

This lab represents an opportunity to practice some of the more complex concepts of genetic inheritance we have covered up to this point in the course. Since mastery of many of these concepts requires a solid grasp of the rules of probability, what better context for the lab than a Genetics Casino? The key to this exercise is not the gambling, which is in place just to make it fun. The important part is using your knowledge of probability and genetics to “beat” the house (Drs. Wichman and Robison, and the TAs).

There are four games, and each student will play each game twice. You will move around the room in groups (of about 8 students). Each student receives \$200 (10 x \$10 and 2 x \$50) for the first game in the first round, and then \$100 (10 x \$10) for each additional game in the first round. At the beginning of the second round, each student receives a one time cash dispensation of \$200.

Good Luck!

1. Sex linkage blackjack

(Hyo Jin / Alternate)

Genetic Concept: Sex linkage and Mendelian Inheritance.

Relevant Chapter: 4

This game involves two decks of custom cards, one for female fruit flies and one for male fruit flies. One deck is chosen at random and is used to deal cards to the players. The other deck is used to deal cards to the house. Prior to each round of play, each player antes \$10. Each player (and the dealer) is then dealt one card with the picture of the fruit fly up (**DON’T LOOK AT THE FACE OF THE CARD YET!**). On the back of each card is a phenotype of a *Drosophila* at a **sex linked eye color** locus (Red is dominant over White) and an **autosomal wing shape** locus (Wild type is dominant over vestigial). The player may then wager on the outcome of a cross between their *Drosophila* and the *Drosophila* represented by the Dealer’s card. The player may choose to forfeit their ante and not place wagers on the outcomes of the cross. If the player wagers, she may bet from \$10 to \$30 on each of eye color, sex, and wing shape of the progeny of her cross with the dealer. Once all wagers are placed, the cards are turned over to reveal gametes. The player’s gamete and the dealer’s gamete are “united” to form a phenotype. Correct wagers pay even money (the dealer matches the players bet), and incorrect wagers are collected by the dealer. If the player gets all three wagers correct (sex, eye color, and wing shape), the ante is also paid even money. If the player gets one or two wagers correct, the player keeps their ante, but no money is paid on it (although the correct wagers are still paid). If the player gets all three wagers wrong, the dealer collects their ante in addition to all the wagers placed.

2. Pedigree

(Barrie)

Genetic Concept: Inheritance of alleles in a pedigree

Relevant Chapter: 6

This game serves as a practice exercise for analyzing allelic transmission through a pedigree. You will calculate the probabilities of being affected or a carrier for certain individuals in the pedigree. We will then simulate (with dice) the inheritance of one or more affected alleles in the pedigree. You will wager on whether particular individuals in the pedigree will be a carrier or have an affected phenotype.

The mechanism of inheritance (X linked recessive, autosomal dominant, etc.) is indicated at the top left of the pedigree. To simplify the gameplay, wagers for carrier individuals may only be placed on yellow areas, and wagers for affected individuals may only be placed on green areas.

Tip: As you become familiar with how pedigrees work you will see that some wagers are better bets than others. Try to identify wagers for which the probability of success is zero. Don't bet on those. Also, you may identify wagers that have a disproportionately high payoff relative to their probability of being affected or a carrier. These are generally good bets.

Players can bet a maximum of \$50 on each square in the first round, and there is no limit in the second round of gaming.

3. Epistasis

(Holly)

Genetic Concept: Epistasis

Relevant Chapter: 5

Each turn, players will wager on the outcome of a dihybrid cross. The trait in question (**color:** white, blue, pink, red, or purple) is controlled epistatically, though the pathway varies each turn.

At the beginning of each turn, all players ante \$10. Players place a wager on the phenotype they expect to observe. Although discussion with other players is allowed, each player makes their bet in secret. This ensures that all students are thinking about the epistatic pathway, and not just following the lead of the student who has already mastered the concept of epistasis. Once all bets are placed, the expected phenotypic ratio of the cross is revealed, and dice are rolled to determine the progeny's genotype. Successful wagers are paid at the approximate reciprocal of the odds of achieving a particular phenotype. Unsuccessful wagers are gleefully collected by Dr. Wichman.

The ante pot is paid to any player(s) that successfully wagered on the double recessive phenotype. If the ante is not paid, it continues to grow until it is won.

4. Meiosis / Mitosis Texas Hold 'em

(Heidi)

Genetic Concept: Mitosis and Meiosis

Relevant Chapter: 2

Betting limit: \$30 (first round); \$50 (second round)

****Note to the fans of “The World Series of Poker”:** This game is only **LOOSELY** based on Texas Hold 'em. There are no checks, and you can't go “All In”. The point is to keep people playing so they gain familiarity with Mitosis and Meiosis, not to eliminate them after the first hand. Relax, take a deep breath, and have fun.

Each card's face has a picture of one of the stages of mitosis or meiosis on it. The goal of the game is to assemble (using your personal cards and the community cards) the longest contiguous run of the phases of mitosis and meiosis. This includes gametes (sperm and egg) which are the ultimate end products of meiosis. For example, a run of 4 cards (Mitosis: Metaphase, Anaphase, Telophase; Meiosis: Prophase I) is superior to a run of 3 cards (Meiosis II: Anaphase II, Telophase II, Sperm, Egg). Ties involving runs of the same length are broken using the point system on the handouts (Prophase of Mitosis = 2; Gametes = 14). In addition, if a player can unite two gametes and Prophase of Mitosis, they receive a point bonus of 20 for fertilization.

Each player antes \$10 at the beginning of each hand. The dealer then deals two cards face down to each player and four “community” cards face up. The dealer will then ask a player to place these cards in the correct position on the game board. If successful (without help), that player receives \$10 from the bank.

Play starts with a sequentially designated player and rotates each game. That player may:

Bet: Place money into the pot (subject to limits above). Generally, a better hand would result in a larger bet (unless you are bluffing).

Fold: Give cards to the dealer and forfeit any money in the pot.

Play then passes to the player on the left. That player may:

Call: Match the amount bet by the preceding player

Raise: Match the amount bet by the preceding player and increase their bet (subject to limits above)

Fold: Give cards to the dealer and forfeit any money in the pot.

Play continues to pass until all players wishing to remain in the game have contributed the same amount of money to the pot. At this point all remaining players receive one additional personal card face down. Another round of betting ensues. At the end of this round of betting, each remaining player indicates on the sheets provided their best hand. The pot goes to the player with the longest run that has the highest point value. Ties in both run size and point value split the pot. **Note:** You must have the male and female gamete to bridge meiosis and mitosis.

