



## Colorado Science and Engineering Fair

## 2024 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Glucose Fuel Cells Made From Graphene Membranes

Finalist's Name: Anna Kumar

School and City: Fairview High School, Boulder

Sponsor's Name: Caleb Song

Category: Energy (ERGY)

Division: Senior (9th - 12th grades)

Abstract (250 words or less):

The World Health Organization estimates that 35-40 million people globally are in need of prostheses. Currently, the majority of prostheses are myoelectric rather than body-powered and thus require an electrical power source. Recently researchers have become increasingly interested in the opportunities a person's own blood glucose presents as a source of power for their prosthetics. The goal of this study is the utilization of graphene and supporting materials to create a glucose fuel cell that can diffuse glucose through itself effectively and convert it into energy. To develop this new type of fuel cell we first must be able to create a graphene membrane that is diffusive, conductive, flexible, and strong. A membrane consisting of graphene and cellulose acetate can be created through a vacuum filtration device and the manipulation of phase inversion. The progression of this project to completion involves developing a membrane casting process that produces graphene that transfers effectively onto cellulose acetate, testing for diffusion constants, resistances, and flexibility of the membranes, and ultimately integrating the membranes into a glucose fuel cell. To date I am working on improving the casting process so that the graphene is securely affixed on the cellulose acetate. Once successful attachment is accomplished, I will conduct diffusion tests with a diffusion test cell, collect resistances through sending electrical current through the membranes, and perform roll tests.

*I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.*

Finalist's Signature:

Anna

Date:

03.01.2024

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.

