GENOMICS KEY TERMS/CONCEPTS TO KNOW FOR SCIENCE SECTION OF THE ASIC200 FINAL EXAMS

(March 22, 2020)

To help with your studying, this document provides an itemized list of terms and general concepts that could be presented in the final exam (for Dave's science section). You can use the course videos, notes, or your own basic literature searches to get at these concepts and terms. If any are confusing, Dave is happy to go over them one on one if you contact him to arrange a time to meet.

Definitions: Genome, genomics, DNA, nucleotides, gene, phenotype. The basic idea that DNA is information in a coded sense (video 1)

Definitions: Central Dogma, transcription, translation (but no higher detail than that seen in the video 2). The biology of the central dogma (i.e. DNA to RNA to protein), both in terms of the role of each of these three different coded molecules, and how that results to your different cells having different functions. (video 2)

The details in the replication reading. https://www.scq.ubc.ca/breakfast-of-champions-does-replication/ (the written material is also basically covered in video 3)

Definitions: Single Nucleotide Polymorphism, CRISPR/cas (in particular, a general idea of how it works as a gene editing tool and the issues associated with its use – this is summarized in the 3 slides on the March 5th lecture shown below:

Some issues with CRISPR/cas:

Technical:

1. **It's not *that* easy.** There's a fair bit of a hype around the methodology, in that it is way easier than previous gene editing tools, but still requires trained hands, and considered expert thought.
2. **It's not perfect** - both in terms of it working 100% of the time (i.e. sometimes, **no edit occurs**); but also not perfect in the sense that **mistakes** can be made (where the wrong part of the genome is edited).
3. This is an amazing system for **basic** research. i.e. I'm working on a cell/model organism and I want to see what happens when I change the DNA code. CRISPR/cas has made this research query much much easier (this is why you see it being used more and more, and goes hand in hand with the sequence data. i.e. **great for testing the seq to phenotype correlations**) BUT, as a tool for gene therapy, or genetic modification, then… **things get a little tricky.**

Some issues with CRISPR/cas:

Ethical:

1. With the issue of errors/mistakes in what gets edited, what is the appropriate risk to use this for **gene therapy** (i.e. medical uses). Does the degree or seriousness of the **disease** factor in? And where do **enhancements** fit? For that matter, what is the line between a treatment and an enhancement?
2. One also needs to consider the cell type. Specifically, is it a **somatic** cell target, or a **germline** cell target? Editing a germline cell also comes with additional risks.

3. As these tools get cheaper and more efficient, and essentially easier to do, then can we assume that **policy** can provide appropriate regulations to make sure unethical uses are avoided? There's already a discussion around concepts of whether even **expert scientists have the necessary training to navigate the ethical considerations**.