Waterloo-Wellington Science & Engineering Fair 2017 Annual Report

Your delegation to the 2017 Canada-Wide Science Fair in Regina.

When you read about the projects we took to the Canada-Wide Science Fair on the next two pages, consider the diversity of problems they were solving. This group used data to work on genomics, traffic safety, cyber security, environmental protection, machine design, physiotherapy and microbiology.

The top 3 projects at the Canada-Wide Science Fair were: Junior - a low-cost system to measure and communicate vital signs wirelessly from a clip-on finger device, simplifying the process of monitoring patients. His innovation has the potential to aid first responders and hospitals by streamlining patient assessment. (just won 1 of 3 First Prizes at the European Union Contest for Young Scientists (EUCYS) in Tallinn, Estonia); Intermediate - a comparison of healthy brains to the brains of Alzheimer's patients to find better diagnostic procedures using an existing technology (EEG); and Senior - a new use for an existing drug to effectively treat Neuroblastoma, a deadly childhood cancer. The research and findings have the possibility to lead to a more targeted approach to chemotherapy with fewer side effects (1 of 3 Second Prizes at EUCYS).
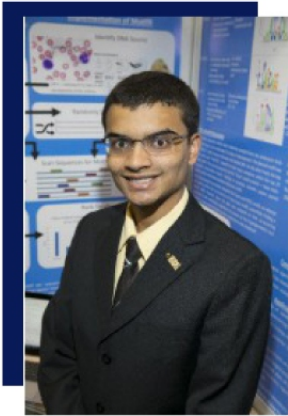
Canadian teens have remarkable ideas that are among the best in the world. Canada has a great system for identifying and developing the country's most promising young scientists, engineers, and innovators.

Visit us on the web at www.wwsef.ca

WWSEF is affiliated with Youth Science Canada

Advait Maybhate, Waterloo. Senior, Innovation

A New Approach to Motif Discovery
Discovering the relationship between genetic sequences and their biological function is crucial to the understanding of life. Samples of genetic sequences can be computationally analyzed to identify significant patterns, termed motifs. Such motifs can be linked to specific functions e.g. PITX1 motif has been linked to limb development. This project proposes a new approach to motif discovery, increasing its speed without compromising accuracy.
**Awards**: Excellence Award Senior Silver Medal, The Statistical Society of Canada Award, Senior ($1000), Entrance scholarships offers from Dalhousie ($2500), UBC, UOttawa and Western ($2000 each).

Sergiu Pocol, Kitchener. Senior, Discovery

Air Gap Thickness and Torque Ripple Induced by Asymmetries
In haptic devices, direct drive actuators perform optimally with low torque ripple, the variance in the output torque of a motor. The effect of the thickness of the air gap on torque ripple was determined in a mechanically commutated DC motor, wherein the rotor`s mass is asymmetrically distributed. A loose positive correlation between the two was noted, while power showed a negative correlation.
Awards: Excellence Award Senior Silver Medal, Entrance scholarships offers from Dalhousie ($2500), UBC, UOttawa and Western ($2000 each).
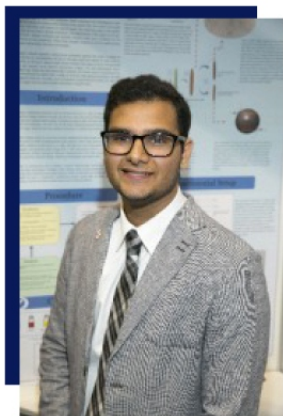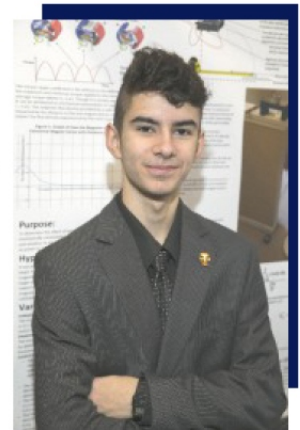
Danish Baig, Waterloo. Senior, Innovation

Bio-friendly Antimicrobial Replacement to 2017 FDA Banned Drugs: Silver NP/CNC
The goal of this project was to develop a stable antimicrobial system offering an advantage over current commercial systems in the form of silver nanoparticles on cellulose nanocrystals. The FDA recently banned 19 drugs found in antibacterial soaps for environmental concerns. My synthesized system offers stability and the same antimicrobial performance, allowing it to be a replacement chemical.
**Awards**: Excellence Award Senior Gold Medal ($250), Entrance scholarships offers from Dalhousie, UManitoba ($5000 each), UBC, UOttawa and Western

Sadia Khan, Kitchener. Intermediate, Health

Firm 'n' Cute
Sucralose changes the composition of intestinal bacteria by unnaturally increasing the population of Firmicutes and elevating the risk of obesity. This in-vitro experiment tested whether antibacterial herbs could prevent the sucralose induced population increase in Lactobacillus rhamnosus GG ATCC 53103, a Firmicute and probiotic bacteria. Contrary to predictions, sucralose decreased population growth instead of increasing it, and the effectiveness of the herbs varied greatly.
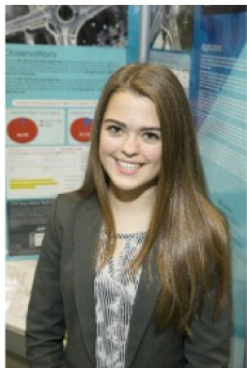
Ruth Meyer, Waterloo, Intermediate, Discovery

Concede to Me! The Effect of Exit Signalling on Yield Rates in Roundabouts

One only needs to drive a short distance within Waterloo Region to notice many inconsistencies with the signalling behaviour of drivers in roundabouts. Through observation, this project examined the effect of exit-signalling on the yield rates of drivers entering roundabouts. Data collected clearly supports that exit-signalling significantly increases the likelihood that entering drivers will yield the right of way.

Awards: Excellence Award Intermediate Bronze Medal, The Actuarial Foundation of Canada Award, Intermediate ($750), Entrance scholarship offer Western ($1000).

Ethan White, Waterloo. Intermediate, Innovation

CPU Load Covert Channels Exploiting Interrupt Latency

A covert channel security vulnerability was discovered that allows a remote adversary to perform easy deanonymization of anonymous Internet users. This attack exploits the fact that latency to reply to network requests decreases when load on the computer being attacked is increased. It is suggested to mitigate this attack by maintaining a running process that will always cause full load on one processor core.

Awards: Excellence Award, Intermediate Bronze Medal, Entrance scholarship offer, Western ($1000).
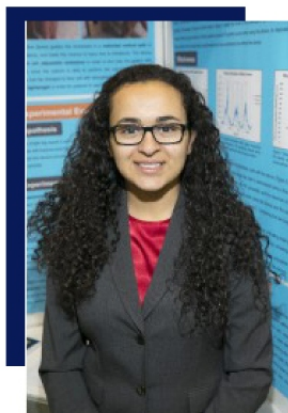
Marina Ilyas, Waterloo. Junior, Innovation

Phixing Physio

In my project, I created an assistive device to improve the form in the single leg squat, (a difficult exercise in physiotherapy). A MyoWare, which is a device that detects muscle stimulation through electromyography, was used to ensure that the intended muscle usage was not compromised when using the device. The impact of explaining the general benefits of the exercise on regularity was also evaluated.

Awards: Excellence Award Junior Bronze Medal, Entrance scholarship offer, Western ($1000).

Zachary Trefler, Waterloo & Atif Mahmud, Kitchener. Senior, Information

NeurAlgae: A Novel Approach to Harmful Algal Bloom Prediction

Harmful algal blooms (HABs)-sudden, rapid growths of algae in water bodies-pose an increasing threat in modern society. The effects on surrounding ecosystems due to oxygen depletion and toxin generation create large ecological and socioeconomic problems. Predicting HABs is useful, but modern methods can be lacking. We propose an Artificial Neural Network to predict HABs which improves upon prior methods in generalization and accuracy.

Awards: Excellence Award Intermediate Silver Medal, Entrance scholarships offers from Dalhousie ($2500), UBC, UOttawa and Western ($2000 each).

2017 Financials

Revenue 2017

- Universities & College
- Individuals
- Corporations
- Science Fair Registration
- Federations, Assoc., Foundations
- Service Clubs
- Area School Boards
- Miscellaneous

Expenses 2017

- Awards & Prizes
- Science Fair Day
- Hospitality
- Finances/General Admin
- Publicity & Public Relations