

# ESSS

EUROPEAN  
SCHOOLS  
SCIENCE  
SYMPOSIUM

22<sup>ND</sup> EDITION

8<sup>TH</sup> - 11<sup>TH</sup> OF MARCH 2026



EEB2 - BRUXELLES WOLUWE



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## INTRODUCTION

Welcome to Brussels, a city of science!

Brussels is a city of many dimensions. At once a centre of architecture and art evidenced by its *Art Nouveau* heritage, the political and economic core of Europe, and a city seeping with history and ever soaring with diversity, Brussels is also a symbol of scientific genius and salience. Indeed, Brussels and Belgium in general have been the home of numerous bright minds in the field of science.

François Englert, a Holocaust survivor, is a Belgian physicist who has contributed to the fields of statistical physics, quantum field theory, cosmology and string theory. In 2013 he won the Nobel Prize for Physics alongside Peter Higgs for their discovery of the Higgs mechanism.

What is more, perhaps the single greatest scientist who called this country home was George Lemaître, a Catholic priest who was also a fervent scientist. His body of work is summarised in his groundbreaking theory of the “Big Bang” (which was a term originally used by one of his critics, Hoyle), which described the Universe as having come into existence 13.8 billion years ago. It also stated that its initial size was infinitesimal – meaning that the massive universe was once smaller than a proton – an outstanding discovery that has made way to the development of other theories, such as that of dark matter.

The European School Science Symposium 2026 will thus be held in this vibrant city, where participants and their teachers will be able to discover the many (sometimes undervalued) wonders Brussels has to offer. Most importantly, though, we hope that the students will be able to get inspired by the whole experience of the ESSS and the marvelous scientific community which the European School of Brussels II will be hosting.



## WELCOME TO ESSS 2026

Kamila MALIK, EEB2 Director



Science starts with a simple question: What if?

As someone with a humanities background, I am often expected to feel more comfortable with books than with lab equipment. That may be partly true, but curiosity has never respected school subjects or labels. And curiosity, after all, is where science begins. I have always been fascinated by the way science helps us understand the world: how things work, why they behave the way they do, and what might happen next. You do not need to be a genius, a prodigy or a modern Leonardo da Vinci (I certainly am not! 😊) to enjoy science. You only need the courage to ask questions and the patience to look for answers.

At the European School, science has a special place. Our strength lies in diversity — of languages, cultures, and ways of thinking. When students from different backgrounds explore scientific questions together, they learn not only about formulas or experiments, but also about cooperation, open-mindedness, and shared responsibility for the future. This Science Symposium is about exactly that. It is a place for ideas, experiments, bold thinking, and fresh perspectives. It shows that science is not just something we study for exams, but something that shapes our everyday lives and our future.

What makes me especially proud is seeing students take ownership of their ideas — testing them, explaining them, and sometimes even changing their minds along the way. Science allows us to learn from mistakes, to think critically, and to stay open to new possibilities. These are skills that matter everywhere, not only in science.

I am incredibly proud that this year's Science Symposium is hosted by the European School of Brussels II. It is led by passionate teachers who inspire energetic and curious students, and you can feel that lively, adventurous spirit at every corner of our school. This energy is contagious, and I hope it sparks even more excitement as you explore the amazing world of science during this event.

Enjoy exploring, questioning and discovering — and remember that every great scientific idea once started with a simple “what if?”



## NOTE FROM THE INSPECTOR OF THE EUROPEAN SCHOOLS

Christina MUNNICH, Inspector of the European Schools



Dear pupils, dear teachers, dear organisers and staff,

Welcome to the European Schools Science Symposium 2026. This marks my first ESSS as European School Inspector of Biology, and I am excited and thrilled to be part of such a special event. This science symposium is so important; it is a moment that brings together pupils and schools from all across Europe, all with at least one thing in common: a love of science. As this year's project entries demonstrate, science has so many facets. It covers a wide range of areas of life and spans from the molecular level all the way to our solar system and beyond.

Events such as the ESSS are a wonderful reminder of the enthusiasm, curiosity and creativity that science inspires. They highlight the importance of providing young people with opportunities to ask questions, explore ideas and engage with the world around them through scientific thinking. It is inspiring to see so many pupils willing to challenge themselves, think critically and pursue their interests in science, supported by dedicated teachers and school communities that value inquiry, collaboration and discovery.

The ESSS allows young minds to explore questions and be creative, to come up with projects that test ideas, analyse data, experiment with outcomes or explore new effects. I am truly blown away by the projects at this year's symposium. The topics are so diverse and all very impressive. I hope you all feel victorious this week—of your ideas, and of the time and effort you invested to bring them to fruition. Dear pupils, your projects do not only represent science projects; they are the result of hard work, perseverance, teamwork and curiosity. Take a moment over the next few days to take it all in. Enjoy the moment, reflect on the journey that brought you here, and thank the people who helped you along the way. Be proud of your projects, your work, your achievements, and most importantly, be proud of yourselves.

The ESSS brings together many great minds and innovative ideas. It represents an opportunity to share, appreciate and admire the hard effort that pupils, teachers and science enthusiasts have invested in a wide range of projects. Enjoy these next few days. Bring the same curiosity that started your journey to this science symposium and use it to discover the journeys of your fellow future scientists. Use this event to meet new people, reconnect with familiar faces, ask questions, learn and grow. I personally am looking

forward to meeting many of you over the next few days, listening to the stories behind your projects, and learning what it is that excites you about science, as well as sharing my own motivation and enthusiasm for science.

This year, the ESSS is organised and hosted by the European School of Brussels II. We also have the honour of being hosted by EUROCONTROL as the venue for this year's project presentations. To all those involved in bringing this event to life, a big thank you. Your work, time and dedication in making this event a success are seen and greatly appreciated.

As we look ahead to the days of presentations, discussions and exchanges, I encourage everyone to embrace this symposium as a celebration of science and learning. May it spark new ideas, strengthen collaborations and leave lasting memories for all involved. I wish you an inspiring, enriching and enjoyable European Schools Science Symposium 2026.



## ACKNOWLEDGEMENTS

From Kristiina Siimes – Deputy Director of EEB2



Dear Students, Teachers, Colleagues, and Scientists from across Europe and around the world,

On behalf of the European School of Brussels II, it is my great pleasure to welcome you all to the Science Symposium 2026 and to invite you to dive into the fascinating world of science.

This event is, above all, a celebration of you – the students of the European schools – your curiosity, your creativity, and your courage to ask questions about how our world works. From the very beginning, we have been excited to see the passion and dedication that you have invested in your scientific projects. The variety, originality, and depth of the ideas presented impress us greatly. Your work inspires us, and we are admirative of your talent and potential.

The Science Symposium represents a wonderful opportunity for the multilingual and multicultural community of the European Schools to come together, to live and celebrate our shared values, and to enjoy the synergy created through collaboration and discovery.

The preparation of the Science Symposium has been a joint effort involving both traditional and accredited European Schools. I would like to express my sincere gratitude to all colleagues, students, parents, stakeholders, the Parents Association of EEB2, volunteering parents and all supporters whose dedication and commitment have made this event possible. A special thank you to EUROCONTROL who is hosting the ESSS 2026. We are extremely grateful for them for letting us enter the world of European aviation during these days.

The world is full of mysteries waiting to be explored, from the tiniest molecules to the vastness of space. Every great discovery began with someone who dared to think differently. Perhaps the next breakthrough idea is already here, presented in this symposium.

I hope these days will spark new ideas, new friendships, and new ambitions. Be proud of your work, be curious, and above all – enjoy the journey of discovery.

Wishing you an inspiring and exciting Science Symposium!

Kristiina Siimes

Deputy Director secondary cycle

## GUESTS OF HONOUR

### Olivier NOUWEN

Postdoctoral researcher/Ecosystem research facility manager

Olivier Nouwen is an alumnus of the European School of Helsinki, where they graduated in 2015. Their interest in nature and ecosystems led them to continue their studies at UHasselt. During their studies, their interests developed towards soil science and microbiology.

During their PhD, Olivier studied how mycorrhizal fungi, fungi that live together with plant roots, affect soil processes such as decomposition and nutrient cycling. As part of this research, they set up a “Mycotron” common garden experiment, the first of its kind, to measure how different types of mycorrhizal fungi influence ecosystem processes.

Olivier is currently a postdoctoral researcher and facility manager of the UHasselt “Ecotron”, “Mycotron”, and “Rapid Assessment Units”. The UHasselt Ecotron is a highly advanced climate change research facility and one of only two in the world. It allows scientists to recreate future climate conditions and study how ecosystems respond to changes in temperature, rainfall, and the atmospheric composition. Their current work focuses on understanding how ecosystems may respond in the future.



### Mr. KAPU

Text & picture to be received

## Kevin GRANT

EUROCONTROL's Liaison Officer for the European Schools

After receiving a Bachelor's degree in Electrical & Electronic Engineering, Kevin Grant opted for a career in air traffic control. After 14 years working as an Air Traffic Controller in several air traffic control units, he took up an administrative role using his operational background on various pan-European projects to improve air navigation services performance. In 2022, he was nominated as the EUROCONTROL Liaison Officer for the European Schools with a remit to maintain and nurture a close relationship between the Agency and the European Schools system. As the father of two teenage girls, he is very motivated to encourage students to consider careers/studies in STEM and potentially future roles in aviation.



## Céline SHAKOURI-DIAS

Director People, EUROCONTROL

Céline Shakouri-Dias joined EUROCONTROL as Director People on 8 April 2024, responsible for all human resources management (HRM) matters.

Before joining EUROCONTROL, Ms Shakouri-Dias occupied a number of senior HR roles at NATO, The North Atlantic Treaty Organization, including most recently leading their Talent Management and HR Integration function.

Celine is an extremely experienced HR leader with over 20 years of experience in the international public and private sectors. Her core expertise spans the full spectrum of HRM – from strategy to policy development, talent acquisition, people development, workforce planning and HR business partnering



## JUDGING PANEL

Luc VAN CLEEMPUT

*Chairman of the Jury*



Out of concern for the environment, I studied biology in Leuven. There I obtained a master's in biology at the department of botany. I'm a lab technician of biology and I have already worked for 38 years in Brussels II. This year I have the pleasure of working for 20 biology teachers. And during my long career I have worked together with so many teachers that I have lost count. Also, I'm the manager of a nature reserve at our school. My hobbies are gardening, forestry, camping, and music festivals.

Daniel NUIJTEN



Daniel Nuijten works at the European Commission's DG Environment and has worked for more than 15 years on environmental protection. To have good environmental policies, science is important to ensure that the EU's policies are driven by proper research and facts to solve our environmental challenges.

## Valérie BEUDIN



Ma jeunesse s'est déroulée dans une région française célèbre pour ses châteaux qui bordent la Loire. Mon profil scientifique m'a conduit à suivre des études supérieures à Tours puis à Rennes. Tournée vers la transmission des savoirs, j'ai été amenée à voyager et à rencontrer des publics très variés, de petits élèves de primaire à des adultes.

Enseignante en sciences physiques dans un lycée gabonais en Afrique équatoriale a été mon premier poste et le début d'un goût pour l'évasion. Mon aventure s'est poursuivie à Montréal au Canada puis à San Francisco aux USA pour se terminer ici à Brussel. L'enseignement est une source de joie qui ne se tarit jamais...

## Bruna TEODORO



I was born in Brazil and have always been very curious about nature and how the world works. Because of this curiosity, I chose to study biology at the University of Brasília. During my studies, I quickly became involved in scientific research, mainly in molecular biology. I also participated in community projects, such as local vegetable gardens and teaching activities.

My passion for research led me to pursue a master's degree in virology. Wanting to gain international experience and deepen my knowledge, I moved to Belgium, where I completed a PhD in Plant Biology at UCLouvain. Today, I feel I have found a good balance between my professional and personal life while working at the science lab of EEB2. In my free time, I enjoy astronomy, running, and creative activities.

## Pauline DACQUIN



Biologiste de formation, j'ai étudié et grandi scientifiquement à l'ULB, où j'ai obtenu un master en biologie des organismes et écologie avant de me lancer dans un doctorat. Ma curiosité m'a rapidement menée vers le monde fascinant des insectes, des fourmis aux scolytes, et plus particulièrement vers leurs stratégies reproductives et leur capacité à conquérir de nouveaux territoires.

Au fil de mon parcours, j'ai eu la chance de mêler travail de laboratoire, analyses de données et terrain, que ce soit en Europe, en Australie ou au Brésil. La recherche m'a aussi permis de transmettre : encadrement de travaux pratiques, suivi de projets étudiants et présentations lors de congrès.

Aujourd'hui docteure en biologie, j'aime explorer et comprendre le vivant, avec une préférence pour les petites bêtes qui ont beaucoup à nous apprendre... et pour les échanges scientifiques menés dans la bonne humeur. Aujourd'hui, je continue mon parcours scientifique en tant que préparatrice en chimie à l'école européenne de Bruxelles II.

## Vincent DAUDON



Musicien amateur et intéressé par le son en général, j'ai orienté mes études vers l'acoustique musicale et architecturale. Passionné également d'astronomie, que j'ai pratiqué en amateur plusieurs années, et d'histoire de la physique, j'ai repris des études, alors déjà enseignant, en histoire et philosophie de la physique qui m'ont amené à rédiger une thèse de doctorat, fondée sur les travaux de Newton, sur le concept de temps mathématique utilisé en physique.

## Nicolas DUQUENNE



Après avoir étudié les sciences de la vie et de la Terre à l'université de Lille, avec une spécialisation en biologie végétale, j'enseigne la biologie depuis près de 30 ans, dont presque la moitié à l'école européenne de Bruxelles

Depuis toutes ces années, je souhaite partager avec les élèves mon intérêt pour les sciences de la vie. Je suis convaincu que la biologie est avant tout une science expérimentale et que l'approche du vivant par l'observation du monde réel revêt aujourd'hui une importance capitale.

Je m'intéresse également aux questions sociétales relatives à l'environnement, à la biodiversité et à la crise bioclimatique actuelle.

## Astrid C. FISCHER



I was born in Vienna, grew up in Germany and gained a degree in mechanical engineering from TU Wien. After several years in industry—including assignments in China and Indonesia—I changed direction, completed a B.A. in Catholic theology in Lucerne, and re-trained as a mathematics and physics teacher. I have taught in Belgian schools and currently work at the European School Brussels II (EEB2). Driven by curiosity, I enjoy helping students turn scientific questions into creative, socially relevant research projects.

## Ana Romina FOX

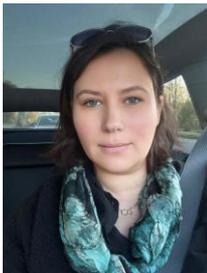


I come from Argentina, a beautiful country where I studied biology at university. Driven by a strong interest in genetics and molecular biology, I completed a PhD at the University of Buenos Aires, working on plant light receptors.

I then continued my research career in both Argentina and Europe. I am currently a researcher at the LABIRIS Institute in Brussels, where I study bacterial enzymes that modify sugars and their role in bacteria-plant interactions.

While I truly enjoy my work in the laboratory, I am also passionate about science communication and outreach, which allow me to share my enthusiasm for science beyond the lab.

## Gabriella SKARA



I am a scientist and educator with a PhD in computational chemistry and a background in chemical engineering and economics. After studying and working in several countries (Spain, USA, Chile), I now live in Brussels, where I founded the Learning Academy of Brussels, a nonprofit organization that offers STEM activities for young people. I am especially passionate about mathematics, creative problem-solving, and learning through play, including LEGO robotics. My aim

is to build a community of like-minded young people who enjoy exploring, questioning, and solving problems together, and to show that science and mathematics can be exciting and a lot of fun. As a judge at the ESSS, I am delighted to meet young researchers and celebrate their curiosity, creativity, and ideas

### Arunas KRIKSTAPONIS



I have been interested in nature and natural sciences since childhood. While studying at the University of Educational Sciences, I researched the behaviour of birds of prey, and later I investigated microorganisms in the human environment. I really enjoy hands-on laboratory work and working with curious, enthusiastic students. I'm looking forward to getting to know the projects and the people behind them at the symposium, picking up new ideas, and simply enjoying the process of discovery.

### Kristin HINDERER



I work as a teacher in Germany, where supporting students in developing their own ideas and experiments is a central part of my work. I studied biology and chemistry in southern Germany, which shaped my interest in hands-on and inquiry-based science education.

Recently, I was given the opportunity to teach in Brussels, allowing me to gain insight into different educational models and approaches across countries. Experiencing how science is taught in diverse contexts has strengthened my interest in student experimentation beyond national borders. I am especially motivated by guiding students as they turn their questions into meaningful experiments.

### Maria BOUMPOUKA



I studied Electrical and Computer Engineering and Business Administration, but my passion for teaching led me to become an ICT teacher. I later completed a PhD in Didactics of Informatics and Web-Based Learning Environments. I have more than 20 years of experience teaching in Greek public schools and this is my second year in EEB2. Over the years, I have taught ICT as well as technology and mathematics. I have also organized STEM projects and collaborated with colleagues on environmental education programmes.



## Wladimir LEFEBRE



J'ai toujours été mu par une grande curiosité. C'est elle qui combinée à une visite des laboratoires du Louvre entant que jeune adolescent ; qui a façonnée mon gout pour les sciences et leurs applications. C'est donc tout naturellement que j'ai poursuivi des études de physique et de chimie, dans premier temps en Belgique (pays qui m'a vu grandir) et dans un second à Maastricht au Pays-Bas. D'ailleurs il m'a été transmis là-bas un vif intérêt pour les approches pluridisciplinaire qui m'avait déjà séduite alors encore adolescent. Après avoir travaillé quelques années pour un laboratoire qui synthétise des oligonucléotides j'ai eu la chance de travailler à l'école européenne comme préparateur en chimie d'abord, puis finalement en physique.

## Viltė PALMANS



I believe that every experiment, whether in the laboratory or in life, is a chance to learn something new. I studied Applied Chemistry and Public Administration in Lithuania and originally imagined a more administrative career path.

During my studies, an unexpected role as a science-themed birthday animator, profoundly changed my perspective. I rediscovered how powerful experiments can be in sparking curiosity and enthusiasm. Since then, the joy of discovery has been at the core of my teaching. I encourage my students to explore, ask questions, and learn through experimentation, and for a few years I have had the opportunity to support young learners as a student mentor at the European Schools Science Symposium.

## Matthieu TISSOT



Originaire des Alpes françaises, j'ai suivi un parcours universitaire en chimie en Suisse, où j'ai obtenu un doctorat en chimie organique. J'ai ensuite passé dix années dans l'industrie pharmaceutique, en Angleterre puis en Belgique, en tant que chercheur impliqué dans la découverte et le développement de nouveaux médicaments. En 2025, j'ai rejoint l'École Européenne comme professeur de chimie et de physique, animé par l'envie de partager mon enthousiasme pour les sciences et la recherche avec les jeunes générations.

## PROGRAMME

### 8th March, 2026

- 12:00 Arrival and Registration at the IBIS BUDGET Brussels Hotel
- 17:00 Arrival at the school site EEB2 Woluwé
- 18:00 Opening ceremony in the Salle Polyvalente
- 19:30 Walking dinner
- 21:00 Accommodation at the IBIS BUDGET Brussels Hotel (Transport to hotel by RioCars)

### 9th March, 2026

- 7:30 Breakfast in the IBIS BUDGET Brussels Hotel
- 9:00 Meeting in Eurocontrol, setting up of posters
- 9:30 Presentation before the jury or school tour and experiments
- During the qualification phase, junior and senior participants will individually present their projects to a panel of 2 judges
- 11:00 Break
- 11:15 Presentation before the jury or school tour and experiments
- 12:45 Lunch at Eurocontrol
- 13:15 Presentation before the jury and poster session
- In parallel, poster presentations will take place, open to the whole school. Participants will vote for the best poster in both the junior and senior categories which will be rewarded with the student prize at the end of the symposium
- 15:00 Students' activity
- 18:30 Announcement of the five best junior/senior projects and a teachers' meeting.
- 19–20:00 Dinner at Evere and return to hotel

## 10th March, 2026

7:30	Breakfast in the hotel
9:00	Teachers' meeting
9:30	Final presentations of the competition. The five best in the junior and senior groups will present their projects to all members of the jury and participants.
12:30	Lunch at Eurocontrol
14:00	Final meeting of the jury (at the end of the presentation, the jury members will decide on the best junior and senior projects.)
14:00	Excursion
19:00	Dinner at Evere
20:00	Return to the hotel.

## 11th March, 2026

7:30	Breakfast in the hotel and check out
9–11:00	Closing ceremony
11:30	Distribution of the lunch boxes
12:30	End of the ESSS 2026 Woluwé

## Opening ceremony

8th of March 2026 – SALLE POLYVALENTE EEB 2

17.55 introduction

by Kevin Hubert and Jean-Pierre Wola

18.00 Musical interlude:

“An die Freude” (Staff choir)

“I Wanna Hold Your Hand” (Staff choir)

18.05 Speech from:

Kamila Malik, –Director of the European school Brussels II

18.15 Musical interlude:

“Más despacio” (Woluwe Primary choir)

18.20 Speech from:

Christina Munnich, Inspector for Biology and Integrated Sciences for the European schools

18.30 Musical interlude:

“Walking on the Moon” (Jazz band EEB2)

18.35 Speech from:

Olivier Nouwen, alumnus of the European school Helsinki, postdoctoral researcher at the U Hasselt

18.50 Speech from:

Kevin Grant, European School Liaison Officer, EUROCONTROL

19.00 Musical interlude:

“Space Oddity” (Rock band EEB2)

19.05 Announcements, distribution of badges, goodie bags



## Closing ceremony

11th of March 2026 – EUROCONTROL

09.00 Musical introduction:

“Rocket Man” (Elton John, from audio tape)

09.10 introduction

by Kevin Hubert and Jean–Pierre Wola

09.15 Speech from:

Tibor Kapu, Hungarian astronaut, ISS

09.45 Musical interlude :

“Count on Me” (Evere Primary choir)

“Plus haute que les étoiles” (Evere Primary choir)

09.55 Speech from:

Céline Shakouri–Dias, Director of People, EUROCONTROL

10.05 Award ceremony:

– Best Junior projects,

– Best Senior projects,

– Best posters

10.40 Speech from:

Kristiina Siimes, Deputy Director of European School Brussels II

Hand over ESSS 2027 to the European School Frankfurt

10.50 Musical interlude:

“Nation” (Evere Primary choir)

11.00 End of the ceremony

## ASSESSMENT

<b>Poor</b>	Participant <b>does not include</b> basic information and/or <b>does not</b> elaborate or clarify.					
<b>Fair</b>	Participant states <b>superficial</b> or <b>basic</b> information <b>without</b> elaboration or clarity.					
<b>Average</b>	Participant states <b>some</b> of the information with <b>limited</b> elaboration and/or clarity.					
<b>Good</b>	Participant states <b>most</b> information with elaboration and clarity.					
<b>Excellent</b>	Participant states <b>all</b> information with <b>extensive elaboration and clarity</b> .					
<b>Max Points:15</b>	<b>Research Problem</b>	<b>Excellent</b>	<b>Good</b>	<b>Average</b>	<b>Fair</b>	<b>Poor</b>
	1 Clearly focused and objective identified / Practical need	5	4	3	2	1
	2 Testable using the scientific method / well defined contributions and criteria for evaluation of success	5	4	3	2	1
	3 Problem is creative, was developed by student and not from the internet or standard experiments	5	4	3	2	1
<b>Max Points:15</b>	<b>Design and Methodology</b>	<b>Excellent</b>	<b>Good</b>	<b>Average</b>	<b>Fair</b>	<b>Poor</b>
	4 Data collection was well designed / Variables were well designed	5	4	3	2	1
	5 A virtual or real model of prototype was developed providing sufficient data to support conclusion	5	4	3	2	1
	6 There was a great degree of independence in conducting the experiment	5	4	3	2	1
<b>Max Points:15</b>	<b>Report</b>	<b>Excellent</b>	<b>Good</b>	<b>Average</b>	<b>Fair</b>	<b>Poor</b>
	7 The report described the aim of the project, its method progress and results clearly	5	4	3	2	1
	8 Sufficient data was collected to support conclusion and appropriate mathematical and statistical methods	5	4	3	2	1
	9 Data analysis and and conclusions drawn were align to experiment results (not expected results)	5	4	3	2	1
<b>Max Points:10</b>	<b>Poster</b>	<b>Excellent</b>	<b>Good</b>	<b>Average</b>	<b>Fair</b>	<b>Poor</b>
	10 Text and Data was well planned and logically organized	5	4	3	2	1
	11 There was clarity in the graphics and supporting documentation was displayed.	5	4	3	2	1
<b>Max Points:15</b>	<b>Oral presentation / Interview</b>	<b>Excellent</b>	<b>Good</b>	<b>Average</b>	<b>Fair</b>	<b>Poor</b>
	12 The students clearly express themselves presenting the project	5	4	3	2	1
	13 There were clear, concise and thoughtful responses to questions.	5	4	3	2	1
	14 There was understanding of conclusions, impact and limitations to the research	5	4	3	2	1

## LIST OF PROJECTS

Project number	Title	Authors	School
J1	<a href="#">How to detect microplastics in water and sand</a>	GALAN PEREZ-MONEO, Santiago; GARCIA, Rodrigo; LAMAS, Carlos	EEB3
J2	<a href="#">Energy generated by walking</a>	POLAND, Jack; FISCHER, David Fischer; MCHUGH Alexander	Bergen
J3	<a href="#">Colour Chemistry</a>	MILWID, Charlotte; BARRON, Melina; TEIXEIRA OLIVEIRA, Sara	Bergen
J4	<a href="#">Save our Trees.</a>	RUBIN, Lily June; DE KORTE, Matilda Lynn	Bergen
J5	<a href="#">Aérosève : système bio-inspiré pour purifier les espaces urbains</a>	LEVY, Aaron; PLANTET Morgane	Paris la Défense
J6	<a href="#">Vision et couleurs chez la fourmi Lasius Niger</a>	DE YINGFEI, Zhang ; LARBI MEZIANE MARINO, Emma ; DHIFLI, Mohamed	Paris la Défense
J7	<a href="#">Too Loud to Ignore: Noise Pollution in Brussels</a>	AKIYAMA ECHEVERRIA-ALDAMIZ, Anna; HORKAY, Lara; LIMANTAITE, Sofija	EEB1
J8	<a href="#">Invisible threat detector: see what the eye can't</a>	CHOUDHARY, Sarthak	EEB1
J9	<a href="#">Stress reduction through physical interaction</a>	ROMME, Stighan	EEB2
J10	<a href="#">The Impact of Stimulants and Depressants on Daphnia magna and Artemia Activity</a>	AL SALHA, Ismail; MAZZON Matteo; D'SOUZA Cristiano	Lycée Edward Steichen
J11	<a href="#">Using Eggshell Waste as a Natural Water Purification Filter</a>	KENDA, Mohamed; SANKALP Krishna; LIENDO, Andres	Lycée Edward Steichen

J12	<a href="#">Étude de l'effet Stroop chez les monolingues et les plurilingues</a>	LANGE, Katharina ; ZARIC, Iskra	Frankfurt
J13	<a href="#">Alternative Paper from banana peels</a>	PAMIES COSTA, Anna; LOPEZ PENARRUBIA, Cinthia; FILIPPONE, Vittoria Maria	European School RheinMain
J14	<a href="#">Wärmen von Wasser mit der Sonnenstrahlung</a>	SOFFER, Raphael	European School RheinMain
J15	<a href="#">Eurobots: un jeu au service de la citoyenneté européenne</a>	EL GHORCH, Elyes ; KINTZ Pierre	Karlsruhe
J16	<a href="#">Automatic Plant Irrigation System</a>	RAJKUMAR, Abhinav; SAHNEY, Saavi	Mol
J17	<a href="#">Recongelindic</a>	GIORDANI Zelig; ALBERTI A ale	Parma
J18	<a href="#">Mars agricultural experiment</a>	MAZZA, Alessandro; SINGH, Gurkirat	Parma
J19	<a href="#">How the aurelia aurita jellyfish can help us research ocean pollution</a>	SCHICH, Valeria	Tallinn
J20	<a href="#">Exploring Aerodynamic Drones</a>	APOSTOLOU, Apostolos Filippou MOLA, Francesco ZIORKIEWICZ Karol	Warsaw
J21	<a href="#">Condensation-based Water Extraction from Air</a>	PAHNECKE, Ella; RIZZO, Sofia; TSIFNA, Georgia	Warsaw
J22	<a href="#">Closed Recycling Loop of contaminated Multilayer Plastic Packaging by Solvent Dissolution</a>	HRADEC Matej	Varese
J23	<a href="#">X-Grow: A robot arm for hydroponic plant care</a>	GARCIA GARCIA Daniel Marc; PEON GONZALEZ Valentino; PIERINI Bruno	Varese
J24	<a href="#">Homemade Biodegradable Plastics</a>	BANEGAS, Génesis; GOMEZ, Nora	EEB3
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J28	<a href="#">The GORDG–Detention Giver</a>	DI GIOIA, Nathan; FAGANEL, Max	Ljubljana
J29	<a href="#">Honey, I shrunk the balloon waste!</a>	DAUD, Maryam; PATWARDHAN, Yulia	Karlsruhe
J30	<a href="#">The Effect of Heavy Metal Salt (CuSO<sub>4</sub>) on Plant Growth, and how Hyperaccumulators can protect other more sensitive plants from them.</a>	QUATTARA, Aina Ajda; KOZLOV, Timofei	Ljubljana
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S22	<a href="#">Effects of Bilingualism on the Brain</a>	COLL PEREZ, June; ABUBAKIROVA, Vera	Strasbourg
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## ABSTRACTS

### Junior projects

J1

#### *How to Detect Microplastics in Water and Sand*

GALAN PEREZ-MONEO, Santiago; GARCIA, Rodrigo; LAMAS, Carlos (S1ESA)

European School of Brussels III-Ixelles. Mentor: ACOSTA MEDEL, Yolanda

Microplastics are super tiny bits of plastic that are hard to see, but they can end up in water and sand, and even in animals! In this project, we wanted to find out if there were microplastics in our tap water and beach sand.

Method: We used something called The Coffee Filter Method.

What we did:

We took a clean coffee filter and put it over a glass jar. Then we poured a lot of tap water through the filter and waited. After the water went through, we looked at the filter with an UV light in a dark box. We looked for tiny fibres, little pieces, or weird colourful dots that didn't look natural. This method doesn't catch super tiny particles that need a microscope, but it's a really good and easy way to start checking for plastic pollution around us. We also tested sand by mixing it with water to make the plastic float and then used the UV light to see what we had found. We will calculate the % of tap water and sand samples that were contaminated with plastic fibres.

Conclusions:

We learned that there is plastic in places we didn't expect, and that even kids like us can find it. This method is easy, cheap, and helps us understand how dirty our environment is. We should try to use less plastic to help save nature!

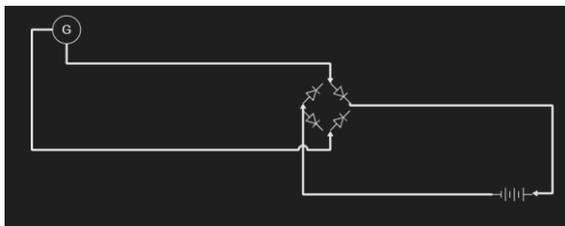
J2

### *Energy generated by walking*

POLAND, Jack; FISCHER, David; McHUGH Alexander, (S3ENA)

European School of Bergen. Mentor: MEIJER, Mai-Britt

Our project's goal is to see how much energy can be generated by walking/running. As it is a clean and environmentally friendly energy source, everyone is always walking, running, sprinting or cycling. And with this project we are also trying to make more people walk and hence protect the environment. This can be done by putting a magnet that is suspended by two springs and copper coil on the side of a shoe. So, as you walk, you move the magnet up and down through the copper coil. This transfers Kinetic energy into electrical energy; the AC (Alternating Current) moves through the system and goes through a rectifier, converting the AC into DC (Direct Current) which is the needed current for charging batteries or supercapacitors. The DC keeps moving through the system and eventually reaches the battery. We will use the Direct Current to charge the battery. We will store the electrical energy inside the battery for later use. When we need to use the battery, we simply take out the removable compartment on the side of the shoe that stores the batteries. However, what we need to do before working on this final product is to test how much energy it will generate.



*Circuit diagram of how the machine will work. The linear induction generator creates an AC current; this current passes through a rectifier, and then the DC current goes into the battery.*

J3

### *Colour Chemistry*

MILWID, Charlotte; BARRON, Melina; TEIXEIRA OLIVEIRA, Sara

European School of Bergen. Mentor: MEIJER, Mai-Britt

This project set out to confirm if natural dyes could be as effective as synthetic dyes. Natural dyes were usually made by boiling material such as flowers, nuts, berries, fungi, animal products and vegetables for hours. They were usually boiled for an hour, and preparing cloth to dye also involved simmering with a mordant. The synthetic dyes used were prepared by diluting them in water for a couple minutes, and every dye was tested on cloth, each cloth being observed before rinsing, after rinsing and after drying. The synthetic dyes produced brighter colours than the natural dyes but didn't cling to the fabric as well as the natural dyes did, leaving excess dye on surfaces even after rinsing. Notably, the synthetic rose red dye did not resemble the dye made of red roses, but the yellow synthetic dye ended up looking similar to the walnut dye. This study concludes that some natural dyes can be just as effective as synthetic dyes, if not more.



J4

### *Save our Trees*

RUBIN, Lily June; DE KORTE, Matilda Lynn (S2ESB)

European School of Bergen. Mentor: MEIJER, Mai-Britt

Our project is about making paper using coconut husk, water, and baking soda (washing soda). The goal of this experiment was to see if coconut husk, which is usually thrown away, can be turned into paper using natural materials. This could help the environment by reducing waste and saving trees. First, the coconut husk was cut into small pieces. Then it was boiled in water with baking soda to soften the fibers. After boiling, the mixture was blended to make a thick pulp. The pulp was poured onto a screen and spread out flat to form a thin layer. Water was pressed out, and the sheet was left to dry. When it dried, it became a piece of paper. The results showed that coconut husk can be made into paper. The paper was a little rough but strong and did not tear easily. This means coconut fibers can work as a material for paper. In conclusion, this project shows that natural plant materials like coconut husk can be reused in useful ways. Making paper from coconut husk could be a good way to recycle waste and help protect the environment.

J5

### *Aérosève*

LEVY Aaron; PLANTET Morgane, (S3 EN)

Ecole européenne Paris-la Défense. Mentor : ZAIDI, Nadjette

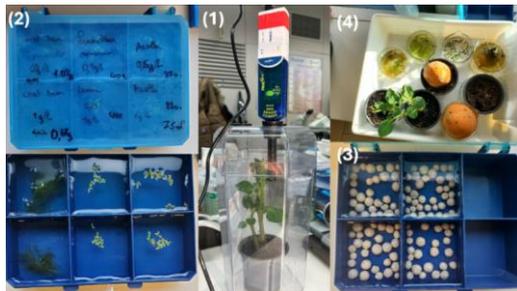
Notre projet consiste à créer une maquette de drone anti-polluant qui pourrait nettoyer l'air. Nous avons soulevé la problématique suivante : Comment faire un système bio inspirés qui pourrait-il purifier et rafraichir l'air dans les villes ?

Environ 7 millions de personnes meurent chaque année à cause de la pollution de l'air ambiant et de l'air intérieur et c'est pour ça que nous avons décidé de faire un projet qui nettoie et purifie l'air de nos villes, empêcher les troubles pulmonaires, et améliorer le bien-être des habitants. C'est pour ça qu'on a décidé de créer Aérosève, notre concept es très simple, Aérosève est un projet innovant qui consiste à créer un système de purification d'air bio-inspiré capable de purifier l'air. Ce drone s'inspire du fonctionnement de la nature, notamment d'une espèce de plante, les Fougère de Boston.

C'est une plante très intéressante parce que son feuillage capte l'humidité ambiante, réduisant ainsi les excès de vapeur d'eau dans l'air.

Pour illustrer ce projet, nous expérimentons à l'aide d'une Fougère de Boston, d'une bougie (qui relâche des PM<sub>2,5</sub> quand elle s'éteint), d'un ventilateur pour éparpiller les PM<sub>2,5</sub>, d'un détecteur à particules fines et toutes tout ça, renfermer dans une boîte en verre. Puis, nous prenons des notes par rapport à la quantité de PM<sub>2,5</sub> toutes les minutes. Pour notre expérience témoin, nous étudions le prototype de la même manière en enlevant la fougère de boston et en ajoutant un filtre EPA pour tester la différence de particule entre le filtre et la plante. Avec nos résultats actuels, il est raisonnable de penser que, en plus d'être plus écologique, la Fougère de Boston nettoie l'air beaucoup plus rapidement que le filtre EPA.

Conclusion : En utilisant la fougère de boston, nous pouvons, d'une manière inspirée de la nature, purifier l'air autour de nous.



J6

### *Vision et couleurs chez la fourmi Lasius Niger*

DE YINGFEI, Zhang; LARBI MEZIANE MARINO, Emma; DHIFLI, Mohamed

Ecole européenne Paris-la Défense. Mentore : BERRIER, Salomé

Notre projet consiste à étudier la perception des couleurs chez les fourmis. Notre problématique est donc "Les fourmis ont-elles une préférence de couleurs ?" Pour ce faire, nous allons présenter une expérience consistant à observer les choix que les fourmis vont entreprendre. Pour préciser nous avons mis des fourmis (de l'espèce *Lasius Niger*) dans un endroit clos (ici une petite boîte) avec des tunnels de couleurs fabriqués à partir de feuille de papier colorées (cellophane colorée) ; nous avons ensuite observé les choix et options prises par les fourmis pour comprendre leur fonctionnement visuel.

Nous avons fait l'expérience avec les trois couleurs primaires : bleu, rouge, jaune. La couleur la plus empruntée fut différente à chaque tour, les résultats ne nous permettent donc pas de donner une réponse fixe. Après avoir discuté autour des résultats donnés, nous nous sommes rendu compte que les fourmis n'ont pas de préférence particulière concernant les couleurs. Nous sommes donc arrivés à une conclusion que les fourmis n'avaient pas spécialement une préférence de couleurs, et se repèrent plus grâce aux traces chimiques laissés par leurs camarades.

J7

### *TOO LOUD TO IGNORE: Noise Pollution in Brussels*

LIMANTAITE, Sofija; HORKAY, Lara ; ALDAMIZ-ECHEVARRIA AKIYAMA Anna (S2ENB)

European School of Brussels I- Uccle. Mentor: CSONK, Dorottya

It is just noise; it is normal, right? Well, no.

Sometimes noise is so loud that you cannot ignore it; you need to act on it.

In Brussels, there are many places where cars, trams, music and even French fry vendors can be too loud and interfere with your daily life, making it hard to listen to yourself. That is what we feel and why we chose this topic.

Our hypothesis is that Brussels is noisy, especially in some neighbourhoods. Our main goals are to identify which communes are the loudest, why, and to spread awareness about this world-wide problem.

In our presentation, we will explain Brussels' noise pollution using academic research, experiments, surveys, news articles, social media analysis, and facts.

We will start with a survey to see if people are aware of constant noise and which commune they find the noisiest, including the main noise sources. Then, using an app, we will measure noise levels in known locations around Brussels to find out what turned out to be the noisiest commune. Finally, we will analyse social media groups' complaints to see their main subjects of complaining and find similarities.



J8

*Invisible Threat Detector: See what the Eye can't*

CHOU DHARY, Sarthak (S4ENB)

European School of Brussels I- Uccle. Mentor: CSONK, Dorottya

In today's world, we have observed that science attempts to provide the correct solution to every problem. There are some problems in our daily life which affect our health and safety that might be ignorable at first sight. However, upon investigation, it reveals that these problems must not be ignored and need urgent attention. My investigation deals with one of the daily health hazard problems which seem invisible but affect all populations across the globe, especially in cold countries like Europe. All of us are aware of the greenhouse gases that can lead to health problems. Hence, we have CO<sub>2</sub> detectors which help to monitor its level indoors. However, there is another hidden factor which is affecting us on a daily basis when we are staying indoors due to cold weather. It's radon, which is the 2nd leading cause of lung cancer after smoking. My aim is to make my target audience aware of the presence of radon and various factors which affect its level. If radon is invisible, odourless, and present in many homes, how can we protect ourselves without first understanding where it comes from and how to measure it?

J9

*How can we Reduce Stress: Stress reduction through physical interaction*

ROMME, Stighan (S2NLA)

European School of Brussels II- Woluwe. Mentor: REYNDERS, Veerle

These days, stress is something that many people experience daily. Existing research already shows us that pet animals can help reduce stress, but not everyone has access to pet animals. For this reason, I wanted to find more accessible ways to reduce stress. This project tested whether very realistic stuffed animals can come close or even match the stress reduction effect of pet animals.

For this research, I made a realistic stuffed animal by inserting a device that simulates breathing motion. The heart rate (bpm) was used as the indicator to determine the amount of stress. Ten test subjects with varying ages (between 7 and 72) and gender, were asked to play a difficult/annoying videogame for 3 minutes to generate stress. After 3 minutes, I measured their heart rate. They were then seated on a comfortable couch with the realistic stuffed animal for ten minutes to relax. The heart rate was then measured again. The same process was repeated with a pet animal so that both results could be compared.



## J10

### *The Impact of Stimulants & Depressants on Daphnia and Artemia*

AL SAHLA, Ismail; MODENEIS, Mazzon Matteo; D'SOUZA, Cristiano (S4EN1)

Lycée Edward Steichen – Clervaux Luxembourg. Mentor: Dr FODOR, Zoltan

This project explores how common stimulants and depressants influence the physiological responses of two aquatic invertebrates: *Daphnia magna* and brine shrimp (*Artemia*). The substances tested—caffeine, alcohol, nicotine, taurine, melatonin, adrenaline, and ascorbic acid—are widely used by humans, making them ideal for demonstrating basic biological effects on heart rate and activity.

#### Hypothesis:

We predict that stimulant substances (caffeine, nicotine, adrenaline) will increase the heart rate of *Daphnia* and increase the swimming activity of *Artemia*. Depressants or calming agents (alcohol, melatonin, taurine) are expected to slow both heart rate and movement. Ascorbic acid is expected to cause little or no change.

#### Procedure Summary:

Both organisms were first observed in distilled water to establish a control. New slides (for *Daphnia*) and Petri dishes (for *Artemia*) were prepared for each substance, and one drop of the treatment solution was added.

The heart rate was measured by counting beats for 10 seconds under a microscope and multiplying by 6 to calculate BPM. The activity level was recorded in a slim aquarium observer tank using the Viana 2 app to measure swimming speed (cm/s) over one minute. Each treatment was repeated 3 to 5 times to increase accuracy, and averages were used for comparison.

Expected Results:

Stimulants such as caffeine, nicotine, and adrenaline are expected to increase heart rate and activity. Alcohol, melatonin, and taurine should decrease both measurements. Ascorbic acid is expected to show minimal effects. These results would demonstrate how different chemicals influence biological systems and provide insight into how stimulants and depressants affect living organisms.

Substance	Heart Rate	Activity level	Reasoning
Caffeine	Increase	Increase	Stimulant properties
Alcohol	Decrease	Decrease	Depressant effect
Nicotine	Increase	Increase	Stimulant effect
Melatonin	Decrease	Decrease	Calming/sleep-inducing effect
Taurine	Slight decrease	Decrease	Calming, regulates nervous system
Adrenaline	Increase	Increase	Strong stimulant (nervous & cardiovascular systems)
Ascorbic Acid (Vitamin C)	No change	No change	Antioxidant, not a stimulant or depressant

▲ Red = Increase   
 ▼ Blue = Decrease   
 ● Gray = No Change

J11

### *Egg Shells Water Purifier—Comparing Food–Waste Water Filters*

KENDA, Mohamed ; SANKALP, Krishna ; LIENDO, Andrés (S3EN1)

Lycée Edward Steichen, Clervaux, Luxembourg. Mentor: Dr FODOR, Zoltan

In short, eggshells do not clean by "magic", but act as a natural filter/adsorbent – especially when dried and ground into a fine powder, rather than used whole.

Chicken eggshells are approximately 90–95% calcium carbonate (CaCO<sub>3</sub>) and have a porous, large–surface structure. Inside, there is a thin membrane consisting of proteins/fibrous material with many "grabbing places" for contaminants. This

combination of porous  $\text{CaCO}_3$  + protein membrane makes eggshells a good, inexpensive biosorbent.

How does it "clean" contaminated water?

- Adsorption (adhesion to the surface)
- Ion exchange and precipitation
- Binding of dyes and organic pollutants

What can it not do (or can only do to a limited extent)?

Our results briefly:

Raw eggshells (more accurately: cleaned, dried, powdered eggshells) are capable of binding (adsorbing) certain heavy metals and dyes due to their calcium carbonate and protein membrane content.

This makes the water appear "cleaner" – but it is not a substitute for a professional drinking water purification system.



J12

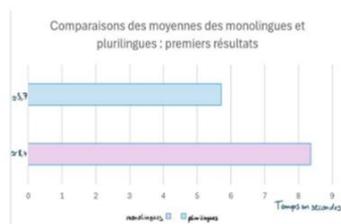
### *Etude sur l'effet Stroop et sa relation avec le plurilinguisme*

ZARIC, Iskra; LANGE, Katharina (S4FRA)

Ecole européenne de Frankfurt. Mentore : KERVARREC, Amaël

Nous avons décidé d'explorer l'influence d'un environnement plurilinguistique sur l'effet Stroop, un phénomène psychologique montrant qu'il est plus difficile de nommer la couleur d'un mot lorsque ce mot désigne une couleur différente. Cette difficulté vient du conflit entre la lecture (automatique) et la dénomination des couleurs (moins automatique).

Méthode : Nous avons testé des élèves de 9 à 18 ans. Le même test Stroop, uniquement composé de mots en couleur, a été administré dans la langue maternelle de chaque participant. Les conditions étaient identiques pour tout le monde : explication des règles, début du chronomètre lorsque la page est tournée, et redémarrage obligatoire en cas d'erreur.



Résultats préliminaires : Les premières données (voir ci-dessous) montrent que les participants plurilingues réagissent en moyenne 2,7 secondes plus vite que les monolingues. L'étendue des temps est également plus faible chez les plurilingues, suggérant une meilleure stabilité et rapidité. Ces observations soutiennent l'hypothèse d'un avantage cognitif lié au plurilinguisme. Nous devons encore élargir notre échantillonnage pour approfondir ces résultats.

Graphique des premiers résultats temps de réaction pour obtenir de bonnes réponses:

### J13

#### *Alternative Paper from Banana Peels*

PAMIES COSTA, Anna; LOPEZ PENARRUBIA, Cinthia; FILIPPONE, Vittoria Maria, (S1ENB)

European School RheinMain. Mentor : Dr SAMLAND, Anne

Our idea was to find out if there was an alternative way of making paper without using wood and saving millions of trees. Solution: After research and experimentation, we came up with an easy, environmentally friendly, and fast solution for making paper with banana peels. To do this, we thought of modifying the base recipe by adding different substances to see which banana paper would turn out better. The purpose of this project is to reduce regular paper consumption, which leads to less deforestation. Every year 76 million cubic metres of wood are harvested<sup>1</sup>. By using banana peels, we also reduce the amount of bio-waste at home. Banana paper helps our environment and saves the homes of animals, as well as their ecosystems. With more trees, we reduce CO<sub>2</sub>and

global warming. After four trials, we got our best banana peel paper. We found the original recipe online<sup>2</sup>, but we added different materials and figured out what worked out better. The results show that when we added glue and nothing else to the recipe, it became too thin, too dark, or had a bad texture to write on. Instead, with white paint, it turned out similar to regular paper, and the colour becomes lighter depending on how much white paint we added; that's the best one. Our experiment concluded through different trials that by using white paint and a base recipe for banana paper, we got the best results. It also helps fight against deforestation, bio-waste, and regular paper consumption. With banana paper we are one step closer to our goal of saving millions of trees per year.

J14

### *Wärmen von Wasser mit der Sonnenstrahlung*

SOFFER, Raphael (S4DEA)

European School RheinMain. Mentor: Dr. Anne Samland

In meinem Projekt möchte ich beweisen, dass man mit Hilfe von konzentrierter Sonnenstrahlung Wasser erhitzen kann. Ich kam auf die Idee aufgrund der dauernd steigenden Energiepreise. Für mein Experiment bündele ich die Sonnenstrahlung so mit einem Parabolspiegel, dass die Sonnenstrahlung direkt auf ein Rohr oder Schlauch zielt. Durch die Bündelung ist es möglich, den Punkt, an dem die gebündelten Sonnenstrahlen auf das Rohr oder den Schlauch treffen, heiß genug werden zu lassen, um das hindurchfließende Wasser zu erhitzen. Ziel ist es auch an weniger sonnigen Tagen die Sonnenstrahlung zum Erhitzen von Wasser nutzen zu können, das Rohr oder der Schlauch durch die Bündelung der Einstrahlung auch bei wenig Sonnenstrahlung genug Hitze erhält. Die Messpunkte, um den Temperaturunterschied des Wassers vor und nach der Sonneneinstrahlung messen zu können, liegen einmal am Anfang und einmal am Ende des Rohrs oder des Schlauchs. Ich habe herausgefunden, dass die am besten zu nutzende Spiegelart der Parabolspiegel ist, da er am optimalsten all die Sonnenstrahlung bündelt.

Abstract

In Zeiten steigender Energiekosten wäre es nützlich, eine Alternative zum Erhitzen von Wasser zu finden unter Nutzung von Sonnenenergie. Die Erhitzung sollte im Idealfall auch bei weniger starker Sonnenstrahlung möglich sein, da wir hier in Europa oft bewölkte Wetterverhältnisse haben.



## J15

### *EUROBOTS : un jeu au service de la citoyenneté européenne*

EL GHORCH, Elyes ; KINTZ, Pierre (S3 FR)

European School Karlsruhe. Mentore: Vanessa Bach

Notre projet consiste à faire une course entre de deux Robots. Deux équipes seront faites, chaque équipe disposera d'une tablette et d'un robot qui devront le mener à la ligne d'arrivée en passant par des obstacles, chaque obstacle va poser une question qui sera affiché sur la tablette ou l'écran du robot. Les questions seront lues par le robot équipé d'un suiveur de ligne : le robot suit la ligne et s'arrête à chaque stop. Les questions seront à choix multiple et sur le thème institution européenne, le niveau sera de plus en plus dure. Les élèves pourront répondre par A, B ou C directement sur le robot. Si l'équipe répond correctement à la question le robot avancera à la prochaine question et s'il répond faux à une question, il retenté sa chance. La première équipe qui amènera son robot à la ligne d'arrivée sera l'équipe gagnante. Les robots seront programmés par Makerblock et les obstacles imprimés avec l'imprimante 3D. Les questions seront dans les 3 langues.



## J16

### *Automatic Plant Irrigation System*

RAJKUMAR, Abhinav ; SAHNEY, Saavi (S1EN)

European School Mol. Mentor : Roel Verstappen

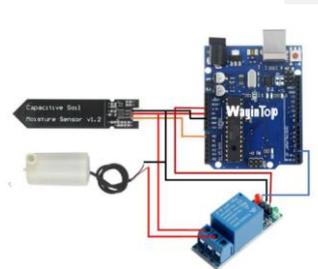
The Automatic Irrigation System project develops an automatic, sustainable irrigation system for potted plants. It uses adjustable humidity thresholds to match watering to plant needs, combining science, technology, and coding.

Introduction:

There is an increasing interest for eating locally produced food and growing your own herbs. Some people have a hard time keeping plants alive, which might prevent them

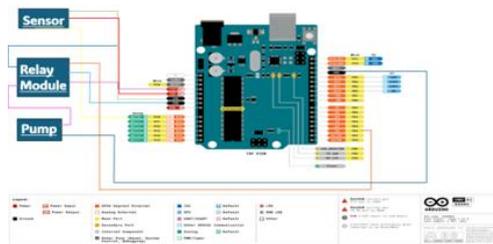
from growing their own herbs and having plants in their homes. A system which could keep plants alive and healthy would enable everyone to grow their own herbs all year round. It would provide a way to get fresh vegetables and herbs with almost no manual input. Growing your own food is good for the environment. Furthermore, having plants in homes or in offices can increase productivity. Therefore, companies will benefit from having plants in their offices. One problem is that someone needs to keep the plants alive for them to boost the health of the employees, a task which today requires a person in the company diverting from their original task. A self-watering system would significantly decrease the amount of time needed to keep plants alive, enabling companies to have many plants without wasting time on care taking.

After all the applications arrived, we used this picture for the correct connections:



Materials and Methods:

The black triangle is the moisture sensor which measures the amount of moisture in the soil. The white rectangle is the water pump used to send water to the plant. The small blue box is the relay module. Without it, water would always be running. The big blue rectangle is the *Arduino Uno Rev 3*, the command chip that gives all the instructions to the other components.



Above is a diagram with carefully drawn lines to show which wire is connected to which circuit.

Below is a graph of the costs of our components:

Components	Qty	Price	Feature
Arduino Uno Rev 3	1	19.03 €	We need it for telling each component what to do
Relay Module	1		For telling the pump when to turn on/off
Water Pump	1	13.61 €	To send water to the plant
Moisture Sensor	1		To sense when to send water to the plant
Cables	1	7.49 €	To connect the components

## Results

The automatic irrigation system worked successfully. The sensor measured soil moisture and automatically switched the water pump on when the soil was dry, and off when sufficient moisture was detected. Soil moisture readings confirmed correct system operation, and the plants remained sufficiently watered throughout testing.

## J17

### *RECONGEL-INDIC*

GIORDANI, Zelie; ALBERTI PARMA A ale (S2FR)

Ecole européenne de Parme. Mentore: ELIETTE, Germain

Ne vous est-il jamais arrivé de rentrer chez vous et de vouloir manger un plat congelé, puis d'avoir soudain un doute: ce plat a-t-il été déjà décongelé et recongelé ? Nous, oui ! Notre projet consiste donc à fournir un indicateur visuel, collé sur les produits congelés, qui change de couleur quand il se réchauffe suffisamment. Pour ce projet, nous avons étudié les propriétés de certaines matières grasses qui se solidifient à différentes températures, et nous avons eu l'idée de mettre un colorant liquide sur la surface d'un bloc de matière grasse solide à basse température. Si le bloc se réchauffe assez pour que la matière grasse devienne liquide, le colorant devrait se mélanger à l'huile. Si le produit est recongelé et donc la matière grasse durcit à nouveau, elle devrait rester colorée. Notre projet a donc consisté à définir une température qui indique qu'un produit alimentaire risque d'être décongelé, trouver ou fabriquer une matière grasse qui devient liquide à cette température, trouver des colorants alimentaires qui se mélangent dans l'huile, afin de mettre à disposition un indicateur de décongélation.



*Formation de cristaux de glaces en surface (0)*

J18

### *Mars Agricultural Experiment*

MAZZA, Alessandro; SINGH, Gurkirat Singh (S2EN)

Ecole européenne de Parme. Mentore: ELIETTE, Germain

Our project explores if plants can grow on Mars. Future astronauts will need food and sending food from Earth would be expensive and slow. We tested beans because they germinate fast and are easy to observe in a short time. We created a simulated Mars soil using 60% sand, 30% clay, and 10% red clay . We planted 1 seed in Earth soil and 1 seed in Mars soil, with artificial light. After seven days the Earth seed sprouted and reached about 2 cm, while the Mars seed showed germination failed. A second attempt also failed due to low winter temperatures. We concluded that beans cannot grow on Mars without temperature control, nutrients, and greenhouses. We need greenhouses so we can protect the plants from the dust storms. We further investigated how to manage them and bring them to Mars.



J19

*How the aurelia aurita Jellyfish can Help us Research Ocean Pollution*

SCHICH, Valeria

European School Tallinn. Mentor: EFATI, Salma

This research project is about the aurelia aurita, a species of jellyfish (more commonly known as the moon jellyfish, or more accurately the moon sea jelly), mostly found in the Baltic Sea due to this species' preference for medium temperatures and low salinity.

The original aim of this project was to find out why their population grew each year as it surfaced in the summer months, washing up on shore. However, this study found that the real reason for the growth in population may be correlated with ocean pollution. Thus, the aim was switched to observe the population, water conditions, and the algae that act as a food source for their species.

J20

*Exploring Aerodynamic Drones*

APOSTOLOU, Apostolos Filippou (S3EN)

International European School Warsaw. Mentors: KOWALSKA, Ewelina; TARGOS – PANAK, Berenika

This project is about exploring different aerodynamic shapes to make a drone fly more efficiently. A wing and a disc shape will be attached to a tetracopter (drone) to study its behaviour and battery efficiency. The experiment will be conducted by first testing the drone without the shapes and checking how long it can hover and fly following a certain path. After establishing a baseline, the two shapes will be attached to the drone. By testing these shapes, we will identify if there is a design that works best and fits our criteria. We will use polyurethane foam as it is very light and rigid enough at the same time to keep the weight within 40 grams. The tests will be performed indoors so that the weather won't affect the results. The Scratch programming language will be used to programme the path that the drone will follow, so as not to have the human element affecting the results.

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J21

### *Condensation-based Water Extraction from Air*

PAHNECKE, Ella; RIZZO, Sofia; TSIFINA, Georgia

International European School Warsaw. Mentors: KOWALSKA, Ewelina; TARGOS – PANAK, Berenika

This project describes the extraction of water from air using condensation. We know condensation from winter, when our warm and moist breath produces fog and drizzle on a cold window. From this follows that warm air must meet a cold surface for condensation to happen, so the air's moisture can gather on the cold surface. This effect can be imitated by using the drastic temperature difference in deserts between 0°C and 50°C for cooling down cans filled with water or other materials during the night and exposing them to hot air during the day. In areas with sufficient humidity in the air, moisture will gather on the surface of the cans and can be collected in a water tank.



J22

### *Closed Recycling Loop of contaminated Multilayer Plastic Packaging*

HRADEC, Matej (S3ENA)

European School of Varese. Mentor: DUDAL, Charlotte

Multilayer packaging is often characterised as a non-recyclable plastic due to its combination of incompatible materials (e.g. polyolefins, PE, PET, Nylon 6-6 and occasionally aluminum). These layers are designed to not separate in use, making the EU mechanical recycling method ineffective, causing most of the MLP to go to incineration, landfills and the waters of the world. Due to these non-sustainable disposal methods, 85% of the MLP is not recycled. This project suggests a solvent-targeted recovery and precipitation (STRAP) closed recycling loop dissolving polyolefins and PE with xylene(C<sub>8</sub>H<sub>8</sub>) while leaving polar polymers intact such as PET, making it a high purity fraction. The solvent used is reusable with a 100% reusability rate, making it an infinite process only requiring energy and certain components like filtration paper and glassware every couple of hundred cycles.

J23

### *X-Grow: A Robot Arm for Hydroponic Plant Care*

GARCIA GARCIA Daniel Marc S2Ena, PEON GONZALEZ Valentino S2Enb, UDIAS PIERINI Bruno (S2Enb)

European School of Varese. Mentor: DUDAL, Charlotte

Our project consists of a robotic arm designed to take care of plants. The main purpose of this project is to make farming more efficient by combining robotics with hydroponic cultivation. We chose to focus on automation because robots can perform repetitive tasks with high precision and reliability, reducing human error and labour while increasing efficiency. The project is composed of two main parts: 1. A hydroponic growing system for lettuce plants 2. A robotic arm programmed to dispense fertilizer automatically.



J24

### *Homemade Biodegradable Plastics*

GOMEZ MOLINA, Nora (S4ESB); BANEGAS SANCHEZ, Génesis (S4ESB)

European School of Brussels III-Ixelles. Mentor: ACOSTA MEDEL, Yolanda

Over the past years, uncontrolled disposal of conventional plastics has caused serious environmental damage. If not handled properly, plastics may pollute ecosystems on Earth because they do not degrade easily. This situation requires finding sustainable, eco-friendly alternatives that are safe and accessible for everyone.

To address this challenge, our project focuses on creating and developing biodegradable plastics made from natural ingredients that can be made at home. To achieve this, we produced several types of bioplastics using starch extracted from algae, corn, and potato.

In this project, we used agar starch, which is a starch made from red algae. The mixtures were gently heated until they reached a plastic-like consistency, then cooled, dried, and evaluated for flexibility, durability, texture, and drying time. Through multiple trials, we observed how small variations in composition affected the quality of the final product. The results showed that agar starch produced the most balanced and resistant plastic: it is not easily broken and presents a shorter drying time compared to the others. Corn starch also achieved acceptable results, while potato starch proved less stable and more fragile. These findings suggest that biodegradable plastics made from agar starch could serve as a viable and environmentally friendly alternative to conventional plastics, offering a practical way to reduce waste and pollution in everyday life.

J25

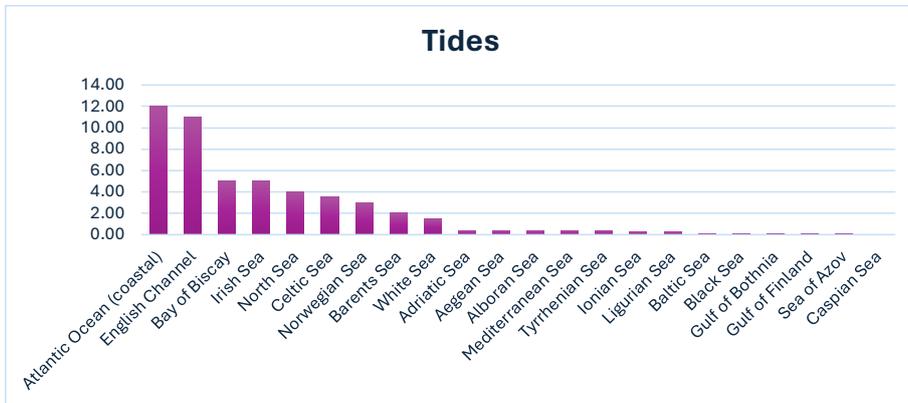
### *Tidal Power Dam*

Sara Pascual and Sonia Vallejo (S2 ESA)

European School Luxembourg 1. Mentor: ZAMBRANA, Justo

Our project is about designing a dam in a bay or cove to harness tidal energy. At the end we found out that it really exists but ours has an advantage over the other one. The structure would have a wall crossed by two tubes. One of the tubes would be inclined (with the side that goes to the inside of the dam higher than the side that faces the ocean), and the other tube would be parallel to the ground. In the first tube, there would be a turbine, a net to keep fish from entering, and a gate. In the second tube, there would only be a gate. When the tide reaches its highest point, we will close the gates and when the water level outside drops, then we open the gate with the turbine. The water inside the dam will then flow out, causing the turbine to spin. This way, we generate energy. When the tide is going in, we open both tubes so that the dam refills with water and fish can freely move between the two spaces through the second tube.

For our project to make sense, it must be in a place where tides are not too small, because building it would be expensive and it would produce less energy. The following graph shows the tidal height of all the seas in Europe.



We are planning to build a model of our project. It will include a turbine and some small light bulbs to demonstrate that we generate energy. To simulate tides, we will use a bag: when we inflate it, it represents high tide, and when we deflate it, it represents low tide. Then we found out that in la Rance, in the north of France, it already exists but it does not have the mechanism for the fish to go through.

## J26

### *Sustainable Hydroponic System using Organic Fertiliser (Food Leftovers Water)*

HOSCH, Aya Clémentine (S2 ENB); BISTI, Lydia (S2 ENA); HOSCH; Zaza Lou (S2 ENB)

European School Luxembourg 2– Mamer. Mentor: PICCOLOMINI, Angela

Despite covering nearly 70% of the Earth’s surface, water is not as abundant as it appears. Freshwater—essential for drinking, sanitation, and agriculture—accounts for only 3% of the world’s total water supply, with approximately two-thirds trapped in glaciers or otherwise inaccessible.

Consequently, an estimated 1.1 billion people globally lack reliable access to water, and roughly 2.7 billion experience seasonal water scarcity. Inadequate sanitation affects approximately 2.4 billion individuals, increasing their exposure to cholera, typhoid fever, and other water-borne diseases. Diarrheal diseases alone account for nearly two million deaths annually, predominantly among children.

For these reasons, we sought to minimise water waste by reusing water that is typically discarded, such as leftover pasta water or cold tea, to irrigate plants and promote their growth.

The idea comes from Caixa Forum Madrid vertical garden, where plants grow without soil and get nutrients from water instead. Instead of using chemical fertilisers, we used natural cooking water to see if it could be a cheaper and more environmentally friendly option. Lettuce seeds were grown using six types of water: pasta water, carrot water, lentil water, green tea, banana peel water, and tap water as a control. Three growing methods were used: a hydroponic system, petri dishes with agar, and soil in pots. All plants were kept under the same light and temperature conditions. Germination, plant length, and weight were measured after one week.



J27

### *The Perfect Potato Chip*

VINNYK, Ivan Vinnyk; DOLEZELOVA, Anna (S4DEC)

European School Munich. Mentors: ORIEFFE, Martina; FEILER, Benjamin

If you have ever made potato chips at home and you manage to get them crunchy, then you know the feeling of eating that one *perfect* potato chip, with just the maximal crunch you could ever imagine. But what if you could always recreate that amazing experience? Our experiment is exactly about finding the correct way to make the potato chips as enjoyable and crunchy as possible.

In our project, we will try to find out, under which circumstances a simple potato chip can get you the loudest and most satisfying crunch. We are already experimenting with different oil temperatures and frying times to see if that makes the difference. We are also thoroughly measuring the area of every single potato chip down to the millimeter and recording every single bite using a decibel meter and a microphone. We use two types of potatoes, bio potatoes and non- bio potatoes, to see if that is also relevant to

the crunch. Our further plans consist of trying to fry potato chips at only 120 degrees to prevent the development of Acrylamide.



J28

*GORDG: The Detention Giver*

FAGANEL, Max Tomaž S1S; DI GIOIA, Nathan S2E

European School Ljubljana. Mentor: CHARLESWORTH, Tanya

This invention is made to help teachers with detention. It is planned to look like a small, rectangular box with 3 lights and a small screen. When it hears loud noises, a green light will appear and stay green. The second time it shows an orange light and the third time it shows a red light and DETENTION will be written on the screen. Now the teacher will decide what to do. The acronym GORDG means: Green, Orange, Red, Detention, Giver. There will be one on each desk. So be aware of this GORDG, it will be well hidden!

J29

*Honey, I shrunk the balloon waste!: Sodium Alginate and Calcium Chloride Edible/Biodegradable Water Balloons Experiment and Study*

DAUD, Maryam; PATWARDHAN, Yulia

European School Karlsruhe. Mentor: BEAUFILS, Philippe

This experiment investigated the biodegradability of sodium alginate–calcium chloride balloons compared to conventional latex balloons. Both balloons were exposed to identical environmental conditions over a set period, and physical degradation was inspected and recorded. The biodegradable water balloon alternatives showed faster visual decomposition than the latex balloons, which had no physical change. These results, together with the results of some research we have done, suggest that sodium alginate –calcium chloride balloons may be a more environmentally friendly alternative to the often–used latex balloons.



J30

*The Effect of Heavy Metal Salt ( $\text{CuSO}_4$ ) on Plant Growth, and how Hyperaccumulators can protect other more sensitive plants from them*

Aina Ajda Ouattara & Timofei Kozlov (S4E)

European School Ljubljana. Mentor: CHARLESWORTH, Tanya

In this research, we will examine an extremely interesting and important topic, both for us and for society. We chose this topic above all others because it can impact our health and lives. In this study, we will explore the following questions: What happens if people stop monitoring the amount of these salts in plants? What would happen to a person if

they consumed a certain amount of these salts through agricultural crops? How might they affect the human body? How do they appear in nature? Do humans influence their levels in the soil, and if so, how? Which regions have the highest levels of these salts? Which plants absorb them? And many others. The goal of this project is to demonstrate the importance of monitoring the amount of impurities in the soil. To do this, we will take a long pot and plant sunflowers and wheat in a row. By analysing these results, we will be able to confirm or refute our hypotheses about the effects of these salts on plant growth and development, as well as demonstrate the ability of hyperaccumulators to protect other plants from various contaminants. And, of course, we will use a control group of plants aiming to prove that hyperaccumulators are capable of protecting other plants.

## Senior Projects

S1

### *Does WiFi Have an Effect on Plants?*

ASPEGREN Sophia; MORÉ NAYLOR Sara; PAPAJORGJI, David

European School Alicante. Mentor: MARTÍNEZ FABREGATE, Mauricio

With this project, we wanted to find out whether something we use every day—WiFi—could actually affect how plants grow. Since WiFi signals are all around us at home and at school, we thought it would be interesting to see if they make any difference during seed germination.

#### Process

We took two groups of bean seeds and placed them on wet cotton pads. One group was kept 12cm away from a 5 GHz WiFi router. The other group was the control, which had the exact same conditions except for the WiFi exposure. We did this three times in three different households. Both groups got the same amount of water and stayed in the same room, so temperature and light wouldn't affect the results. We tried to obtain the same conditions for both of them.

We watched them grow over two weeks and measured them every three days. We also took pictures to compare them.

#### Results

- The control group sprouted faster and looked more even and healthy.
- The WiFi-exposed group still sprouted, but the seedlings were generally shorter, less dense, and grew a bit slower.
- The difference wasn't huge, but it was noticeable enough to make us think WiFi might have a small effect on early plant growth. This is also aligned with several published studies showing that EMF can influence early plant development

#### Why This Matters

Plants are excellent biological indicators. Any measurable effect on them—especially from something as common as home WiFi—helps scientists understand how electromagnetic fields might interact with living systems. While WiFi is considered safe for humans, subtler biological impacts are still worth exploring.

## Further Studies

We are now working on:

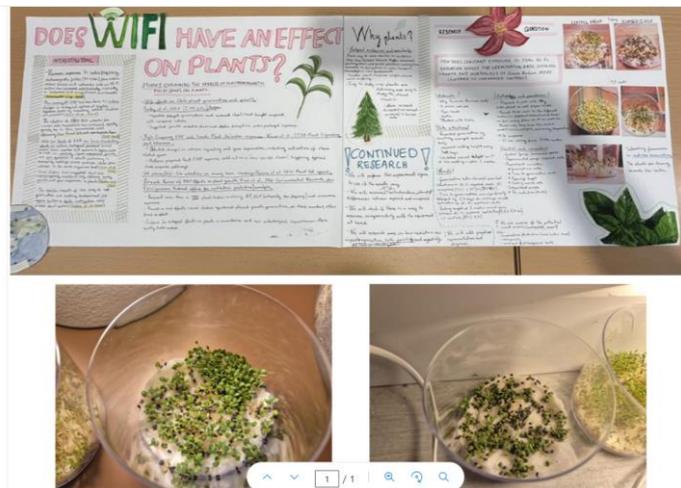
- Testing different WiFi frequencies (2.4 GHz, 5 GHz, 6 GHz)
- Changing the distance from the router
- Trying different types of seeds
- Soundwaves.

Some research says that sound—like music, vibrations, or certain frequencies—can affect how plants grow. It would be interesting to compare whether plants react more to WiFi or to sound, or if both have different effects.

## Conclusion

This project provides a fascinating look at how modern technology may interact with living organisms. While WiFi doesn't appear to severely impact plant germination, the results hint at subtle differences worth investigating more deeply.

By expanding the research—especially by comparing electromagnetic radiation with soundwave-induced plant responses—future experiments could uncover how different forms of energy shape plant biology. This opens the door to creative scientific questions, new variables, and even potential applications in agriculture or controlled-environment growing.



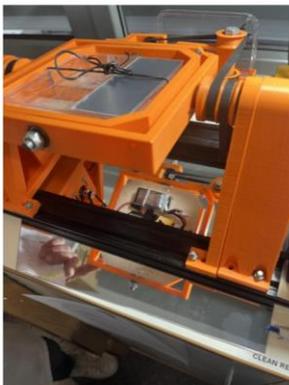
S2

*Growing Life on Mars: Investigating Plant Responses to Simulated Martian Conditions*

ARACIL PÉREZ, Carlos (S5ES), RUIZ MORENO, Candela (S5ES)

European School Alicante. Mentor: MARTÍNEZ FABREGATE, Mauricio

This project studies plant growth under conditions simulating the Martian environment, including Mars gravity and Mars atmosphere, enriched in CO<sub>2</sub> with reduced oxygen levels. To simulate the gravity of Mars, we have built our own twoaxis clinostat configured to reproduce it, allowing plants to grow in stable and controlled conditions during the experiment. Plants grown under these conditions are compared with control plants grown under Earth conditions. All selected plants have four leaves at the start and are individually weighed, allowing for precise statistical analysis and ensuring similar initial mass. An aseptic protocol is followed throughout the experiment to minimise contamination. Root growth is also measured at the end of the experiment to see if there is a change in the way plants absorb nutrients in these conditions. In upcoming stages of the experiment, the effects of other Martian factors, such as UV radiation, low atmospheric pressure, salinity, and drought, will be investigated. Each factor will be investigated separately to get more specific data. The goal is to understand which conditions challenge plant growth, and which do not, providing valuable information on how plants could develop in a Martian environment.



## S3

### *Chatbot*

Educational chatbot for bullying detection and student well-being

CARBÓ PÉREZ, Carla (S5ES), HROMEK, Timur (S5EN)

European School Alicante. Mentor: MARTÍNEZ FABREGATE, Mauricio

Our project involves developing a chatbot that will help with issues related to bullying, learning, and student well-being. This project is being carried out internationally by two students who are currently enrolled in different European Schools. As a result, the scope is broader, allowing for the analysis of outcomes among students from different countries

Bullying has become a scourge on our society. According to the data from studies by the European Union Agency for Fundamental Rights (2023) and the World Health Organisation (2021), approximately one in three students aged 11 to 15 in the European Union has experienced some form of bullying or violence in school.

As we know, the European Schools are deeply concerned to fight against this, and in order to prevent cyberbullying, Teams chats between students have been banned. However, in our team, we believe that chats are simply a tool, not the root of the problem.

Therefore, we have developed a chatbot (a system that interacts with the user in a chat interface), whose purpose is to detect and prevent bullying, improve students' linguistic competence, and become a tool for student well-being. The project has been divided into different stages:

#### 1. First stage –detection of swearwords and offensive language in Teams chats:

On the one hand, our chatbot detects swear words and offensive language in Teams chats using a workflow diagram from the Microsoft Power Automate platform. When it detects the use of a word from the list of words that should be reported, it notifies the user, and the chatbot also records the number of times the user uses it. (See Figure 1. and Figure 2.)

#### 2. Second stage – Correcting grammatical errors

On the other hand, this chatbot helps students improve their language skills. It is connected to different dictionaries, for 4 languages initially, to help them to use vocabulary and grammar properly.

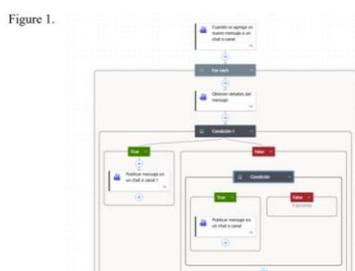
#### 3. Future goals: Third Stage – Student Well-being



In addition, in future goals for its final and complete development, the chatbot will be connected to artificial intelligence and school policies. Therefore, when it detects a situation that could be considered harassment, the chatbot will be able to act, such as contacting counsellors or notifying the group chat that the situation is inappropriate.

In summary, the chatbot we have created is a powerful tool to improve three key competencies: language skills, digital competence (critical and responsible use of digital technologies for social participation), and learning-to-learn skills (managing one's own emotions and learning independently), as well as to detect and prevent bullying and to contribute to the student well-being.

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S4

### *Chemical Conundrum (Small-Scale Experiments)*

POLECH, Oliwia, S6EN; GARCÍA DEL CAMPO, Carla, S6EN; MARTÍNEZ ALONSO, Claudia (S6EN)

European School Alicante. Mentor: MARTÍNEZ FABREGATE, Mauricio

Now more than ever, environmental sustainability has become a major global concern, as increasing levels of waste and resource consumption continue to place pressure on ecosystems. According to reports, millions of tonnes of chemical waste are produced worldwide each year, much of which requires specialised treatment to prevent soil and water contamination. Even small-scale sources of this waste, such as school practicals, contribute to this problem through chemical solutions that are often used more than what is needed. We believe that contributing to positive change can begin at a school level by

rethinking how experiments are carried out and how resources are used. The extensive use of chemicals in school laboratory experiments can lead to significant material waste, increased costs, and limited student participation, particularly in large classes. This study investigates whether microscale experimentation can provide a more sustainable and educationally effective alternative to traditional laboratory practices while maintaining reliable experimental outcomes. To evaluate this approach, the Daniell cell experiment was adapted to a microscale format by reducing the volume of copper sulphate and zinc sulphate solutions used, while keeping the experimental setup and conditions consistent. The electrical output of the cell, including voltage and current, was measured and compared with results obtained using standard laboratory volumes. In the case of titration experiments, the focus was placed on decreasing the volumes of acid solution required for each trial while preserving the original concentrations and method. The same indicator was used to ensure consistent endpoint detection. Data was collected by observing the colour change at the equivalence point and recording the titration volumes, which were then compared to values obtained from standard titrations. The results indicate that microscale Daniell cell experiments can produce clear and reliable measurements comparable to those achieved at larger scales. Reducing the volume of chemicals significantly decreased material consumption without compromising the visibility or validity of the results. Additionally, the use of smaller quantities allows more experimental setups to be prepared with the same resources, enabling greater student participation and reducing the need for repeated experiments due to errors.



S5

*Using a phone application to prevent eye strain by detecting and correcting unhealthy screen viewing habits*

DEMIR, Alp (S5ENA)

European School of Bergen. Mentor: MEIJER, Mai-Britt

People often strain their eyes by watching screens, in this case, watching phone screens from too close. This repeated eye strain can eventually lead to long-term negative effects on eye health. In order to prevent this, my project detects when the user is too close through the webcam and sends the user an alert so that they move and watch the screen from further away. This warning when the user gets too close to the screen helps break unhealthy screen viewing habits while encouraging the development of healthier viewing habits which allow for minimised eye strain and better long-term eye health.

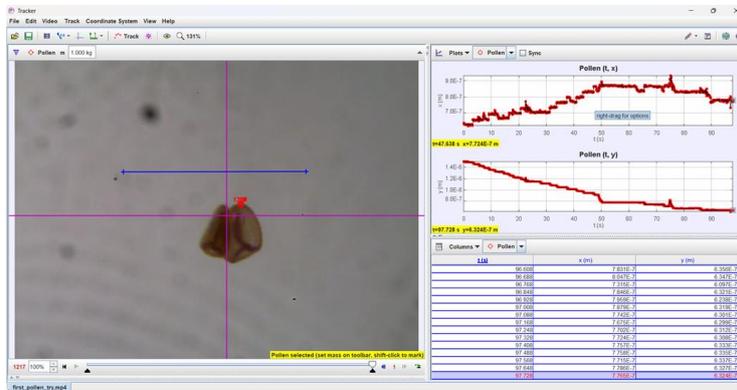
S6

*Tracking Brownian Motion*

CARUJO, Aloys; NORTON, Jake; DAVISON, Lucie

European School of Paris-La Défense. Mentor: VACCOSIN, Boris

Following Albert Einstein's description of Brownian motion in terms of atoms and molecules, Jean Perrin conducted the first of several experiments confirming Einstein's theory. However, due to the complexity of the experiment, their works are largely overlooked in high school curricula. This study investigated how size affects the movement of colloids in water. Three distinct samples of varying sizes were analysed every five seconds. Data was gathered using a Python-based program. Our study revealed that the particle with the size  $1.0 \times 10^{-7} \text{m}$  has the greatest displacement among the other particles observed. The findings suggest that particles with smaller size tend to have greater displacement.



S7

### Will it Grow Faster?

CHYLINSKA, Natalia; KUIK Martyna; FIJALKOWSKA, Ewa (S5PLA-B)

European School of Brussels I- Uccle. Mentor: CSONK, Dorottya

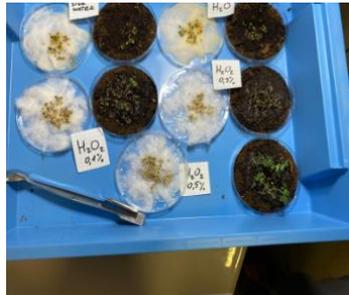
“Will it grow faster?”

In our experiment, we wanted to explore a simple but exciting question: Can plants grow faster, and if so, how? What would happen if we watered them with something other than regular tap water? Could different liquids actually speed up germination or make seedlings stronger? To investigate this, we compared tap water, distilled water, and diluted hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). We soaked the seeds in the same liquids we used for watering and placed them on cotton and in soil to find out which environment helped them sprout best.

During the experiment, we tested several seed types and adjusted our hydrogen peroxide concentrations to make sure they were safe for the plants. We experimented with mustard seeds, cress, and even beans, while carefully preparing diluted solutions of 0.1%, 0.3%, and 0.5%. These steps helped us observe plant reactions under different conditions and better understand how each liquid could influence early growth.

This project allowed us to explore how everyday substances might affect plant development and raised new questions about how simple changes in watering could

impact gardening or farming. Future research could apply these liquids to larger plants or crops to discover whether similar effects appear on a bigger scale and what impact this might have on everyday life.



S8

### *Comment fonctionne un robot d'échecs?*

CHATARD-MOULIN, Alexis; NERO, Gabriel

European School of Brussels I- Uccle. Mentor: CSONK, Dorottya

Le jeu d'échecs est un jeu de société complexe, ancestral mêlant à la fois réflexion et stratégie. L'objectif de ce projet est de présenter le fonctionnement d'un robot d'échecs.

Premièrement, notre projet est consacré à l'étude d'algorithmes de base de jeu d'échecs, comme l'arborescence Minimax ou les fonctions d'évaluation. L'algorithme Minimax, par exemple, permet de calculer récursivement chaque branche de coups possibles, jusqu'à une certaine profondeur donnée. L'évaluation, ensuite, permet d'approximer l'avantage d'un joueur lors d'une position d'échecs donnée.

Deuxièmement, nous avons aussi, en guise d'expérience, développé un robot d'échecs en Python. La réalisation de ce robot nous a permis de mettre en pratique les algorithmes mentionnés dans la première partie, ainsi que d'en mesurer leur efficacité.

Lors de la présentation, nous expliquerons comment fonctionnent les robots d'échecs, de manière intuitive et dynamique, à l'aide de notre robot. En outre, nous présenterons aussi les difficultés rencontrées lors de l'élaboration de ce robot.

Un robot peut toujours être amélioré en termes d'efficacité et de rapidité. Nous essaierons finalement de montrer les améliorations possibles pour rendre un robot

d'échecs plus performant, à la fois celles que nous avons implémentées et celles que nous n'avons pas eu le temps ou les compétences de réaliser.

Le code source de notre projet, ainsi que des cahiers exécutables pour plusieurs systèmes d'exploitation sont disponibles à l'adresse suivante : <https://github.com/GNInk-code/Tobi-Chess-bot>.

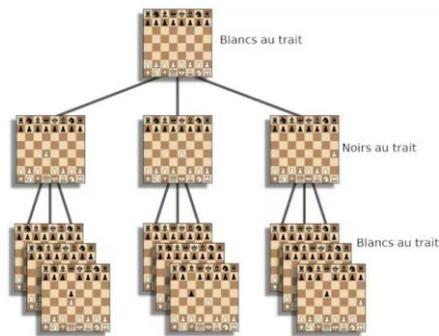


Figure 1 : Exemple graphique simplifié d'un arbre de décision

S9

### *Detecting Cortisol with a Colorimetric Biosensor*

MANGA HORLBECK, Louise-Eleanor; DI PALMA, Frida, ASTON, Torin

European School of Brussels I- Uccle. Mentor: CSONK, Dorottya

What is our project's purpose? We adapted a biometric colour sensor to detect cortisol in the human body. We got our ideas from examples from nature such as seahorses changing their colour when stressed. There are a lot of stress-related diseases or diseases that can worsen due to stress, which is why it is important to know beforehand if there is cortisol in the body. Our aim is to help these people detect cortisol as fast as possible so that measures can be taken.

Cortisol is a hormone produced by the body in response to stress. It helps regulate metabolism, reduces inflammation, controls blood pressure, and helps the body react to danger. It is important to be able to detect cortisol since it can lead to stress-related diseases, such as Cushing Syndrome or Adrenal Adenoma. This means that conditions

can be caused or worsened through the stress hormone cortisol, making it even more important to detect it early on to be able to act faster.

In our experiment, we used a colourimetric sensor that detects substances through visible colour changes. Such sensors are useful because they are fast and easy to observe. In nature, similar mechanisms exist, such as animals changing colour in response to environmental or physiological stress. In another experiment, the reversibility of our sensor was tested by using an ultrasonic cleaner. This would make the sensor practical to work with and cheaper. To gain better insight, we looked at the sensor under a microscope at 400 times magnification. The aim of this experiment is to develop a simple colourimetric biosensor capable of detecting cortisol through a visible colour change.



Figure 2; Agglomerated Nanogold in a tube



Figure 1; Microscope with 400x magnification

S10

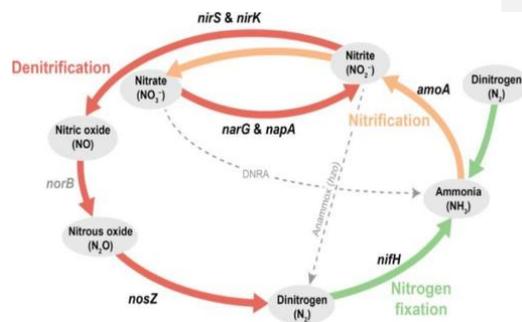
### *When Plastics Meet Microbes: How Microplastics Affect Ammonia-Oxidizing Microbes in Agricultural Soils.*

NINU, Izabela (S7FRA); PASCA, Maia (S7ROA),

European School of Brussels IV–Laeken. Mentor: CLEMENCE, Olivier

Microplastics (MPs) are increasingly showing up in agricultural soils. In our earlier work, we found that polyethylene (PE) microplastics altered nitrate levels and interfered with the nitrogen cycle during watercress plants growth. This raised an important question: could MPs be affecting the microbes responsible for nitrification, the process that converts ammonium into the nitrate that plants can use?

In this project, we will explore whether PE microplastics change the abundance and activity of ammonia-oxidizing bacteria (AOB) and archaea (AOA), the microbes that drive the first and rate-limiting step of nitrification. Because nitrite is highly transient, we will focus on ammonium oxidation by quantifying the *amoA* gene, which encodes the key enzyme ammonia monooxygenase and serves as a reliable marker for nitrification potential.



We grow lettuce (*Lactuca sativa*), dandelion (*Taraxacum officinale*), and flatweed (*Hypochaeris radicata*) under controlled 12-hour light/dark cycles in soils with increasing PE microplastic concentrations (0%, 1.5%, 2.5%, 3.5%, and 5%). Soil nitrate will be measured using a Vernier nitrate probe, while microbial DNA will be extracted using a soil-specific kit. We will use qPCR to quantify *amoA* in both AOB and AOA, giving us a picture of how nitrifying microbes respond to microplastic contamination.



Conducted in collaboration with the ULB Laboratory of Agroecology and the Crop Production and Biostimulation Laboratory, this study will shed light on how microplastics may interfere with early nitrification steps by altering microbial communities. By combining chemical measurements with molecular analysis, we aim to uncover the mechanisms through which MPs affect soil nitrogen cycling, and ultimately, plant nutrition.

S11

*A Natural Household Spray Using Allium Ursinum (Wild Garlic) as a Biopesticide Agent*

GEORGESCU, Erica Ioana (S5ROa), PREDOIU, Ilinca Georgia (S5ROb), APOSTOL, Clara (S5ROb)

European School of Brussels IV–Laeken. Mentor: PALAGHICIUC, Gabriela

This experiment wants to investigate whether *Allium Ursinum* (wild garlic) can be used as a natural biopesticide to repel or kill common household pests in an eco-friendly and safe way, compared to chemical sprays.



**Introduction:** Many households use chemical biopesticides to control insects and other pests. However, these products often contain synthetic substances that can harm the environment, pets, and even humans. Natural alternatives, such as plant-based sprays, are becoming more popular because they are biodegradable and less toxic. *Allium Ursinum*, also known as wild garlic, contains sulphur compounds like those found in cultivated garlic, which are known for their antimicrobial and insect-

repelling properties. This project explores whether wild garlic can act as an effective natural biopesticide. The experiment aims to test if the spray can act as well as a chemical one.

**Method:** We will be making different plant-based sprays out of natural, environmental-friendly ingredients.

**Products used:** The experiment consists in testing 3 sprays with different base ingredients: water, alcohol and oil. To obtain these, we used dried wild garlic (since *Allium Ursinum* does not grow at this time of year). This plant has proved not to be very pretentious after it matures, however seedlings grow slowly at first. Springing starts at about 4 months after being planted (indoors) and achieves maturity only after 2–3 years. Although it is hard to maintain when growing, once it reaches full maturity it is a very easy plant to maintain.

To make the alcohol extract, we used 2 grams of *Allium Ursinum*, 25 millilitres of alcohol (ethanol, 40% and 60%). Since these plants have a naturally strong smell and are proven efficiently to have insect-repelling properties, the spray can be enriched with lavender,

though it is yet to be determined if it dulls the effect of the Allium Ursinum or if it reacts with the compounds of the plant, changing the chemical properties.

Furthermore, the remaining two solutions, namely the oil and water extracts, were prepared using the same procedure. The oil extract was obtained using 2 grams of plant material and 25 millilitres of oil, while the water extract was prepared with 2 grams of plant material and 125 millilitres of water.



## S12

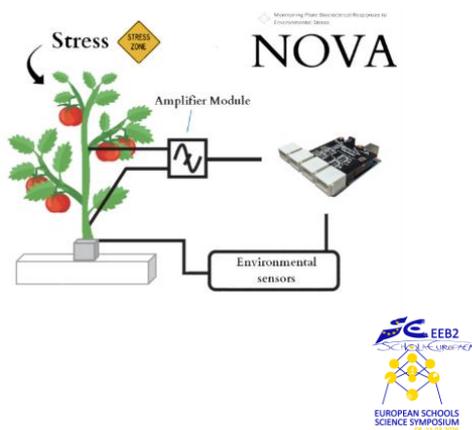
### *NOVA – Detecting Early Plant Stress Through Electrical Signaling*

BOCHEV, Boyan (S6BGa); NATSEV, Tomislav (S6BGa); GEORGIEV, Kaloyan (S6BGa)

European School of Brussels IV–Laeken. Mentor: Olivier CLEMENCE

Plant electrophysiology offers a way to track plant health through electrical activity. Recent work shows that plants react to specific stressors with measurable electrical patterns. Yet few studies have investigated whether these signals can serve as an early-warning indicator of overall plant health. Our goal is to build a simple model that links electrical activity to plant stress. If such a link exists, it could provide a practical method for detecting stress before visible symptoms appear.

We grow a set of tomato plants under controlled settings and expose them to different degrees of abiotic stress. For each tested variable – temperature, light, moisture, and pH – five plants are used: one as a control, two under mild stress, and two under severe stress, ensuring replicability.



We use non-invasive electrodes connected to a low-noise amplifier and an Arduino-based data collection system. At the same time, we collect environmental data through temperature, light, moisture, and pH sensors. The collected signals undergo noise reduction, and we then compare the electrical patterns observed across the stress levels.

Fig. 1: NOVA schematic diagram

We expect stressed plants to display clear shifts in electrical activity compared with the control group. We aim to check whether such patterns remain consistent across conditions.

This approach matters for researchers, agronomists, and growers who need a simple way to monitor plant stress. NOVA seeks to show that electrical signals can reveal problems before visible symptoms appear, which can support better irrigation, reduced losses, and clearer insight into plant adaptation.

By keeping the method accessible, we want to make plant electrophysiology useful outside specialised labs. If a clear signal pattern remains across conditions, NOVA could offer a practical tool for early stress monitoring.



S13

### *A Quantitative Analysis of the Riparian Zone of the Woluwe River and its Impact on Pollution within the Brussels Capital Region*

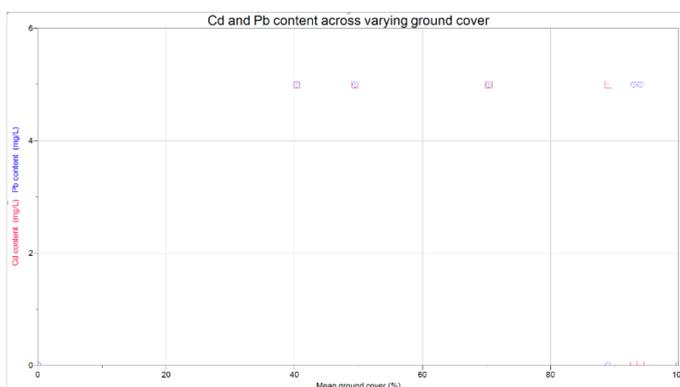
DI VEROLI, Agata S6ENB; HOLTEN, Mathilde S6ENC; KOWALSKA, Alicja S6ENC

European School of Brussels IV-Laeken. Mentor: PASSARO, Romina

Our study consists of a quantitative analysis of the riparian zone of the Woluwe river within the Brussels Capital region. We are investigating the effect of width of the riparian zone and the ground cover, as well as the presence of phytoremediating species on the possibility of the riparian zone mitigating road runoff from the nearby R22 route with significant traffic, analysing the pH, presence of thiophene (an organosulfur compound present in petrol and thus emitted from car exhausts), and concentration of Pb and Cd at seven different sites along the overground section of the Woluwe with varying riparian zone widths and ground cover.

We hypothesise that the larger the width of the riparian zone and the more bioremediating species there are, the lower the acidity and content of Pb and Cd, and the likelihood of the presence of thiophene there will be. We have conducted transect studies of the riparian zone from the water to the end of the riparian zone (based on terrain slope, soil humidity and presence of upland plants criteria). We have used test strips for the analysis of pH, and Pb and Cd concentrations in water samples from our experimental sites and the source control (where the Woluwe river surfaces for the first time), and we have plotted graphs of the levels of these parameters against the width of the riparian zone, and mean ground cover of the site.

Subsequently, we will evaluate the correlation of the quantities using the Spearman test and the indophenine reaction to detect the presence of thiophenes in each of our experimental samples and source control.



S14

### *How to Dye Fabric Sustainably Using Lichen*

SIVASHANKAR, Rishikaa (s6En)

Lycée Edward Steichen, Clervaux, Luxembourg. Mentor: Dr. FODOR, Zoltan

Lately, people have been looking for ways to make clothing and fabrics more eco-friendly. Regular fabric dyes can harm the environment because they often contain chemicals that pollute water and soil. One cool and sustainable idea is to use fungi called LICHEN to make natural dyes. These fungi can produce bright colors that could replace synthetic dyes in a safer way.



In my project, I'm testing how different fungi can be used to dye fabric in a natural and eco-friendly way. I'm working with several species of lichen found in our everyday normal forests. These fungi can produce colourful pigments that can stain fabric without the need for harmful chemicals.

I'll be growing these fungi on nutrient agar and then using the pigments to dye small pieces of fabric. I want to compare how well each colour sticks to the fabric, how bright the dye looks, and how it attracts the eyes. By doing this, I hope to find out which lichen produces the most vibrant and long-lasting colours. It's also a chance to see how biology can be used in creative ways, like designing eco-friendly art and textiles.

I'm doing this project to learn more about sustainable science and to show that we can use nature to solve problems. If natural dyes work well, they could help reduce pollution and make fashion more eco-friendly. It's also a fun way to mix biology with creativity and learn something new.

S15

### *Smart Healing Bandage*

By MURALIDHARAN, Trajan Muralidharan; VOLK, Paul-Rubens (S5 EN)

Lycée Edward Steichen, Clervaux, Luxembourg. Mentor: Dr. FODOR, Zoltan



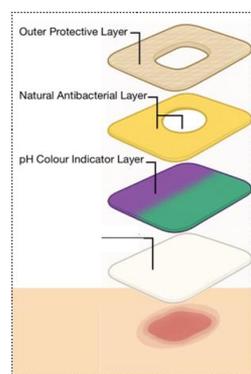
#### Abstract

Chronic wounds pose many issues for diabetic people, often healing slowly with an increased risk of severe infection and possible amputation. This complication inspired the following project which aims to develop a *Smart Healing Bandage* designed to both accelerate tissue regeneration and track healing progression through a colour-changing

pH indicator. The bandage consists of four main layers, combining the essential components of a traditional bandage with innovative ones. These include a natural antibacterial layer to prevent infection and a pH-sensitive gel that changes colour to measure the wound's acidity—where alkaline levels suggest infection, whereas neutral levels indicate proper healing. This simple visual detection system enables both patients and physicians to easily monitor the state of their wound without removing the bandage, significantly reducing the risk of infection and the overall cost of diabetic wound treatment.

#### Hypothesis

An innovative bandage that integrates an antibacterial component and a pH-sensitive layer will facilitate tissue regeneration and prevent dangerous inflammation or infection of diabetic people's wounds.



S16

#### *AI for Knowing our Food Carbon Print*

DUBOIS, Hadrien (S5EN)

European School of Frankfurt. Mentor: SYRRIS, Ioannis

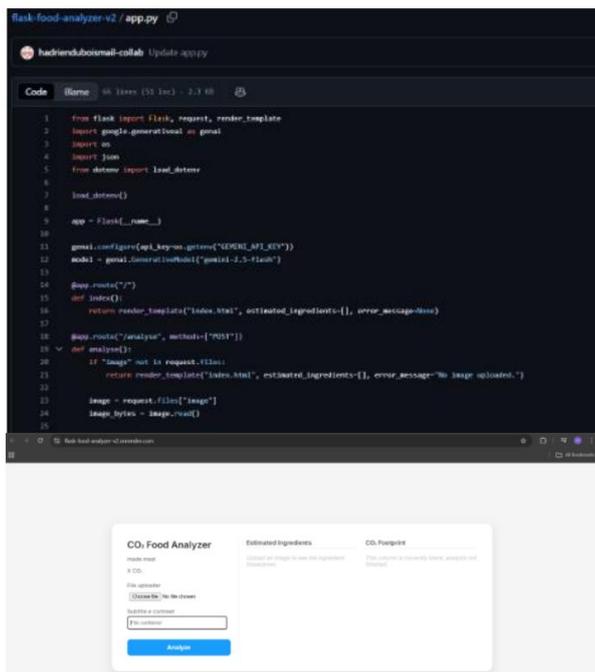
For my Science Symposium project, I developed a prototype website designed to analyse images of food to identify the items shown and estimate the amount of CO<sub>2</sub> emissions associated with producing them.

The main goal of this project is to explore how artificial intelligence can help consumers better understand the environmental impact of their dietary choices. The system uses an

image-recognition model to detect food items from a photograph and then links these results to carbon-emission data from environmental databases.

After several weeks of development, I have created a functional prototype capable of analysing an image and reporting what food is present. The website is hosted on Render, and the code is stored in a private GitHub repository.

Below is an image demonstrating the current state of the prototype:



Screen shots of code and results

S17

*Les vers de cire (Galleria mellonella) face au polyéthylène basse densité : un espoir durable contre la pollution plastique ?*

DE FLINES, Claire; VERSTRAETEN, Olivia (S5FRA)

European School of Frankfurt. Mentore : KERVARREC Amaël

La pollution plastique, notamment par les microplastiques, est un problème environnemental mondial critique, avec une production annuelle dépassant 430 millions de tonnes.

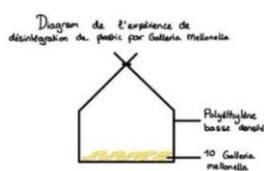
Notre projet explore la capacité des larves de la fausse teigne de la cire (Galleria mellonella) à dégrader le polyéthylène basse densité (PEBD), un plastique très courant.

- Observation Initiale : En moins de 48 heures, 10 larves enveloppées dans une bande de PEBD l'ont percé et partiellement consommé, confirmant leur capacité à attaquer rapidement le plastique, potentiellement grâce à des enzymes salivaires.
- Objectif de l'Expérience : Déterminer si les larves biodégradent réellement le PEBD en molécules organiques (dégradation complète) ou s'il s'agit d'une simple fragmentation mécanique (sans dégradation complète).
- Méthode : Nous comptons analyser les excréments des larves à l'aide de la méthode de détection Erasmus Maris (JRC) pour rechercher la présence de microplastiques.

La compréhension de ce mécanisme est essentielle pour évaluer le potentiel des larves de Galleria mellonella comme outil biologique durable et naturel pour atténuer la pollution plastique et microplastique à l'échelle mondiale.

Source : <https://www.un.org/sustainabledevelopment/blog/2023/08/explainer-what-is-plastic-pollution/>

Fig 1 : Schéma du dispositif expérimental et du constat initial



S18

### *Antibacterial Mushroom–Based Wound Bandage for Improved Skin Healing*

EIRICH, Margareth (S7DEB); GRUN, Valérie (S7DEA)

European School RheinMain. Mentor: Dr. SAMLAND, Anne

Cap & Care addresses the significant environmental problem of plastic waste from conventional adhesive bandages (4) and the lack of green innovation in medicine. We propose an antibacterial (3) alternative made primarily from the Wood Ear mushroom (*Auricularia auricula-judae*) (5) as a solution to these problems (1). Scientific literature shows that this mushroom's protein extract (2) possesses natural wound-healing and antimicrobial properties, as well as a fibrous structure suitable for cloth manufacturing, making it the perfect candidate for sustainable wound care.

We aim to design, fabricate, and test a functional prototype. Our methods involve cultivating the mushroom, processing it into a flexible "cloth" for the bandage backing, preparing a protein extract for the wound pad, and formulating a natural gelatin-based glue for stability and skin adhesion. We will then test performance criteria, including moisture permeability and skin adhesion, against a conventional commercial bandage, since the testing of antimicrobial properties is restricted and has been successfully demonstrated previously (5).

As this is a project focusing on design and development, we present predicted results based on our research. We expect the Cap & Care bandage to demonstrate comparable. This project demonstrates how a natural design can be innovative and exhibits how eco-friendly medical solutions can reduce environmental impact.

S19

### *Machine Learning–Based Screening of Catalysts for CO<sub>2</sub> Reduction*

MAHAJAN Shivansh; ROCA LAUINGER Cristian (S6)

European School Karlsruhe. Mentor: MÖLLER, Friedrich

Climate change remains one of the world's most urgent challenges, largely due to rising CO<sub>2</sub> levels in the atmosphere. At the same time, many regions—especially across parts

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of Africa—struggle with food shortages caused by droughts, poor soil quality, and unstable weather conditions. These issues put millions of families at risk of malnutrition.

Our project explores a scientific approach that could help both problems: using artificial intelligence to identify catalysts capable of converting atmospheric CO<sub>2</sub> into useful edible compounds such as carbohydrates. Instead of allowing CO<sub>2</sub> to contribute to global warming, the goal is to transform it into ingredients that can support food production.

A major challenge is finding the right catalyst—a material that triggers and speeds up the reaction turning CO<sub>2</sub> into carbohydrates. Traditional laboratory testing is extremely slow because thousands of materials must be examined one by one.

To solve this, we are developing a machine-learning model trained on the Open Catalyst Project dataset, which contains millions of atomic-level simulations showing how CO<sub>2</sub> interacts with different materials. By learning from this data, the AI can predict which catalyst structures are most promising even before they are created in a lab.

This approach allows us to explore millions of possible materials quickly. The AI highlights the best catalyst candidates, which can then be tested and refined. If successful, this method could contribute to reducing greenhouse gases, at the same time also helping create new ways to produce food ingredients, addressing both climate change and global food scarcity.

S20

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### *The Potential of Fungal Mycoremediation for Soil Depollution Using Pholiota and Pleurotus Mushrooms*

Zoé NAGY, Melina RAPTIS, Mia GUERRERO (S6FRD)

European School Brussels II– Woluwe. Mentor: DUQUENNE, Nicolas

Soil pollution caused by human activities is a major environmental threat, as contaminated soils can negatively impact ecosystems and human health. Most traditional soil remediation methods currently in use remain expensive and environmentally invasive, which motivated the investigation of a more biological alternative, such as mycoremediation. In this experiment, the aim was to evaluate the potential role of mushrooms in pollution reduction by assessing whether *Pholiota adiposa* and *Pleurotus ostreatus* mushrooms can reduce pollution levels in contaminated soil using a controlled experimental model.

Mycelium cultures were first developed under sterile conditions on Potato Dextrose Agar (PDA). Sixteen substrates were prepared using either hay or sawdust, sterilised at 120°C for three hours. To simulate hydrocarbon contamination while ensuring laboratory safety, oxidised vegetable oil was used instead of real hydrocarbons. Four experimental conditions were established for each substrate: direct mycelium injection, PDA culture with oxidised oil, PDA culture with oxidised coloured oil, and a water-only control group. Each condition was tested with both fungal species. Growth was monitored macroscopically, and microscopic observations were performed after several weeks of growth to detect and inspect lipidic residues.

Out of sixteen trials, six showed successful mycelial development. *Pleurotus ostreatus* demonstrated significantly better growth than *Pholiota adiposa*, accounting for five of the six successful trials. *Pleurotus* mushrooms grew comparably on oily and non-oily substrates and showed greater resistance to mold contamination. In contrast, *Pholiota* growth was frequently inhibited by contamination, which limited the interpretation of results. Hay substrates supported mycelial development more effectively than sawdust, while the combination of sawdust and *Pholiota* produced no successful growth. Microscopic analysis confirmed the presence of oily residues in treated samples.

These results suggest that *Pleurotus ostreatus* shows greater tolerance to hydrocarbon-like substrates and may be more suitable for mycoremediation applications. However, contamination and substrate choice significantly influence experimental outcomes and should be carefully controlled in future studies.

S21

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### *Pressure Sensing Shoes Through Electromagnetic Induction*

PATRICIO-LEIDEKKER, Gabriel; FLETCHER, Maya; EBERSOLD, Christine Rose (S5EN)

European School of Strasbourg. Mentor: CHAKER, Ziyad

Europe is facing an unprecedented energy crisis in this modern world, which is currently being addressed through joint policy efforts. The ongoing events in Europe and the prior pandemic have contributed to inflation and the current shortage of energy resources. Governments have imposed and implemented measures to reduce gas and electricity use and avoid waste. A recent report of the European Commission, “2024 State of the Energy Union Report”, published on 11th of September 2024, describes how the EU has managed all these challenges. We have found a potential start to a new perspective, a new way to remedy these issues. This was the inspiration for our project. However, upon

further examination and experimentation, it was determined that the electricity produced would be too little and thus insufficient in powering even the smallest device. Consequently, we decided to alter the aim of our project whilst still using the same concept.

Inspired by the motion of walking, our project aims to develop shoes capable of generating electricity using minute solenoids encrusted in the studs. These studs would then move up and down, based on the person's steps, moving the neodymium magnet through the copper coils surrounding it, generating usable electricity. Instead of this electricity being stored for later use or to power a device, it would be used to send signals to another device such as a phone to be interpreted and the data collected. This data would be, for instance, where more pressure was applied by the foot.

We experimented using the voltage measured in a way that simulates a person walking and concluded that over a day, a walking person could generate a small amount of electricity. The solenoids would have to be arranged in individual circuits, each one connected to a voltmeter which would in turn be capable of transmitting the voltage produced by the speed at which the magnet travels through the coils to a receiver. This receiver would then be able to correlate the voltage produced to the force that is being applied to the shoe. We do not, however, currently have access to such voltmeters, small enough and capable of transmitting signals, but it would be feasible in the future. This device could be turned into a tool providing insightful details for an amateur runner or elite runner wanting to perfect their art or for rehabilitation (e.g. a person who has trouble walking or has been injured recently could use these shoes to determine further problems or to solve issues).

S22

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### *Effects of Bilingualism on The Brain*

PEREZ, June Coll; ABUBAKIROVA, Vera (S6EN)

European School of Strasbourg. Mentor: TOURON-TOUCEDA, Patricia

Bilingualism and multilingualism are important characteristics in modern societies, particularly within international and European school systems. Our study examines the cognitive and psychological effects of bilingualism in adolescents aged 12 to 18, with a

focus on executive functioning, language processing, and the spreading of learning-related difficulties. A large-scale survey-based methodology was employed across multiple educational and social contexts, resulting in a final sample of 612 participants. The survey investigated language background, frequency of language switching, academic language use, perceived cognitive load, and the presence of diagnosed or self-reported learning difficulties such as dyslexia and dysgraphia. Statistical analysis revealed no significant correlation between bilingualism and diagnosed learning disabilities. While a substantial proportion of bilingual participants reported challenges in reading, writing, or spelling, these difficulties were not predictive of a disability and rather reflected the increased cognitive demands of managing multiple linguistic systems. The results support the view that bilingualism shapes cognitive processing without constituting a risk factor for neurodevelopmental disorders, and they highlight the importance of pedagogical strategies that recognise bilingual cognitive diversity.

S23

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### *Harvesting Every Step: A Piezoelectric Power System for Autonomous In-Shoe Signaling*

SALFA, Jacopo Lawrence; ADAMCZYK, Mikolaj; MARTINEZ, Alessio

Tallinn European School. Mentor: EFATI, Salma

Over the past decades, technological advancements in the field of extraction of natural resources have greatly increased operational efficiency. However, worker safety technologies remain limited in accessibility and carry large costs with them. In our research, we sought to investigate the feasibility of energy generated by piezoelectric Energy Generators to power low-energy safety devices, specifically a 433MHz radio transmitter.

To do so, we designed and created a shoe sole via 3D printing, made with TPU plastic, and integrated 34 piezoelectric sensors inside. Mechanical pressure from walking was used to generate electrical output, which we then measured in a controlled environment. Firstly, we connected the Piezoelectric system directly to an AC voltmeter, where we documented peak AC voltage at 28V and average at 16.41V. For the second measurement, the self-developed AC to DC converter diode was connected to the multimeter. Peak DC was recorded at 18V, while the average was at 12.24V. Another measurement done was current. Documented amperage reached as high as 200uA.

These outputs ensured that our transmitter operated successfully. Our prototype recorded a range of 19m vertically and 17m horizontally, with a margin error of 5%.

These results demonstrate the potential of footwear-based piezoelectric energy harvesting as a low-cost power source for low-energy safety devices. This approach shows promise as a low-cost, self-sustaining technology for enhancing the safety of workers in hazardous environments, such as caves.

S24

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### *LaLaFocus: The Effect of Different Music Genres on Attention and Concentration in Adolescents*

AVRAM, Raisa Maria; MATHIOUDAKI Androniki Sotiria; FOTOU, Margarita (S5EN)

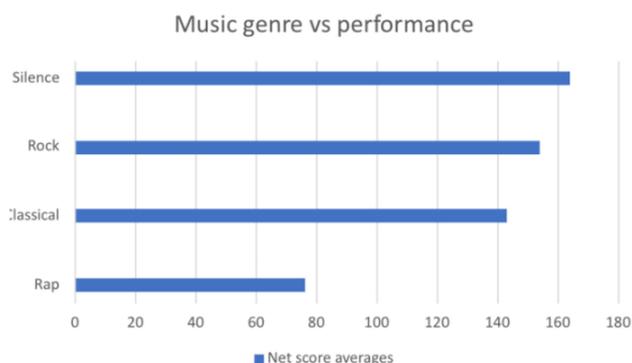
International European School Warsaw. Mentors: Ewelina Kowalska, Berenika Targos – Panak

Learning and music are both common parts of adolescents' daily lives, with 50–60% of teenage students listening to music while studying. While previous research suggests that music can improve focus and concentration, the effects may differ depending on the genre. The aim of this research was to analyse the effect of different background music genres that adolescents listen to daily and while studying their attention and concentration.

During this research, an experiment was conducted on approximately 40 high school students aged 14–17. The experiment consisted of completing two questionnaires and four letter-cancellation tasks like the d2-R Test of Attention while exposed to four different music settings: rap music, classical music, rock/alternative music, and silence. Each task lasted 90 seconds. Student performance was evaluated using hits (correctly marked target letters), errors (wrongly marked non-target letters), net score (hits–errors), accuracy percentage (hits/target letters 100), and efficiency (net score/second). Furthermore, pre- and post- questionnaires were used to assess students' study habits, daily listening habits, sleep duration, self-reflection on concentration, and expectations regarding the music and concentration/attention task.

The results showed that silence produced the highest concentration and performance scores, followed by rock and classical music, which had similar performance levels. Rap music resulted in the lowest scores out of the four. These outcomes also revealed that older students tended to perform better on concentration tasks than younger students. Additionally, students' expectations, such as assuming that rock, rap and classical music would be the most helpful, did not fully correspond with the task results.

Overall, these findings suggest that while daily listening habits and personal preference influence expectations, silence as well as slower and more mellow tracks may be more effective for attention and concentration-based tasks.



S25

Commented [F(11)]: PR Faller

### *Sustainable, Biological Electricity Production using Bacteria, Assisted by Algae in a Microbial Fuel Cell*

ZOBELL, Matti; KRASA, Jiri; POPESCU, Adrian (S6NL)

European School Mol. Mentor: VERSTAPPEN, Roel

The microbial fuel cell could be one of the answers to the search for an alternative to fossil energy. This is why multiple designs and setups were explored during this research.

Algae and collected bacteria were grown to set up a microbial fuel cell. In this design, bacteria act as the anode, breaking down organic molecules, and the algae as the cathode, accepting the freed electrons of the broken-down molecules. Two types of microbial fuel cells were built: a dual chambered setup and a single chambered setup.

The dual chambered fuel cell is made of two chambers, algae and bacteria. There is an electrode in each and the electrodes are connected by an electrical wire. A salt bridge ( $\text{KNO}_3$ ) connects the two.

The single chambered fuel cell consists of a single cell with a layer of mud at the bottom and on top of that algae culture. One electrode is completely buried under the mud while the other floats in the algae. Both are connected by an electrical wire; no salt bridge is needed.

The results indicate that the single cell setup produces a lower voltage (81,2 mV) compared to the dual cell setup (331,0 mV).

When comparing amperage, on the other hand, the single cell produces a higher amperage (26,8  $\mu\text{A}$ ) compared to the dual cell (0,988  $\mu\text{A}$ ). This leads to the conclusion that each design has its advantages and disadvantages. As the difference between the setup with and without algae was too small, this leads to the conclusion that the most efficient microbial fuel is without algae as they are redundant.

S26

Commented [F(12)]: PR Faller

### *The Effect of Sound on the Efficiency of our Memory*

MAKRI, Veatriki , GURGENIDZE, Kesaria , PETROVIC, Stefan

European School Paris la Défense. Mentor: GEORGOUDIS, Panagiotis

In this collaborative experiment, we focused on the way different sounds and frequencies affect our memory. We analysed the effects of each sound category by conducting a test. More specifically we have chosen memory cards in order to evaluate the sound's efficiency in terms of memory. Our experiment was spread out over four weeks. The volunteers therefore completed the test a total of four times. The test remained the same during the whole experiment while the sounds were different each time. Therefore, the memory cards were treated as our controlled variable and the sound was considered our independent variable. The sounds that were considered were silence, binaural beats (*Water*, by the Binaural Monk), jazz (*So What*, by Miles Davis) and finally heavy metal (*Odyssey*, by Scale the Summit).



In order to prevent the memorization of the results from the memory cards completed by the volunteers, the experiment was conducted over an interval of one week for every sound. Furthermore, we have chosen certain intervals from each of those sounds that were played in a loop throughout the duration of the experiment, ensuring the consistency of our results.

With our obtained results, we constructed a graph showcasing our findings which helped us highlight the sound that best affected memory in contrast with the least effective one.

This allowed us to compare the results of the sounds with those of silence, determining the best possible solution for the brain to work more efficiently and recall elements more rapidly.

S27

Commented [F(13)]: PR Faller

### *“Revolution” of Crickets*

DRAGOMIRESCU-GAINE, Silvia; GHERGHI, Cristina Anca; YESILDAL, Sinem Bilge (S5ENA)

European School of Varese. Mentor: DUDAL, Charlotte

Our study uses hand-collected data from a home experiment to examine how external factors affect cricket survival in winter. We used 4 different groups of 5 samples each and exposed each group to the same environmental conditions: one group of paired crickets, one group of single crickets, one group of single crickets but exposed to stress (stress = being shaken 4 times a day), and one group of 5 crickets per sample.



Each group would be placed outside at night where temperatures ranged between 6°–10°C and would be placed back inside in the morning having spent an average of 8 hours outside. Our experiment lasted a total of 14 days in which observations of each sample were made daily and an “activeness index” was assigned.

We find that in nature, crickets are a solitary insect, but our experiment leads to the conclusion that being in a big group and having a low level of stress can in fact make crickets survive longer in cold climates. Finally, we discuss which factors could increase crickets' survival in nature.

S28

### *Vitamin C: Absorption and Heat Stability*

KUBISTOVA, Karla; PUDILOVA, Lucie; VASS, Magdalena S6CSA

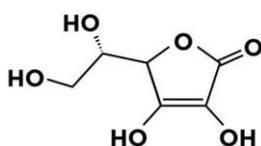
European School Brussels III–Ixelles. Mentor: CREEDON, Helen

Vitamin C, also known as ascorbic acid, is an essential water-soluble vitamin that plays an important role in human health due to its antioxidant properties and its involvement in immune function, collagen formation, and iron absorption<sup>1</sup>. Since the human body cannot synthesize vitamin C, it must be obtained from food, mainly fruits and vegetables; however, vitamin C is highly sensitive to heat and can be significantly degraded during cooking<sup>1</sup>.

The aim of this study was to investigate how different heating methods affect the degradation of vitamin C and to compare microwave heating with water bath (boiling) heating. Vitamin C concentration was determined using a spectrophotometric method based on the reduction of the dye DCPIP (2,6-dichlorophenol-indophenol), which absorbs light best at 520 nm. Samples were heated for different time intervals and measured repeatedly to ensure reliable results.

The results showed that heating causes a decrease in vitamin C concentration, with microwave heating leading to a faster loss compared to water bath heating. These findings support the hypothesis that microwave heating accelerates vitamin C degradation and highlights the importance of cooking methods in preserving nutritional value.

#### ASCORBIC ACID - Vitamin C



S29

### *Lightning in a Bottle?*

WEIXLER, Lili (S5S)

European School Ljubljana. Mentor: CHARLESWORTH, Tanya



**Commented [VJ14]:** Jména a název školy uveďte do těla dokumentu a školu nezkráceně. Pokud chcete něco dát do hlavičky, dejte tam název projektu.

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**Commented [F17]:** PR Faller

Lightning in a bottle? A fairy tale surely... And yet, to me, it seems not unlike a lightbulb; the filament removed, an arc of electricity replacing the emptiness left in its wake; or in more concrete words a reality. A bolt of lightning is not uncommon, occurring during most thunderstorms, almost globally, save for places like Antarctica and Egypt. Think on that for a moment, see forwards, cast your gaze upon the Polar regions; there may be a lack of what we call everyday storms, but there is a surplus of magnetic storms, the result of which are Auroras.

Now, not many have seen one in person, as that usually requires travel to the northern or southernmost parts of the Earth, but what if they could be carried around? In a flask perhaps? To me that sounds much more mystical. Not for long, I hope; it is one of my dearest wishes to create such a phenomenon. An Aurora in a bottle; it is that which I aspire to accomplish, although an Aurora in a terrarium is probably more feasible.

S30

### *Isolation de bactériophages et leur utilisation contre des bactéries pathogènes*

MISKOLCZI, Botond

Ecole européenne Bruxelles III- Ixelles. Mentore : R'HONI , Yasmina

Les bactériophages (ou phages) sont des virus qui infectent uniquement les bactéries. Lors de cette recherche, mon but a été d'isoler des phages puis de tester leur efficacité contre des cultures de plusieurs espèces de bactéries pathogènes.

Pour cela, j'ai isolé des phages de 2 manières différentes : depuis des échantillons naturels et depuis des brins d'ADN bactériens contenant des phages en cycle lysogénique. J'ai préparé des milieux de culture pour 24 espèces de bactéries différentes et j'y ai confronté les phages. J'ai trouvé des phages efficaces contre 22 espèces bactériennes, notamment des pathogènes de poissons et de végétaux. J'ai observé les phages efficaces au microscope électronique à transmission, et j'ai pu déterminer leur nombre leurs classes selon leur morphologie.

Comme ils sont inefficaces contre les cellules eucaryotes, les bactériophages offrent un nouveau moyen simple, rapide et performant pour éliminer les infections sans nuire à l'organisme infecté.

S31

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### *L.I.P.A.S.: Comparing a Multi-Hazard Lunar Forecast System to Single-Purpose Models*

TAKKI Luka

European School of Luxembourg I. Mentor: ZAMBRANA, Justo

L.I.P.A.S. (Lunar Impact and Predictive Analysis System) is an innovative machine learning model designed to accurately predict and assess key environmental conditions on the Moon, including temperature, radiation, dust activity, micrometeorite impacts, solar storms, and minor moonquakes. By combining space-weather data from NASA and NOAA APIs with historical data, machine learning, and probabilistic modeling, L.I.P.A.S. delivers accurate short-term forecasts through an interactive, web-based dashboard for multiple lunar locations.

In this research, I investigate whether integrating machine learning and probabilistic modeling into a single platform improves predictions and operational usability compared to existing single-purpose lunar environmental models. A comparative framework is introduced to see how well different models focus on hazard coverage, data integration, temporal forecasting capability, update frequency, and usability.

The results indicate that while specialized physics-based NASA models remain essential for high-precision analysis, a unified system such as L.I.P.A.S. provides significant advantages in accessibility, integration, and fast decision support for mission planning.

Overall, this project demonstrates how combining scientific research, advanced coding, and publicly available datasets can produce a practical tool that contributes to safer and more predictable lunar exploration.

S32

Commented [F(19)]: PR Faller

### *The Future of Antibiotics*

ARDIACA GIUDI Julia (S6 DEA) , FISCHER, Sophia (S6 DEB)

European School Luxembourg II, Mamer. Mentor: PICCOLOMINI, Angela



The general resistance to antibiotics has risen rapidly over the past decades, making many infections considerably more difficult to cure. We also know people who became more severely ill due to resistances than they would have if the antibiotics had worked. Therefore, we came up with the idea to examine traditional medicinal plants for antibacterial effects to possibly find an alternative to antibiotics.

We set up two control groups: one containing only bacterial colonies of a non-pathogenic *Escherichia coli* strain and one containing added antibiotics. We opted for this bacterial species because it is often used in laboratories for similar research.

On two additional Petri dishes, we used extracts from cloves and basil leaves instead of antibiotics. We chose cloves because there are already studies that have investigated their antibacterial effects, some of which have been published in Nature magazine. However, cloves are grown mainly in tropical regions, which gives them a relatively large CO<sub>2</sub> footprint, and they are poorly tolerated by people who are highly allergic. Therefore, we wanted to find a European equivalent and ultimately decided on basil. Not only does it grow in Europe and is easily accessible in almost every household, but its essential oil is also less aggressive than that of other plants and better tolerated by people with allergies. Furthermore, the extraction of active substances from basil is simpler and therefore more likely to be successful in a school laboratory than with other medicinal plants.



*Cloves in 55 V-% Ethanol during extraction Basil leaves during drying process*

S33

Commented [F(20)]: PR Faller

### *A Closed Autonomous Ecosystem for Human Inhabitation*

SAMSON ZILLIOX, Clémentine; CIOBANU Oriana-Mara; FUNAMIZU, Maya (S6FRC)

European School Luxembourg II, Mamer. Mentor: PICCOLOMINI, Angela

Autonomous human survival in hostile and non-fertile environments such as space or deserts is still a major challenge, and this subject has always interested all of us. Two years ago, we searched for a solution to this problem and identified an incredible plant: the duckweed *Lemna minor*. This plant has a huge potential: it is edible, has a high concentration of protein (15 to 30% of its dry matter), grows rapidly (in optimal conditions it can double in mass in 48h) and efficiently filters organic matter such as nitrates. It is already used in aquaponics to feed farm fish, and experiments on its use in wastewater treatment have been conducted. We then conducted an ESSS project on this topic with the goal of creating a theoretical version of a closed ecosystem designed to operate with solar energy as its only external energy input. This ecosystem was based on the duckweed *Lemna minor*, humans, and nitrifying bacteria (*Nitrosomonas* and *Nitrobacter*), as well as the nitrogen and carbon cycles. In this ecosystem, humans provide duckweed with nitrogen compounds, via urine, as well as carbon dioxide via exhaled air. The duckweed provided dioxygen and nutrients, especially protein, but more importantly, with the help of the bacteria, created purified water from the urine.



This year, we decided to complete the idea of the closed autonomous pod while basing ourselves on Clementine's past project. The foundations of our project are still the nitrogen and carbon cycles, but instead of *lemna minor* duckweed as our central plant, we decided to improve the concept by comparing different plants. To ensure all the needs are met, we chose only edible plants. We selected the *Ceratophyllum demersum* hornwort as an aquatic plant and the *Azolla filiculoides* water fern as a floating plant, both rich in protein, as well as two carbohydrate-rich tuberous plants, the potato plant (*Solanum tuberosum*), and the sweet potato plant (*Ipomoea batatas*), and one vitamin-rich plant, the spinach plant (*Spinacia oleracea*) which was later replaced – as a result of experimental limitations – by the radish (*Raphanus sativus*). This project's goal is to determine how much space and water, and quantity of each plant would be needed to ensure fulfilment of the main vital human needs: food, water, oxygen.

For this purpose, we started three experiments: one comparing each plant's carbon dioxide consumption (1), one measuring the aquatic plants' nitrate uptake (2), and one

measuring the bacteria's ability to transform ammonium into nitrate (3). We also monitor their growth regularly (4)

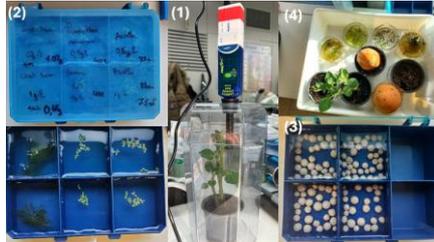


Figure 1: center – carbon dioxide consumption; left – nitrate uptake; bottom right – transformation of ammonium into nitrate by bacteria; top right – observation of growth speed

S34

### *Deep Learning Based Threat Analysis on an Autonomous Mobile Robot using yolov8 and Ros2*

PILLE, Leonard (S5DEC); DIPPOLT, Katharina (S5DEB)

European School Munich. Mentors: ORIEFFE, Martina; FEILER, Benjamin

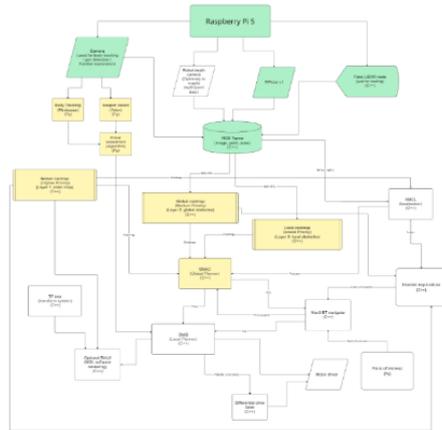
In this project, we are building an autonomous mobile robot that can detect threats in its environment using a self-trained deep learning detection model. The robot is based on a Raspberry Pi 5 and uses the AI model yolov8 which we train with a modified dataset. The project aims to investigate how reliably modern AI models operate on low performance mobile hardware and how they can be integrated into a robotics system.

For control, we use Ros2 which utilises navigation sensors and other data to make decisions. The AI model is integrated into ROS2 and processes sensor data from the robot to detect threats or obstacles.

In our analysis, we evaluate reaction time stability and how the system performs under real world conditions.

We expect to gain insights into the requirements of deep learning models in mobile robot systems, and which measures can improve their performance. This project demonstrates how AI can be used practically and effectively for threat analysis in robotics.

Software infrastructure:



S35

*AI-based Calculation of Companies' Carbon Footprints (and Corresponding Optimisation Proposals)*

MUELLER Achim Johan (S6)

European School Munich. Mentors: ORIEFE, Martina; FEILER, Benjamin

In today's time, the recording of CO<sub>2</sub> footprints of distribution-intensive companies is essential. Many carbon-accounting solutions on the market require that companies manually enter their data into predefined templates or tables. This is time-consuming and prone to errors. Other providers rely on extensive on-premises software, which is expensive to purchase and operate. It must be installed and maintained locally, which is often not economical for small companies. Therefore, I asked myself how this problem could be solved.

After reconstructing the situation of the company, I came up with the following idea. The system had to be fast and user-friendly, but also accurate. Thus, I came to the development of a system that automatically calculates the CO<sub>2</sub> balance of companies and replaces the time-consuming manual allocation of values to internal company processes. For this purpose, I use a Python script that reads the texts from the uploaded bills of materials via text recognition (OCR). Subsequently, an AI model automatically assigns these extracted terms to the appropriate categories of the life-cycle assessment; the associated emission factors from the local LCA database are then summed.



S36

*A Computer Vision-Based System for Real-Time Exercise Form Analysis with Multimodal Feedback*

Aniruddh Gannavarapu, (S5ENA)

European School Karlsruhe. Mentor: CHABANIS, Sophie

Incorrect exercise technique is a major contributor to training-related injuries and inefficient movement patterns. Beginners often struggle to maintain correct form without continuous supervision. Traditional fitness feedback methods rely heavily on mirrors or visual displays, which require constant visual attention and may disrupt movement execution.

This project investigates the use of real-time computer vision and poses estimation to automatically analyse exercise form and provide instant multimodal feedback, combining on-screen visual cues with audio feedback. The system focuses on push-ups, pull-ups, and squats and only counts repetitions performed with acceptable biomechanical form, encouraging quality over quantity.

S37

### *The Impact of Music on Short-Term Memory*

FIRKET, Sophie; ENEV, Nicola; DYLAG, Olga (S5FR)  
European School Brussels II- Woluwe. Mentor: HIGGINS, Shaun



Overview:

This project investigates whether listening to music whilst revising (a common habit among students) aids memorisation or acts as a distraction.

Theoretical Background:

- The study defines memory as a multi-dimensional construct involving emotions and sensory data; by engaging different lobes of the brain (each lobe is used for a specific type of memorisation) through various stimuli.
- To ground up the research, we consulted a specialist Neurologist at Delta Chirec Hospital, and used books, scientific journals, internet, and did tests on volunteers.

Hypotheses:

- Direct Hypothesis: Music is a success in aiding memory, increasing the cognitive capacity of volunteers.
- Null Hypothesis: Music has no discernible effects on memory
- Alternative Hypothesis: Music distracts the test subject, hindering the learning process.

Methodology:

We carried out a few practical experiments involving 2 groups of 5 volunteers.

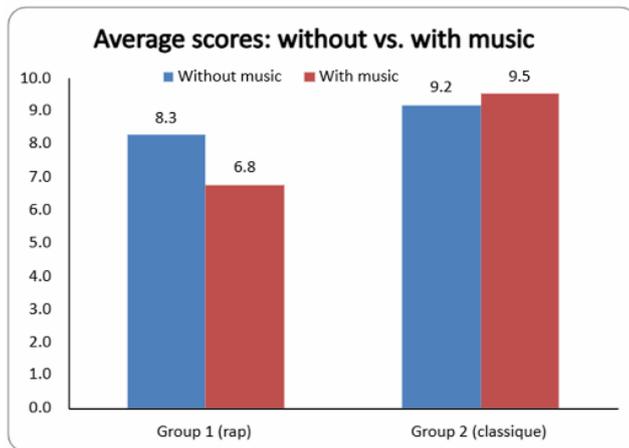
- Participants were given 5 seconds to memorise 10 simple shapes based on the Benton Visual Retention Test.
- To ensure the test focused strictly on short-term memory, an “interference” task has been added; volunteers had to solve a simple calculation problem before drawing the shape on a blank paper.
- The experiment was repeated using different musical genres (specifically rap and classical music) to compare against silent control.

Current Results:

- The Rap Group performance levels generally dropped. One student's score fell significantly from 7.5/10 (in total silence) to 4/10 while listening to rap.
- The classical group results were far more favourable compared to the other group. Several participants maintained their excellent score, while the others just improved going from a 9/10 (without music) to 10/10 (with music).
- Research is still in progress so further information will be added soon

Conclusion:

- Our results suggest that calmer music indices a higher retention level, and that it is currently the best way of memorising, while music with lyrics slows down and even lowers retention levels.



## WITH GRATITUDE - REMERCIEMENTS

EEB2 warmly thanks the following people for their dedication, enthusiasm and invaluable commitment. Your hard work, support and positive energy made **ESSS 2026** truly possible;

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We welcome 151 students from all over Europe to present their scientific projects:  
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The word 'HUNOR' is written in a bold, blue, sans-serif font. A colorful, multi-colored swoosh (red, green, blue, yellow) curves over the letters 'U' and 'N', and under the letters 'O' and 'R'.The logo features a hexagonal icon on the left, divided into three colored sections (orange, green, yellow). To its right, the word 'MOBEE' is written in a colorful, sans-serif font where each letter has a different color: M (green), O (yellow), B (orange), E (yellow), E (green).The logo is circular with the text 'THE LEARNING ACADEMY' at the top and 'OF BRUSSELS' at the bottom. In the center, the word 'LAB' is written in large, bold, colorful letters (L is green, A is orange, B is blue) with a yellow background behind them.



**Liszt Institute  
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A semi-circle of ten stars in various colors (blue, red, purple, green, purple, red, blue) arching over the text.

**A Pee**  
Evere Woluwe  
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