CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
38741

Project Title
Modeling Kidney Filtration

Abstract

Objectives/Goals
The primary objective of this study is to show how the filtration system in the kidney works and how different amounts of salt affect the efficiency of filtration. My hypothesis was that, if there was an excessive amount of salt in the kidney, then the kidney would take longer time to reduce the salt concentration.

Methods/Materials
Prepared 3 concentrations of salt solutions and 1 glucose solution, filled separate dialysis tubing (diffusion cells) with each solution and combinations of salt and glucose solutions. Placed cells in plastic containers with filtered tap water and measured conductivity and glucose content inside and outside the cells over a period of 4 hours. Conductivity of a solution was used as a measure of dissolved salt concentration. The glucose concentration in the solution was measured using the dip stick method.
Filtered tap water, table salt, ReliOn Glucose tablets, Diastix Reagent Strips for Urinalysis, 1-inch diameter dialysis tubing, 450 mL clear plastic glass containers, plastic plate, scissor, cotton threads, digital measuring scale, Myron 6P Ultrameter, and sharpie.

Results
Results showed, over a fixed period of time, higher initial salt concentrations took longer time to reduce to a lower value. Results also showed that diffusion cells with high salt concentrations inside produced high salt concentrations in the outside solution at the end of the experiment. Similar results were noted when these salt solutions were mixed with a known strength of glucose solution. The osmosis experiment showed that since the salt crystals could not pass through diffusion cell membrane, water from outside moved across the membrane via osmosis to bring the salt concentration in equilibrium.

Conclusions/Discussion
The results obtained during the experiment fully supported my hypothesis. The study showed as the salt concentration becomes elevated in the influent blood entering the kidneys, it would take longer time to filter out all the unnecessary salt. The high salt concentration in the filtered blood will also trend to retain back more water, which would put more pressure on the blood vessels. Hence, the more table salt we have in food, the more water we are going to reabsorb back into the body. In real life to counter this phenomenon doctors prescribe diuretic medications which forces greater volume of urine generation to help the body in getting rid of excess water to lower blood pressure.

Summary Statement
The study showed as the salt concentration becomes elevated in the influent blood entering the kidneys, it would take longer time to filter out all the unnecessary salt.

Help Received
Mr. John Wood, Mr. Joel Sotolongo, and Dr. Susamita Kesh