

**50**  
YEARS

**WWSEF**

WATERLOO - WELLINGTON SCIENCE & ENGINEERING FAIR

Developing Canada's capacity for high-quality research in science, technology & engineering since 1974.

# Annual Report 2023

## You Can See the Future from Here

It was really good to provide once again an in-person regional science fair for our communities' youth. The 2023 Fair marked 50 years since WWSEF began. That's something for our community to celebrate, and someone agrees (see page 2).



*The WWSEF Science Fair Exhibit Hall*

We can also celebrate how often the youth you support have represented Canada on the international stage (page 6), and review the wide range of research projects science fairs support (page 7).

We added a few new features this year, while maintaining our successful program. One new feature was a large display of former exhibitors noting their achievements and current status. Our mission statement is ***“Developing Canada’s capacity for high-quality research in science, technology and engineering”***.

The display affirms that that's what we're achieving. Thank you to the Rotary Club of Guelph who provided funds for the display panels.

A second feature was another display of our generous community sponsors – you and a few dozen more individuals, businesses and institutions. With your support our young researchers are able to shine.

Many things stayed the same: We had 170 young researchers exhibiting projects. Our judging panel was comprised of 125 volunteers from business and academia. The Fair engaged another 36 volunteers to assist with Registration, Safety Checks, Judging Administration and DEAR, our afternoon environmental education program, and photography. The afternoon program had participation from Laurier Science, UW, Perimeter Institute, Reep Green Solutions, Royal City Science, Let's Tree Wilmot, Water Environment Association of Ontario and Green Learning.

This report features exhibitors who went to national and international events (pages 3,4 and 5). But we do much more. At WWSEF we presented 18 Gold Medallions, 23 Silver, 30 Bronze and 32 Pewter. Most of these carry small cash prizes, but 12 intermediate and senior exhibitors (high school) also received scholarship offers as a result of their outstanding skills.



PRIME MINISTER · PREMIER MINISTRE

**Message from the Prime Minister of Canada**

It is with great pleasure that I send my greetings for the 2023 Waterloo-Wellington Science and Engineering Fair.

As a former teacher, I have the utmost appreciation for fairs like this. They help teach participants a sense of discipline, patience, and commitment that last them a lifetime.

They also help remind us all of the fact that our country's future is indeed in brilliant hands.

To all the exhibitors here today, I wish you nothing but the very best. Win, lose, or draw, I hope that this competition gives all of you an opportunity to take a well-deserved moment of self-fulfilment for your own talents.

And, to the organizers, please accept my deepest gratitude for everything that you do for your community. I wish you many more years of continued growth, success, and impact.

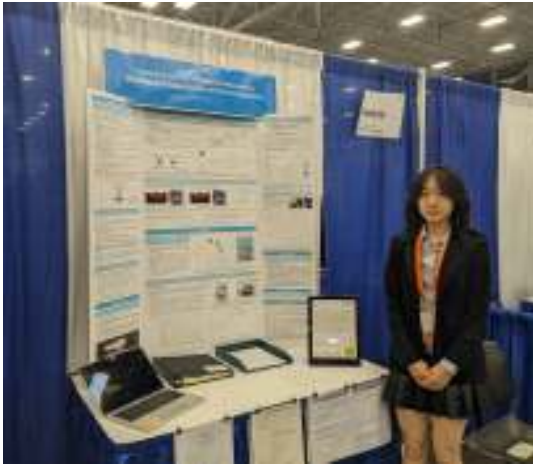
With warm regards!

Ottawa  
2023



# Going Further- Beyond WWSEF

## Team Canada International Science & Engineering Fair Dallas



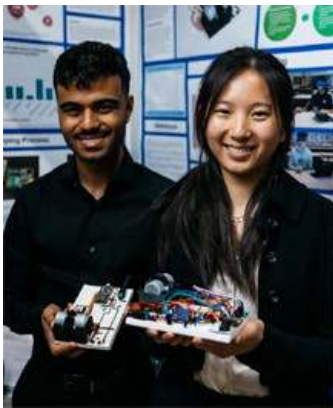
Cindy Cheng

### **A Sweat Lactate & Tissue Oxygen Sensor for Hypoxia**

Hypoxia is insufficient tissue oxygenation that can lead to tissue damage and organ failure. A wearable non-invasive integrated device was developed consisting of two main components: a chemical lactate biosensor and optical electronics that read out both tissue oxygenation and the colourmetric sweat lactate change. The device can be applied in post-operative care, detecting sepsis, and measuring endurance in athletes. It could facilitate cost-effective and sustainable healthcare to under-resourced regions and populations

Awards: 4<sup>th</sup> Biomedical Engineering

## Canada-Wide Science Fair Edmonton

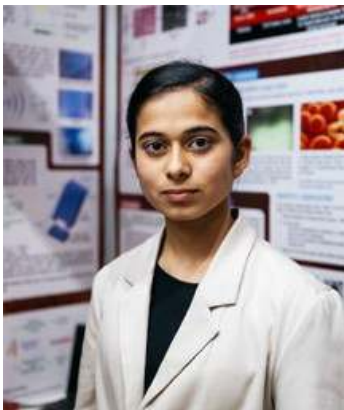


Katelyn Wu & Moulik Budhiraja

### **Nail Braille: A Novel Approach Towards Braille Education**

This project designed, 3D printed and tested a new device that allows visually impaired individuals to self-learn braille. The developers aim to fight the global braille literacy crisis by using an approach that is low-cost and accessible to the visually impaired population.

Awards: CWSF Excellence - Gold; **Platinum Best Senior Project – Innovation**; Youth Can Innovate, \$8K; Challenge Award, Digital Technology, Senior; SM Blair Family Foundation. Scholarship offers (each): \$32K



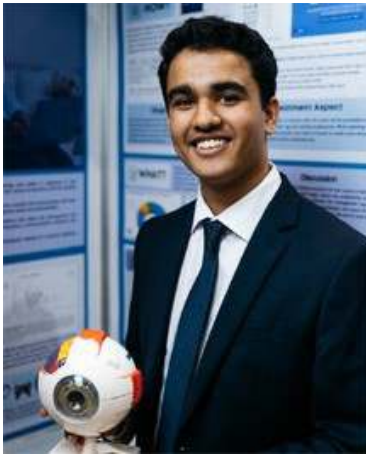
Gurnoor Kaur

### **MalaScope: A Deep Learning Enabled Lensless Microscope for the Rapid Detection of Malaria**

Malaria kills hundreds of thousands of people annually. MalaScope offers accurate, accessible, and affordable testing by using low-cost lensless microscopes and deep-learning algorithms. The use of imaging of stained blood smears and convolutional neural networks resulted in an accuracy of over 98% in identifying infected red blood cells. A second feature distinguished healthy from infected cells, eliminating staining.

Awards: CWSF Excellence - Gold; Canadian Artificial Intelligence Assn., Youth Can Innovate. Scholarship offers: \$9K





Ashish Chettimada

**ReAlign: A Novel Solution for the Early Detection and Management of Amblyopia**

Amblyopia (lazy eye) affects about 400 million people worldwide. It is a type of neurodevelopmental disorder that is the largest threat to the vision of children. This project developed ReAlign, a web application, to diagnose and treat amblyopia using advancements in technology. By combining personalization and games, the app creates an engaging experience for children of all ages.

Awards: CWSF Excellence - Gold; SM Blair Family Foundation. Scholarship offers: \$9K

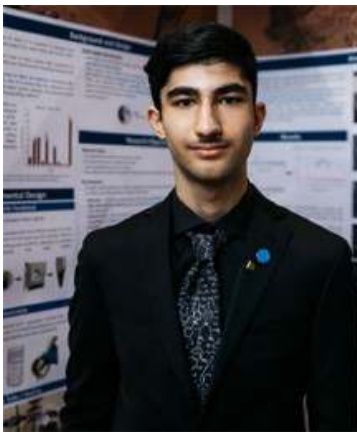


Roocha Shukla

**The Power that Brings Flowers**

This project focused on protecting plants from temperature fluctuations and increasing flowering by using electrolyzed seaweed extract. The efficiency of the seaweed extract was increased through electrolyzation, while optimizing application-based extract concentrations, inducing more flowers and made the plants more resilient to cold stress.

Awards: CWSF Excellence - Bronze. Scholarship offers: \$2.5K

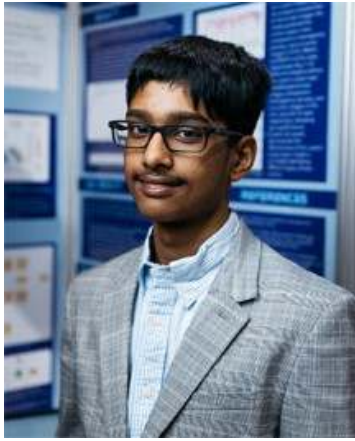


Hooman Reza Nezhad

**From Dust to Habitation – Molten Salt Electrolysis for the In-situ Reduction of Martian Regolith**

The complexity of missions to Mars prompts the need for In-Situ (on-site) Resource Utilization processes. This project involved the development of a molten salt based electrochemical cell in breaking down Martian soil (regolith), successfully producing oxygen and pure metals/alloys while resulting in a 550°C reduction in temperature from current techniques. The process enables resource production anywhere on Mars with fewer consumables from Earth.

Awards: CWSF Excellence - Silver; Nanotechnology for Sustainable Society. Scholarship offers: \$11.5K



Safwan Hussain

**Building a Multiclass Brain Tumor Classification Model using a Convolutional Neural Network (CNN)**

This project developed a multiclass brain tumor classification model using a convolutional neural network to aid diagnosis of brain tumors, particularly in areas with limited access to medical professionals. The model was trained on an MRI dataset and successfully identified four different brain tumor types with high accuracy. Rapid identification can reduce diagnostic time and workload for doctors, allowing effective treatment to their patients.

Awards: CWSF Excellence Bronze. Scholarship offers: \$2.5K



Charlie Martinez

**The Metallic Havoc: How Heavy Metals Select Antibiotic-Tolerant Microbiomes.**

This project examined the potential role of a heavy metal pollutant, silver nitrate, in exacerbating antibiotic resistance. Bacteria from a rural stream were exposed to  $\text{AgNO}_3$  for 18 days, after which their resistance to four widely-used antibiotics was tested. Bacteria exposed to  $\text{AgNO}_3$  demonstrated a heightened resistance to chloramphenicol, an antibiotic utilized worldwide.

Scholarship offer: \$1K



Jasmine Schneider

**Biochar Modified with Water Softener Brine Rinse for Phosphate Removal**

Phosphate pollution contributes to harmful algal blooms. This project aimed to make biochar, a super adsorbent material with few unfavourable features, better-suited for removing phosphate from water. The project investigated whether modifying the biochar with water softener brine rinse could improve its performance and compared it to mussel shell biochar.

Scholarship offer: \$1K

# WWSEF Exhibitors Selected for Team Canada

## **Team Canada - International Science and Engineering Fair**

- 1995 Mark Nowinski and Jack Nowinski  
Thomas Ichim and Christine Ichim
- 1997 Bryon Hughson.  
Vanessa O'Connor
- 1998 Mark Nowinski and Jack Nowinski  
Cady Pocrnich
- 2001 Heather Hughson
- 2004 Benjamin Schmidt
- 2010 Zach Elgood
- 2011 Vivienne Tam and Janelle Tam
- 2012 Christina Ding
- 2013 Janelle Tam  
Avinash Pandey
- 2015 Avinash Pandey
- 2017 Adam Martinez
- 2018 Sajeev Kohli
- 2019 Kevin Hu
- 2022 Hardit Singh  
Cindy Cheng
- 2023 Cindy Cheng

## **MILSET International Movement for Leisure Activities in Science and Technology 2009, Tunis, Tunisia**

- Eddie Kim and Bryan Hatton
- Hillary Dawkins

## **Sustainable World Project Olympiad**

### **2010, Houston TX**

- Zach Elgood
- Hillary Dawkins and Susie Pan

## **National Youth Science Forum, Canberra, Australia**

- 2001 Kellen Shenton
- 2006 Sarah McCuaig

## **European Union Contest for Young Scientists**

### **Salamanca, Spain**

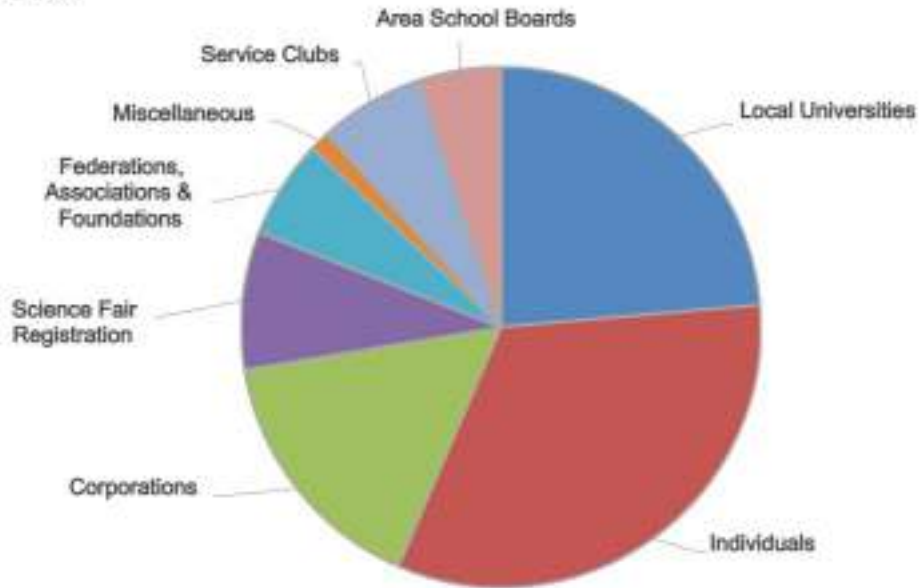
- 2021 Hardit Singh

# You Can See The Future From Here

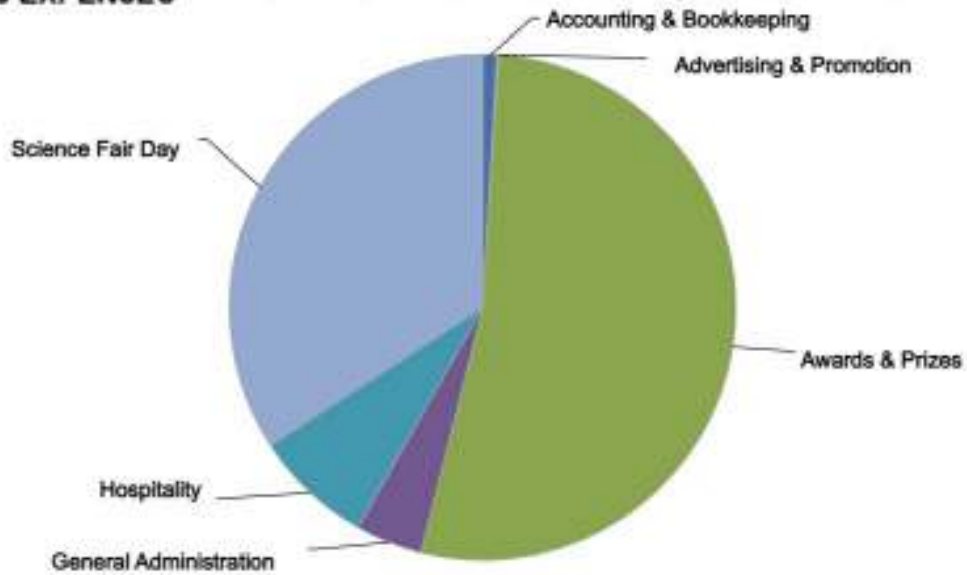
- In 1980 a WWSEF exhibitor made a computer to control a Meccano factory. The computer was comprised of a piece of broomstick, some thumbtacks and a small motor to rotate the broomstick. The next year it 'competed' with his Vic 20 computer. By 1985 he'd created a robotic arm that played 'X's and O's'.
- In 1986 a WWSEF exhibitor grappled with the challenge of networking a number of computers to share computing power.
- Our top award in 1988 went to an exhibitor for her project Death in the Soil. It was about 'acid rain' and the vital role of micro-organisms in making nutrients available to plants. Thirty-five years later, that's still news as we learn how mycorrhizae connect trees to each other and soil nutrients.
- In 1994 a team of WWSEF exhibitors presented their research on the benefits of anti-oxidants in cancer prevention. At the time it was a radical idea. Not anymore. Another WWSEF team developed a 5-button 'talking' word processor.
- In 1996 a WWSEF innovator showed how to use the red-eye effect of flash photography to prescribe glasses.
- In 1999 a WWSEF exhibitor manipulated ants using pheromones. He won Best in Fair at the Canada-Wide Science Fair.
- A 2001 science fair project noted that waste water treatment in the prairies depends in some measure on dilution in the rivers, a risky assumption. Two years later, this exact caution became news when the prairies had a dry summer. The project was titled Walkerton Warning.
- In 2001 a WWSEF exhibitor won Best Junior at the CWSF for his autonomous remote vehicles that could explore a terrain and plan a return route back to base.
- In 2008 a WWSEF young researcher was first in the world to show how a consortium of soil bacteria could digest polyethylene grocery bags. This won Best in Fair at the CWSF.
- In 2021 one WWSEF exhibitor had his smart phone learn how to identify glaucoma (another Best in Fair at the CWSF) while another developed a 'smart' bandage that changed colour when infections were present.
- In 2022 a WWSEF project was awarded a Platinum Award at the CWSF as Best Innovation (Intermediate). Another reported on the potential of phage therapy; in 2023 the world's first patient was treated with phage therapy in Toronto to end 7 years of previously incurable pain.
- In 2023 a team of WWSEF exhibitors introduced a whole new way of teaching braille. Read about their awards on page 3.
- WWSEF exhibitor Cindy Cheng's selection for the International Science and Engineering Fair was the 33rd time a WWSEF young researcher or innovator you support represented Canada at international events.

# 2023 Financials

## 2023 REVENUE



## 2023 EXPENSES



Donation information: [wwsef.ca](http://wwsef.ca) > Donors > Donate