



Colorado Science and Engineering Fair

2025 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: A novel approach to wound management using hydrovoltaic effect

Finalist's Name: Anirudh Rao

School and City: STEM School Highlands Ranch, Highlands Ranch

Sponsor's Name: Bharathi Rao

Category: Biomedical & Health Sciences

Division: Junior (grades 6 - 8)

Abstract (250 words or less):

Currently, there are no easy ways to identify the onset of infection in chronic wounds due to resulting in costs, continued pain, and even loss of life. According to NIH, wounds affect approximately 10.5 million people in the United States, which represents nearly 2.5% of the total US population, with a higher percentage among the elderly.

The primary cause of infection is uncontrolled moisture in the wounds. The project offers a highly accurate, sustainable, reliable, and inexpensive option to detect the presence of excess moisture in wounds early enough to stop any infection before it happens.

The invention is a leap forward in wound-care technology, built on hydro-voltaic effect: a process of converting water moisture to create a potential voltage difference.

The idea is a device embedded in a bandage that indicates the presence of excessive moisture beyond the allowed levels for a wound. Moisture in the wound, is absorbed by the graphene-oxide or carbon nanotube layer, which creates a potential difference between the top and bottom layers. This difference creates a small current flow that is routed via electrodes to a voltage sensitive electrochromic material such as Tungsten-Trioxide layer, which changes color to indicate presence of moisture. A prototype was created and was tested with graphene-oxide on a Fiberglass and PET substrates with indication on the Tungsten-Trioxide layer, creating a calibration scale.

The results verified the developed sensor detects moisture and converts to electricity using hydro-voltaic effect and the presence of excess moisture is visually indicated.

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:

Date:

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.**