FONDAZIONE DiaSorin

Mad for Science
the fourth edition

2019/20 EDITION

MAD FOR SCIENCE

The national challenge continues

Given the great success of the national edition of the **Mad for Science** Competition, for the 2019-2020 fourth edition DiaSorin continues to involve all those Scientific High Schools from all over Italy that already have their own bio-laboratory, providing students with the opportunity to explore science firsthand. Schools will have to reflect on the 2030 Agenda and its Sustainable Development Goals to show how science should increasingly be in service of Society.

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The theme of the fourth edition

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Through the Mad for Science Challenge, **Scientific High-School students actively engage in change towards sustainability**. DiaSorin has took up the challenge launched by the UN Global Agenda for Sustainable Development with its 17 SDGs (Sustainable Development Goals) that 193 Member States have pledged to achieve by 2030. The Agenda implementation requires a strong commitment from Countries but also from people and the whole Society, from private enterprises to the public sector, from civil society to universities and research institutions.

Scientific High Schools taking part in the national Challenge will develop a list of **5 educational experiences consistent with the 2030 Agenda goals**, in particular with those concerning hunger (**SDG 2**), health and well-being (**SDG 3**) and the sustainable management of water and sanitation (**SDG 6**).

The project aims to stimulate **reflection on health, with particular reference to two key issues such as nutrition and water**. The importance of proper nutrition and clean water for human health is recognized both in developed and developing countries. According to the **World Health Organization (WHO)**, a large number of diseases and disorders are caused by ambient and household air pollution, lack of access to clean water and sanitation, spread of disease vectors and exposure to chemicals. Therefore, the challenge will be to **apply science education to Food and Nutrition** (SDG 2), to the **management of water and sanitation** (SDG 6), **focusing on human health and well-being** (SDG 3). The Challenge announcement asks students and their teachers to analyze the territory around them, becoming aware of the **health-water-food trio** through experimental and interdisciplinary research activities to be conducted at school and in collaboration with local scientific institutions to highlight the importance of healthy nutrition and access to clean water in relation to people's health and quality of life.

Challenge Timeline*

- **Launch of the project**
  16 September 2019
- **Application presenting details of the project**
  by 18 November 2019
- **First phase: selection of the 50 finalists**
  by 28 November 2019
- **Project submission deadline**
  by 30 June 2020
- **Second phase: selection of the 8 finalists**
  by 31 July 2020
- **Mad for science Challenge**
  14 October 2020

* Due to Covid-19 health emergency, some closing dates has been postponed

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Prizes

1° Prize

The winning High school of the Mad for Science Challenge 2019 is awarded a prize of **50,000 thousand euros** to be used for **implementing** its own existing **biolaboratory** and **5,000 thousand euros per year** for the following 5 years (for a total of 25,000 thousand euros over the five-year period) for the **supply of consumables required for the new laboratory experiences** proposed.

2° Prize

The High School which ranked second at the Mad for Science Challenge 2019 is awarded a prize of **25,000 thousand euros** to be used for **implementing** its own existing **biolaboratory** and **2,500 thousand euros per year** for the following 5 years (for a total of 12,500 over the five-year period) for the **supply of consumables required for the new laboratory experiences** proposed.

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Prizes

Environment Prize

The High School that will best integrate the eco-sustainability and environmental protection concept within one or more laboratory experiences will be awarded the **Environment Prize**, amounting to **12,500 thousand euros** for the **purchase of small laboratory equipment and items** chosen by the winning High School.

Finalist Prize

Furthermore, the 8 finalist High Schools that do not win the 1st or 2nd prize, or the Special Environment Prize described above, will each be awarded a **Finalist Prize** amounting to **10,000 thousand euros** for the **purchase of small laboratory equipment and items**, demonstrating DiaSorin's concrete commitment to promoting hands-on science learning during a particularly challenging time for Italian schools due to the Covid-19 pandemic.

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In-depth analysis of SDGs

SDG2 – End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Climate change is having increasingly severe consequences on our Planet: soil consumption and desertification, biodiversity loss, increasingly invasive agricultural techniques causing soil degradation. SDG 2 focuses on hunger and malnutrition affecting today 795 million people worldwide (one in nine people) causing 45% of deaths in children under five, mainly in Asia and Africa. Another relevant aspect is the development of sustainable agriculture practices for communities and for the environment to meet the increased food demand of the world population, without threatening crop biodiversity, farm animals and wild species. If properly managed, agriculture, forestry and fisheries can provide nutritious food for all and generate adequate incomes, while supporting people-centered rural development and protecting biodiversity and the environment.

Excerpted and modified from: https://unric.org/it/obiettivo-2-porre-fine-alla-fame-raggiungere-la-sicurezza-alimentare-migliorare-la-nutrizione-e-promuovere-unagricoltura-sostenibile/

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SDG 3 - Ensure healthy lives and promote well-being for all at all ages

The right to health is a top priority for every human being, without distinction of age, nationality, gender and social class. Huge strides have been made in reducing child mortality, fighting deadly diseases, such as malaria and tuberculosis, and protecting people's health. Despite this progress, more than six million children still die before their fifth birthday every year. In developing countries maternal mortality ratio is 14 times higher than in developed regions and medical care is provided only in some regions of the Planet. Goal 3 focuses on people and their most fundamental right: equal access to healthcare to ensure healthy lives and well-being for all at all ages. Much can be done to improve the current situation: from reducing maternal and neonatal mortality to ensuring universal access to health care, from combating smoking to preventing drug use, from strengthening international cooperation to supporting research to find new treatments and medicines.

Excerpted and modified from: https://unric.org/it/obiettivo-3-assicurare-la-salute-e-il-benessere-per-tutti-e-per-tutte-le-eta/

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SDG6 - Ensure the availability and sustainable management of water and sanitation for all

Ensuring access to drinking water and basic sanitation is a human right and an important factor for social and economic development. Although water is a natural resource essential for human life and the environment, today still 663 million people do not have access to drinking water and about 1.8 billion people use contaminated sources of drinking water. More than 80% of wastewater produced by anthropic activities goes into waterways without adequate treatment. The management of water is crucial to promote its fair and sustainable use for people and the Planet. Therefore, it is important to act now in order to increase water-use efficiency and improve its quality. This SDG considers the water cycle as a whole, from the safeguard of water-related ecosystems to the protection of drinking water resources, from the responsible use of water from industries and communities to the treatment and use of wastewater.

Excerpted and modified from: https://unric.org/it/obiettivo-6-garantire-a-tutti-la-disponibilita-e-la-gestione-sostenibile-dellacqua-e-delle-strutture-igienico-sanitarie/

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The 8 Finalist
High Schools

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High School 1

High School name: Filippo Buonarroti High School - Pisa (PI)

Team members:

TEACHER Barbara Cei

STUDENTS Marta Orlati, Alessandro Lagonegro, Francesco Luperini, Elisa Pagano, Tommaso Terreni

Years: second, third, fourth, fifth

Theme: The use of the spirulina algae to improve the injera nutritional properties, a common staple food consumed in the Horn of Africa

Abstract: The project examines ways to improve the nutritional properties of a food widely used in the countries of the Horn of Africa: the *injera*. The nutritional characteristics of this unleavened bread, which is produced with teff flour and is rich in carbohydrates but low in proteins, can be improved with the addition of Spirulina, an alga particularly rich in proteins, essential amino acids, polyunsaturated fatty acids and B vitamins. Spirulina finds microclimatic conditions that are suitable for its cultivation in warm climates. The project has been carried out in collaboration with the Department of Agricultural, Food and Agro-Environmental Sciences of the University of Pisa and the Cosvig / ENEL consortium of Chiusdino. The contact with the local Ethiopian community also allowed a deeper understanding of the Horn of Africa populations' eating habits and use of agricultural resources. The laboratory experiences aim to investigate the characteristics and methods for alga cultivation and assess organoleptic and nutritional properties of spirulina, teff and *injera*, by determining the total nitrogen content, protein content and pigments.

High school 2

High School name: Filippo Lussana High School – Bergamo (BG)

Team members:

TEACHER Rosaria Delfino

STUDENTS Marcella Decapitani, Michele Gambirasio, Flavio Torri, Federica Ravassi, Elisa Bonazzi

Years: from first to fifth

Theme: Study of human impact on ecosystems and biodiversity, with particular reference to kiwi fruit cultivation

Abstract: Soil, water, air and light ... this is how we have expressed the sustainability goals required by the 2030 Agenda. We studied the needs of plants that are also the needs of the Earth. We started from the cultivation of *Actinidia arguta*, from the "bare ground", and thanks to the valuable collaboration with the botanical garden of our city we designed a series of experiments aimed at strengthening disciplinary knowledge, enhancing student's problem-solving skills and guiding them towards useful reflections on environmental issues. By combining theoretical study with both "on-field" and laboratory practice, we designed vertically, over the five school years, a series of experimental activities supported by theoretical insights, with the aim of progressively sharing a common vision of the scientific disciplines. We actively involved students in co-design, formulating hypotheses and possible experimental paths aimed at developing skills and raising awareness about human actions on ecosystems and making people reflect on the consequences of such actions.

High school 3

High School name: Italo Calvino High School – Genoa (GE)

Team members:

TEACHER Paola Ferrari

STUDENTS Giorgia Bozzolo, Gabriele Cerrito, Francesca Pesci, Mattia Ponzo, Gabriele Temporelli

Year: third

Theme: Study of water pollution caused by drugs: what are the effects on freshwater and marine ecosystems?

Abstract: The sea is a life partner to us. How often do we ask him: how are you? The sea replied to our team: “I’m not feeling too good”. Alas, this is partly due to drugs. We all use medicines to treat a disease but what happens after we take them? Once they have been absorbed by our body, they reach the target site, produce their pharmacological effect and then are converted into inactive substances. Several drugs are expelled without being made completely inactive, as we discovered thanks to the collaboration with Dr. Garaventa, researcher of the CNR-IAS in Genoa. The medicines’ active substances remain unaltered when they reach urban sewage plants since they do not destroy the pharmaceutical active substances that reach rivers, lakes and seas. Our project aims to define drug toxicity through the use of ecotoxicological assays that assess acute and sublethal effects on various marine and freshwater organisms belonging to different trophic levels. It also focuses on monitoring any transfer of toxic effects along the food chain, setting up small aquariums where microcosms representing simple marine and freshwater trophic chains can be recreated.

High school 4

High school name: Giovanni Battista Ferrari High School – Este (PD)

Team members:

TEACHER Manuela Granella

STUDENTS Giulio Zanardi, Mattia Tessari, Filippo Pressendo, Ludovica Borile, Alessia Simonato

Year: fourth

Theme: The project studies food safety of water and sugary drinks stored in water-bottles, from a chemical and biological point of view

Abstract: The project stems from the observation that, more and more frequently, even in our school, the use of reusable bottles of aluminum, glass, etc. is encouraged to limit and curb the use of single-use plastic bottles. The project focuses on SDG3 and its ultimate goal is to assess beverage food safety in water-bottles. Our objective is to verify safety of beverages kept in these containers from a microbiological and chemical point of view and to monitor the effectiveness of different cleaning systems (such as hand dishwashing detergents and dishwashers) by analyzing any residual bacterial load or the presence of surface-active agents on the container's walls and bottom. Any species found will be identified through molecular biology techniques. The project entails a collaboration with the SESA Company, which has been dealing with separate waste collection and waste recovery for many years. For the part regarding molecular biology, we worked with the Golinelli Foundation and the Microbion Company in the person of Mr. Fracchetti.

High school 5

High school name: Leonardo da Vinci High school – Trento (TN)

Team members:

TEACHER Claudio Gambaretto

STUDENTS Martina Santarelli, Elena Betti, Leonardo Largher, Andrea Farinaro, Giacomino Farina

Year: fourth

Theme: Molecular study of the relationships between soil microorganisms and blueberry plant in organic, intensive and spontaneous growth conditions

Abstract: The project addresses SDG2 and focuses on soil, a non-renewable natural resource which plays a vital role since its "health" affects crop yield and quality. We focused on soil microorganisms and their relationship with blueberry plant, a typical Trentino product that can either grow wild in the woods or also be largely cultivated throughout the region. Through genetic tests, we want to characterize and analyze the composition of bacterial communities associated with the rhizosphere of blueberry plants and understand how the soil microbiota can change under different conditions (intensive or organic farming or spontaneous growth). The proposed experiences range from blueberry harvest for the determination of antioxidant content to soil sampling associated with the plant rhizosphere that will be used for the DNA extraction and for the determination of microbiota through species-specific PCR. Analyzes will be carried out to identify factors affecting growth of blueberry plants, their productivity and antioxidant content of fruits. Our team worked with WonderGene, a start-up from Trento.

High school 6

High school name: Failla Tedaldi High school - Castelbuono (PA)

Team members:

TEACHER Annunziata Cangelosi

STUDENTS Gloria Corradino, Vincenzo Giaimo, Giulia Gulino, Federica Pedrazzini, Martina Polizzotto

Year: fourth

Theme: Development of models of wastewater treatment plants for sustainable water management in rural and urban environment and in public and private buildings

Abstract: Our project focuses on sustainable change based on technological and scientific development applied to water in an area which is characterized by chronic water shortage and poor water management. The proposed experiences concern circular economy practices applied to the water sector to provide services to individuals and to an ECOCITY community:

- farm: phyto-purification and action of microbial consortia inhabitating filtration media;
- private wells: biocide effect of UV radiation;
- urban park: redox reactions on nanometric particles of titanium dioxide;
- sports center: ozonation;
- municipal swimming pool: Internet of Things, an innovative form of process management applied to the equally innovative optofluidic sensors integrating optics and microfluidics.

At first sight, the experiences may seem very ambitious, but they are actually extremely feasible both from an economic and educational point of view: the basic concepts of Natural Sciences, Mathematics and Physics can be acquired through different levels of in-depth investigation. We have worked with the ENEA Agency in Bologna, the University of Palermo, the CNR Institute in Naples and the ITALTEL company in Carini to develop our project.

High school 7

High school name: Laurana-Baldi High school – Urbino (PU)

Team members:

TEACHER Federica Mercantini

STUDENTS Febe Pappafico, Matteo Pettinari, Lorenzo Piccinini, Gianmarco Rombaldoni, Veronica Sacchi

Years: third and fourth

Theme: Production cycle of milk, analyzing its quality and the environmental impact of dairy processing

Abstract: The aim of our project is to introduce students to the role of chemical and biological laboratories in food production, with a special focus on food quality and the environmental impact of food industry. We propose different lab activities by analyzing a local dairy: from raw material selection (analysis of milk quality/ salubrity – chemical, physical and microbiological parameters) to the management of dairy waste (disposal/exploitation of whey according to its organic load). The analysis includes the dairy's need to make its own product appealing to consumers by focusing on research activities to enhance the beneficial and technological properties of the product (use of probiotics as food supplements and how probiotics can be used to increase milk shelf life). Our project entails collaboration with various Companies and Institutions: the Val d'Apsa Dairy, the Nuova Energia biogas plant, the University of Urbino and the Regional Environmental Protection Agency- ARPAM.

High school 8

High school name: Enrico Fermi High school – Aversa (CE)

Team members:

TEACHER Daniela Glinni

STUDENTS Alessio Marra, Francesco Letizia, Rosa Molitierno, Ines D'Ambrosio, Sara Della Volpe

Years: second and fourth

Theme: The project focuses on local agrobiodiversity, studying the biological properties of the annurca apple and melissa strawberries and their health benefits

Abstract: Consistently with Goals 2 and 3 of the 2030 Agenda, our project aims to make people understand the need to make sustainable food choices in order to safeguard our health and the environment. We have designed laboratory activities that are deeply linked to Aversa territory, with the aim of promoting the local cultivation of PGI "Annurca" apple from Campania and "Melissa" strawberry. The project, which is called "from the countryside to laboratory: from proper nutrition to health", encompasses the different stages of the project: knowledge of local agrobiodiversity, characterization of annurca apple's and strawberries' edible extracts and analysis of their biological properties in relation to health. The qualitative parameters, such as soluble solids content (° Brix) and titratable acidity, will be determined at harvest and qualitative and quantitative analyses of phytochemicals (total phenols, anthocyanins and flavonoids) will be carried out on fruit extracts. Furthermore, antioxidant and chemopreventive activities will be analyzed in relation to different tumor cell lines. The project entails a collaboration with the Department of Environmental, Biological, and Pharmaceutical Sciences and Technologies of the Vanvitelli University in Naples.

Winners

First Prize

Filippo Buonarroti High School
Pisa (PI)

Second Prize

Leonardo da Vinci High School
Trento (TN)

Special Environment Prize

Failla-Tedaldi High School
Castelbuono (PA)

Finalist Prize

Filippo Lussana High School
Bergamo (BG)

Italo Calvino High School
Genova (GE)

Battista Ferrari High School
Este (PD)

Laurana-Baldi High School
Urbino (PU)

Enrico Fermi High School
Aversa (CE)

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