Development of a Low Cost Multi-Analyte Microfluidic Device

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Access to health care in low income communities and developing countries is limited. The purpose of this project was to develop a prototype of a string-based microfluidic device to detect analytes in a solution towards a cost-effective method that can be locally developed. String based microfluidic systems are also emerging as promising tools in the development of advanced wearable devices, increasing the scope of the project. Procedure: In Phase 1 of this project a paper-based microfluidic device prototype was made and migration properties were tested using different food colors to understand the principles. Nail polish was successfully used to create barriers for channel patterns. In Phase 2 of the project, migration of dye through a mercerized cotton string was tested and determined the optimal volume of the test solution as well as the length of the string required. In Phase 3 of the project, a multi-analyte microfluidic device prototype was created by developing a device that can simulataneously test three analytes: glucose, pH and protein. In Phase 4, using an Arduino (FLORA), light sensor, and LEDs, an electronic detection device was created. Data Analysis: Tests were done in replicates. Mean, standard error and t-test for p-value were calculated using Excel. Hexadecimal and grayscale values of colors were computed in Arduino. Conclusion: A low cost string microfluidic device and an Arduino-based color detection system were developed. Based on this prototype, wearable devices also can be developed. Futhermore, the prototype can be used in high schools to teach fundamentals of microfluidic techniques.