Please print your name: ______________________

Instructions:

Please write only on these pages, in the spaces allotted and not on the back. Write your number on each page (not your name), so that we can split them up and grade them anonymously. There are a total of 5 pages including this cover page. You may not use any books or notes, and no electronic aids, including calculators.

Answer only in the space provided; short, concise answers are preferred and will be rewarded. Please be as neat as possible.

When you are finished, turn this in to the TA.
Molecular Cell Biology 5068 Exam 3

Dr. Miner’s Lectures (28 Points)

1. List 3 functions of the ECM. (3 points)

2. Describe how integrins direct fibronectin fibril formation. (3 points)

3. Fill in the table of general organization of tissues (8 points)

<table>
<thead>
<tr>
<th>Type</th>
<th>Embryonic Layer</th>
<th>Tissues (give one example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epithelium</td>
<td>Ectoderm</td>
<td>Gut, liver, pancreas, lung, other glands</td>
</tr>
<tr>
<td>Muscle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connective Tissue</td>
<td></td>
<td>Interstitium blood</td>
</tr>
</tbody>
</table>
4. Matching (4 points):

___ Scurvy
___ Osteogenesis Imperfecta
___ Marfan Syndrome
___ Muscular Dystrophy

A. Defective muscle cell/matrix interactions, results in progressive muscle weakness and necrosis.
B. Caused by Vitamin C deficiency. Ascorbate is required for prolyl hydroxylase and lysyl hydroxylase activities.
C. Caused by mutations in either Type I collagen gene COL1A1 or COL1A2. Patients have bone fragility, short stature, and bone deformities.
D. Caused by a dominant FBN1 mutation. Patients have skeletal, ocular, and cardiovascular defects.

5. List the primary components of all basement membranes. (4 points)

6. Fill in the blanks (6 points)

___________ is a form of apoptosis that is induced by inadequate cell/matrix interactions.

___________ chains assemble into trimers in the ER and are secreted as trimers into the extracellular space.

___________ are found widely in basement membranes in cartilage.

___________ are found in connective tissue proteins that provide tensile strength. They are also found in bone, skin, tendons, cartilage, and arteries

___________ is made by, assembled by, stick to, and respond to fibroblasts. KO mouse embryos die at E8.5 due to defects in the vasculature and in heart development.

___________ are transmembrane receptors for extracellular matrix and cell surface proteins. They need to be activated.
Dr. Bose's Lecture (12 Points)

1. List the cyclin and CDK partner associated with the various phases of the cell cycle. (4 points)

<table>
<thead>
<tr>
<th>Phase of cell cycle</th>
<th>Cyclin</th>
<th>CDK partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1/S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Where do the three DNA damage response checkpoints occur in the cell cycle? (3 points)

3. List the two families of Cyclin-dependent kinase inhibitor proteins and briefly describe their function in regulating CDKs. (2 points)

4. What are 3 cellular responses to checkpoint activation? (3 points)
Dr. Weber's Lecture (8 Points)
1. What are the three types of gain of function mutations that can lead to activation of an oncogene? (3 points)

2. What are 3 features of a tumor suppressor? (3 points)

3. What two features define a cancer cell? (2 points)

Dr. Stewart's Lecture (9 Points)
1. Briefly describe the two functions of telomeres. (2 points)

2. What are 3 characteristics of senescent cells? (3 points)
3. Pre-neoplastic cells are pre-cancerous cells that precede tumorigenesis. Their ability to become tumorigenic cells is partially dependent upon their microenvironment. The table below shows four experimental conditions that were mentioned in class. Based on the starting cell type and fibroblasts exposed to them, write the resulting outcome for each case. (4 points)

<table>
<thead>
<tr>
<th>Starting cell type</th>
<th>Type of fibroblast</th>
<th>Resulting cell type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-neoplastic</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Pre-neoplastic</td>
<td>Cancer-associated</td>
<td></td>
</tr>
<tr>
<td>Tumorigenic</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Pre-neoplastic</td>
<td>Old/Senescent</td>
<td></td>
</tr>
</tbody>
</table>

**Dr. Huettner’s Lecture (11 Points)**

1. List and briefly describe the three types of stem cells. (3 points)

2. What are the 4 types of potency? Briefly describe each type. (4 points)

3. List two types of cellular reprogramming and briefly explain them. (4 points)
Dr. Mercer’s Lecture (12 Points)

1. What are the three basic types of neurons? (3 points)

2. Briefly explain the similarities and differences of chemical and electrical synapses. (3 points)

3. What are the 4 types of glial cells? Briefly explain one function of each. (6 points)
Dr. Schlesinger’s Lecture (7 Points)

1. Compare and contrast necrosis and apoptosis. Be sure to comment on changes in cell volume and membrane integrity in both processes of cell death. (2 points)

2. True or False; If the statement is false, please edit the statement to make it true. (1 point)
   The execution of apoptosis does not require ATP.

3. What are two reasons that cells undergo apoptosis? (2 points)

4. Fill-in-the-blanks (2 points):
   _____________ forms a pore on the outer mitochondrial membrane allowing ________________ to be released into the cytoplasm, initiating apoptosis.

Dr. Amarasinghe’s Lecture (6 Points)

1. List one advantage and one disadvantage of using NMR to study biomolecules. (2 points)

2. True or False; If the statement is false, please edit the statement to make it true. (1 point)
   To measure NMR signal, the nuclei must have a magnetic moment.
3. Match the following measured parameters to the information obtained from each of them. (3 points)

___ Dipolar coupling constant

___ NOE

___ Chemical Shift

A. Dihedral angle constraint, very sensitive to local environmental changes

B. Distance constraint, space correlation

C. Bond vector orientation relative to magnetic field

Dr. Fremont’s Lecture (7 Points)

1. Name two methods used to test monodispersity of protein. What is one method to decrease protein heterogeneity? (3 points)

2. What is the crystallographic phase problem? Name one experimental and one computational method used to solve this problem. (3 points)

3. Seeing a hole in a tyrosine or phenylalanine ring is accepted as proof of good phases. What is the resolution you need to see these holes? (1 point)