

What: Self-Test Questions – You should be able to answer these questions after doing the readings (largely off the top of your head without digging for the answer in the book).

Why: The goal of this assignment is for you and me to find out what you got out of the readings and to make sure we are all starting on the same page.

How: Please answer these questions and we will discuss them in class. You don't have to write a novel, but be thoughtful. Turning these self-test questions in is required although they will not be graded.

Questions

- 1) What are some tissue types that we might want to replace?
- 2) What do autologous, allogenic, syngeneic, and xenogenic mean?
- 3) What is a cell-based therapy?
- 4) What is the origin/history of tissue culture? What is the difference between tissue culture and cell culture in practice?
- 5) What are some advantages and disadvantages of tissue culture (or in vitro experiments in general)?
- 6) How does a biological safety cabinet (Class II) work?
- 7) What are autocrine, paracrine, and endocrine signaling?
- 8) Describe, semi-quantitatively, what happens to the cell number after primary culture. What are the differences between normal and transformed cells?
- 9) What are the roles of the extracellular matrix?
- 10) What are mesenchymal cells? Epithelial cells? What are some of their defining characteristics? What tissues do they come from?
- 11) What are some of the relevant length scales in tissue engineering? Do you also find the hospital picture a bit cheesy? Do you buy their length scales or are there others that might be important?
- 12) What are some common cell culture substrates? Why might you choose one over another?
- 13) What is the purpose of keeping cells in the incubator?
- 14) What role does CO₂ play? (Use as much chemistry as you can).

- 15) Why is there phenol red in many media?
- 16) What is the importance of salt in media? Glucose?
- 17) What is serum? What does it do? What are the advantages and disadvantages of using it?
- 18) What is a hemocytometer?
- 19) What are primary cells? What are their advantages and disadvantages?
- 20) Where might we get primary cells experimentally? For clinical use? Advantages and disadvantages of various sources??
- 21) What are some general approaches to isolating primary cells?
- 22) What are collagenase and trypsin and why might they be useful?
- 23) What is subculture? Confluence?
- 24) What is a cell line (NOTE: there is some discrepancy in the older definition and how this word is actually used)?
- 25) Why do we change the media on cells? Why do we subculture them (a.k.a. passage them)?
- 26) What is contamination and what are some forms it comes in?
- 27) What are some sources of contamination? What are some steps we take to avoid contamination?
- 28) Why might we want to cryopreserve (freeze) cells? Engineered tissues?
- 29) What are the properties of stem cells? Where are they found?
- 30) What is a pluripotent cell? Progenitor cell?
- 31) What are differentiation and de-differentiation? How can we detect them?
- 32) What are some ways we can induce differentiation?
- 33) What are the 3 dynamic states of tissues (according to Palsson & Bhatia)?
- 34) What is morphogenesis? What are some of the processes that are involved?
- 35) What are receptors and ligands and what are their roles? What are some examples?
- 36) What are some ways that we might analyze cells in regular culture (2D)?

- 37) Will these also work for engineered tissues (most likely 3D)?
- 38) What are some of the additional characteristics of engineered tissues that we might like to analyze?
- 39) What is your working definition of a biomaterial? Give some examples of biomaterials.
- 40) Based on what you know about native tissues, what might some desirable features of biomaterials for tissue engineering be?
- 41) What are some of the key aspects of a cell's environment (that we might want to manipulate for our own goals and/or to keep the cells alive and well)? (There should be A LOT of these)
- 42) What are some cell behaviors that we might want to attempt to manipulate/affect?
- 43) What are different ways that cells communicate with each other and their environment?
- 44) What components should we add to our engineered tissues to make them perfect?
- 45) What are some of the limitations to successfully engineering tissues today?
- 46) What are some of the design principles guiding TE?