Bi 336 Study Guide, Chapter 7. My brief answers are given below. Your answers may be more complete, which is good.

1. What is a one sentence definition of the extracellular matrix (ECM)?
The organized material beyond plasma membrane

2. Name at least 4 physio-chemical factors that act to organize the ECM?
free energy changes, binding specificity, pH, redox, enzymes, hormones, mechanical, electrical forces

3. What is the factual basis for a statement that says that carbohydrates can provide more molecular information than other organic molecules of similar size?
--Different conformations of the carbon backbone or rings and many different spatial arrangements of residues

4. What is meant by molecular information?
Information given about size, shape, charge distribution, hydrophobicity, hydrophilicity that comes from sequence and orientation of atoms within a molecule.

5. Explain differential RNA splicing and give examples of how tissue-specific variability can be achieved with this molecular strategy.
Differential RNA splicing describes the situation when a single gene can produce different gene products. This is possible because, depending on conditions or tissue type, parts of the primary (coding) transcript is cut or 'spliced' out, thereby producing a shortened version of mRNA. This is in addition to the typical splicing that gets rid of the non-coding introns. Example: the ECM protein fibronectin can be produced in different sizes, with different molecular domains included depending on the tissue in which the transcription occurs. Different fibronectin proteins are produced although all products are derived from the same master fibronectin gene.

6. What is the most abundant protein in the human body? collagen

7. What does RGD stand for in terms of amino acid sequence? arginine-glycine-aspartic acid

8. What is RGD in relationship to cell-cell and ECM interactions? a common binding site between extracellular and integral membrane proteins.

9. What kind of molecule <u>has</u> RGD sites? collagen, fibronectin, proteoglycans, "various other ECM proteins"

10. What kind of molecule <u>binds to</u> RGD sites? integrin, fibronectin

11. A certain molecule has multiple RGD sites, what advantage is this in terms of molecular interactions?
--can bind to more than one molecule. Having the ability to have multiple binding gives the potential for producing different sorts of "molecular information" . For example having different binding sites can link two or more molecules or cells, or each binding site may bring about a different reaction perhaps by conformational changes..

_____True or False:

12. Collagen fibrils form double helixes. F
13. Collagen is formed by muscle cells. F
14. Collagen forms the cornea of the eye. T

15. In some cases collagen is anchored directly to the cytoskeletal system by hydrogen bonds. F
16. Most animal species have only one or two collagen genes; tissue variation of collagen occurs through mutation. F
17. IgSF proteins are highly conserved in terms of amino acid sequences. That is, there is little variation from one IgSF protein to another. F
18. IgSF proteins are typically located on the inside surface of the plasma membrane. F
19. IgSF proteins are found in vertebrate species but not in invertebrates. F
20. IgSF proteins bind only to other members of the SF. F

_____

21. Describe (or draw) the shape, number of subunits, and precise location of integrin in cells.
Two subunits (alpha and beta), both are closely associated integral proteins. They have a relatively large bulbous region on outside face of plasma membrane and small tail on the cytoplasmic side of the membrane.

22. What is an example of outside/in communication in relationship to cells.? When a selectin binds to its specific carbohydrate that appears within the ECM , or from material from the bloodstream that baths the cell. The binding causes a conformational change that effects the cytosol side of selectin. This conformational change may provoke metabolic changes in the cytoplasm.

23. EGTA is a substance that binds divalent cations. What might happen if the cells shown in Fig. 7.19 were bathed with a balanced saline solution containing 0.003 M EGTA?
Cell/cell recognition would not occur because major recognition proteins require Ca ++. Therefore, over time, cells may drift away from each other.

24. A certain genetic disease causes disruptions to the intermediate filaments associated with desmosomes. What might the consequences of this condition be?
Cells come apart under mechanical stress.

25. Describe the molecular features of a typical proteoglycan of the ECM.
Polymeric protein core with glycosamine side chains. Neg charges associated with sugars bind cations.

26. Proteoglycans are flexible molecules. They are NOT (sorry a mistake in the typing in the handout, "not" was omitted) solid like bone, yet they serve a protective function. What is the basis for their ability to protect tissues and organs?
cation binding traps water, forms gel--resists compression, provides protective padding

27. What are glycosamine, glycosamineglycan, and glucosamine (as far common useage goes, that is)?
linked 6C sugars with an amine group

28. There are 4 large plasmamembrane- associated proteins that were discussed in lecture in relationship to cell-cell interactions.

a. What are the names of these proteins? IgSF proteins, selectins, integrin, cadherins

b. Give at least two features that they all have in common. glycoproteins, integral proteins, associate with RGD

c. What characteristic do 3 out of the 4 have in common. require Ca++

29. How is tissue specificity achieved with integrin proteins?
gene family for each subunit, mix and match

30. What is a lectin?
a protein that binds to a specific carbohydrate

31. The proteins that form antibodies are members of what gene family? IgSF

32. What are two examples of how diffusion or other transport pathways are controlled by features of the ECM?
tight junctions, in cell walls, water insoluble substances (lignin, suberin, waxes) differentially deposited.

33. Explain how actual cytoplasmic connections can be achieved between adjacent plant cells or adjacent animal cells.
plants: review plasmodesmata , animals, review gap junctions via connexons.

34. What are three types of polymers that are common in the ECM of plants? cellulose, hemicellulose, pectin

35. List at least 3 functions of plant cell walls. support, protection, translocation pathway

36. Explain how calcium bridging can organize extracellular matrix components.
holds polymers together through ionic interactions, can provide different conformation depending on exposed residues (e.g., methyl groups, carboxyl, hydroxyls)

37. What is a current theory on how cellulose microfibrils are produced in plant cell walls?
One theory states that cellulose synthase rosettes are connected via motor proteins to microtubules (MT) . Motor protein pulls rosette complex along MT tracks. The factory moves, not the microfibril.
Another theory states that tracks of microtubules flank rosette positions and act to guide sugar building blocks into rosettes.

38. What is the current theory on how collagen fibrils are produced in the ECM?
Fibroblast (usually) cells excretes procollagen. A portion of the procollagen molecule is cleaved within ECM triggering self assembly of procollagen subunits into collagen fibrils that twist around each other forming triple helix.