Practice exam 2 topics: Chapters 14-15 MCDB 2222 April 2018 - Genetics (be able to explain)

- What is the evidence that mutations arise randomly, as opposed to in response to the needs of the organism
  - Explain why there is more fluctuation (variation) associated with random versus induced mutagenesis.
  - When mutations are induced experimentally (using chemicals or radiation), why backcrossing to wild type animals is necessary.
  - In the Aimes test, why is a His^- strain used? Does this over- or under-estimate the number of mutations generated.
- What factors influence the mutation rate in an organism?
- Explain why an organism with a 0 probability of mutation might be at an evolutionary disadvantage? What advantages, if any, would be associated with a very low or 0% mutation rate?
- In the bacterial megaplate, antibiotic resistance experiment, horizontal gene transfer (HGT) does not occur - how would the experiment change if HGT did occur?
  - how might a early mutation in a population influence later evolutionary changes?
- Can could you used the CRISPR-Cas9 system to delete an entire gene?
  - What provides the CRISPR-CAS9 system with its specificity
  - How does the CRISPR system protect the host prokaryotic cell?
  - How could a CRISPR system be used to generate mutations in a human cell?
- Mendel based his model of inheritance on unlinked genes - how would gene linkage have complicated his conclusions?
- Mendel based his model of inheritance on non-interacting alleles - how would interacting alleles have complicated his conclusions?
- What were Mendel's conclusions (regarding inheritance)?
  - Why could he not make conclusions about sex determination as a genetic trait?
  - You define the parental genotypes, predict the outcomes of a dihybrid cross if the two genes are unlinked versus if they are closely linked.
  - How do you determine if an F1 individual is heterozygous.
  - What does a chi square analysis tell you?
    - In an experiment with 9 different phenotypic outcomes, what is the "degree of freedom" to be used in a chi square analysis?
    - Why do you use phenotype rather than genotype?
  - In a dihybrid cross, individuals homozygous for both recessive alleles (or both dominant alleles) are not found. What would you conclude and why?
  - How is it possible that the "same" genes are often localized to the same region of a chromosome in different types of organisms?
    - If you make a prediction, how would the level of synteny along a chromosome be related to the time when two types of organisms shared a common ancestor.
    - A gene is missing within a conserved syntenic chromosomal region (in Genomicus) - where did it go?
  - Make a drawing of the various ways that the products of two different genes could interact (get at least three different mechanisms).
  - How can one gene influence the activity of another?
  - Why are some alleles temperature sensitive (or rather differentially temperature sensitive compared to the wile type allele?)
  - The frequency of alleles of a gene in a population changes after 100 generations; what can you conclude