

COGS 169 Final Exam Study Guide

The exam questions will focus on material covered since the midterm. Of course, you can't forget what you learned for the first midterm, as it's still important to understand inheritance, know what DNA is, understand the central dogma of genetics, know about model organisms, etc.; however, our focus turned to scientific studies of genetics and behavior and the exam will reflect this.

Epigenetics & Maternal Behavior

- Define/explain epigenetics
- Understand DNA methylation and histone modifications - what they are and what the downstream consequences are (i.e. DNA methylation leads to transcriptional repression)
- Know what cis- and trans-acting factors are and their role in gene expression
- Paper: Epigenetic programming by maternal behavior
 - Know the hypothesis driving the research
 - Understand the phenotype (LG/ABN)
 - Be able to interpret figures/explain the most important findings from the study
 - Summarize the findings/conclusions

Sleep & Circadian Rhythms

- Understand what the molecular clock is generally (know what the word endogenous means)
- Describe how circadian rhythm mutants in the fly were found, how they differed from one another, and how that helped our understanding of circadian rhythms in fruit flies
- Understand and be able to explain the molecular mechanism behind the transcriptional control of the circadian clock
 - know what kinases are and their role in this process
- Describe the definition of sleep (and how *Drosophila* do and do not fit into this definition)

Intelligence

- Describe the common phenotypes/measurements studied with respect to intelligence (i.e. IQ, educational attainment, etc.)
- Understand the genetic basis of heritability in general and its general interaction with other traits (i.e. age, socioeconomic status, etc.)
- Discuss the problematic history in the study of intelligence (i.e. eugenics & inaccurate studies/conclusions)
- Describe the Olfaction Condition (T-maze) assay in fruit flies and discuss how it was used to learn that spaced timing improves memory in flies
- Be able to explain "how a fruit fly forgets", with specific focus on the figure in the short answer question (and from the intelligence notes (from MacGuire et. al); be able to interpret results from that figure

- Describe what Polygenic Risk Scores (PRS) are generally and how they have been studied with respect to educational attainment

Social Interaction

- Be able to describe seminal findings about social interaction in both the worm and the fruit fly
 - Know the role of the *npr-1* gene in *C. elegans*
 - Know the role for olfaction in establishing social networks in *Drosophila*
- Paper: Social structures depend on innate determinants and chemosensory processing in *Drosophila* (Understand the experiment and results)
 - two different wild type strains; results stratified by sex; comparisons of fly interactions based on movement, rate of interaction, duration of interaction, and reciprocation
 - Use of mutants to understand what drives the established interaction
 - Be able to interpret the figures (Note: I'm NOT going to ask about density of networks; I know that was most confusing and I don't think it's the most important thing to know)
- Monogamy in Voles: be able to generally describe how mice helped tease apart the role of Vasopressin (and its receptor) in monogamy in voles (and what the role of Vasopressin is in voles)

Eating and Movement

- Understand and explain the role of *for*/PRKG1 across organisms
 - Sitters vs rovers (flies)
 - Roles of *for* in behaviors in flies (larvae and adult stage)
 - General understanding of roles in *C. elegans*
 - And then understanding of possible role in humans given the paper Self-regulation and the foraging gene (*PRKG1*) in humans
 - Experiment: Questionnaire + foraging task game
 - Compared genotype of SNP within PRKG1
 - Found AA associated with Assessor phenotype

Sexual Selection & Orientation

- Be able to explain the "born this way" argument
- Describe the basics of the Dean Hamer study and its findings
- Comment on overall what we know about the genetic basis of sexuality today

Overall

- Understand and be able to explain how model organisms have helped us understand human behavior (I'd recommend being familiar with at least two specific examples of model organisms helping us understand a human behavior a bit better)

- Be able to trace a genetic variant (typically against a control) through an experiment and interpret results from that experiment