CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Shreyas G. Kallingal

Project Number

S0515

Project Title

Computationally Designing Antibodies for Target Proteins to Create a Novel Test to Detect Schistosomes in Water

Abstract

Objectives/Goals

The objective of this project was to create a two-part system for the detection of schistosome parasites in a body of water. An attraction device to concentrate the proteomic sample for testing was the first part. The second part was to design antibodies to target biomarker proteins.

Methods/Materials

To increase the probability of including all the parasites in a body of water in the sample, a heat-based attraction device was created using a heating pad, battery, and bottles for flotation. A thermometer was used to measure the heat of the heating pad for a set of 6 trials. Next, I identified 284 proteins secreted by schistosomes through a literature search. NCBI BLAST was used to compare sequence alignment scores to find 2 target biomarker proteins of different life cycle stages. SVmTriP was used to combine protein tri-peptide similarity and propensity to find 2 epitopes for each target protein so antibodies could be developed. 1 antibody for each protein was designed through the 4-step workflow OptCDR.

Results

The attraction device was able to reach an average of 34.46 degrees Celsius after 6 trials. One protein from the parasite's cercariae (matured) stage, GST 28, and one protein from the parasite's egg to sporocyst (pre-matured) stage, SmVAL3, were identified as target proteins. Of the 2 epitopes selected for each protein, one was chosen based on prediction score from SVMTriP. OptCDR yielded thousands of CDR-based antibody structure, from which 1 for each protein was selected.

Conclusions/Discussion

The proteins I identified through this research are biomarkers that indicate the presence of schistosomes in water. Antibodies that were designed can be produced through in-vitro methods in the future in order to create immunassay-based tests for proteomic detection. The attraction device mimics the warmth of human skin and can be inexpensively deployed into a water body to ensure all parasites present in the water are included in the sample. This novel testing method for schistosomes can warn communities if their water is contaminated, allowing for selective diagnostics and preventing further contact with parasites.

Summary Statement

I created a 2 part system to detect schistosomes through a parasitic attraction device and by computationally designing antibodies for target biomarker proteins.

Help Received

I used government databases to gather data, and I used publicly available software to perform my experiment. My biology teacher read my work, but did not provide any additional help. All research and experimentation was done at my house.