

# Annex 1

## 29<sup>th</sup> European Union Contest for Young Scientists, Tallinn 2017

### Core Prizes

---

#### Three first prizes (€7 000 per project)

<b>Country:</b> Czech Republic
<b>Contestant:</b> Karina Movsesjan (18),
<b>Field:</b> Biology
<b>Project title:</b> The role of RAD51 mutations in cancer development
<b>Abstract:</b> RAD51 protein repairs highly toxic DNA damage via homologous recombination and protects replication forks from nucleolytic degradation. Recently, RAD51 mutations were identified in several tumor types. However, the mechanism of how these mutations contribute to tumorigenesis remains elusive. This work reports a biochemical characterization of RAD51 S121Y mutation found in uterine carcinosarcoma. Intriguingly, while RAD51 S121Y is recombination proficient, reconstitution of fork protection using synthetic DNA substrates revealed that RAD51 S121Y is unable to efficiently prevent MRE11 exonuclease-mediated DNA degradation. All together these results elucidate a mechanism by which can RAD51 mutations promote tumorigenesis.

<b>Country:</b> Switzerland
<b>Contestant:</b> Adam Jan Alexander Ohnesorge (20),
<b>Field:</b> Social sciences
<b>Project title:</b> The forgotten prisoners – Civilian prisoners of the Great War in Corsica
<b>Abstract:</b> Did you know that during the Great War thousands of civilians were detained in France? This project examines the fate of civilian detainees and the role of Swiss peace missions in Corsica from 1914 to 1918. Extensive research was done in various European archives and three prisoner memoirs were studied. There are only scant academic publications on this topic and documentation in the archives is poor. The detention camps in Corsica were crowded, living conditions were largely desolate and the mortality rate was high. The results reveal the forgotten prisoners and remind us of the humanitarian aid supplied by the neutral states and the ICRC. They also urge us to reflect on the current situation of prisoners in war zones.

<b>Country:</b> Canada
<b>Contestant:</b> Danish Mahmood (14),
<b>Field:</b> Engineering
<b>Project title:</b> W.I.N.I.T.S. (Wireless Interconnected Non-Invasive Triage System)
<b>Abstract:</b> W.I.N.I.T.S. is a cost-efficient vital sign monitoring system based on a novel wearable biomedical device, W.I.N.I.T. Band. The device can be attached to a patient's finger during mass casualty incidents, providing first responders, paramedics, and hospital staff with real-time updating of vital signs on an online dashboard and a small screen on the device, eliminating the need for patient reassessment. W.I.N.I.T. Band wirelessly and non-invasively measures cuffless blood pressure, heart rate, blood oxygen (SpO2), and body temperature in real-time. The algorithms automatically adjust to each patient, so they do not require calibration. W.I.N.I.T. Band improves on existing commercial monitoring systems by eliminating the need for blood pressure cuffs and electrocardiogram (ECG) attachments.

### Three second prizes (€5 000 per project)

<b>Country:</b> Poland
<b>Contestant:</b> Kamil Humański (18),
<b>Field:</b> Environment
<b>Project title:</b> Taxonomic diversity of the Middle Ordovician – early Silurian echinoderms from Siljansringen, Sweden
<b>Abstract:</b> Palaeontology is mostly associated with dinosaurs. Of course, overlords of early continents can affect our imagination, but only few people realize that occurrence of huge reptiles was very short part of the life timeline. For the most time of its existence, life hadn't even left the ocean. In my project I focused on identifying fossilized echinoderms – most evolutionary advanced invertebrates. Crinoids and blastozoans described in my project, may not look frightfully, but they had become a dominant species in Palaeozoic seas. They even had created their own ecosystems, called crinoid meadows, providing shelter and food for many other species. The magnificent complexity and geometry of their calcite armour helps me with identifying in total 23 species: 16 blastozoans and 7 crinoids.

<b>Country:</b> Ukraine
<b>Contestant:</b> Yana Zhabura (17),
<b>Field:</b> Engineering
<b>Project title:</b> Enhancement of technical capabilities of delta robot
<b>Abstract:</b> Robots are used in different spheres of life; in particular, manipulators allow to move people away from dangerous manufacturing processes and routine work. It is important to develop new kinds of manipulators that can do the work more efficiently. The prototype of a manipulator, developed in this project, is a modification of delta robot. The developed prototype differs from the known constructions as it is the combination of ability to both move and rotate the instrument, relatively wide workspace and high operation speed caused by relatively simple construction of the moving part. Software used to demonstrate prototype capabilities and the

mathematical model of its kinematics have been developed. A robot made with respect to the proposed prototype can be used for many applications.

**Country:** Canada

**Contestant:** Colette Benko (16),

**Field:** Medicine

**Project title:** Novel Pediatric Cancer Therapy: Targeting Epigenetics to Induce Differentiation

**Abstract:** Neuroblastoma (NB) is a deadly childhood cancer arising from immature nerve cells. One of the methods of treating NB is by inducing cell differentiation, the process of specializing to form a specific cell type. Inducing differentiation allows for better treatment outcomes and a lower chance of relapse, but the current drug (CRA) has significant side effects. I investigated how epigenetics – the control of gene expression - could be used to treat NB by "turning on" genes responsible for cell differentiation silenced by the disease. In my testing, the drug DZNep was more effective in inducing NB cell death at a lower concentration than CRA, with the added benefit of increasing cell differentiation. As a result, DZNep has the potential to be an effective treatment for NB in the future.

### Three third prizes (€3 500 per project)

**Country:** Austria

**Contestant:** Florian Cäsar (19), Michael Plainer (19),

**Field:** Mathematics

**Project title:** Sigma – Learning how computers learn

**Abstract:** So-called "Artificial Intelligence" is now to be found in previously unimaginable places thanks to powerful computers becoming more affordable. With the project "Sigma – Learning how computers learn", Florian Cäsar and Michael Plainer from the HTL Wels have set themselves the objective of distributing AI so that it is available to and understandable for everybody. Sigma is an intuitive building block system that automates almost every application for which human intuition is normally needed—available freely, without cost, and for any purpose. From students without previous knowledge through to professionals, with Sigma everybody can realise innovative ideas, work together directly with others and enable computers to learn complex relationships by themselves using only examples.

**Country:** Bulgaria

**Contestant:** Chavdar Tsvetanov Lalov (17),

**Field:** Mathematics

**Project title:** The structure of self-avoiding walks and the connective constant

**Abstract:** A self-avoiding walk (SAW) is a path that does not self-intersect, and the study of its properties leads to important applications in chemistry, biology and computer networks. We consider SAWs on a restricted square lattice with a finite height equal to 3 and infinite length. We obtain close lower and upper bounds for the number of SAWs of length  $n$  and for the connective constant. Additionally, we present a transformation of SAWs on the square lattice to

a special kind of walks on the honeycomb lattice. By using H. Duminil-Copin and S. Smirnov's results for SAWs on the honeycomb lattice we present ways by which close bounds for the connective constant of the non-restricted square lattice could eventually be obtained without the need of thousands of hours of computer calculations.

**Country:** Germany

**Contestant:** Arne Jakob Geipel (16), Matthias Paul Grützner (16), Julian Egbert (16),

**Field:** Physics

**Project title:** Liquid stream hits rough surfaces – showing an extraordinary and stable wave pattern

**Abstract:** A steady stream of water, hitting a rough surface (e.g. a wooden board) perpendicularly, yields a surprising result. A water wall encloses a regular spiral pattern centered on the water stream. The objective of our paper is to both explain the pattern's emergence and describe its shape mathematically. Ultimately, we were able to explain the appearance of the pattern. Starting from simple assumptions about the flow, we derived a mathematical model that describes the shape accurately. The surprising result is that all spiral arms are semi-circles. We could show that this structure is stable for different viscosities, flow rates and protrusion densities of the considered surface. Dependence of the size of the pattern on various parameters will be considered as well.

# Honorary Awards

---

## Stockholm International Youth Science Seminar 2017

Selected winners attend the 2017 Nobel Prize ceremonies, meet the Nobel Laureates and take part in a series of other scientific/cultural activities during the week.

<b>Country:</b> Poland
<b>Contestant:</b> Kamil Humański (18),
<b>Field:</b> Environment
<b>Project title:</b> Taxonomic diversity of the Middle Ordovician – early Silurian echinoderms from Siljansringen, Sweden

<b>Country:</b> Ukraine
<b>Contestant:</b> Yana Zhabura (17),
<b>Field:</b> Engineering
<b>Project title:</b> Enhancement of technical capabilities of delta robot

## London International Youth Science Forum 2018

Selected winners meet young scientists from around the world and take part in the annual two-week intensive summer science festival during July-August 2018.

<b>Country:</b> Czech Republic
<b>Contestant:</b> Karina Movsesjan (18),
<b>Field:</b> Biology
<b>Project title:</b> The role of RAD51 mutations in cancer development

<b>Country:</b> Switzerland
<b>Contestant:</b> Adam Jan Alexander Ohnesorge (20),
<b>Field:</b> Social sciences
<b>Project title:</b> The forgotten prisoners – Civilian prisoners of the Great War in Corsica

<b>Country:</b> Bulgaria
<b>Contestant:</b> Chavdar Tsvetanov Lalov (17),
<b>Field:</b> Mathematics
<b>Project title:</b> The structure of self-avoiding walks and the connective constant



# Special donated Prizes

---

There are 17 special donated prizes:

- JRC (Joint Research Centre): The European Commission's internal science service
- Intel ISEF 2018
- 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
- BBI JU (Biobased industries bioeconomy prize)
  1. The European Food and Drink Industry prize
  2. The Danone prize
  3. The DSM prize
  4. The PepsiCo prize
- EuCheMS (The European Association for Chemical and Molecular Sciences)
- WOLFRAM: licence to Mathematica and WolframAlphaPro

## JRC - Joint Research Centre

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

Country	Contestants	Field	Project title
Slovenia	Domen Kulovec (19) Uroš Prešern (20) Tristan Kovačič (20)	Medicine	Active targeting of cysteine cathepsins with liposomes conjugated with cystatin C
Poland	Aleksander Paweł Kostrzewa (20)	Biology	A comparison of primates' memory and learning skills, with use of an interactive platform in the Warsaw Zoological Garden
France	Solène Noémie Dumas-Grollier (17)	Physics	Les mystères de la Tasse (A mysterious cup)

	Emma Marie-Christine Josette Jacqueline Robin (18)		
--	---	--	--

## Intel ISEF 2018 Prizes

3 prizes: participate at Intel ISEF 2018, Pittsburg (PA), USA

Country	Contestants	Field	Project title
Spain	Juan Sánchez Mateos (16) Claudia Rodríguez Rodríguez (17)	Biology	On the structure and mechanics in vivo of the ostial cells and the aortic valve of the <i>Drosophila melanogaster</i> larva heart by analyzing high resolution microscopic images
Portugal	Gabriel Silva Silva (17) Eduardo Teixeira Rocha Nogueira (18) Francisca Santos Martins (18)	Environment	ShealS - Sea Heals Soil
Hungary	Áron Molnár (18)	Engineering	New high accuracy tilt sensor

## EIROforum Prizes

### CERN - The European Laboratory for Particle Physics

One week stay in Geneva, Switzerland

Country	Contestants	Field	Project title
Austria	Florian Cäsar (19) Michael Plainer (19)	Mathematics	Sigma – Learning how computers learn

### EUROFusion - JET

One week stay at Culham, United Kingdom

Country	Contestants	Field	Project title
---------	-------------	-------	---------------



Germany	Arne Jakob Geipel (16) Matthias Paul Grützner (16) Julian Egbert (16)	Physics	Liquid stream hits rough surfaces – showing an extraordinary and stable wave pattern
---------	---	---------	--

**EMBL - The European Molecular Biology Laboratory**

One week in Heidelberg, Germany

Country	Contestants	Field	Project title
Switzerland	Nina Chiara Kathe (19)	Medicine	Small non-coding RNA induced gene silencing of tetracycline resistance gene in E. coli

**ESO - The European Southern Observatory**

Visit to ESO site in Chile

Country	Contestants	Field	Project title
Turkey	Can Pak (17)	Physics	Measuring the surface vibration frequency with laser diode

**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
Hungary	Dávid Puskás (18)	Materials	3D printed Moonbase

**ESRF - The European Synchrotron Radiation Facility**

One week stay in Grenoble, France

Country	Contestants	Field	Project title
Germany	Johannes Nicolas Waller (18) Philipp Nikolas Kessler (17)	Chemistry	Fehling's solution – Do we need a new interpretation?

**ILL - The Institute Laue-Langevin**

One week stay in Grenoble, France

Country	Contestants	Field	Project title
Slovakia	Miroslav Kurka (19)	Physics	Dynamic magnetization behavior in soft magnetic alloys of different structure

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

One week stay in Hamburg, Germany

Country	Contestants	Field	Project title
Ukraine	Mykola Veremchuk (17)	Physics	The investigation of the distribution of the density in gases using the Schlieren photography

**Bioeconomy Prizes****BBI JU**

Country	Contestants	Field	Project title
Israel	Gal Levy (18)	Environment	Production of biodiesel from organic wastes by the “black-soldier” fly larvae

**The European Food and Drink Industry Prize**

€2,000

Country	Contestants	Field	Project title
Lithuania	Matas Aliuškevičius (18)	Engineering	Honeybee Colony Sounds Reveal Secrets of Life in Hives

**The Danone Prize**

Laptop for each member of the winning team

Country	Contestants	Field	Project title
---------	-------------	-------	---------------

USA	Kendra Zhang (17)	Environment	A paper-based microbial fuel cell for self-powered glucose monitoring in saliva
-----	-------------------	-------------	---

**The DSM Prize**

Visit to DSM Nutritional Products application lab facilities in Kaiseraugst

Country	Contestants	Field	Project title
European Schools	Camilla Hurst (17)	Materials	The role of materials and surfaces in the transmission of bacteria in public places

**The PepsiCo Prize**

Laptop for each member of the winning team

Country	Contestants	Field	Project title
Denmark	Ayumi Rie Mayer (14) Olivia Linnea Rygaard-Hjalsted (14)	Environment	Sound PoliSea

**EuCheMS**

€2,000

Country	Contestants	Field	Project title
China	Songrui ZHAO (18)	Chemistry	A Research on Synthesis, Characterization and CO <sub>2</sub> Absorptive Character of Pyridinium-based Ionic Liquids

**Swiss international talent forum**

Country	Contestants	Field	Project title
Czech Republic	Alexandr Jankov (18)	Mathematics	The Basel problem

## Wolfram Research

One year licence to Mathematica and WolframAlphaPro

Country	Contestants	Field	Project title
Belarus	Andrei Shvedau (17) Nikolay Sheshko (17)	Mathematics	Any Heron Set can be Embedded in $\mathbb{Z}^2$
Czech Republic	Alexandr Jankov (18)	Mathematics	The Basel problem
Latvia	Aleksandrs Jakovlevs (17) Edvards Janis Recickis (17)	Mathematics	Magic Polyiamonds
Russia	Alena Igorevna Teselkina (17)	Mathematics	Centered figurate numbers
Slovenia	Tjaš Božič (20) Miha Torkar (20) Sara Maraž (20)	Mathematics	Origamics: Mathematical exploration of the equilateral triangle through paper folding
Poland	Adam Piotr Klukowski (20)	Mathematics	The floor-polynomials
Denmark	Gustav Møller Grimberg (19)	Mathematics	Use of comparative entropy analyses for dating and quantifying historical divergences between languages
Austria	Florian Căsar (19) Michael Plainer (19)	Mathematics	Sigma – Learning how computers learn
Finland	Barry Philip Owiti (18)	Mathematics	An Application of Queuing Theory On Relief Systems
Bulgaria	Chavdar Tsvetanov Lalov (17)	Mathematics	The structure of self-avoiding walks and the connective constant

# Special donated Prizes

---

## Salveti Foundation Award

€2,000

Country	Contestants	Field	Project title
Germany	Philipp Sinnewe (18)	Engineering	A more energy-efficient aeroplane engine

## Prace

Visit to supercomputing center

Country	Contestants	Field	Project title
Lithuania	Adomas Paulauskas (18)	Computing	Virtual Reality Games for Rehabilitation

# Host Organizer Prizes

---

## The Tallinn City Government Prize

€1,000

Country	Contestants	Field	Project title
Portugal	Luís Miguel Afonso Pinto (17) Beatriz Sampaio Bastião (17) Olavo Filipe Estima Saraiva (16)	Engineering	EasyPark

## Ministry of Education and Research Award

€1,000

Country	Contestants	Field	Project title
Denmark	Gustav Møller Grimberg (19)	Mathematics	Use of comparative entropy analyses for dating and quantifying historical divergences between languages