Wearable Electrochemical Sweat Sensor for Patients with Chronic Kidney Disease, Year II

Somawardana, Suran (School: BASIS San Antonio Shavano Campus)

Chronic kidney disease (CKD) hinders the ability of kidneys to filter the blood effectively and in most cases result in renal failure that forces patients to depend on a blood dialysis machine at scheduled appointments to filter their blood for the rest of their life. This project aims to mitigate this problem by designing an at-home, point-of-care, wearable biosensor that can detect the level of urea from sweat. This will help determine how often patients need to get their blood filtered, saving time and money. Previous scientific literature suggests that the level of urea in sweat is directly correlated to that of urea in blood. For this project, an electrochemical sweat sensor was created utilizing an Arduino microcontroller that determines the voltage created when urease enzyme is added to a solution with known concentration of urea. This voltage produced is said to be directly proportional to the amount of urea. The hypothesis is that there will be a direct relationship between the voltage produced concentration of urea in the solution. It is also hypothesized that the relationship will be independent of volume such that miniaturization will be possible. Varying concentrations of urea were used (0.2M-1.0M). The Arduino voltmeter was used to determine the relationship, if any, of the voltage created and the concentration of urea. 15 readings were taken for each concentration at 10mL, 50mL, and 100mL of solution. The result of the experiment suggests that there is a direct relationship between concentration of urea and voltage produced that is independent of volume, such that miniaturization is possible in future experiments.

Awards Won: