatus
B. Mitochondria
C. Sarcoplasmic reticulum
D. All of the above
E. Only 2 of the above

29. What is/are the function(s) of the nuclear pore complex?
A. Enables movement of molecules into and out of the nucleus
B. Contribute to cell shape
C. Provide structural support for the cell
D. All of the above
E. Only 2 of the above

30. How many protofilaments form a single microtubule?
A. 1
B. 2
A. 3
B. 12
C. 13

31. During step 1 of oxidative phosphorylation, hydrogen ions move:
A. Along a series of respiratory enzyme complexes
B. Into the matrix
C. Through ATP synthase
D. Into the intermembrane space
E. Through the outer mitochondrial membrane

32. What type of myosin generates force and contributes to motility in non-muscle cells?
A. Unconventional myosin

B. Conventional myosin
C. Motor myosin
D. Non-motor myosin
E. None of the above

33. Which type of movement across a biological membrane requires input of energy?
A. Facilitated diffusion
B. Active transport
C. Diffusion through a channel
D. Simple diffusion
E. None of the above

35. What is normally not present inside the nucleus?
A. Histone H1
B. Lamin
C. Nucleoid
D. RNA
E. Nucleolus

36. Which is true about the first level of condensation?
A. DNA condenses into a two-stranded, 2 nm thick strand.
B. Histone H1 completes nucleosomes.
C. You could find this condensation level in a metaphase chromosome.
D. It is 13 nm wide.
E. More than one of the above.

37. A strand of DNA contains 25% adenine and 25% guanine. What is true about this DNA strand?
A. A/T = C/G
B. A + T = C + G
C. A + U = C + G
D. The ratio of A/T = 0.25
E. The ratio of C/G = 0.25

38. The complementary strand of this DNA sequence ‘5 - ATCCGATCGGAT - 3’ is:
A. 5’ - TAGGCTAGCCTA - 3’
B. 5’ - TAGGCTACCCTA - 3’
C. 5’ - ATCCGATCGGAT - 5’
D. 5’ - ATCCGATGGGAT - 3’
E. 5’ - ATCCGATCGGAT - 3’

Section 2: Short Answer

1. _____ is an event which helps make all offspring unique and occurs in the _____ phase of Prophase I in meiosis. It involves _____ chromosomes pairing in a process called _____, which is facilitated by the _____ complex. Chromosomes are broken apart and exchange the broken parts between _____.

2. Check off the appropriate boxes in this chart about membrane fluidity.

Variable	**Increase MF**	**Decrease MF**
High Temperature		
Low Temperature		
Unsaturated Fats		
Saturated Fats		
Cholesterol		

3. What is the chance of getting 3 round (W) and 5 wrinkled (w) peas from a cross between 2 Ww plants? $[\ n!\ /\ x!\ y!\ ]\ p^{x}q^{y}$

Section 3: Long Answer

1. Describe (with a diagram) the process of co-translational import. Be sure to include SRP, translocon, mRNA, ribosome, plug, SRP receptor and membrane labels.

2.

a. Identify three characteristics of vesicular transport.

b. Describe the functions of coat proteins with respect to vesicular transport.

c. What is a major difference between COP I and COP II proteins?

3. Mitochondria provide the cell with energy by going through the process of oxidative phosphorylation.

a. What is oxidative phosphorylation?

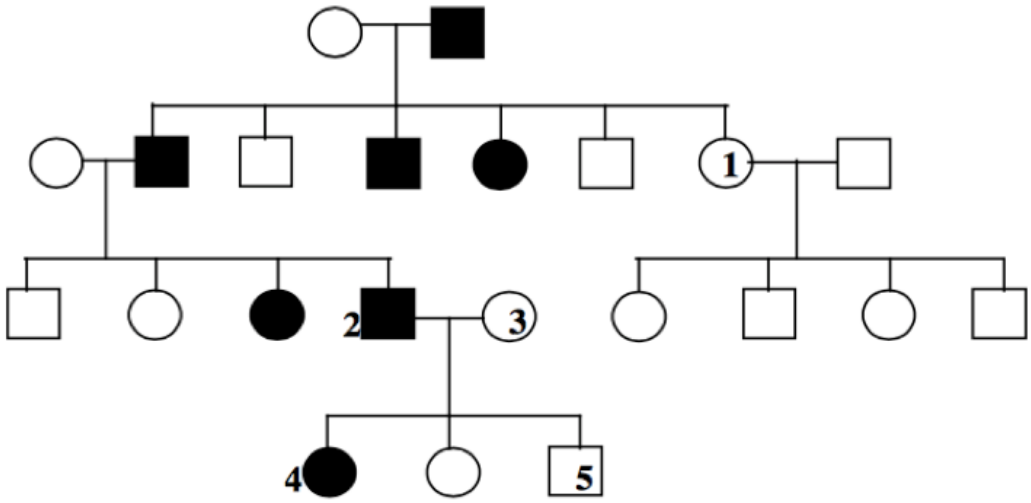
b. Oxidative phosphorylation can occur in two general steps. Describe the details of what happens in each step.

4. Describe the two main types of viral infections.

5. You are an aspiring animal researcher and are currently studying the cellular behavior of deer cells in different environments. You have been following a deer named Daria around her natural environment for the winter and summer seasons. You notice that the cell membrane in Daria's cells are more crystalline during the winter and more liquid crystal during the summer. How will adding cholesterol to each type of cell membrane change their fluidity?

6. Draw what this transmembrane protein will look like in the membrane of the ER after translation has finished. The N terminus is in the lumen while the C terminus is in the cytosol. The boxes represent transmembrane domains.

7.



a. Is this a pedigree for a dominant or a recessive trait?

b. What are the genotypes of individuals 1, 3, 4 and 5?

c. If III-4 and III-5 had another child, what's the probability that it would be affected?