

Annex 1

30th European Union Contest for Young Scientists, Dublin 2018

Core Prizes

Three first prizes (€7 000 per project)

Country: Germany
Contestant: Adrian Fleck (20), Anna Amelie Fleck (16),
Field: Materials
Project title: FleckProtec – Body Protection Made From Starch
Abstract: Whether for inline skating or motorsport, protectors keep our backs, shoulders and joints protected, which is vital especially in the event of a fall. Most protective equipment is made from rigid plastic and limits an athlete's freedom of movement. That is not the case for the protector from Anna and Adrian Fleck. It is made of a flexible silicone shell filled with a fluid containing starch. This fluid turns into a solid when a strong force is applied, providing reliable protection from injury as a result. Not only have the siblings used the unusual non-Newtonian property of the starch liquid but they also have developed their own measuring equipment with which they compared the effectiveness of their "FleckProtec" with the effectiveness of commercially available products.

Country: Canada
Contestant: Nicolas Fedrigo (17),
Field: Medicine
Project title: Improving Spinal Fusions: Redesigning the Pedicle Probe to Prevent Vertebral Breaches
Abstract: Twenty-nine percent of patients who undergo spinal fusion surgery suffer from accidental damage to the spinal cord from pedicle screws, causing various complications, including paralysis. My goal was to make spinal fusions safer by redesigning the tool used to direct placement of the screws – the pedicle probe – to provide real-time feedback on the probe's location. I developed a probe that detects the difference between the higher density compact bone and lower density spongy bone in vertebrae. The probe warns the user when it contacts the wrong type of bone with a vibration and a light, informing the surgeon to redirect the probe to place screws correctly. My sensor-enabled probe has the potential to significantly reduce the incidence of vertebral breaches during spinal fusion surgery.

Country: Canada
Contestant: Brendon Matusch (15),
Field: Engineering
Project title: Development of a Level 2 Autonomous Vehicle Using Convolutional Neural Networks and Reinforcement Learning
Abstract: This project investigated autonomous driving to identify software strategies that are reliable, safe, and efficient. I developed several techniques based on machine learning concepts, extended and combined with my own innovations, to create a level 2 autonomous vehicle. I tested first using a custom Unity software simulation and then in a real-world vehicle that I constructed from a modified go-cart. I focused on the steering system, testing many machine learning techniques to detect road lines, locate the center of the lane and then use this information to plan a path for the vehicle. Some of these techniques enabled the vehicle to learn to drive without any human-collected training data. I also developed systems for adaptive cruise control and road sign recognition.

Three second prizes (€5 000 per project)

Country: France
Contestant: Alexandru Liviu BRATOSIN (17), Petru MOLLA (17), Mihnea Vlad BOJIAN (18),
Field: Biology
Project title: DNADrive
Abstract: Have you ever experienced the hopelessness of being left without storage space on your phone? Or you may have wanted to back up all of the files that your company created, but cloud services were too expensive and of low capacity? Or maybe you're an ex-politician whose secret files leaked? Fret no more! DNADrive aims to create a safer and more extensive digital data storage alternative for all of your archiving needs. By exploiting the immune system of a certain bacterial strain, we've managed to write information in bacterial genome, encoded by our home-cooked conversion algorithm. Besides its uncountable advantages, 1g of DNA would have a capacity equivalent to 450 million 1TB hard disks, all at a maintenance rate of around 10€ a year. This is the beginning of a new era in data storage.

Country: Estonia
Contestant: Karl Hendrik Tamkivi (18),
Field: Biology
Project title: Positioning of bat maternity roosts in relation to surrounding landscape complex in Western Saaremaa
Abstract: Landscape fragmentation and the decreasing number of natural habitats have brought bat populations to their historical minimum. In this research bats' preferences for maternity roost buildings were studied. Within 17 fieldwork nights during midsummer 21 roost sites in Western Saaremaa were mapped and later analyzed with QGIS in different size buffers while comparing the results to randomly selected buildings. Landscape analyses showed that colonies

of northern bat were positively correlated to length of surrounding woodland edge and negatively to amount of human related land-classes. The simplest measures for changing the landscapes while also considering the well-being of northern bat would be observing the ratio of open and wooded land classes and regulating the density of buildings.

Country: Portugal

Contestant: Francisco Miguel Araújo (17),

Field: Mathematics

Project title: Commutativity theorems for groups and semigroups

Abstract: Commutativity theorems for groups are statements with the following structure: If a group G satisfies property P , then G is commutative. For example, if in a group G every element is the inverse of itself, then G is commutative. In 2016, G. Venkataraman, an expert in groups holding a PhD from Oxford, proved the following commutativity theorem: If in a finite group the squares commute and the cubes commute, then the group is commutative. She also offered the conjecture that the result holds for arbitrary groups. Our main result is the following. Let S be a subsemigroup of a samlattice of cancellative semigroups. If the p -powers commute and the q -powers commute, for p and q natural coprime numbers, then S is commutative. This result, in particular, fully answers Venkataraman's question.

Three third prizes (€3 500 per project)

Country: Georgia

Contestant: Marina Gudzhabidze (18), Dea Ilarionova (17), Shorena Gudzhabidze (17),

Field: Physics

Project title: Hand-Held Detector With Retroreflective Mosaic Screens To Visualize Optical Inhomogeneities

Abstract: We have all seen shimmering mirages on a hot road, or the optical distortions caused by the hot air emerging from an aircraft jet engine. These phenomena are an example of the Schlieren effect. In classical Schlieren photography is used concave mirror, which reveals technical and economic difficulties. To solve these problems we created optical system that includes: hand-held detector which reveals local fluctuations in the air and mosaic screens formed with retro reflective elements, such as: cube corner retro reflectors or reflective glass spheres that excludes concave mirrors' difficult setting up process. Thus with our innovation the usage of Schlieren method widened and can be used in: leak detection, study of boundary layer detachment etc.

Country: South Korea

Contestant: Kyuhee Jo (18), Chaeyoung Lee (18),

Field: Computing

Project title: Building a robust classification model for speech-based Parkinson's Disease diagnosis

Abstract: Parkinson's disease (PD) impacts more than 10 million people worldwide. However, the

conventional method of diagnosing PD based on physicians' decision is time-consuming and often inaccurate. Hence, we aim to develop an accurate PD diagnosis model based on subtle voice impairment. With the help of deep learning, we have successfully increased the classification accuracy and efficiency by eliminating complex feature extraction and selection steps necessary in machine learning. Furthermore, we propose to implement Generative Adversarial Network to standardize parameters such as the volume of voice and the quality of the recording which may confound the diagnosis. The revised inputs, when put into a network particularly trained with the standard data, resulted in higher accuracy.

Country: China

Contestant: Sijia Zhang (18),

Field: Social sciences

Project title: Investigation into the Verbal Conflict Problem in Middle School Students' Families

Abstract: The purpose of this project is to analyse the interactions between family members, identify the most likely situations to cause conflict and propose approaches to a more effective resolution. The project was conducted across twenty-five provinces in China, surveying 1,800 people by questionnaire. The results were then analysed using SPSS software and six categories of situations were identified that could lead to conflict. Using FSEM, the most common situation that could cause this was also determined. The project looked into three main types of training experiment of association chain construction based on the constructivist learning theory. The project included 264 experiments lasting 9 months and involved 22 families. It showed that the experiment was both practical and effective.

Honorary Awards

Stockholm International Youth Science Seminar 2018

Selected winners attend the 2018 Nobel Prize ceremonies, meet the Nobel Laureates and take part in a series of other scientific/cultural activities during the week.

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London International Youth Science Forum 2019

Selected winners meet young scientists from around the world and take part in the annual two-week intensive summer science festival during July-August 2019.

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Special donated Prizes

There are 28 special donated prizes:

- JRC (Joint Research Centre): The European Commission's internal science service (3 prizes)
- Intel ISEF 2019 (3 prizes)
- EIROforum: a one-week stay at each of the eight members of EIROforum
 1. CERN - The European Laboratory for Particle Physics
 2. EUROfusion – JET
 3. EMBL - The European Molecular Biology Laboratory
 4. ESO - The European Southern Observatory
 5. ESA - The European Space Agency
 6. ESRF - The European Synchrotron Radiation Facility
 7. ILL - The Institute Laue-Langevin
 8. XFEL - the European X-Ray Free-Electron Laser Facility
- Bioeconomy prizes
 1. The BBI JU Biobased Industries Joint Undertaking prize
 2. The European Food and Drink Industry prize
 3. The CarGill prize
 4. The Kerry prize
 5. The Tate&Lyle prize
- EuCheMS (The European Chemistry Society) prize
- Swiss international talent forum prize
- WOLFRAM: licence to Mathematica and WolframAlphaPro
- PRACE Prize
- Salvetti Foundation prize
- Bulgarian Mathematics Summer School Award
- Host Country awards
 1. Science Foundation Ireland prize
 2. Irish Research Council prize
 3. Institute of Physics prize

JRC - Joint Research Centre

3 prizes: two-day stays at the JRC's Institutes in Ispra, Italy

Country	Contestants	Field	Project title
Bulgaria	Aleksandar Kostadinov Shopov (18) Atanas Konstantinov Stefanov (17)	Physics	Colour relations in young stellar objects
France	Lisa BATTISTINI (18) Thomas BOISSIN (18) Léo-Nils BOISSIER (17)	Engineering	Eyeprint, give relief to your senses
Austria	Stefan Gruber-Hofer (19) Johannes Ortner (19) Michael Eder (19)	Engineering	Development of a sampler for solid recycled materials

Intel ISEF 2019 Prizes

3 prizes: participate at Intel ISEF 2019, Phoenix (AZ), USA

Country	Contestants	Field	Project title
Bulgaria	Ivaylo Malinov Zhelev (19)	Computing	Digital image denoising based on sphere-constrained total variation optimization with an additional noise component
Spain	Ginés Marín Martínez (17)	Social sciences	Collaborative economy suspended, The Legal Challenge of Uber and BlaBlaCar: Job Precarity? Unfair Competition?
Switzerland	Tobia Simon Ochsner (18)	Computing	Creating playlists with artificial intelligence

EIROforum Prizes

CERN - The European Laboratory for Particle Physics

One week stay in Geneva, Switzerland

Country	Contestants	Field	Project title
Denmark	Kasper Fredenslund (18)	Physics	Neural Networks for Detecting Elementary Particles

EUROFusion - JET

One week stay at Culham, United Kingdom

Country	Contestants	Field	Project title
Greece	Paraskevi-Marina Kandreli (16) Nikolaos-Panagiotis Kalampokis (18) Konstantinos Lolos (17)	Engineering	Algorithm Guided Modular Probe (AGMP)

EMBL - The European Molecular Biology Laboratory

One week in Heidelberg, Germany

Country	Contestants	Field	Project title
Slovakia	Janka Motešická (18)	Medicine	Influence of PKC δ regulators on photodynamic therapy efficacy

ESO - The European Southern Observatory

Visit to ESO site in Chile

Country	Contestants	Field	Project title
Switzerland	Sébastien Christophe Garmier (19)	Physics	cuRRay: CUDA ray tracer for light rays in relativistic Kerr-Newman spacetime

ESA - The European Space Agency

Participate at a major European space science conference under the sponsorship of the European Space Agency, including coverage of their travel and accommodation costs.

Country	Contestants	Field	Project title
Germany	Max von Wolff (18)	Physics	A method for particulate raindrop analysis contributing

			to more accurate weather forecasts
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ESRF - The European Synchrotron Radiation Facility

One week stay in Grenoble, France

Country	Contestants	Field	Project title
United Kingdom	Emily Shao Ting Xu (18)	Chemistry	Chiral separation of racemic mixtures using liquid phase separation techniques with homochiral metal organic frameworks

ILL - The Institute Laue-Langevin

One week stay in Grenoble, France

Country	Contestants	Field	Project title
Israel	Ittai Eden (18)	Physics	Paleomagnetic Dating of a Mud Brick Wall in Tel Megiddo

XFEL - the European X-Ray Free-Electron Laser Facility

One week stay in Hamburg, Germany

Country	Contestants	Field	Project title
United Kingdom	Joshua Luke Mitchell (18)	Engineering	The PlyBot - A Low-Cost Flatpack SCARA 3D Printer

Bioeconomy Prizes**BBI JU**

Study trip to Belgium

Country	Contestants	Field	Project title
Lithuania	Gabija Imbrasaitė (18)	Materials	Bioplastic film with <i>Penicillium roqueforti</i> for pear preservation

The European Food and Drink Industry Prize

€2,000

Country	Contestants	Field	Project title
Cyprus	Ioanna Karaiskaki (15) Anna Maria Agathokleous (16) Pavlos Makrides (17)	Environment	Plastics in the marine environment of Cyprus: monitoring and potential bioremediation strategies

The CarGill Prize

Visit to its state of the art R&D centre at Vilvoorde, Belgium

Country	Contestants	Field	Project title
Portugal	João Maria Pinto Leite (18) Mário Jorge Queirós Ribeiro (18) Catarina Isabel Fonseca Brandão (18)	Environment	ENTOFARM.PT

The Kerry Prize

Visit back to Dublin for winning team

Country	Contestants	Field	Project title
Hungary	Blanka Novák (18)	Biology	Innovative approach to the antibacterial and prebiotic <i>Lycium barbarum</i> extract

The Tate&Lyle Prize

Visit to either France or Germany laboratories

Country	Contestants	Field	Project title
Latvia	Kārlis Emīls Vītols (17) Annija Kotova (18)	Biology	The research of the feed base of Riga State German Grammar School's bee colonies

EuCheMS

€2,000

Country	Contestants	Field	Project title
European Schools	Leandra Marie, Viktoria Zinke (17) Katarina Juhart (17) Sofia Quitter (17)	Chemistry	Anti-Bacterial Silvernanoparticle Coating

Swiss international talent forum

Country	Contestants	Field	Project title
Bulgaria	Ivaylo Malinov Zhelev (19)	Computing	Digital image denosing based on sphere-constrained total variation optimization with an additional noise component

Wolfram Research

One year licence to Mathematica and WolframAlphaPro

Country	Contestants	Field	Project title
Finland	Anne-Maria Salmela (18)	Mathematics	Investigating SIR Mathematic Epidemic Modelling and the Basic Reproduction Number
Russia	Andrey Sergeevich Shchebetov (17)	Mathematics	Testing Chebyshev's bias for prime numbers up to 10^{15}
Turkey	Aylin Özkan (15)	Mathematics	Investigating the Relation of Numbers on Ulam Spiral
Ukraine	Maksym Hryhorchuk (17)	Mathematics	Solving tasks of the enumeration theory of orbits of permutation groups by functional superposition in Mathematica
Belarus	Yanina Sandryhaila (17)	Mathematics	Generalized convexity of the functions
Portugal	Francisco Miguel Araújo (17)	Mathematics	Commutativity theorems for groups and semigroups

Special donated Prizes

Salveti Foundation Award

€2,000

Country	Contestants	Field	Project title
Russia	Mariia Andreevna Soloveva (18)	Chemistry	Protection of metal from destructive corrosion

Prace

Visit to supercomputing center

Country	Contestants	Field	Project title
Slovakia	Filip Kučerák (17)	Computing	Trevo: Trees as a result of an algorithm

Bulgarian Mathematics Summer School Award

Visit to Summer School in Bulgaria

Country	Contestants	Field	Project title
Switzerland	Tobia Simon Ochsner (18)	Computing	Creating playlists with artificial intelligence

Host Organizer Prizes

Science Foundation Ireland (SFI) Prize

€2000

Country	Contestants	Field	Project title
China	Qingyang Wang (18)	Physics	The Study of Carbon Dots Synthesis and Fluorescence with Assistance of Microplasma Processing

Irish Research Council prize

Country	Contestants	Field	Project title
South Korea	Dahyeon Choi (17)	Engineering	Development of an interactive and dynamic artificial intelligence storytelling system based on neural conversation models and speech recognition

Institute of Physics prize

Country	Contestants	Field	Project title
USA	Daniel Zion Kang (16)	Materials	Paintable Electronics - Novel Graphene Acrylic Thin Film