Osmosis lab report

NAME: Donna Ha TITLE: Measuring the Rate of Osmosis Using “ De-shelled" Chicken Eggs INTRODUCTION: In order to fully understand the concept of this experiment, one must first be introduced to diffusion. Diffusion is a spontaneous process by which molecule particles move from one area that is highly concentrated to another area in which its concentration is lower. Cells contain fluids and are surrounded by fluids; in order for a cell to function it is required to be in a balanced state. The progress in which a cell is in its balanced state is called equilibrium. Diffusion is a functioning way for cells to reach their equilibrium. Equilibrium is reached by controlling what enters and exits the cell through a cell membrane that selectively filters molecules by slowing down their movement, allowing them to pass through, or not allowing them to pass through the membrane. Diffusion and osmosis go hand-in-hand. Osmosis is generally the same as diffusion, however, deals solely with water. Osmotic pressure is the pressure of a solution against a semi-permeable membrane to prevent water from flowing into the membrane. In this lab, we are going to study tonicity; tonicity is the measure of this osmotic pressure and is the differential of pressure between two solutions separated by a selective membrane. To help identify the relative concentrations of solute particles of different solutions, we must understand that there are three possible differences in concentrations between a cell and its environment. The terms hypotonic, hypertonic, and isotonic are used in referring to the identification of the possible relative concentrations. The first term, hypotonic, is the solution that contains lower concentrations of solute particles, which means that the concentration inside the cell is greater than the concentration outside. A hypotonic solution causes the cell to swell in size. The second term, hypertonic, is the solution that contains higher

concentration of solute particles, which means that the concentration of the cell is less than that outside the cell. A hypertonic solution causes the cell to shrink in size. Lastly, the third term, isotonic, is the solution in which the cell stays the same, which means concentrations inside and outside the cell are equal, so water enters and exits the cell equally resulting in equilibrium. OBJECTIVE: The objective of this lab is to identify each egg in its relative concentration of solute particles of different solutions as either a hypotonic, a hypertonic, or an isotonic solution based on the change in each egg's mass from time 0 to time 60 in minutes. With that, one's aim is to find the concentration of the unknown solution given by the instructor, and to identify at which point an isotonic solution occurs. HYPOTHESIS: If an egg is placed in a hypotonic solution, then the egg will increase in water mass and swell. If an egg is placed in a hypertonic solution, then the egg will decrease in water mass and shrink. MATERIALS AND PROCEDURE: In order to proceed in the experiment, the following materials were obtained: - 6 de-shelled eggs - Scale - Weighing trays - Paper towels - Timer - Beakers of solutions containing 0%, 10%, 20%, 30%, & 40% sucrose and an unknown solution To begin this experiment, first each group was given six de-shelled eggs, a scale, weighing trays, paper towels, a timer, and beakers of solutions containing 0%, 10%, 20%, 30%, 40% sucrose, and an unknown solution. To get this lab started, the scale was first plugged in. Once the scale was plugged and ready for use, we placed the weighing trays on the scale and tarred it to zero, so that the tray's weight wouldn't have any impact on the weights of the eggs. After the weighing trays were tarred, each egg was placed atop the trays and the initial weight of the eggs were measured and recorded in lab notebooks under results in Table 1 Chart. Correspondingly,

each of the six de-shelled eggs were placed in the various solution concentrations, 0%, 10%, 20%, 30%, 40% sucrose, and an unknown solution. After being merged in the various concentration solutions for fifteen minutes, the eggs were then taken out of the beaker-filled solutions, patted dry with paper towels, and weighed. The new weights of the eggs were again recorded in lab notebooks under Table 1 Chart. This process was repeated in fifteen minutes intervals from time zero to time 60 minutes. Thereafter, the values in the chart for Table 2 was calculated by subtracting the weight at any time intervals 15, 30, 45, or 60, from the initial weight to get the total change with respect to time. All data was recorded in two formats: the weight of each egg at each time interval, and the change of weight of each egg at different time intervals. RESULTS: Table 1: Determination of the Weight of Eggs in Different Solute Concentrations at various Times Time (min.) 1 0% Sucrose 2 10% Sucrose 3 20% Sucrose 4 30% Sucrose 5 40% Sucrose 6 Unknown 0 84. 87 g 79. 67 g 92. 95 g 81. 45 g 86. 59 g 93. 45 g 15 90. 34 g 80. 64 g 92. 93 g 80. 75 g 84. 89 g 95. 11 g 30 95. 01 g 81. 61 g 92. 85 g 80. 27 g 83. 42 g 96. 58 g 45 97. 43 g 82. 40 g 92. 76 g 79. 82 g 82. 15 g 97. 71 g 60 100. 28 g 83. 23 g 92. 74 g 79. 46 g 81. 05 g 98. 65 g In table 1: this table shows weight of each de-shelled egg, in grams, of which are in different solutions of various concentrations at various times. As shown on this table, the egg in 0% sucrose solution gained weight with respect to time. At time zero, this egg weighed 84. 87 grams; at time 15 minutes, it accumulates its mass to 90. 34 grams, at time 30 minutes, it accumulated to 95. 01 grams, at time 45 minutes, it accumulated to 97. 43 grams, at time 60 minutes, it accumulated to 100. 28 grams. Egg in 10% sucrose solution also gained weight with respect to time. As shown on this

table, at time zero, this egg weighed 79. 67 grams; at time in 15 minutes intervals, it increase its mass from 80. 64 grams at time 15 minutes, 81. 61 grams at time 30 minutes, 82. 40 grams at time 45 minutes, 83. 23 grams at time 60 minutes. Egg in 20% sucrose solution, differs from eggs 1 and 2 because this egg 3 lost weight with respect to time. As shown on this table, at time zero, this egg weighed 92. 95 grams; at time 15 minutes 92. 93 grams, at time 30 minutes 92. 85 grams, at time 45 minutes 92. 76 grams, at time 60 minutes 92. 74 grams. Egg in 30% sucrose solution also lost weight with respect to time. As shown on this table, at time zero, this egg weighed 81. 45 grams; at time 15 minutes 80. 75 grams, at time 30 minutes 80. 27 grams, at time 45 minutes 79. 82 grams, at time 60 minutes 79. 46 grams. Egg in 40% sucrose solution also lost weight with respect to time. As shown on this table, at time zero, this egg weighed 86. 59 grams; at time 15 minutes 84. 89 grams, at time 30 minutes 83. 42 grams, at time 45 minutes 82. 15 grams, at time 60 minutes 81. 05 grams. However, egg in the unknown solution gained weight with respect to time. As shown on this table, at time zero, this egg weighed 93. 45 grams; at time 15 minutes 95. 11 grams, at time 30 minutes 96. 58 grams, at time 45 minutes 97. 71 grams, at time 60 minutes 98. 65 grams. Overall, this table indicates that the more concentrated the solution was, meaning the more sugar there was in a solution, the smaller the egg gets with time. Table 2: Total Weight Change (grams) of Eggs in Different Solute Concentrations from Time Zero. Time (min.) 1 0% Sucrose 2 10% Sucrose 3 20% Sucrose 4 30% Sucrose 5 40% Sucrose 6 Unknown 0 0 0 0 0 0 0 15 5. 47 g 0. 97 g -0. 02 g -0. 70 g -1. 70 g 1. 66 g 30 10. 14 g 1. 94 g -0. 10 g -1. 18 g -3. 17g 2. 13 g 45 12. 56 g 2. 73 g -0. 19 g -1. 63 g -4. 44 g 4. 26 g 60 15. 41 g 3. 56 g -0. 21 g -1. 99 g -5. 54

g 5. 20 g In table 2: this table shows total weight change of each de-shelled egg, in grams, of which are in different solutions of various concentrations at various times starting from time zero. As shown on this table, the egg in 0% sucrose solution had a change in mass difference of “ 0" at time zero. At time 15 minutes, a difference in mass of 5. 47 grams, at time 30 minutes difference in mass of 10. 14 grams, at time 45 minutes difference in mass of 12. 56 grams, at time 60 minutes difference in mass of 15. 41 grams. For the egg in 0% sucrose, as time passed, the difference of mass in grams increased. The egg in 10% sucrose solution had a change in mass difference of “ 0" at time zero. At time 15 minutes difference in mass of 0. 97 grams, at time 30 minutes difference in mass of 1. 94 grams, at time 45 minutes difference in mass of 2. 73 grams, at time 60 minutes difference in mass of 3. 56 grams. For the egg in 10% sucrose, as time passed, the difference of mass in grams also increased. The egg in 20% sucrose solution had a change in mass difference of “ 0" at time zero. At time 15 minutes, it had a difference in mass of -0. 02, at time 30 minutes difference in mass of -0. 10 grams, at time 45 minutes difference in mass of -0. 19 grams, at time 60 minutes difference in mass of -0. 21 grams. For the egg in 20% sucrose, as time passed, the difference of mass in grams decreased. The egg in 30% sucrose solution had a change in mass difference of “ 0" at time zero. At time 15 minutes difference in mass of -0. 70 grams, at time 30 minutes difference in mass of -1. 18 grams, at time 45 minutes difference in mass of -1. 63 grams, at time 60 minutes difference in mass of -1. 99 grams. For the egg in 30% sucrose, as time passed, the change of mass in grams decreased. The egg in 40% sucrose solution had a change in mass difference of “ 0" at time zero. At time 15 minutes difference in mass of -1. 7 grams, at

time 30 minutes difference in mass of -3. 17 grams, at time 45 minutes difference in mass of -4. 44 grams, at time 60 minutes difference in mass of -5. 54 grams. For the egg in 40% sucrose, as time passed, the difference of mass in grams decreased. The egg in the unknown solution had a change in mass difference of “ 0" at time zero. At time 15 minutes difference in mass of 1. 66 grams, at time 30 minutes difference in mass of 2. 13 grams, at time 45 minutes difference in mass of 4. 26 grams, at time 60 minutes difference in mass of 5. 20 grams. For the egg in the unknown solution, as time passed, the difference of mass in grams increased. Graph 1: Weight Change of Eggs with Time In graph 1: this table shows the weight of each de-shelled egg with respect to time, in grams and minutes, of which are in different solutions of various concentrations. As shown in this graph, any line above the “ 0" horizontal line represents a hypotonic solution. Therefore, distilled water, 10% sucrose, and the unknown solutions are all hypotonic solutions. This graph states that any line below the “ 0" horizontal line is a hypertonic solution. Therefore, 20%, 30%, and 40% sucrose solutions are all hypertonic solutions. Graph 2: Weight Change of Eggs in Solutions of Various Concentration In graph 2: this table shows the weight changes of each de-shelled egg in various concentration solutions, in grams and percent in sucrose. As shown in this graph, any line above the “ 0" horizontal line exhibits a hypotonic solution. Therefore, distilled water, 10% sucrose, and the unknown solutions are all hypotonic. This graph shows that any line below the “ 0" horizontal line exhibits a hypertonic solution. Therefore, 20%, 30%, and 40% sucrose solutions are all hypertonic. The isotonic point is at which the point has reached equilibrium, in this case, at 24. 5 percent sucrose and 0 weight in grams. DISSCUSSION AND CONCLUSION: Overall,

since the egg in 0% sucrose solution gained a total mass of 15. 41 grams after 60 minutes of being soaked in solution in graphs 1 and 2, it could be determined that 0% sucrose is hypotonic. De-shelled egg in 10% sucrose solution gained a total mass of 3. 56 grams after 60 minutes of being soaked in solution in graphs 1 and 2, so it could be determined that 10% sucrose is also hypotonic as well. However, de-shelled egg in 20% sucrose solution lost a total mass of -0. 21 grams after 60 minutes of being soaked in solution in graphs 1 and 2, so it could be determined that 20% sucrose is hypertonic. De-shelled egg in 30% sucrose solution lost a total mass of -1. 99 grams after 60 minutes of being soaked in solution in graphs 1 and 2, so it could be determined that 30% sucrose is hypertonic as well. De-shelled egg in 40% sucrose solution lost a total mass of -5. 54 grams after 60 minutes of being soaked in solution in graphs 1 and 2, so it could be determined that 40% sucrose is hypertonic as well. De-shelled egg in unknown solution gained a total mass of 5. 20 grams after 60 minutes of being soaked in solution in graphs 1 and 2, so it could be determined that the unknown solution is hypotonic. The data charts accommodated above supported the hypothesis that eggs in a hypotonic solution will increase in water mass, which means the de-shelled egg will swell. While eggs in a hypertonic solution will decrease in water mass, which means that the de-shelled eggs will shrink. Throughout this osmosis lab experiment, there could have been many possible sources of error. For example, in the process of wiping excess water off the eggs after removing them from the various concentrated solutions, some eggs may not have been patted completely dry and that excess water could have contributed to the eggs overall mass in grams. REFERENCES: Biology 2107-2108 Principles of Biology Laboratory Manual, Sheryl

Shanholtzer, July 2010, “ Measuring the Rate of Osmosis Using Deshelled Chicken Eggs, " pg. E1-E5.