Exam 3 study guide – BB2920-C15

General notes:

While I would not consider this final exam to be fully comprehensive, you will need to draw upon information that you have learned throughout the course. The questions will focus on the last third of the material, but you may need to draw upon important information such as types/effects of certain mutations, transcription and translation, and basic principles of Mendelian inheritance, mitosis and meiosis (all of our genetics vocabulary is not going away!)

What exactly do I mean by that? For example, what might be the affect of a deletion that incorporates the *GAL1* promoter in the activation *GAL* gene transcription? What would be the effect of a promoter deletion in the *lacI* gene? How aneuploidy could arise during meiosis II?

You will need a calculator, and I will ask a question that will require the use of the Hardy-Weinberg equation (which will be difficult to solve without a calculator)

Chapter 11 - gene regulation in bacteria

* positive and negative regulation of the lac operon
* cis- vs. trans- regulatory events
* location and function of the major players involved (P, O, Z, Y, I, lactose, glucose, cAMP, CAP)
* gene expression from this operon under various conditions (+ glucose, +lactose, + glucose and lactose)
* understand the consequences of mutations in the various parts of the operon

Chapter 12 - gene regulation in eukaryotes

* the GAL-UAS system, how it works under various conditions (glucose or galactose), cis- and trans- regulatory events, consequences of mutations in various parts of the system
* you should know the function of all of the regulatory players (Gal4, Gal80, Gal3) but you do **not** need to memorize the specific functions of the *GAL1 GAL2 GAL7* and *GAL10* gene products in the pathway of galactose metabolism
* Tetracycline regulatory system, both tet-off and tet-on, but in particular how it was used for the journal club article.

*Be prepared to draw comparisons and note differences between bacterial and eukaryotic gene regulation*.

Chapter 17: Chromosomal Changes and Gene Dosage

* aneuploidy vs. euploidy
* how aneuploidy can arise via nondisjunction during meiosis (yes, this will require you to review the material on meiosis)
* Dosage Compensation for sex chromosomes in worms, flies, and humans, and why this is necessary (each method of equalizing X chromosome genes is a little bit different!)
* Mechanism of X chromosome inactivation in humans (the nature/function of the Xist RNA)

Journal Club

* I will ***not*** ask a specific question about an item of data in the paper (like what was the name of the specific gene locus where they integrated Xist into Chr21 – I wouldn’t ask you to memorize these details)
* You ***should*** understand what the point of the experiment was, how the mechanism of X inactivation was applied to silence Chr21, and what the pluses and minuses of this system are in terms of its use for a therapy
* You ***should*** be able to describe the hypothesis and the conclusion of an experiment if I show you a figure from the article.

Chapter 18 and 20.3: Population genetics

* describe the gene pool in terms of number of individuals (N) and number of alleles (2N).
* calculate both genotype and allele frequencies for a given population
* use the Hardy-Weinberg equation to predict the genotypes of a generation, or to calculate the prevalence of an allele within a population, and determine whether a population is in H-W equilibrium
* Apply H-W to pedigree analysis to assess probabilities of disease, and compare disease risk within a family to the risk in the general population
* identify the major factors that disturb the Hardy-Weinberg equilibrium within a population