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Prof. Dennis Shasha

Department of Computer Science

Courant Institute of Mathematical Sciences

251 Mercer Street

New York, NY 10012-1185

Email: shasha@cs.nyu.edu

Telephone: (212) 998-3086

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I met Kevin Kuonqui during the month of September 2017 after Dr. Yoel Ohayon suggested he could be of assistance on a joint collaborative research effort between the Seeman lab and my research group. He has been highly recommended by the Seeman lab and has demonstrated an eager interest in applying his lab training in nanotechnology to develop techniques pertinent to the medical sciences.

The aim of the project is to perform Boolean operations on sets of bacteria, as might be found in a microbiome. For example, we might want to isolate the bacteria in the gut of patient A who responds well to some immunotherapy that is not present in the gut of patient B who doesn’t. Or if A and B both respond well, we might want to find the bacteria they hold in common. The key experimental problem is to identify cells in one patient that found in the other. After much literature review, largely led by Kevin, we have decided to use the concept of fluorescence hybridization, a technique readily available nearly every biology lab, for this purpose. The project is simple in the sense that the data collected will either be evaluated as ‘match’ or ‘non-match’ for each cell being evaluated.

The key experimental technique being utilized to collect data is called fluorescence resonance energy transfer (FRET). In this technique, two strands of DNA are independently labeled with different fluorescent tags that emit certain signals that can be recorded by software. When two strands are in proximity to each other, the signals emitted by each strand interfere with each other to produce a unique signal that can be recorded by the software. Thus, this technique will be used to evaluate when two strands of DNA hybridize with each other, thus constituting a match. The funding will be used to support the purchase of supplies.

This project has a lot of promise due to the simplicity of the technique, as well as the fact that it does not require large amounts of base-pair data to compare two microbiomes. Kevin has contributed his experience from biology and biochemistry in developing this technique and has shown himself to be an avid and careful reader of the existing literature on the subject, effectively presenting his findings at our weekly meetings. I think the project will lead to meaningful results and give him excellent research experience.

Warm Regards,

Dennis Shasha