Wearable Electrochemical Sweat Sensor for Patients With Chronic Kidney Disease (CKD): Year III

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Chronic Kidney Disease (CKD) is an incurable disease that hinders the ability of kidneys to filter the blood effectively and in most cases result in renal failure that force patients to depend on a blood dialysis machine to filter their blood for the rest of their life. The scheduled use of these blood dialysis machines is very costly. This project aims to mitigate this problem by designing a wearable biosensor that provides an at-home, point-of-care device that is able to detect the level of urea from the sweat. This will help determine how often patients need to visit the doctor's office to get their blood filtered. Specifically, for this project, experiments were conducted involving the creation of an electrochemical sweat sensor utilizing a 3D printed case with two cells (one sensing cell with urease enzyme and one reference cell without enzyme), aluminum electrodes lining both cells, and a differential voltmeter to determine the voltage created when urease enzyme is added to a solution with known concentration of urea. The hypothesis for this project is that there will be a linear, direct relationship between the voltage produced in the solution and the concentration of urea in the solution. Varying concentrations of urea were used (20mM, 40mM, 60mM, 80mM, and 100mM). The data suggests that this novel sensor is able to accurately detect renal function. Specifically, the sensor was able to detect an increase in voltage that was proportionate to an increase in urea concentrations. The development of a fully-functioning, electrochemical sweat sensor can provide patients with CKD a much more liberating lifestyle, as they are no longer confined to scheduled, invasive blood dialysis appointments, but rather, only get treatment as needed.

Awards Won:
Fourth Award of $500