M3D1: Design Experiment

Announcements

- Module 2 Report due **Wednesday, 4/23 at 5pm**
  - ★ submit to Stellar
  - ★ free late day if you visit writing center
  - ★ methods -- me ; all else -- Leona
- Next time, two shifts (1pm or 3pm) -- quiz before or after

Module 2 Introductions

- Comments on Intros
  - Note: these are first pass read comments - I will be grading this weekend and will have for you at office hours on Monday (perhaps sooner).
  - Tone: Academic vs. Pop Sci
  - Most people are doing a good job with the 'funnel':

- You need to form a strong hypothesis and motivate it!

Filoviruses are single-stranded, negative sense RNA viruses that cause severe hemorrhagic fever in humans and nonhuman primates.(1) The family Filoviridae includes genera Ebolavirus and Marburgvirus and a proposed genus of Cuevavirus.(2) The genus Ebolavirus contains five species, which are Zaire Ebola virus (EBOV), Sudan virus (SUDV), Taï Forest virus (TAFV), Reston virus (RESTV), and Bundibugyo virus (BDBV), ….(3) Among the five species of Ebolavirus, RESTV does not cause disease in humans, although it is pathogenic in nonhuman primates.(4, 5) However, RESTV was recently isolated from a swine population in the Philippines, whose animal handlers were seropositive suggesting the potential zoonotic nature of filoviruses.(5, 6) Together, these observations highlight the potential public health risk posed by filoviruses and the need to develop innovative countermeasures.

http://www.ncbi.nlm.nih.gov/pubmed/24067086

Lung cancer is the leading cause of cancer death in males and the second-leading cause of cancer deaths in females worldwide [1]. In the past decades, lung adenocarcinoma, one histological subtype of non-small cell lung cancer (NSCLC), has become the most common histologic type among all lung cancers diagnosed [2]. Platinum based combination chemotherapy is the standard chemotherapy for NSCLC, and cisplatin is widely used for the treatment of lung cancer [3]. However, individuals respond to chemotherapy differently and the efficacy of cisplatin treatment is often impaired by the emergence of resistance to this drug [4]. Therefore, elucidating the mechanism underlying the development of chemoresistance would promote our understanding of lung cancer progression and treatment failure.

Ma et al., Journal of Experimental & Clinical Cancer Research 2012, 31:99

At first, people infected with the Ebola virus appear to have the flu—fever, chills, muscle aches. Then the bleeding begins. As the virus hijacks cells throughout the body to make copies of itself, it overwhelms and damages the liver, lungs, spleen and blood vessels. Within days organs begin to fail and many patients fall into a coma. Some outbreaks, primarily in Central and West Africa, have killed up to 90 percent of infected individuals.

http://www.scientificamerican.com/article/could-rna-drugs-defeat-ebola-virus/

Physicians have long marveled at the body's ability to heal itself. Over time, breaks, tears, burns and bruises can often disappear sans medical intervention. Less well-understood are the similarly extraordinary repairs that take place on the molecular level, in DNA….Ultraviolet radiation, chemotherapy and other agents can cause lesions in cellular DNA that must be fixed before the cell divides and replicates the mutations, which can lead to cancer, among other problems. Previous work had implicated ATR in the repair of damaged DNA, but exactly which part of that cascade of events the protein is responsible for remained a mystery.

http://www.scientificamerican.com/article/researchers-identify-prot/

Tissue culture environment

Regeneration

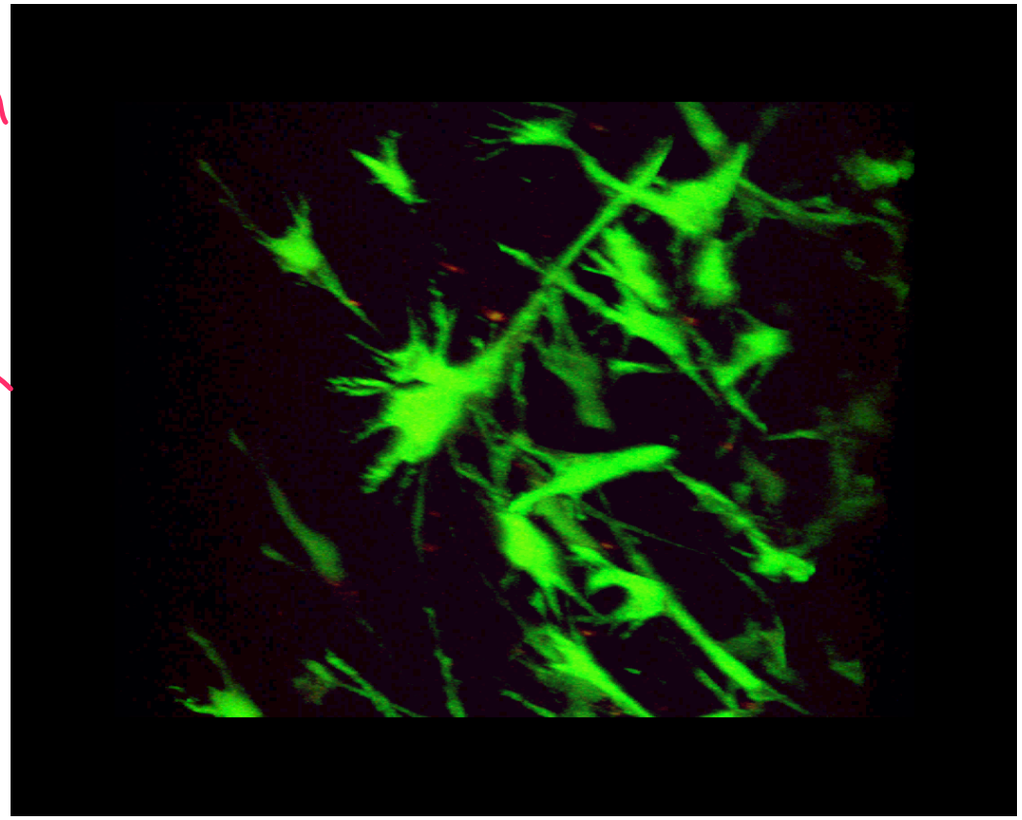
What is the 'cellular environment' *in vitro*?

in vitro	in vivo
1.	• Extracellular Matrix
2.	- collagen, fibronectin
3.	- GAG, mucin
4.	• cytokines/Growth Factors
5.	* bind to matrix
6.	• Nutrient Supply

blood/Lymph flow

X → cells have to supply G.F./cytokine (Autocrine signaling)

Bovine bone marrow stem cells in exracellular matrix



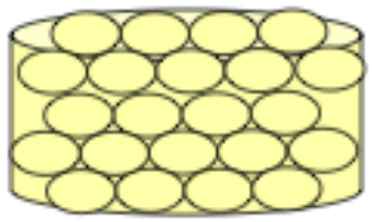
University of Oxford Bioengineering

Tissue engineering considerations:

alginate

scaffold/matrix

→ usually degradable, porous



You choose!

soluble factors

→ made by cells or synthetic

→ various release profiles

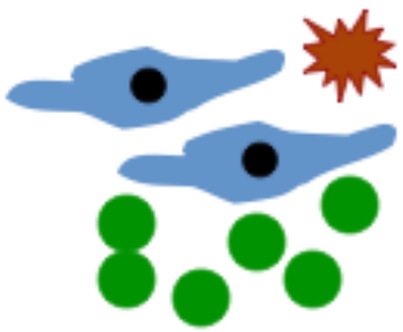
MSC

cells

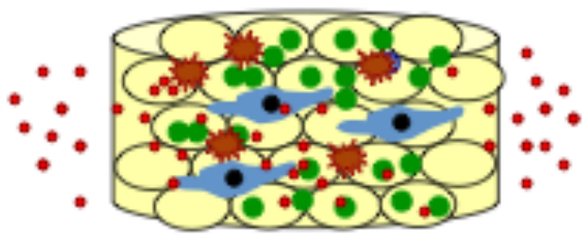
chondrocyte

→ precursors and/or differentiated

→ usually autologous



integrated implantable or injectable device



Today in lab:

★Experimental design:

1. Read/Skim 4 papers to get ideas
   - Read abstract.
   - Skim methods.
   - Skim results/discussion -- summarize in 1-2 sentences.
   - Goal: pick something interesting to you.

1-2 paragraphs

2. Make your plan! **Collaborate with another team??**
   - Vary one parameter: simple or sophisticated
   - Check cell availability with teaching faculty
   - Request materials and/or equipment as needed
   - Goal: ★ details + hypothesis by end of day

     ★ send me your EN page

*If alginate is NOT your parameter, please choose an intermediate weight%**