Refinement and Increased Efficiency of Human Papillomavirus Field Assay

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***Abstract*—Point-of-care (POC) testing requires the user to have all testing and evaluation equipment available on-site. The current POC assay that has been developed requires 16 individual steps and several hours to process. This process is not sufficient for deployment to the field because it requires extensive lab equipment and training. This technology will be streamlined in complexity so that it can be used by someone with minimal training in third world countries.**

Keywords: Point-of-care diagnostics, Lateral flow assay, Nano-particle, Nitrocellulose membrane, HPV detection

I. Description of your project

Point-of-care (POC) diagnostics have become the an effective tool for testing in low resource environments and austere locations. These tests must be simple to use and rugged in their design to be effective for field use. The threat of cancer caused by Human Papillomavirus is not unique to any country. To combat this threat it is imperative that it can be detected in its early stages and in the case, of low resource areas, it must be done inexpensively. The diagnostic assay that we are working on meets the requirements on cost but must be made easier for use by untrained personnel outside of a lab. At this point the testing strip has thirteen steps before the results can be read and evaluated by the scanning device.

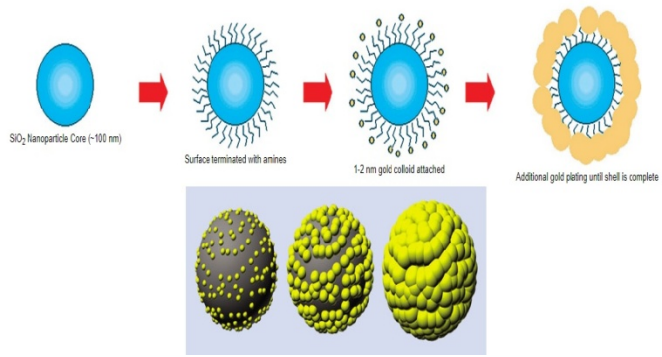

Figure 1: Gold Nanoshell Synthesis [3]

Currently, the entire process takes around two hours to complete. This also relies on the test taking place in a modernized lab with an excess amount of supplies. The current assay uses nitrocellulose that is designed for quick flow rates but creates tests that aren't as sensitive. We are going to implement nitrocellulose that is designed to run slower but that should require less washing steps to prevent non-specific binding. This will increase the accuracy of the tests while simultaneously decreasing the amount of steps. As the protocol reads now there are multiple individual wash steps that require long periods of time to allow the fluid to pass through the test completely. [1] The initial pre-wetting step takes around twenty minutes before the diluted plasma serum can be applied to the sample pad. The slower flowing nitrocellulose has a smaller pore size, we believe this will allow us to decrease both the number of wash steps and the amount of liquid applied per step. We are also exploring the different types of nano-particles available as an indicator for the assay results. For our purposes we are going to use gold nano-shells as opposed to gold nano-particles. The main difference between the two is that instead of being completely gold, the nano-shells have a silica core wrapped in gold particles. This creates a less dense product that should flow faster through the assay displaying results more quickly. Using these different products we will attempt to create an assay that is more user friendly and that meets the requirements of POC.

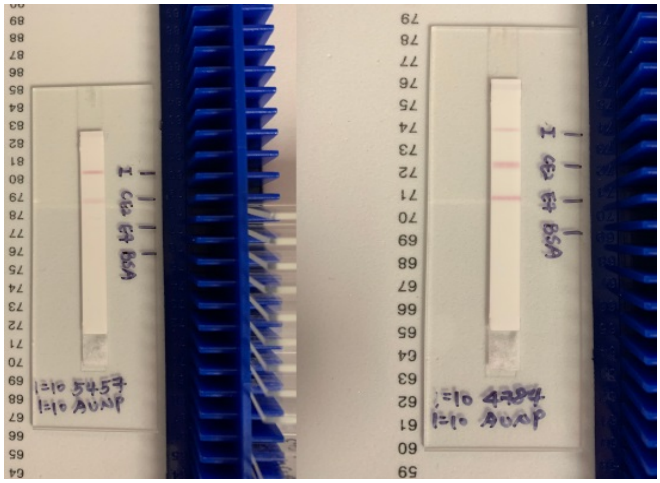

Figure 2: Examples of assays: left assay is positive for CE2 protein and right is positive for both CE2 and E7 HPV proteins.

Acknowledgements:

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