

STANSW YOUNG SCIENTIST AWARDS

Virtual Presentation Ceremony Awards Booklet

Monday 16th - Thursday 19th November 2020



Connecting school and society through the active promotion of Science, Technology and Mathematics

STANSW Young Scientist Awards:

**A major project of the
Science Teachers Association of New
South Wales**



Program

Monday 16th November - 7pm

Welcome message

Anjali Rao, STANSW Young Scientist Awards Coordinator

Presentation of Awards

STANSW Scientific Investigations - Primary

STANSW Scientific Investigations - Secondary - Biology

Australian Society for Biochemistry and Molecular Biology (ASBMB)

Award

STANSW Scientific Investigations - Secondary - Chemistry

Royal Australian Chemical Institute (RACI) Chemistry

Encouragement Award

National Measurement Institute (NMI) Awards - Science

Tuesday 17th November - 7pm

Welcome message

Ann Hanna, STANSW Young Scientist Awards Committee

Presentation of Awards

STANSW Scientific Investigations - Secondary - Earth &
Environmental Science

Primary Environment Award

STEP Environment Award

STANSW Scientific Investigations - Secondary - Physics

AARNet (Australia's Academic and Research Network)

Communications Awards - Science

Australian Institute of Physics (AIP) Most Outstanding Physics
Award

Rowe Scientific Depth Study Awards

Wednesday 18th November - 7pm

Welcome message

Firth Garth, STANSW Young Scientist Awards Committee

Presentation of Awards

OSHClub (Primary) Inventions and Innovation Awards

Secondary Innovations and Engineering Design Awards

AARNet (Australia's Academic and Research Network)

Communications Awards - Technology

National Measurement Institute (NMI) Awards - Technology

Sebel Testing Awards

STANSW Most Promising Awards

Thursday 19th November - 6pm

Welcome message

Daisy Kong, STANSW Young Scientist Awards Committee

Presentation of Awards

MANSW Working Mathematically Awards
AARNet (Australia's Academic and Research Network)
Communications Awards - Mathematics
National Measurement Institute (NMI) Awards - Mathematics

Thursday 19th November - 7pm

Message from the President

Margaret Shepherd, Science Teachers Association of NSW

Presentation of Awards

Australian Water Award
NSW Student Nominees for the 2021 BHP Foundation Science and
Engineering Awards - Primary and Secondary
NSW Nominee for the 2021 BHP Foundation Science and
Engineering Teacher Award
Budding Young Scientist (K-2)
Primary Young Scientist (3-6)

Keynote Address

Dr. Cathy Foley, Chief Scientist, CSIRO and
Chief Scientist, Australia (January 2021)

Announcement of Grand Awards

Broadcom Honourable Mention
Broadcom Representative to 2021 (virtual) Broadcom Masters
Program
ISEF Finalists
Young Scientist of the Year

Acknowledgement of Country

We at the Young Scientist Awards would like to pay our respects to the Traditional Custodians of this land on which we work, learn and live. We recognise Country includes but transcends land and borders, being both belongingness and a way of being.

Recognising this, we pay our respects to Aboriginal peoples past, present and to those of the future who are our knowledge holders and teachers. As we share information, teaching, and learning, we remember to appreciate and value the knowledge embedded forever within the Aboriginal custodianship of Country.”

Message from the President



This year COVID-19 cannot stop us. Whilst we will miss attending our amazing awards ceremony in person, we still continue to acknowledge and celebrate the very talented young scientists who are the best of 855 entries into the Science Teachers' Association Young Scientist Awards Program for 2020. All students in NSW have access to this competition and we

are very happy to see entries from all school sectors and both girls and boys. We commend all the teachers of these schools for their commitment to their students and passion for scientific research.

The Science Teachers' Association of New South Wales is very proud to have this amazing state program that truly incorporates all STEM subjects and brings together the professional teaching associations. As President of the Association, I would like to acknowledge and thank our Young Scientist committee and its hard working convenor, Anjali Rao. This is the third year Anjali has committed to being convenor of this project for the Association. There are also a large number of sponsors of our YS program that support this STEM initiative and I would like to thank them for their commitment to the future scientists of Australia. There are also hundreds of teacher and non-teacher volunteers that are required for this ongoing initiative to succeed so well and the program could not occur without their support.

Can I request all schools consider sending a teacher along to gain experience judging the student projects? It is a wonderful accredited professional learning opportunity, through which teachers can read for themselves some of the amazing research projects being developed by high calibre students across the state. So next year when the judging notice is sent out, think about coming along. You will be impressed.

So congratulations to all students who reached this level of the YS Awards. That is an achievement itself. Congratulations also to the winners. Well done.

Best wishes from STANSW
Margaret Shepherd President 2020

STANSW Young Scientist Committee

The STANSW Young Scientist Committee is a group of dedicated volunteers who work to develop innovative STEM strategies for supporting NSW teachers.

Anjali Chandrasekar-Rao (Coordinator)

Leonard Cheung

James Cleaver

Firth Garth

Stuart Garth

Ann Hanna

Edwina Hine

Daisy Kong

Matt McKenzie

Philippa Miller

Elizabeth O'Connor

Sian Ware

ISEF Judging Panel

The ISEF Panel is a highly experienced judging panel, who review the top 20+ projects and select the STANSW Young Scientist of the Year and the finalists for the International Science and Engineering Fair.

Dagmar Arthur McCloughan (Judging Chair)

Dr Melissa Thompson (Science Education Expert)

Associate Professor Kerry Hitos (Biomedical Scientist)

Sandra Woodward (Science Educator-Physics)

James Cleaver (IBM)

Stuart Garth (SRC Chair)

Message from the Coordinator

What an incredible year 2020 has been for our country and for the whole world. The challenges of the global pandemic to the way we live, work and learn meant we had to adapt at every stage to a new normal this year.

After months of supporting our ISEF 2020 finalists to refine and finalise their projects, we switched to helping them prepare for a virtual experience online. Our wonderfully talented students continued to make their mark in this format as well (See Stuart Garth's description below). ISEF 2021 has already been announced as a virtual (competitive) fair and we look forward to working with our team over the next six months.

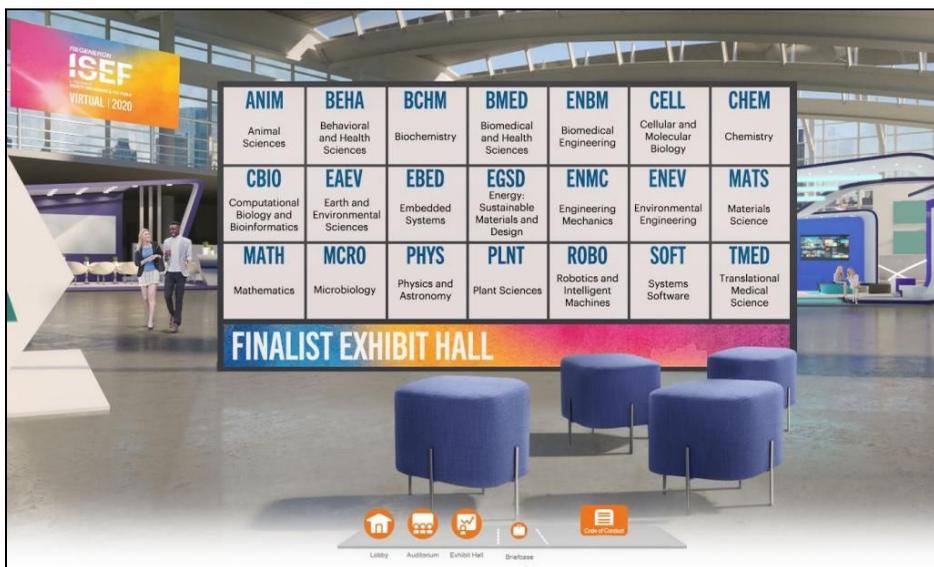


We were also overwhelmed by the number of entries we received this year despite the very real challenges all students would have faced because of the lockdown earlier in the year and COVID-19 restrictions. In a year when the role of science and the advice and counsel of well informed scientists has been so significant in our lives, the commitment that the students have shown in persevering with their investigations, design projects or inventions has been so heartwarming to see. The Young Scientist Committee would like to congratulate and commend each and every one of our participants. It is also a mark of the times that so many projects had an environmental concern at their core.

Our hard working committee has also demonstrated creativity and adaptability in meeting the challenges of an entirely online program. Along with the rest of the education system, we have moved relatively seamlessly to a virtual world which has brought some wonderful benefits with it. We have been so pleased to welcome many more of our rural and regional colleagues to the judging teams now that distance from Sydney is no longer a barrier. My thanks to all of the members of the committee as well as the executive committee of the STA NSW for their support and encouragement. Lastly, I would like to acknowledge the work of Lachlan Bolton - multiple YS award winner and ISEF Finalist 2018, in putting together our online awards presentation.

Anjali Rao
STANSW Young Scientist Awards Coordinator 2020

NSW Young Scientists make Virtual Impression! ISEF 2020



ISEF 2020 ended up being a virtual event. Our 9 Young Scientist ISEF finalists took part in a week-long virtual event which included an Opening Ceremony and a Finalist Exhibit Hall, where all of our projects were on display for a few weeks. All of their official abstracts can be found on the [ISEF Archives](#) webpage by clicking on Australia, "2020 Virtual ISEF" and "All Abstracts Matching Criteria" to see our 9 Young Scientist and 5 BHPFSEA ISEF finalists.

The highlight of the week was a number of panel discussions where panellists answered three to eight video-recorded questions that were chosen from the 1200 finalists. Our Young Scientist team was very well represented with Eleanor Clifton-Bligh, Emma Leggett-Budden having a question selected and Molly Dixon had two separate questions selected for different panels. Eleanor's question which related to the COVID-19 virus highlighting the challenges of globalisation was discussed for 13 minutes by Nobel Prize Laureates on the Excellence in Science & Technology Panel.

Presentation Night 4: Thursday 19th November

Category Awards - Mathematical Investigations

MANSW Working Mathematically K-2



Thaddeus Candra, Redeemer Baptist School, *My Robodoz3r on the Surfaces*

Thaddeus built a robot with Lego Mindstorm EV3 and then completed a number of investigations to find out if the surface it travelled on affected time taken to cover a set distance. He measured distances, recorded times, calculated averages and made graphs in spreadsheets to record his data. The fastest travelling time was on varnished wooden planks, and the slowest was on grass.

Romilly Merani, PLC Sydney, *My Marvellous Mucus Project*

Romilly investigated how water temperature and salt concentration affected nasal irrigation performance. She measured volume, temperature, calculated averages, created tables and hand drew graphs to record data. She concluded that a temperature of 40°C with two packets of nasal irrigation is best for a sinus rinse for nasal mucus however for safety reasons this was not appropriate.

Muyao Zhang, Arden Anglican School, *How different materials affect the motion of a spinning top*

Muyao's favourite toy is a spinning top and he loves to keep it spinning for as long as possible. For his investigation he gathered data on the length of time a top spun on different surfaces. He completed 10 trials for each material and organised the data he gathered in a table. He ranked the materials by looking at the range of times they spun for. He hand drew column graphs to display the results. Marble was the material that kept the top spinning the longest.

MANSW Working Mathematically 3-4

Bryant Diep, Wyvern House Preparatory School Newington College, *Which brand of hand sanitiser is best at reducing bacteria and viruses in my community?*

Bryant tested over 30 types of hand sanitiser to determine if they were effective in killing viruses and bacteria. This meant that after three trials for each product he had gathered a large amount of data. He made tables and graphs to represent the data and calculated standard deviations. Not only did he test bought products but he made his own hand sanitiser and found that it needed to have an alcohol content of 70% and above for it to be 99.9% effective in killing bacteria.

Travis Kennard, Oatley West Public School, *Why Don't Most People Make It To Black Belt?*

Travis takes part in Taekwondo and at a presentation he noticed that there were lots of white belts, less yellow belts, even fewer green belts and barely any blue or brown belts. It looked like a curve which he thought was interesting. He decided to investigate. He got a huge spreadsheet of all past students and added extra formulas. He hand drew 19 graphs including pie charts, belt graphs, and age graphs to look for patterns. Travis shared his findings with his Taekwondo instructor.

Lachlan Murnain, Northern Beaches Christian School, *Watch the Gap*

The aim of Lachlan's investigation was to gather data to determine whether age, height and armspan of a sample group affected accuracy in estimation of a distance of 150cm, to comply with COVID 19 social distancing rules. He gathered data from 100 people and then hand drew graphs to display his results. An interesting discovery was that nearly 40% (39 out of 100) of the sample group could not estimate a safe 1.5m social distance.

MANSW Working Mathematically 5-6

Jasmine Civardi & Zara Portolesi, St Ambrose Concord West, *The FreshDesk*

Jasmine and Zara invented a self sanitising desk that used UV light. They gathered a wide range of data and conducted tests with their final prototype by using special cards designed to measure the UVC radiation and indicate when the surface has been sufficiently sanitised. They used stopwatches to time how long it took for the surface to be sanitised and then created graphs to display their results.

Abby McCutcheon, Castle Cove Public School, *What retains soil moisture most effectively?*

Abby's experiment aimed to determine the best way to retain moisture in the soil. She measured soil moisture using a micro:bit and gathered a range of data over 18 days. The data was collated in a number of tables and then used to create bar, line graphs and scatter graphs to display her results.

Jaylen Nicotra, Arden Anglican School, *Under the doona during COVID-19*

The aim of Jaylen's project was to investigate people's level of physical activity before and during the COVID-19 lockdown by examining their Fitbit data. He created TinkerPlot graphs. He thought using TinkerPlots was great as it helped him to be able to see and easily interpret the results. He felt he became better at understanding data range, looking at Percentage Hats, average values, and looking for outliers.

MANSW Working Mathematically 7-8

Danielle Gibson, Redeemer Baptist School, *Advance Australian Fare*

Scientific Investigations are usually highly dependent on mathematical skills and understandings and Danielle's project is no exception. Her project involved the comparison of sugar levels in six native bush fruits with published values of non-indigenous fruits. One of her three methods was using a refractometer to measure their brix value. As a number these values are meaningless without a mathematical reference point. Danielle produced her own Brix/sugar calibration curve and used a known relative sugar standard of 9.75g/100g for raw pear to calibrate and compare her measurements.

Henry Liu, Barker College, *Figurate Numbers*

Most students are fully aware of square numbers 1, 4, 9, 16 ... and how they can be represented diagrammatically as a square of dots with n columns and n rows and therefore have the formula n^2 . Henry explored other figurate numbers such as triangular, pentagonal and even hexagonal numbers and came up with formulae for each and then went on to prove how numbers such as 2752 and 861 are pentagonal and hexagonal numbers respectively. In his solutions, he used novel guess and check methods for solving quadratic equations.

Olivia Virtue, Hunter School of the Performing Arts, *Do Supermarket Shoppers use Hand Sanitiser?*

Concerned with the public response to social distancing and sanitising in public places, Olivia observed 1323 shoppers, over a six-week period to see how many people sanitised their hands at the clearly-marked dispenser at the entrance of her local supermarket store. A disappointing 31% used the hand sanitiser and women (34%) were far better than men (25%). To Olivia's surprise, it was the older shoppers (47%) who strongly outperformed the younger shoppers (24%) by exhibiting better sanitising behaviour.

MANSW Working Mathematically 9-10

Gregory Burns, Redeemer Baptist School, *As easy as Pi*

When introduced to the irrational number π , students learn that it approximates to 3.14 or $22/7$ and students may even do a practical activity of measuring the circumference of a circular object with string and dividing by the diameter length to approximate the π ratio. Gregory conducted an extensive background research and found countless methods for approximating π and he explored and replicated eight of these alternative methods. He found Archimedes' method using regular polygons and their diameter to be the best method approximating π to 14 decimal places for a 25,165,824-sided polygon. This was the limiting decimal value that his Excel spreadsheet could handle.

Daniel Fihrer, Moriah College, *Monopolies and the Use of Indexes to Measure them*

The purpose of this investigation was to study the benefit of using indexes such as the Kwoka Dominance Index and the Herfindahl-Hirschman Index to measure monopolies. It was discovered that in many circumstances, indexes can be used to judge if monopolies have formed, as they provide a comparable value that provides an indication about the monopolization of an industry. It uncovered that monopolies are not always detrimental as sometimes purported to be, yet can also have harmful effects on the industry.

Kayley Garth, Redeemer Baptist School, *Looking for Clear Air with 2020 Vision*

Kayley accessed government data on Sydney air quality during the 19/20 bushfire and COVID lockdown periods, using ANOVA to compare the concentration of pollutants in the same area at different times. Kayley showed that there was a statistically significant increase of most of the contributors to air pollution in metropolitan Sydney during the bushfire period and that levels varied based on time of day. Kayley also found that there was a large reduction in the concentration levels of most pollutants during the lockdown period.

MANSW Working Mathematically 11-12

Jemmima Schembri, Inaburra School, *Full Versus Partial Vaccination for Meningococcal Meningitis*

Before the outbreak of COVID-19, Jemmima had commenced her mathematical modelling project comparing the effectiveness of full versus partial vaccination for meningococcal meningitis within the Meningitis Belt of Sub-Saharan Africa. A Susceptible, Infected, Recovered (SIR) model was used to determine the effectiveness of six vaccine scenarios and results demonstrate that vaccinating a greater percentage of the population with a partial vaccine is more effective than vaccinating a smaller percentage of the population with a full vaccine.

Emily Shen, Kambala School, *An exploration of the Fourier Transforms and its applications in music*

Interested in the compound transformations of sine and cosine functions, Emily explored how these compound graphs could be used to model the sound waves produced by instruments that she played. Using theoretical Fourier Transform calculations that decompose complex sinusoidal waves based on their dynamics, frequencies and length of time sustained, Emily successfully broke down a cello piece that she was playing by Tchaikovsky into sine and cosine functions.

Emily Shen, Kambala School, *Parrondo's Paradox*

No, this is not a Control C mistake! Emily submitted two prize-winning Maths projects and she also has an award-winning project in Chemistry! For Parrondo's Paradox, Emily used an application of game theory to explain the paradoxical situation put forward by Juan Parrondo in 1996 that two losing games, when played together, can become a winning situation. Using Markov chains and probability spaces, she was able to prove Parrondo's Paradox is true for Mod 4, building on earlier research that it is true for Mod 3.

Sponsored Awards



AARNET Communications Award

*For best use of electronic communications in
Working Mathematically*

Primary: Abby McCutcheon, Castle Cove Public School, *What retains soil moisture most effectively?*

Abby investigated the best way to retain moisture in soil. Her first experiment was a comparison between sugar cane mulch, eco-hydrate and a control. The second experiment was a comparison between 3 mulches; sugar cane mulch, pebbles and pine bark chips. She used a Micro:bit soil testing kit for all readings.

Primary: Ronin Naumovski, Wollongong Public School, *Sound of Silence*

Using a sine-wave sound generator, a decibel meter, audio analysis software, a microphone and speaker, Ronan investigated the effectiveness of different layers of wall soundproofing against low, high and stepped frequencies of sound.

Secondary: Victoria Garth, Redeemer Baptist School, *Applying Logarithms to Determine Ideal Background Colour for Electronic Devices*

Victoria designed a set of gold-standard LogMAR eye charts with 5, 10 & 20% yellow, pink and grey backgrounds to determine the ideal background colour for laptops. Her logarithmic results found that 10% yellow background had a 1.66% improvement in visual acuity over the conventional white background.

Secondary: Stephanie Herbert & Godnah Johnson, Redeemer Baptist School, *Cool it! A study of thermodynamics and its effects on the cooling of liquids*

Stephanie and Godnah explored thermodynamics and in particular Newton's rate of cooling with 4 household liquids and 3 heating devices - a total of 48 experiments, each with a cooling time of 30 minutes. All measuring equipment was calibrated and an ANOVA statistical analysis was performed.

NMI Measurement Award



Australian Government
Department of Industry, Science,
Energy and Resources

National
Measurement
Institute

Awarded to entries in the category of Working Mathematically that demonstrate an excellent understanding of measurement

Gregory Burns, Redeemer Baptist School, *As easy as Pi*

For a measurement award, this project takes the cake or should we say the pie! Gregory researched a number of extravagant methods by which approximations of Pi are determined and tried them out for himself. One method, known as Count Buffon's Experiment, involved randomly dropping matchsticks on a series of parallel lines that are one matchstick distance apart. The probability that a matchstick lands on part of a line, divided by the number of matchsticks dropped is $1/\pi$. He ended up dropping 25,000 matchsticks and ended up with 8015 crossing a line, which yielded an approximation of Pi of 3.11915.

Yvonne Zhao, PLC Sydney, *Sounds about Right*

The purpose of this investigation was to find the positions of maximum sound intensity and volume in Room Q202 at PLC Sydney. All windows and doors were closed and the volume and sound intensity at each grid point was measured at 200Hz, 300Hz, and 400Hz for five seconds. From this investigation, Yvonne found that the sound intensity and volume followed a node, antinode pattern across the classroom, demonstrated by the shading on the heat graphs and the peaks in the surface graphs. Yvonne found the positions of maximum sound intensity seemed to occur underneath the room's sound dampeners.

AUSTRALIAN WATER

Australian Water Association Sustainable Water Prize

ASSOCIATION

Awarded to a Primary and Secondary project that best deals with the issues of water conservation and management

Primary: Hannah Chalmers, PLC, *Stormwater - It Bugs Me!*

Hannah's investigation sought to discover the impact that different types of stormwater drains had on water quality and flow, as well as on invertebrate biodiversity. She found that naturalised stormwater drains had a much lower impact and higher levels of biodiversity than concrete or non-naturalised stormwater drains. As part of her project she contacted her local council and produced a short film about her findings in order to create community awareness of the situation.

Secondary: Angus Edmundson, Newington College, *An investigation into microplastic quantities in Sydney Harbour seawater at different tides*

Microplastics are an ongoing concern in waterways. Angus investigated the differences in microplastic concentrations at different tide heights, to determine whether this was a factor. His analysis of seawater taken from Sydney Harbour at high and low tide showed that all the microplastics found were in the form of filaments, and that there was a distinct increase in concentration in samples collected at low tide, possibly due to reduced clean water coming from the ocean.

**BHP Foundation
Science & Engineering Awards****NSW Nominee: 2021 BHP Foundation
Science and Engineering Teacher Award****Ian Fairhurst, Knox Grammar Preparatory School**

The BHP Foundation Teacher Awards recognise outstanding contributions made by classroom teachers to science education, especially in the area of open ended investigations.



Team Leader of Technology Integration at Knox Grammar Preparatory School, Ian has opened the door to wonderful opportunities for his students in Design and Digital Technologies. Many of his current student cohort have won 2020 Young Scientist awards with Micro:Bits coded devices. He was the STANSW Young Scientist Digital Resources Coordinator 2014-2019 and he's presented at numerous workshops, including the ISTE19 Conference in Philadelphia.

Presentation of Grand Awards

Budding Young Scientist

The Budding Young Scientist is presented to the best overall K-2 project.

Primary Young Scientist

The Primary Young Scientist is presented to the best overall 3-6 project.

Keynote Speaker

Dr. Cathy Foley, AO

Chief Scientist, CSIRO



Dr Cathy Foley has made distinguished contributions to the understanding of superconducting materials and to the development of devices using superconductors to detect magnetic fields and locate valuable deposits of minerals.

She is also renowned for her significant contributions to research science, the advancement of women in physics, and to professional scientific organisations.

Dr. Foley was awarded the Order of Australia in 2020 and will take office as Australia's Chief Scientist in January 2021.

Presentation of Grand Awards



2020 Broadcom MASTERS International Delegate

One student with a quality entry from Years 7-8 will participate in the virtual Broadcom MASTERS International program in May 2021.

Broadcom MASTERS International provides a unique opportunity for select middle school students from around the world to observe the International Science and Engineering Fair (ISEF).

The selected student must be a prize-winner, a good communicator and fit the age requirements.

2020 Broadcom MASTERS International Honorary Mention

One student with a top entry from Years 7-8 will be selected as a reserve for the Broadcom MASTERS International delegate. The selected student, who will receive \$100 in cash, must also be a prize-winner, a good communicator and fit the age requirements.

2021 ISEF Finalist Pathways



The International Science and Engineering Fair (ISEF) is the world's largest school STEM fair with over 1800 students competing from 80 countries. It is organised by the Society for Science and the Public. The STANSW Young Scientist Awards are an ISEF-affiliated State Fair that have a project allocation of 9 projects that can be sent to ISEF, subject to funding.

There are currently two main pathways through which Years 9 to 12 projects are selected for ISEF. Eight projects come from the Science or Technology pathway selected by the ISEF panel. One project comes from the Mathematics pathway selected by the ISEF Panel.



2021 ISEF Prize

A maximum of nine winning projects will be selected from Years 9-12. The winning students will represent Australia at the virtual International Science and Engineering Fair (ISEF) in May 2021.

Confirmed ISEF Sponsors



2020 Young Scientist of the Year Award

\$2000 award to the student who submits the most outstanding project overall