The European Schools Science Symposium is a competition open to students of the European Schools years 1 to 7 inclusive. Individuals or groups of up to 3 students, guided by a teacher-mentor, are encouraged to explore an area of scientific interest of their choice, not normally covered by the European Schools' science syllabus.
The projects will be showcased during the symposium and judged by teachers and subject experts. Prizes will be awarded for the best entries. Juniors and seniors will be judged separately.
The overall winning project in the senior category will represent the European Schools at the European Union Contest for Young Scientists later in the year.

ESSS
UCCLE 2025

ABSTRACT BOOKLET

European Schools
Science Symposium 2025
6th- 9th of April
at the EEB1 Brussels

Contents

WELCOME

to ESSS 2025

DAVID TRAN Director UCCLE & BERKENDAEL EEB1

Chers lecteurs et lectrices du livret ESSS 2025,

En tant que Directeur depuis le 1er septembre 2022, je suis très honoré de vous accueillir à l'École Européenne de Bruxelles 1 à l'occasion de cette nouvelle édition du Symposium des sciences des Écoles européennes - ESSS 2025.

De formation scientifique, j'ai étudié les mathématiques durant 5 ans à l'université pour ensuite me destiner à une carrière dans l'enseignement.
Durant près de 15 ans, j'ai été professeur de mathématiques à tous les niveaux du cycle secondaire.

Pour moi, enseigner les mathématiques aura été une aventure formidablement enrichissante, pleine de défis mais aussi de créativité lorsqu'il fallait faire preuve d'inventivité pour aider tous les élèves à comprendre des notions difficiles et parfois abstraites ! Ce plaisir d'enseigner les sciences, c'est aussi celui que chacun de nous peut rencontrer lorsqu'il est récompensé par une recherche fructueuse après de nombreux efforts marqués par le doute ou cette sensation de ne pas pouvoir y arriver.

Les sciences et plus particulièrement les mathématiques m'ont permis de développer un sens aigu de la rigueur, du dialogue, de l'esprit critique, mais aussi et surtout de la curiosité ! Modestement, à mon échelle, j'ai assuré la promotion des sciences à travers quelques projets ponctuels, mais jamais je n'ai eu la chance de participer à un événement aussi remarquable que notre Symposium des sciences des Écoles européennes.

Mon parcours professionnel m'a conduit à travers les différents continents, de Portland-Oregon à Hong Kong en passant par São Paolo. Partout, j'ai pu constater la dimension universelle des sciences. Chaque fête ou chaque festival scientifique soulève le même enthousiasme et l'envie d'échanger entre toutes les générations, au-delà de toute frontière géopolitique. C'est donc à un véritable **moment de partage** auquel je souhaite vous convier grâce au travail extraordinaire de toute notre équipe de l'ESSS.
Et pour commencer, je vous invite à parcourir ces pages qui vous donnerons un aperçu de la variété et de la qualité des sujets abordés.

Excellent Symposium à toutes et à tous !

ESSS
UCCLE·2025

Dear readers of the ESSS 2025 booklet,

In my capacity of Director since 1 September 2022, I am very honoured to welcome you to the European School of Brussels I for this new Science Symposium Edition ESSS 2025.

With a background in science, I studied mathematics for 5 years at university, before heading for a career in teaching.
For almost 15 years, I taught mathematics at all levels of secondary school.

For me, teaching mathematics has been a tremendously enriching adventure, full of challenges but also of creativity when it comes to helping students understand difficult and sometimes abstract concepts! The pleasure of teaching science is also the pleasure that each and every one of us can experience when we are rewarded with a fruitful piece of research after many efforts marked by doubt or the feeling of not being able to achieve it.

The sciences, and mathematics in particular, have enabled me to develop a keen sense of rigor, dialogue and critical thinking, but above all curiosity! Modestly, in my own humble way, I have promoted science through a number of small projects, but never have I had the chance to take part in such a remarkable event as our European Schools Science Symposium.

My professional career has taken me to the four corners of the globe, from Portland-Oregon to Hong Kong to São Paolo. Everywhere, I've witnessed the universal dimension of science. Every science festival generates the same enthusiasm and the same desire for exchange between all generations, beyond geographical and political borders. I therefore invite you to join us for a real **moment of sharing**, thanks to the outstanding work of the entire ESSS team.
And to begin with, I invite you to explore these pages, which will give you an idea of the variety and quality of the topics covered.

I wish you all an excellent Symposium!

ESSS
UCCLE 2025

MAX WOLFF *Inspecteur des Écoles*

Chers élèves, chers jeunes scientifiques,
Chers participants aux Symposium des Sciences des Écoles européennes,

Le ***Symposium des Sciences des Écoles européennes*** fête cette année son 20e anniversaire. Ce qui a commencé comme une petite initiative scientifique de quelques enseignants dédiés est devenu aujourd'hui un événement phare du système des Écoles européennes, auquel participent un nombre croissant d'écoles traditionnelles et agréées. Le Symposium promet d'être à nouveau un grand succès. Des élèves et enseignants de nos écoles vont se rassembler du 6 au 9 avril 2025 à l'EE Bruxelles I pour présenter leurs projets scientifiques.

Cet événement témoigne de l'importance de l'enseignement des sciences et permet aux élèves de présenter leurs découvertes, leurs idées et leurs projets de recherche. En partageant leurs travaux, les élèves ont pu développer leurs compétences de collaboration, de communication et d'échange d'idées, autant de compétences cruciales pour tout scientifique.

En participant à ce symposium, vous les élèves vous avez développés une série d'aptitudes et de compétences, telles que la pensée critique, la résolution de problèmes et la créativité. Vous jeunes pouvez démontrer que vous êtes capables d'aborder des questions complexes afin de trouver des solutions innovantes, des compétences essentielles pour réussir au 21e siècle.

Continuez à travailler avec passion, et vous allez constater que beaucoup de filières vous ouvriront leurs portes. N'ayez pas peur d'approcher d'autres personnes, d'échanger vos idées et d'apprendre des autres. Entourez-vous de mentors plus âgés et plus expérimentés. Soutenez-vous réciproquement. Mais dans tout cela, n'oubliez jamais de chercher une manière de vous évader, pour trouver un domaine que vous adorez et qui vous passionne.
Vivez l'identité européenne au quotidien.

J'aimerais remercier les enseignants qui ont consacré leur temps libre afin de guider les élèves dans leurs démarches. Sans leur engagement de telles initiatives ne pourraient pas avoir lieu.

Un très grand merci à la direction d'École hôte, a l'association des parents ainsi qu'à toute l'équipe organisatrice (Dorottya Sconka, Arnaud Jutier, Urszula Rybałtowska, Bogumiła Tarapata) pour leur travail insatiable tout au long de l'année.

Mes remerciements vont aussi à tous toutes les institutions et autorités qui contribuent au succès de cet événement phare des écoles européennes, le bureau du Secrétaire général des Écoles européennes, les JRC ainsi que l'EPO pour leurs soutiens financiers et matériels.

L'équipe qui remportera l'ESSS ira représenter les EE au prestigieux **EUCYS** (*European Union Contest for Young Scientists*), qui aura lieu du 16 au 20 septembre 2025 à Riga en Lettonie. Ce concours est la vitrine des meilleures performances scientifiques des élèves. Profitez de cette occasion unique pour entrer en contact et vous échanger avec des jeunes du même âge, venus des quatre coins de l'Europe.

Or le but de l'ESSS n'est pas de pouvoir envoyer une minorité d'élèves à l'étranger, mais d'éveiller l'intérêt pour les sciences chez une majorité de nos jeunes. Ce sont bel et bien de telles initiatives qui permettent de transmettre une image positive des sciences. L'enseignement scientifique est et restera une priorité dans notre système éducatif. Elle sera fortement ancrée dans la nouvelle mission et vision du système des Écoles européennes.

Pour le moment, il me reste de féliciter tous les participants au symposium. Bravo pour votre engagement et vos travaux. Beaucoup de plaisirs avec les sciences et à l'année prochaine pour la prochaine édition de du symposium des sciences !

Max Wolff
Inspecteur des Écoles européennes

EMILIA MAKARSKA *Deputy Director Secondary EEB1*

Dear Students, Faculty, and Guests,

On behalf of the Secondary School at EEB1, it is my great pleasure to welcome the European Schools' ESSS Festival into our school!

This is a wonderful occasion to celebrate the vibrant cultural diversity, talents, and creativity that our schools represent.

This event brings together students from different backgrounds, languages, and countries, creating a unique environment for learning, sharing, and fostering collaboration. We are thrilled to see how the festival will showcase the remarkable work and spirit of our community.

I encourage everyone to immerse themselves in the activities, performances, and workshops, and to take full advantage of the opportunity to connect with fellow students and educators. Let this festival be a celebration of our shared commitment to excellence, innovation, and mutual respect.
Thank you for being a part of this special event. I look forward to seeing the inspiring work and moments that will unfold during the festival!

Warm regards,

Emilia Makarska
Deputy Director of the Secondary Cycle
EEB1

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HE Mr Tamás Iván Kovács *Ambassador of Hungary*

H.E. Mr. Tamás Iván Kovács is a lawyer and a diplomat, currently serving as the Ambassador of Hungary to the Kingdom of Belgium and to the Grand Duchy of Luxembourg since 2018.

He used to work before as an Attorney, a Hungarian civil servant and as an official of the European Commission, at the European Anti-fraud Office (OLAF) between 2007-2010 and 2014-2018.

He also served as a Deputy State Secretary for EU and International Relations at the Hungarian Ministry of National Development during the first Hungarian EU Presidency in 2011. His primary mission is to develop the bilateral relations between Hungary and Belgium and Hungary and Luxembourg.

Embassy of Hungary
in Belgium and Luxemburg

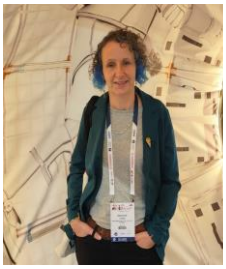
KEYNOTE

Speakers

Amélie NEF

Amélie NEF
is a data scientist at Euranova. Her core business is computer vision, which means that she extracts information from images or videos using artificial intelligence models. She has worked on several projects in various sectors such as pharmaceuticals, armaments, and, more recently, aeronautics/air surveillance. She is looking forward to meeting the students taking part in the ESSS and explaining her projects in more detail.

Amandine DENIS



Amandine DENIS
graduated from the University of Liège as a physics engineer in 2007. She served as project manager for the first Belgian nanosatellite OUFTI-1, before joining the von Karman Institute for Fluid Dynamics for coordinating the space segment of QB50 project in 2014. She continued her nanosatellite career with the final steps of QARMAN, the VKI reentry CubeSat. Amandine is now project manager at VKI, working on several space-related projects.

QARMAN (Qubesat for Aerothermodynamic Research and Measurements on AblatioN) is the world's first CubeSat designed to survive atmospheric re-entry. The QARMAN project, funded by the European Space Agency, started in 2013 at the von Karman Institute for Fluid Dynamics (VKI). It was deployed into orbit in February 2020, worked nominally for 5 months before encountering a thermal issue, and finally reentered the atmosphere in February 2022. It provided researchers and engineers with a lot of knowledge and learnings.

Stefan DOMBROWSKI

Stefan DOMBROWSKI
I joined EEB1 in 1974 and made my baccalaureate in 1983.
Started self-study in electronics and programming and joined a French company as head of R&D.
Now self-employed and consultant in several space projects with NASA, ESA & Space-X.
Active radio amateur and trying to transmit my knowledge and experience to the next generations

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JUDGING *Panel*

Maria CALVO

María CALVO BLANCO
holds a Master's degree in Aerospace Engineering and have over two decades of professional experience in the aircraft manufacturer Airbus with a primary focus on Flight Physics and Overall Aircraft Design. She has been part of the design office engineering, contributing to modelling, simulation and validation up to flight test in a diverse range of civil and military European programs such as Eurofighter, A400M, A320, A330…
In May 2022, she embarked on a new journey in Clean Aviation Joint Undertaking, an agency of the European commission which drives for sustainable technologies development, to reduce emissions on next generation aircraft. Maria is mother of P5ES EEB1 child and a passionate engineer. She has been also a mentor in TechnovationGirls, an international initiative where she was mentor of groups of girls between 10 to 16 years-old to bring their ideas into an App.

Adriana COLOTTO

Adriana COLOTTO
physics and mathematics teacher in EEB1 Brussels. She has got a PhD in chemistry (Physical Chemistry and Biophysics). Her main field of research in Biomembranes. She also worked for many years as a Medical physicist in Radio-Oncology, and Material analyst.

Saswati CHOUDHARY

Saswati CHOUDHARY
biology, mathematics and physics teacher in EEB1 Brussels. Very passionate and dedicated educator with a strong background in
Biochemistry and teaching certifications from India and Belgium. With diverse teaching experience in Physics, Chemistry, Biology, and Mathematics for secondary school students across both countries, she brings a unique, interdisciplinary approach to science education.
Committed to making learning engaging and accessible, she has launched her own STEM channel to promote interdisciplinary science teaching, inspiring students to explore the wonders of science beyond the classroom.

Guillaume DANDREY

Guillaume DANDREY
French biology (and geology in France!) teacher living in Belgium since 2016. I am particularly interested in evolutionary science, immunology, genetics and epigenetics.

Olaf HEIDELBACH

Dr Olaf HEIDELBACH
is an agricultural and development economist with 20 years working experience in sustainable agricultural and rural development in transition and developing countries (South and Central Asia and the Caucasus). He is currently working as team leader for the policy perspectives unit of the European Commission Directorate General for Agriculture and Rural Development with a focus on resilient and sustainable food systems. He holds a Ph.D. in agricultural economics from IAMO/Martin Luther University in Halle/Germany.

Maruška ČUš

Dr. Maruška Čuš
B.Sc. in Chemistry and Chemical Engineering and Ph.D. in Biomedical Technologies.
She began her career as a researcher at the University Medical Center Maribor, in the Laboratory for In Vitro Fertilization and the Center for Human Genetics and Pharmacogenomics of the University of Maribor. She then moved to the Knowledge and Technology Transfer Service of the University of Maribor, where she worked in the field of intellectual property protection and marketing of researchers' professional inventions, as well as in the field of digitalization. She currently runs her own company, which operates in the field of biodiversity and nature conservation.

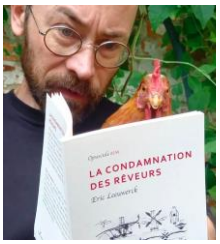
Arnaud JUTIER

Arnaud JUTIER
I came to Brussels in 2015 to start a postdoctoral position at ULB, right after my PhD from McGill in Theoretical Physics. Very quickly though, I felt like I was missing something: teaching! During my university degrees, I always had been a teaching assistant (for a ElectroMagnetism lab for non-science students). During my Teacher Training, I found my current position at EEB1. Since then, I have been in the Working Group for the new Physics syllabus, current coordinator of the Physics department, and keep myself busy with many fun projects related to STEM.

Kristian KJAERGAAR

Kristian KJAERGAARD
[pronounced "*care-guard*"] is an MD, Ph.D., and researcher at The Accident Analysis Group at Odense University Hospital in Denmark and The European Association for Injury Prevention and Safety Promotion. His work involves measuring and analysing accidents and injuries and presenting knowledge to stakeholder and the public.
He likes designing and conducting experiments, exploring curiosity and abstract ideas, and sharing these ideas with people around him.
"It is a great honor for me to be invited as jury to The European School Science Symposium 2025, I am looking forward to meeting you—the next generation of young promising scientists and entrepreneurs."

Erik LEEUWERCK



Eric Leeuwerck.
Science teacher. I studied bioengineering at the Université Libre de Bruxelles (ULB) in the previous millennium before packing my backpack to travel in Latin America. I returned in Brussels in 2004 and started to work as a science teacher at the Institut De Mot Couvreur and to study for my agrégation in secondary education at the ULB.
Then I left again but for Rwanda in 2008 where I taught sciences at the Ecole Belge de Kigali for more than 10 years.
And I came back to Brussels in 2020 at the European School of Brussels 1, where I teach Integrated Sciences, Biology, sometimes Chemistry and recently Science Technology and Society.
What are my specialities? All the possible and imaginable (but above all improbable) experiments with materials you can find at home.

Dietmar POPP

Dietmar POPP.
Chemistry, SCI and French teacher.
Seconded from Germany, I used to teach on a small island called Föhr in the North Sea, near Denmark.
My hobbies: triathlon, but especially racing bikes; reading, travelling. I've been at EEB 1 for 5 years.

Neil MASSINON

Neil MASSINON
I teach economics and sociology in eeb1 since 2004. I did my BA and Masters in UCD (Ireland) and my H.Dip in education in ULB Solvay russels).

Zsolt PATAKI

Zsolt PATAKI
has background in physics (MSc), international economy (MA) and holds a PhD from the University of Paris. He is a senior policy analyst at the in-house research service of the European Parliament.
Earlier, as head of service at the EP's scientific body (STOA), he was carrying out scientific foresight and technology assessment projects. Previously, at the European Commission's in-house science service (Joint Research Centre), he coordinated modelling activities and scientific inputs to EC impact assessments in various fields (energy, climate change, industry etc.).

Aleksander KĘDRA

Aleksander KĘDRA
PhD in Biology, specialized in ecotoxicology, parasitology, environmental biology.
In 1994-2007 worked in Polish Academy of Sciences, since 2007 scientific and project officer in DG Research European Commission.
Amateur ornithologists and naturalists with interest in nature protection and geology.

Gabrielle SKARA

Dr. Gabriella SkARA
graduated from Budapest University of Technology and Economics with an MSc in Chemical Engineering and earned a BSc in Economics from Budapest University of Economics and Business. She later obtained her PhD in Chemistry from Vrije Universiteit Brussels, Belgium.
Her career has taken her across the globe, having lived and worked for many years in the United States and Chile before settling in Brussels in 2022.
Passionate about STEM education, she recently founded the Learning Academy of Brussels, a nonprofit organization dedicated to providing hands-on learning experiences in science, technology, engineering, and mathematics. The academy provides programs focusing on developing critical thinking, creativity, and problem-solving skills through activities that go beyond the traditional school curriculum.
An avid enthusiast of mathematics, LEGO, and LEGO robotics, Dr. Skara is committed to inspiring young minds through engaging educational activities. She is also the recipient of an Erasmus+ small-scale cooperation grant in partnership with Medve Matek, a Hungarian nonprofit organization renowned for its innovative approach to mathematics education for over 25 years. Their cooperation focuses on popularizing mathematics, promoting the importance of cooperative thinking, and enhancing problem-solving skills through unique programs such as outdoor math competitions.
As a judge at the European Schools Science Symposium, she looks forward to supporting and celebrating the creativity and scientific curiosity of young researchers.

Ioana VASILESCU

Dr. Ioana Vasilescu
is senior researcher (directrice de recherche) in linguistics at LISN
CNRS (https://www.lisn.upsaclay.fr/), in the Human Language Science and Technology department, where she leads the team LIPS (“Langue Interaction Parole Signes”). She joined the Centre National de la recherche Scientifique (CNRS) in 2002 after earning a PhD in linguistics from Université de Lyon and later obtained an HDR (Habilitation to Conduct Research) in computer science from Université Paris-Saclay. Her research focuses on spoken language variation, exploring differences across languages, speaking styles, socio-demographic patterns, or emotional expressions. She examines these variations from both production and perception perspectives, leveraging speech technology—particularly speech recognition systems—to analyze linguistic patterns on a large scale. She is author of more than 100 articles and book chapters about linguistic variation in production and perception, emotion modeling and detection in speech, speech technology peformance compared to human expertise.

Dominik SOBCZAK

PROGRAM

ESSS 2025

Sunday, 6 th April, 2025

from 12.00
arriving to the school site of EEB1
registration
setting up the posters
16.30 Opening Ceremony
18.30 Dinner
20.00 Accommodate in the Hostel

Monday, 7 th April, 2025

7.30 Breakfast in Hostel
9.30 Presentations front of the Jury
or school tour and experiments
11.00 Break
11.15 Presentations front of the Jury
or school tour and experiments
12.45 Lunch in school
13.15 Poster session
15.00 Visit the Mini Europe, experiments front of the Atomium
18.30 National dinner (Hungarian, Polish, Italian)
19.00 Students: sport activities
Teachers: meeting with the Jury
21:00 Back to hostel

Tuesday, 8 th April, 2025

7.30 Breakfast in Hostel
9.30 Finals' presentation with break
12.30 Lunch in school
14.00 Scavanger hunt in Brussels city center
18.30 Thai dinner
19.00 Leisure activities: Our bands, disco and board games
21:30 Back to hostel

Wednesday, 9 th April, 2025

7.30 Breakfast in Hostel, check out
9.30 Award Ceremony
12.00 Distribution of the lunch boxes
12.30 end of the ESSS 2025 UCCLE

ASSESSMENT

criteria

Poor	Participant **does not include** basic information and/or **does not** elaborate or clarify.
Fair	Participant states **superficial or basic** information **without** elaboration or clarity.
Average	Participant states **some** of the information with **limited** elaboration and/or clarity.
Good	Participant states **most** information with elaboration and clarity.
Excellent	Participant states **all** information with **extensive elaboration and clarity.**

Max Points:15	**Research Problem**	**Excellent**	**Good**	**Average**	**Fair**	**Poor**
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 sucess	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

Max Points:15	**Design and Methodology**	**Excellent**	**Good**	**Average**	**Fair**	**Poor**
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

Max Points:15	**Report**	**Excellent**	**Good**	**Average**	**Fair**	**Poor**
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

Max Points:10	**Poster**	**Excellent**	**Good**	**Average**	**Fair**	**Poor**
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

Max Points:15	**Oral presentation / Interview**	**Excellent**	**Good**	**Average**	**Fair**	**Poor**
12	The students clearly express themself 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

ESSS
OCCLE-2025

List of Junior Projects ESSS 2025:

Number	School	Title of Project	Name
J01	ALI	Hiccup Lollies	Natalia Chylinska Nika Iankova Ignatieva
J02	CLX	Global warming leading to the cooling of Europe: a 21st century paradox	Isabelle Abella Paul-Rubens Volk
J03	FRA	"AIRBOTTLE" Eco-friendly Air Conditioning with Recycled Bottles	Anna Moschberger Jiménez Leire Gutierrez Lois Maria del Mar Casanova
J04	RHM	Sustainable Cities: Can we Really Make our Cities Sustainable	Vedha Sabharwal
J05	UCC	Small Plastics, Big Problem	Eliza Slavova Maja Limantaitė Oleksandra Yevtushenko
J06	VAR	The Transformation of Polystyrene to Cinnamaldehyde	Matej Hradec
J07	ALI	Kalanchoes on Mars, closer to living in space	Carlos Aracil Pérez Laura Márquez Pérez Matteo Suárez Boudron
J08	BER	Preventing eye strain by monitoring a user's screen distance using python	Alp Demir
J09	CLX	Luxembourg water quality	Ben James Crawford
J10	FRA	Enhancing Bulletproof Vests with Non-Newtonian Fluid: A Solution for Urban Security Challenges	Cristian Pambianco Lorenzo Pastori Stefano Marcelli
J11	LUX	E-School, a Digital Gateway to School Life	Luka Takki
J12	PAR	Classroom Environment Monitoring: Information for a Better Learning Space	Alabiso Deveze Matteo Alvarez Romero Lucas
J13	RHM	Fine Tuning Photosynthesis - Focusing on Plants' Favorite Colors	Abdullah Siam
J14	UCC	L'énergie osmotique – Une solution pour le futur ?	Paul Fourestié
J15	VAR	Walking Electricity: Generating Power with Every Step	Foivos Syrris-Tsompanopoulos Miron Myroshnychenko
J16	WAR	Reasons Behind Changes in Bird Migration Routes : An analysis of potential	Jesús Álvarez Ruiz

J17	ALI	Do plants and mushrooms serve as natural antibiotics?	Rodrigo Martínez Barberá Javier Canals Estirado
J18	CLX	Study of different plants under lighting conditions to determine how they thrive.	Freddie Lee Kenda Mohamed Sathvika Krishna
J19	IXL	The importance of food offered in school cafeterias for a healthy diet	Georgina Iris Dimopoulou Vantsiouri Vittoria Passanisi
J20	KAR	Containment of oil spillage on surface water	Jack Laban Tristan Weller
J21	LAE	Biodegradable Hydrogels: "A Solution for Watering and Growing Plants"	Kaloyan Georgiev Kuzmanov Mario Neshevski
J22	LUX	What happens to an apple in space?	Sara Pascual Sonia Vallejo
J23	WAR	Organic Waste Fuel Cell (Energy from dirt)	Karol Ziorkiewicz Apostolos Apostolou Francesco Mola
J24	ALI	The proper use of reduced mobility spaces. Proposal for signage in the event of misuse.	Mauro Pais Álvarez
J25	IXL	Early detection of mental health conditions through text analysis and biometric signals with AI.	Catalina Valero Peces
J26	KAR	Reaction between Coca-cola® and Mentos	Joanna Sweeting Luna Bosir Scek Mohamed
J27	LAE	Vertical farm	Larisa Ştefania Vetisan
J28	LUX	The Plant-Caring Robot: Feeding Our Planet and Mars!	Raphael Newton Raphael Sniter-Revest

List of Senior Projects ESSS 2025:

Number	School	Title of Project	Name
S01	BER	Triggers Affecting Crayfish Burrowing Behaviour	Arnav Dhole
S02	IXL	Agatha: The App for the Mind	Verónica Jara Gómez
S03	KAR	Plastic-eating Bacteria: Investigating bacteria that can break down plastic and assessing their potential for large-scale waste management.	Amelia Wood Shradda Vijaya Kumara
S04	LAE	Notre drone samare : quand la nature tombe, l'innovation décolle!	Arno Bonnamy Mona Benkhabecheche Mona Sonck
S05	LUX	Investigating Psychopathy: A Novel Enzyme-Based Treatment Targeting MAOA Gene Dysregulation	Lea Guerard
S06	MAM	Liquid soap spherification	Maeve Bouchez
S07	MOL	Self-Sustained Moisture-Involved Electricity Generation	Matvey Nikonorov Oberon Johnson Arnav Gupta
S08	MUN	KI – GESTEUERTER MÜLLEIMER	Damiano Ciccarese Stephan Hazebrouck
S09	PAR	Pollution catcher	Lena Moussaoui Chenot Nadia Quaye
S10	WAR	Barn Swallow (Hirundo Rustica) Eggs as an Indicator of Female Quality	Klára Levrincová
S11	IXL	Microplastics in the food chains: The effect of microplastics in the growth of photosenthetic organisms (Elodea canadensis)	Dimitrios Kremezis Eleni Patri Iliana Iakovidou
S12	KAR	Cleaning Products: Helpful or Harmful?	Janka Hugelmann Mathilda von Fürstenberg
S13	LAE	Impact of polyethylene plastic (PE) on plant growth and nitrogen cycle.	Cristian Hogas Izabela Ninu Maia-Elena Pasca
S14	MAM	Un filtre, de l'eau pour tous	Clémentine Zilliox Samson Leon El Assadi Maya Funamizu
S15	MUN	Optimal sleeping conditioner	Diego De Santos Burgueno Nicolás Fernández Munoz
S16	RHM	Can Yeast Cells Adapt? A study of how yeast adapts to antifungal medication.	Allegra Gross Emily Bach

~~S17~~	~~BER~~	~~Sea Current: Magnetohydrodynamic Electricity Generation with Seawater~~	~~Aderyn Mccurdy-Luksch~~
S18	FRA	The Tipping Point: Environmental threats to Biodiversity. How Environmental Conditions affect Fungi, Animals and Plants	Lauren Christensen Rachel Christensen
S19	MAM	Using the Blob as a Navigation System	Ana Marija Kukovec Mariana Waicman Gonçalves Nicolo Broom
S20	RHM	Waste to Watt	Riya Kalkar Yijin Wang
S21	UCC	How do screens affect memory?	Karolina Kuśmierz Magda Dróżdż
S22	CLX	Calorie deficit and lifespan	Rishikaa Sivashankar
S23	MAM	Le gâteau marbré du futur	Julia Ardiaca Guidi Sophia Fischer
S24	UCC	From Dogs to Humans: The Role of Motivation speeding up the Learning process.	Emilia Staniszewska Maria Gardy Zofia Roszak
S25	WAR	Does the method of isolation of aloin affect its content in the sample?	Agnieszka Darmos

JUNIOR Projects

J-01
Hiccup Lollies

Nika Iankova and Natalia Chylinska (S3ES), ES Alicante

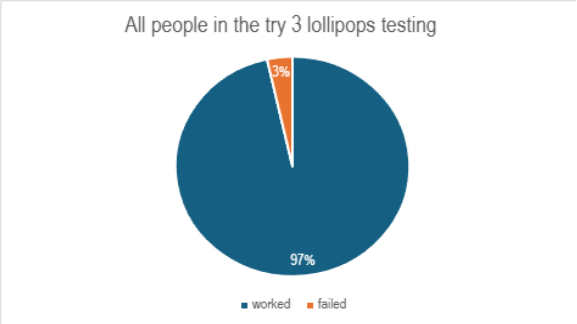
We are doing this project because we want to be able to show how to make anti hiccup lollipops so anybody can make them at home with simple ingredients and a good step by step recipe. We also want to reveal the secret ingredient to stop hiccups.

The sour compounds can stop hiccups. They relieve hiccups by resetting the involuntary movement of the diaphragm. Moreover, the strong and sour tastes will keep you distracted while the muscles involved are given room to reset.

Vinegar is highly acidic, and its strong taste can stimulate the vagus nerve. When you consume a small amount of vinegar, it triggers a reflex that can interrupt the hiccup cycle. This is like other remedies that involve strong sensory stimulation, such as biting into a lemon or swallowing a spoonful of sugar. That is why it helps to stop hiccups.

INGREDIENTS FOR ONE BATCH: (12 lollipops)

White Sugar	321g
Glucose DE 42	214g
Water	95g
Apple cider vinegar	16g
Citric acid	25g
Flavoring	7g-11g



This is one of our data graphs from when we went out to the center of Alicante to test our lollipops. We tested 86 people. We took 6 tries to make the lollipops. With the third try lollipops we conducted an experiment. The table above is the data for our try 3 lollipops testing. Our experiment was very successful, as you can see, 97% of people found our lollipops worked.

J-02

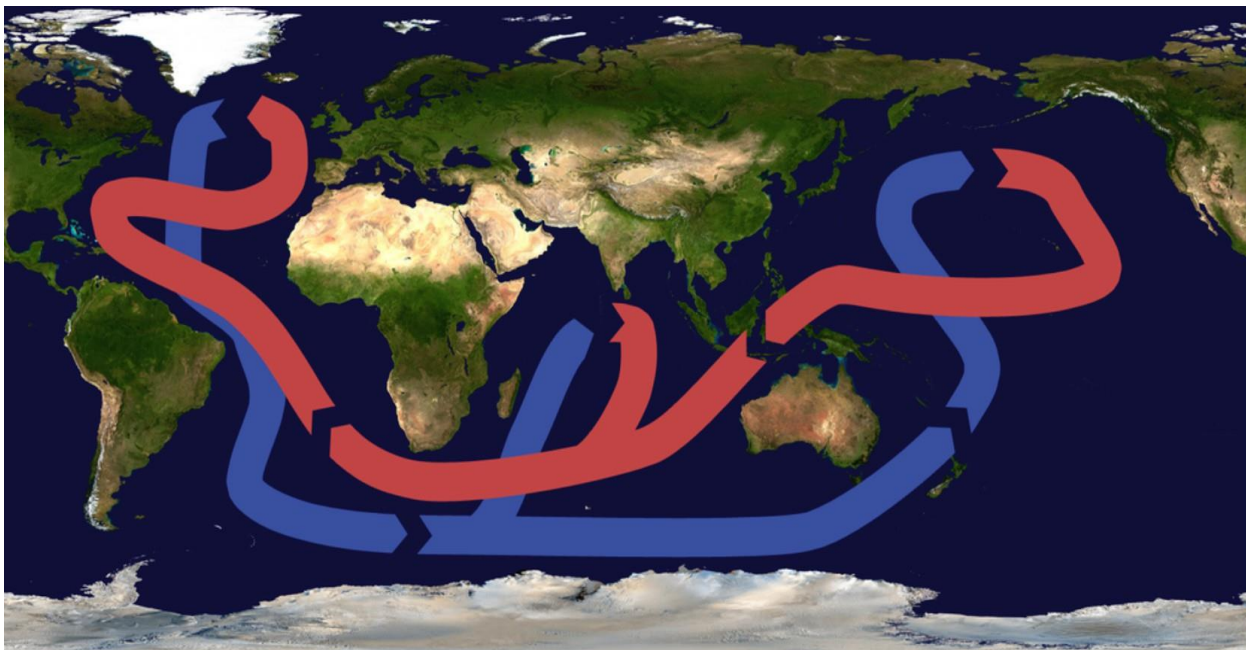
Global Warming Leading to the Cooling of Europw: A 21st-Century Paradox

Paul-Rubens VOLK and Isabelle ABELLA (S4EN), EN LESC
Clervaux--Luxembourg

Scientists decades ago predicted the natural catastrophes we face today. It is now widely understood that the effects of global warming could significantly alter the world's climate as we know it. This project aims to give insight on the paradoxical relationship between global warming and the potential cooling of Europe, propelled by the disruptions to the Atlantic Meridional Overturning Circulation (also known as AMOC).
The AMOC is an essential ocean current system that transports warm waters from the southern regions of the globe to Europe. This process plays a vital role in moderating temperatures in their respective hemispheres.

Recent studies indicate that rising greenhouse gas emissions may destabilise the AMOC's system, potentially causing a significant weakening or even a collapse within the 21st-century. This disruption could result in harsher winters, agricultural challenges, and economic instability in Europe, whilst other regions may experience an increase of temperature, dry seasons, and intensified storms.

Furthermore, this project examines the AMOC's sensitivity to climate change, specifically the impact of glaciers as a result of change in its stability. The conclusions drawn from our research highlight the urgency and importance for global corporations to take action in order to mitigate the risks associated with the potential AMOC's collapse.



Source for Image: https://www.collegesidekick.com/study-guides/geophysical/deep-currents

J-03

“AIRBOTTLE”
Eco-friendly Air Conditioning with Recycled Bottles

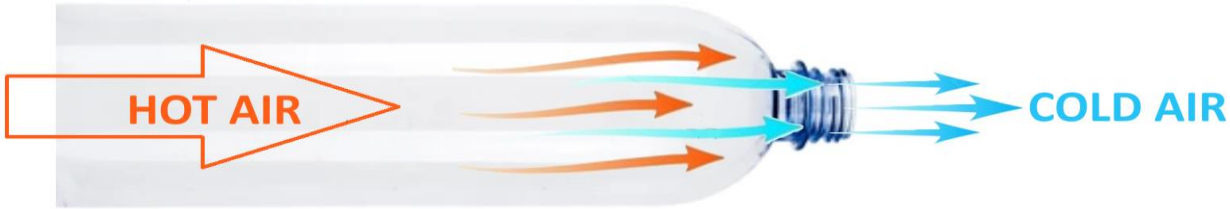
María del Mar Casanova Villanueva, Leire Gutiérrez Lois, Anna Moschberger Jiménez
(S1ESA), ESA Frankfurt

Our project aims to create an air conditioning device made from recycled plastic bottles that operates without electricity.

During the summer, using air conditioning not only consumes energy but also contributes to rising temperatures, creating a vicious cycle that exacerbates climate change.

Inspired by a video of an Indian project where plastic bottles were used in windows to reduce indoor temperatures, we designed “Airbottle,” an air conditioning device that aims to save energy, reduce contributions to global warming and climate change, and provide an affordable cooling solution for those who cannot afford traditional air conditioning.

Our hypothesis is that when air passes through a bottle, it cools as it moves from the wide end to the narrow end due to the air compressing in the bottle's neck. This is similar to the sensation of cool air felt when blowing on the palm of the hand.
Based on this principle, we constructed “Airbottle” using 35 plastic bottles inserted into a wooden panel and tested it on a model cardboard house. Our preliminary experiments show a temperature reduction of approximately one degree Celsius. We are currently working on improving the design to achieve even further reductions in temperature.



J-04

Sustainable Cities: Can we Really Make our Cities Sustainable?

Vedha Sabharwal , Ruofan Yang, Mihika Parashar (S2EN), EN RheinMain

Our team noticed that cities must be more sustainable. We noticed that a lot of cities do not offer adequate protection from the harmful effects of climate change such as heatwaves. We also noticed that cities often fail to provide a habitat for animals. Many cities also contribute to climate change. We want to change this. We want to make cities that help restore biodiversity and mitigate climate change a reality. This is why we did this project.

To understand what citizens would like to have in sustainable cities and to know which actions citizens are willing to take for making our cities sustainable, our team conducted a survey. In the survey we included questions that asked for people's opinions on sustainable cities. As well as questions that asked for what they think should be included in sustainable cities. We also asked if they think governments are doing enough to make our cities sustainable. And most importantly, we asked for appealing action ideas that participants are willing to take for transforming our cities into sustainable ones. One example of a question is: "Do you think sustainable cities are important?". Another example of a question is: "Please mention more things the government can do for making our cities sustainable."

We will also ask the mayor of Frankfurt for the feasibility of making Frankfurt a more sustainable city. Our team will present the results of our survey to the Frankfurt mayor and ask him if the results are possible to implement in Frankfurt. Based on the reply we will make a realistic 3D model of a sustainable city.

One of our main focuses is to present action ideas to the audience. We will present appealing and realistic ways to help make our cities sustainable. Some of these action ideas are going to come from our survey, others will be our ideas.

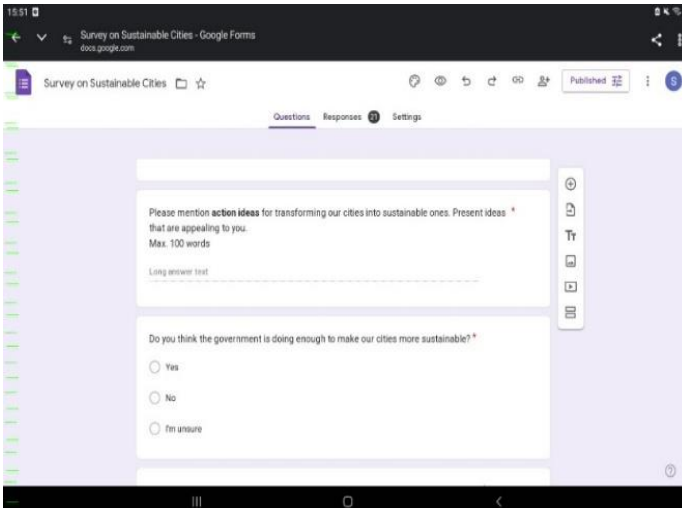


Figure: screenshot of survey

J-05

Small Plastics, Big Problem

Maja Limantaitė , Eliza Slavova , Oleksandra Yevtushenko (S3EN), EEB1 Brussel

The objective of our project is to **raise awareness** about the worldwide problem of microplastics and find out if people know how present they are in our daily lives.
What problems do **microplastics** cause and how can we address them?

The first part of our project is raising awareness. We will address questions such as **what microplastics are, what problems they cause and how we can reduce their use.**

The second part is a **survey**. We have already collected **230 responses from 31 countries all around the world, from people aged 10-75+** and we will continue to collect more. Initial results show varying levels of general awareness and of specific knowledge on the presence of microplastics in our daily life and the environment. Despite the varying knowledge, **over 90% of the respondents believe that the government should take action to reduce the use of plastics.**

The third part is an **experiment to make bioplastics**. The global use of plastic has **increased** dramatically since 1950 and we urgently need an alternative. Our solution is **bioplastics** which is 100% biodegradable and environmentally friendly. **Using vinegar, glycerine, water and cornstarch**, we will make different recipes and models which will be presented. We will also make a cup using bioplastics to see if it would be possible to replace plastic cups with these eco-friendly ones. We will see under what conditions the bioplastics material dries best and how it affects its overall quality.

If possible, in the fourth part we will investigate the process of **filtering microplastics** and the **effect** they have on living things. However, this requires professional equipment which we are yet to acquire.

J-06

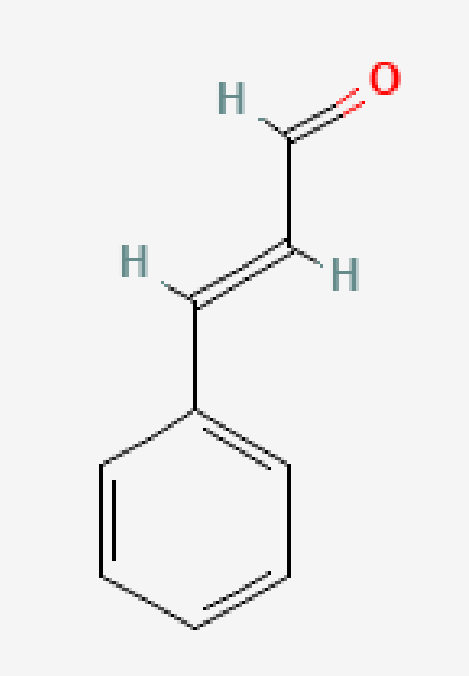
The Transformation of Polystyrene to Cinnamaldehyde

Matej Hradec (S2EN), EN Varese

Polystyrene waste poses a significant environmental challenge, this project demonstrates a sustainable approach to upcycling polystyrene into cinnamaldehyde, a widely used compound. During an experiment, an error in the procedure involving excessive heating resulted in the formation of a partly repolymerized styrene resin.

This material, which has not yet been previously described in existing studies, can hold up to 2kg/1ml. I believe its potential applications in some fields requiring high load bearing capabilities highlights the need for further research. While I tested the properties of this resin,

I discovered the resin undergoes accelerated polymerization when exposed to UV light. The original project involved a pyrolysis of polystyrene with a catalyst, getting styrene from it, was then going to be used in an experiment named the Vilsmeier-Haack reaction which would in the end give me cinnamaldehyde. In the end I think that this approach could solve a percentage of the polystyrene waste produced yearly if done on a large scale



J-07

Kalanchoes on Mars, closer to living in space

Matteo Suárez Boudron, Laura Márquez Pérez and Carlos Aracil Pérez (S4ES)
ES Alicante

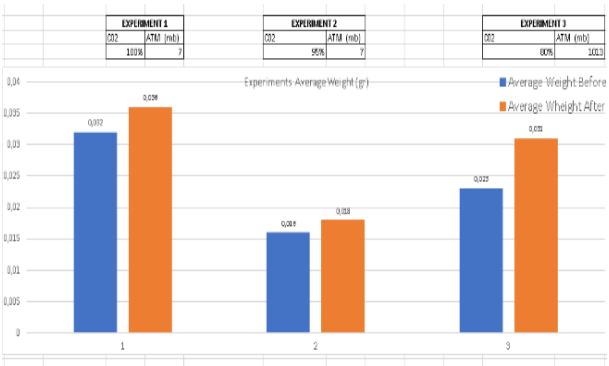
The need to advance and control the unknown is what makes us human beings, as Francis Bacon, one of the great fathers of the scientific method, established in the seventeenth century. Wondering what will happen to us in the future was the reason why we decided to start this project. In this research, we set out to study how plants would react in different atmospheric conditions, both on Mars and on Earth in the future, with the purpose of analysing whether it would be possible to grow them and how they would respond to a higher concentration of CO_2, reduction of O_2 and different atmospheric pressures.

To develop our project, we used kalanchoes, a plant which reproduces through plantlets. This makes sure that every kalanchoe is genetically identical. This helps to have more specific and reliable results. We simulated various atmospheric conditions using a vacuum chamber and a hydroponic system with agarose gel and MS medium, as water could evaporate at lower pressures.

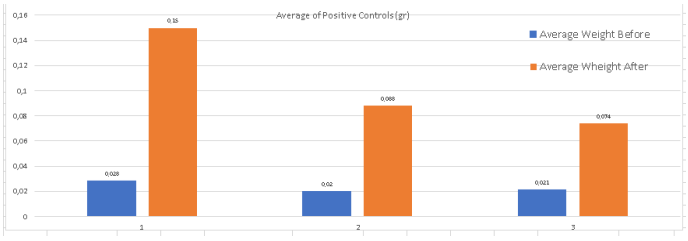
We have carried out three experiments with different gas mixtures and atmospheric pressures, having much data on kalanchoe growth. In all cases, we observed similar reactions in plant development. The first two experiments revealed little change in the kalanchoes, likely due to the oxygen and nutrients absorbed before placing them in the vacuum chamber. However, in the third experiment, we noted more significant changes; the plants retained their original greenish tone and showed a slight opening in the leaves.

For future experiments, we are going to study how kalanchoes are affected by potential future atmospheric compositions on Earth, considering the possible modifications caused by the climate change.

These results show us the importance of the oxygen to the vegetal development and leave us open questions about the possibility of life in other planets.



Exp. #	Pressure (milibar	% CO2	%O2	Average Weight Before	Average Wheight	% Growth	Pressure (millibars)	% CO2	%O2	Average Weight Befo	Average Whei	% Growth
1	7	100	0	0,032	0,036	112%	1013	0,04%	21	0,028	0,15	541%
2	7	95	5	0,016	0,018	121%	1013	0,04%	21	0,02	0,088	441%
3	1013	80	20	0,023	0,031	135%	1013	0,04%	21	0,021	0,074	352%



J-08

Preventing eye strain by monitoring a user's screen distance using python

Alp Demir (S4 EN), EN Bergen

The aim of this project is to reduce eye strain by monitoring the user's distance from the screen through a python script. By detecting and warning the user when they are too close to the screen, it helps build healthy viewing habits which prevent people from straining their eyes and helps maintain their eye health.

Materials:

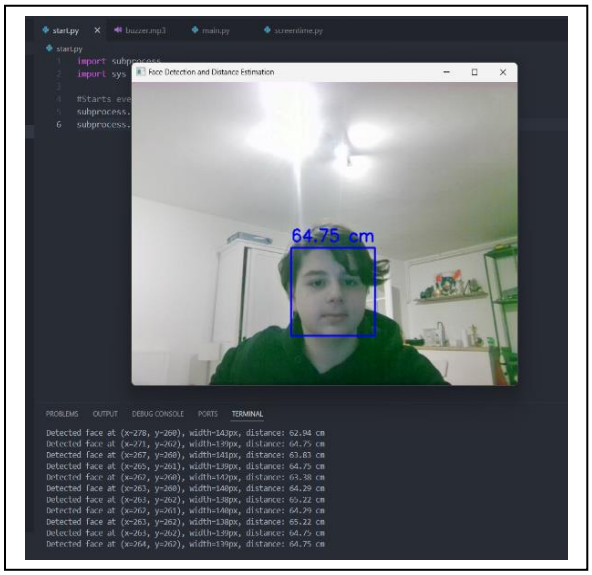
- Webcam or live camera
- Computer with python program and open-source face detector loaded
- Participant

Variables:

- **Independent variable:** The different participants.
- **Dependent variable:** How many times the participant gets too close to the screen in the first half and the second half.
- **Control variable:** The computer program, the webcam, and the video the participants watch.

Method:

The method of this experiment is to first set up the computer with its webcam and the python program. Once the setup is complete, play the selected video to the participant (All participants watch the same video). Record how many times the participant came too close to the screen in the first 5 minutes, then, create a new count and record how many times the participant came too close to the screen in the second 5 minutes. Once the 2 halves are complete, compare the number of times the participant got too close to the screen during the experiment. A reduction in the second 5 minutes indicates that the experiment successfully encouraged healthy viewing habits.



J-09

Luxembourg Water Quality

Ben James Crawford (S1 EN), EN LESC Clervaux--Luxembourg

This project is about measuring how clean the water in Luxembourg is.

This subject is important because if you drink too much contaminated water you can become ill. For example, if the water contains many Nitrates, it can give you a sickness called *methemoglobinemia* that reduces the amount of Oxygen your blood cells can carry and it can kill you.

My hypothesis is that the water quality in the north of Luxembourg is better in the rivers than in the south of Luxembourg, because more people live next to the river in Luxembourg City for example than in Clervaux. With this project, I wanted to see if I could see a relationship between the size of the population and the river water quality.

I tested my hypothesis by firstly identifying in what direction the main rivers flow. I took samples from rivers at various points in Luxembourg close too some major towns and out in the countryside. I also took tap water samples and rainwater samples for comparison. I did some online research to find the best test methods for analyzing water for pollution. From this, I decided that testing for pH, Electrical conductivity, Nitrates, Nitrites, Oxygen level, Phosphates and biological content would be important for showing pollution level.

I then collected samples, measured them, summarized, and compared the results to see if changes in pollution level could be observed along the flow of the river. From this project, I was able to show that the water quality in the rivers in the north of Luxembourg was better than those in the south. This proved my hypothesis correct.

From this project, I learned how to analyze water for pollution. I also learned about the geography of Luxembourg's rivers, and I found out in what areas water is polluted.

Sample label	Water type	Location
1	creek	Drauffelt
2	creek	Drauffelt
3	river	Drauffelt
R1	Rainwater	Drauffelt
4	river	North of Clervaux
DT	Tap water	Drauffelt
5	River	Diekirch
6	River	Petrusse
7	River	Walferdange
8	River	Luxembourg City
9	River	North of Goebelsmuehle
10	River	North of Goebelsmuehle

J-10

Enhancing Bulletproof Vests with Non-Newtonian Fluid: A Solution for Urban Security Challenges

Stefano Marcelli, Cristian Pambianco, Lorenzo Pastori (S3IT) IT Frankfurt, Germany

This project aims to highlight the need for improved protective equipment in response to escalating assaults in high-risk urban areas, particularly train stations in Frankfurt, Milan, and Rome. By introducing non-Newtonian fluids—specifically, shear-thickening fluids (STFs)—into bulletproof vests, we seek to demonstrate how these innovative materials can improve both the comfort and effectiveness of personal protective equipment (PPE) for security personnel and civilians.

The primary objective is to explore the unique properties of non-Newtonian fluids that allow them to remain flexible during normal movement and instantly solidify upon high-impact events. This dual behavior facilitates better mobility for the wearer, while ensuring optimal energy dispersion to guard against bullets and sharp objects.

Through detailed comparison with traditional Kevlar-based armor, our study examines STF-based vests' performance in terms of wearability, weight distribution, and protective capacity. Testing through field simulations and feedback from users has underscored STF technology's potential to enhance protection without sacrificing comfort.

Ultimately, this research aspires to provide practical advancements in PPE that address the urgent security needs in urban environments. By combining agility with reliable protection, STF-based vests offer a promising solution for safer, more adaptable defensive gear in vulnerable public spaces.

J-11

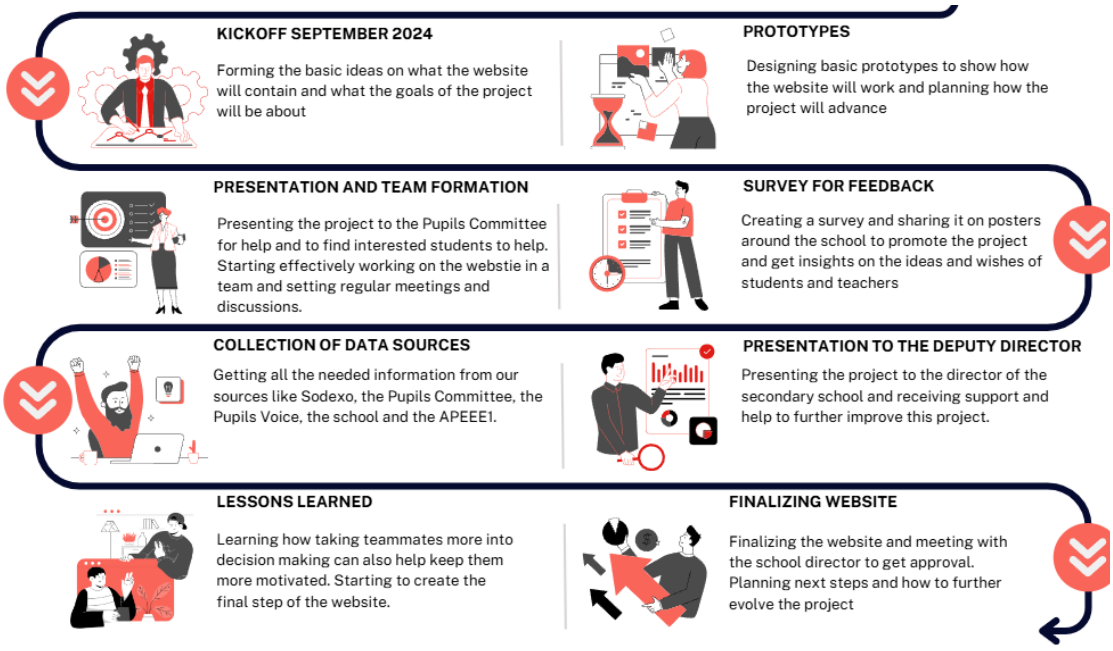
E-School, a Digital Gateway to School Life

Luka Takki (S4FIA)
European School of Luxembourg 1

E-School is a unique, fully student-led research project that improves access to essential school information and promotes digitalisation in schools. E-School solves the problem of many school websites and scattered data. It brings together all key information such as food menus, extracurricular activities, events, teacher absences and school news in a user-friendly website, enhancing communication and student engagement.
The website has been developed by me and three other students using modern web development tools and coding. Through the project I have been in contact with companies and organisations within the school to get the necessary information and support. The project began with sociological research that consisted of an online survey which 83 students responded to. 83% of the students stressed that there is not enough information available, and a new website central is needed. Two prototypes for a website were created and reviewed by teachers, the Pupils Committee, and the secondary school director, who supported the initiative and agreed to its setup.

By further analysing survey data and carrying out interviews, this project examines the impact of student involvement on motivation, engagement and creating a sense of community within the school. In addition, it investigates how integrating digital tools have improved learning and communication. This project demonstrates that student-driven projects can enhance academic outcomes for both participants and users while supporting the development of essential skills in leadership, collaboration, and the application of emerging technologies.

Infographic on the project timeline and process:



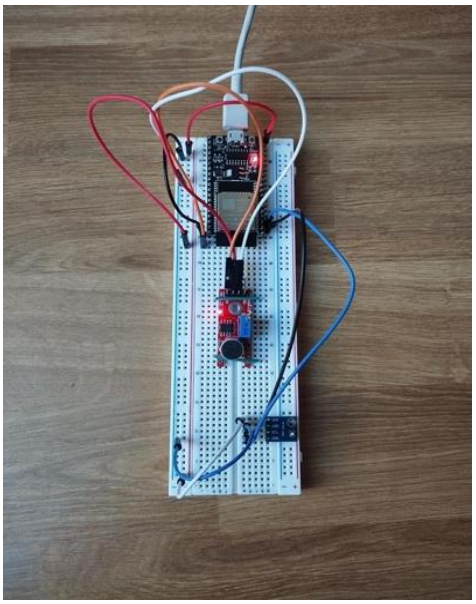
J-12

Classroom Environment Monitoring: Information for a Better Learning Space

Matteo Alabiso, Lucas Álvarez
(S4EN), EN Parma

The project Classroom Environment Monitoring focuses on measuring and analyzing two factors in the school environment that affect student learning: noise and CO_2 levels. We will employ an Arduino-based system to record the data throughout the day inside the school. The recorded data will be based on 45-minute school periods followed by breaks. This format will allow us to track trends over different times of the day and across the week.

The system will include the SGP30 sensor to measure CO_2 and KY-037 for noise detection. Data will be logged and sent to an online cloud storage service using an esp32 Wi-Fi chip for visualization in graphs that are easy to interpret. Active signals, such as LED indicators for CO_2 and noise, warn students and teachers when levels surpass acceptable thresholds. These prompts not only allow teachers to take immediate action to improve the classroom environment, but also encourage students to self-adjust their noise levels. This project is focused on providing the most valuable insights into classroom conditions that support the optimization of learning environments.



J-13

Fine Tuning Photosynthesis - Focusing on Plants' Favorite Colors

Abdullah Siam (S3EN), EN RheinMain

The global population is projected to reach 9.1 billion by 2050, necessitating a 70% increase in food production. This demonstrates the need for more efficient ways to grow crops. One method is to use LEDs or other forms of artificial lighting to selectively emit wavelengths which can significantly increase the energy efficiency of photosynthesis above the usual 1 - 3% for plants. However, there are some drawbacks to the use of LEDs, LEDs have a high first cost, consume a lot of electricity (although ~75% less than other forms of lightning), exacerbate light pollution, and the mining of rare earth metals for their production is harmful to the environment.

This project explores an alternative to LEDs by using optic light filters. Optic light filters are more environmentally and cost friendly. The filters will selectively transmit wavelengths which Chlorophyll A and B best absorb blue (430 – 470 nm) and red (640 – 670 nm), increasing the rate of photosynthesis. While incident sunlight arriving too the plants will be reduced, this effect will not be significant since photosynthesis is more efficient at lower light intensities, plants anyway only absorb approximately 34% of photosynthetically active radiation and reduced light intensity can prevent photoinhibition in plants which can further lower photosynthetic energy efficiency.

The plant species *Thymus vulgaris* (Thyme) and *Primula acualis* (Primrose) will be used. From each species there will be six specimens; two will be the control, the other two will experience filtered red light, and the last two will be subjected to filtered blue light. Every three days, metrics such as plant height, number of leaves, and canopy area will be recorded. At the experiment's end, biomass will be measured and mathematical models such as Net Assimilation Rate (NAR), Light Use Efficiency, and Relative Growth Rate (RGR) will be used to determine photosynthetic efficiency.

Figure: Experimental setup

J-14

L’énergie osmotique – Une solution pour le futur?

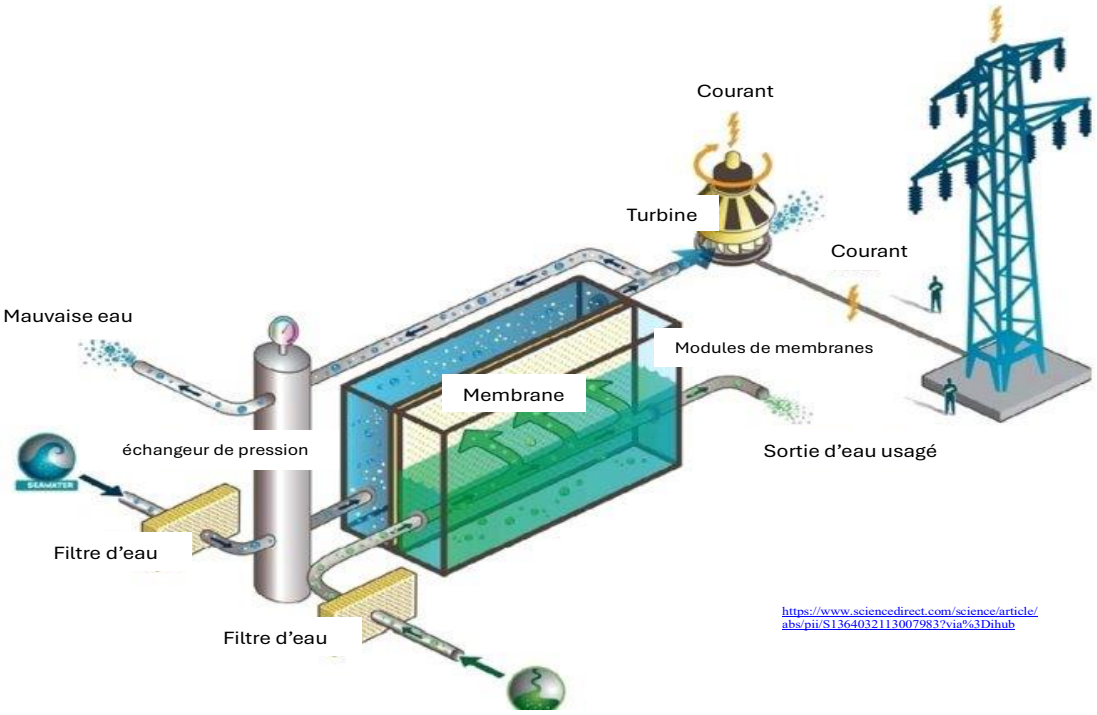
Paul Fourestié (S3FR) EEB1 Brussel

Les activités humaines nécessitent de plus en plus d’énergie. Mais malheureusement la production et la consommation d’énergie conduit souvent à rejeter du CO_2 ou du méthane dans l’atmosphère. Cela suscite un effet de serre et une augmentation de la température qui perturbe le climat, avec des conséquences qui peuvent être désastreuses.

C’est là que les énergies vertes interviennent : on cherche des énergies qui ne rejettent pas de CO_2. Parmi ces énergies vertes, on parle souvent de l’éolien ou du solaire mais rarement de l’énergie osmotique.

Dans mon projet je vais expliquer et illustrer par des expériences en quoi consiste l’énergie osmotique. En particulier, je vous parlerai des expériences que j’ai réalisées avec l’équipe Micromégas du laboratoire de physique de ENS (l’Ecole Normale Supérieure de Paris). Je vais aussi expliquer quelles sont les difficultés à surmonter pour que la production de cette énergie soit suffisamment performante pour être commercialisée, et pour construire des centrales osmotiques.

L’énergie osmotique est une énergie verte, qui ne crée pas de déchets, et qui pourrait être installée dans de nombreux endroits. En plus cette énergie a un potentiel gigantesque cette énergie pourrait produire environ 30% de l’électricité. Ça pourrait être une des solutions pour le futur de notre planète !



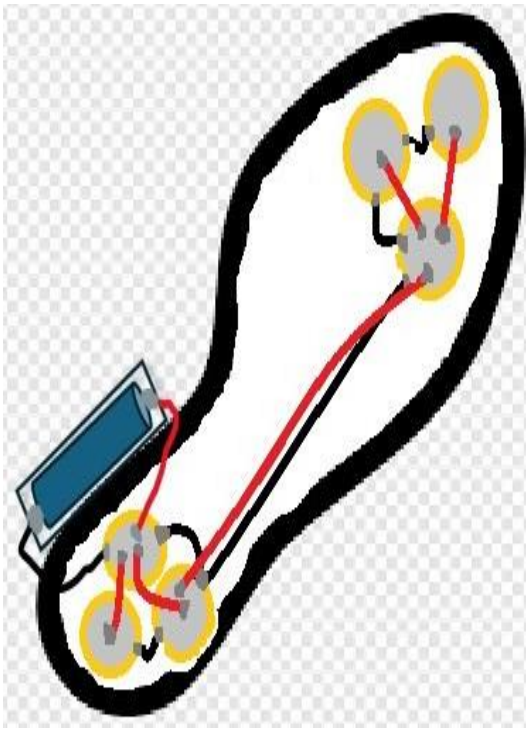
https://www.sciencedirect.com/science/article/abs/pii/S1364032113007983?via%3Dihub

J-15

Walking Electricity: Generating Power with Every Step

Foivos SYRRIS-TSOMPANOPOULOS, Miron MYROSHNYCHENKO (S2EN)
EN Varese

This project explores the integration of renewable energy generation into everyday activities by designing a shoe capable of producing and storing electricity during walking. Using piezoelectric discs embedded under the insole, mechanical energy from each step is converted into electrical energy, which charges a small rechargeable battery



The prototype will be tested to evaluate its efficiency, including the amount of electricity generated per step, the time required to fully charge the battery, and the number of steps needed to charge devices such as a smartphone. This innovation not only offers a convenient power source for small electronics like TV remotes but also promotes physical activity and contributes to a sustainable future. By reducing reliance on conventional energy sources and encouraging healthier lifestyles, this project represents a step forward in the quest for environmental sustainability and practical green technology.

J-16

Reasons Behind Changes in Bird Migration Routes : An analysis of potential causes

Jesús Álvarez Ruiz (S4 EN), EN Warsaw

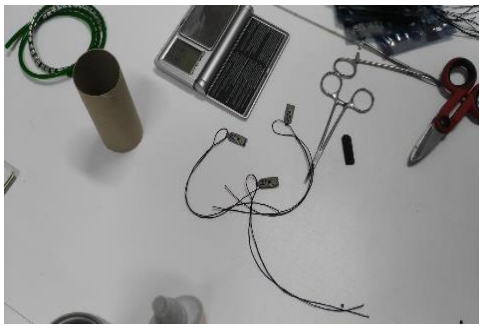
Over the course of life, habits are formed that are quite hard to eliminate or modify, in both humans and animals. One of these remarkable habits is migration.

The aim of this research is to identify the primary factors contributing to the alterations in birds' migratory paths and the role of humans in accelerating this phenomenon. The impacts of environmental influences, climate change, human-related factors, and the dietary habits of specific birds on their migrations will be examined. For this study, prior research will be referenced, sourced from libraries and websites, including texts like "Collins Bird Guide/ Larss Svensson, 1999" and "All The Birds Of The World/ Josep del Hoyo, 2020". Additionally, field observations will be conducted at key locations such as Gibraltar (renowned globally as a prime spot for watching migratory birds) and Gdansk (where the Baltic area's surroundings present an unmatched diversity of aquatic and land migratory species). Professionals in the area, including biologists and ornithologists, as well as meteorologists and casual bird enthusiasts, will be interviewed regarding their perspectives and hypotheses. Monitoring through ringing and micro GPS in the selected species will also provide crucial data for the research, as these are the most established and effective methods to understand the migratory paths of these bird. Various hypotheses will be examined, with the anticipated answers being highly beneficial in the future due to the comprehensive data supplied.

The initial hypotheses of the research are as follows:

I. Over the past 40 to 50 years, the migratory paths of some bird species have noticeably shifted because of various influences.
II. Certain birds have ceased their annual migrations, as they discover food, shelter, or other factors that persuade them to remain in the countries they visit.

Recognizing these factors is crucial for formulating conservation plans and safeguarding the biodiversity of these migratory birds. All evidence suggests significant alterations in migratory paths, and that certain species have ceased migrating, but the research must strive to the fullest to uncover the reasons.



J-17

Do plants and mushrooms serve as natural antibiotics?

Rodrigo Martínez Barberá, Javier Canals Estirado (S2ES), ES ALICANTE

The aim of our research is to demonstrate that plants and some mushrooms can serve as natural antibiotics, both for gram-positive and gram-negative bacteria. To test our hypothesis, we used two species of bacteria (*Escherichia coli* - gram positive- and *Enterococcus faecalis* - gram negative-), and we cultivated them in Petri dishes and confronted them with paper discs soaked in different extracts, corresponding to eight plants (aloe vera, lavender, onion, rosemary, turmeric, oregano, ginger and tea tree) and a fungus ("nízcalo", *Lactarius deliciosus*).

As a positive control, discs soaked in four commercial antibiotics were used (tetracycline 30 micrograms/disc; penicillin 10 IU/disc; streptomycin 300 micrograms/disc; and chloramphenicol 30 micrograms/disc). The results obtained have been positive, after measuring the inhibition halos around the discs demonstrating that the bacteria tested are sensitive to some of the extracts depending on the species, as well as to three of the commercial antibiotics, being *E. faecalis* resistant to penicillin.

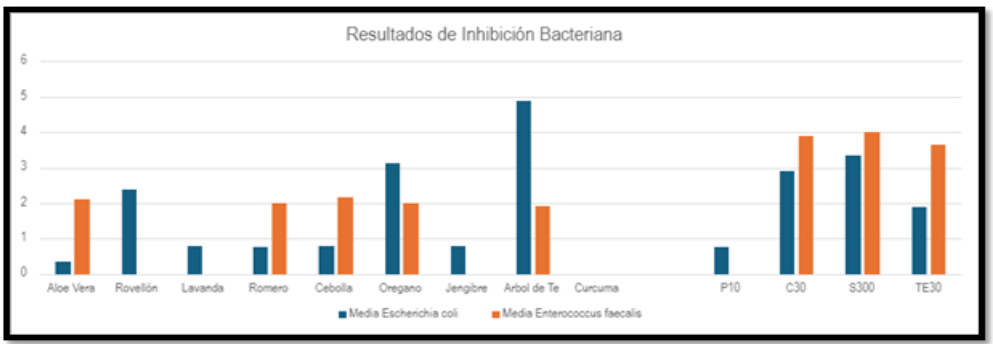


Figure 1. Bacterial inhibition zone of commercial antibiotic discs and discs of natural substances (in cm). Natural substances: aloe vera, *Lactarius deliciosus*, lavender, rosemary, onion, oregano oil, ginger, tea tree and turmeric. Commercial antibiotics: P10: penicillin 10 IU/disc; C30: chloramphenicol 30 micrograms/disc; S300: Streptomycin 300 micrograms/disc; Te30: tetracycline 30 micrograms/disc.

J-18

Study of different plants under lighting conditions to determine how they thrive

Kenda Mohamed, Sathvika Krishna, Freddi Lee (S2EN-) EN LESC Clervaux--Luxembourg

This study shows us which type of plants germinate best under different lighting conditions.

We used paper as an alternative organic matter from plants to replace soil. This experiment was carried out for ten (10) days to draw a common conclusion.

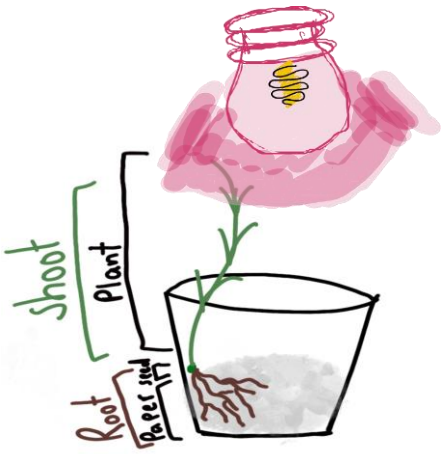
The seeds we used were **Lactuca sativa** (*lettuce*), **Zea mays** (*corn*), and **Phaseolus vulgaris** (*bean*) under different wavelengths of light and complete darkness.

Each of these seeds is placed under **5 different lighting** (LED) conditions:

- under red light (about 660 nm);
- under blue light (450nm-495 nm);
- under yellow light (570nm-590nm);
- under green light (545nm-555nm)
- under complete darkness

The use of this experiment is to determine which type of plant can germinate best under certain lighting conditions. People who wish to be able to produce more outputs from crops within a small amount of time can implement the information/knowledge that we were able to obtain from the results of this experiment.

Based on our experiments the seeds can be divided into **LIGHT-REQUIRING SEEDS** (*lettuce or thyme*) and **DARK-REQUIRING SEEDS** (*cornflowers, onion*).



J-19

The importance of food offered in school cafeterias for a healthy diet

Georgina Iris Dimopoulou Vantsiouri, Vittoria Passanisi (S1EN), EN EEB3 Brussels

1. Why are we doing this project (to help people not eat unhealthy foods).

Our group has decided to work on this project, so that kids in all schools can be aware of what they eat and how it affects their health. We hope that this will change the way some kids eat by making the healthy choice the easy choice.

2. Why some food is unhealthy and healthy and why we should be careful when eating?

Highly processed foods tend to be low in nutrients and high in empty calories. This is because they contain high levels of unhealthy fats, sodium, and sugar. If we are not careful with what we eat, then we may have health issues when we grow up!!! Eating a variety of foods and consuming less salt, sugars and saturated fats and trans-fats, is essential for healthy diet. Healthy foods can relieve you from muscle aches, joint pains, fatigue, heart problems and facilitate efficient body functions for growth and development.

3.The importance of healthy food being offered in school cafeterias.

Many schools around the world have cafeterias. This is a big problem because kids are gaining weight fueling childhood obesity.
We think if the cafeteria sells healthier foods and drinks then kids would be in a position to make healthier choices.

4. What is a healthy diet?

Nutritional food protects you against many chronic non communicable diseases, such as heart disease, diabetes, and cancer. Food is made from nutrients. Nutrients are chemical compounds in food used by the body to function properly and maintain health!

5. Methodology

We asked the cafeteria of EEBIII to share with us the catalogue of foods that they offer. We then categorize all the foods offered according to how many negative nutrients they have: saturated fats, sugar and salt. Based on this categorization, we concluded whether the majority of the foods offered at the school cafeteria are healthy. We can draw conclusions from our school cafeteria.

6. Conclusions

In summary, we think that cafeterias around the world should have more healthy choices than unhealthy. They should also show what ingredients are in their products, so that kids are aware of what they are buying and if it is unhealthy and not good for them.

J-20

Containment of oil spillage on surface water

Jack Laban, Tristan Weller (S1EN), EN Karlsruhe

Aim:

The aim of this experiment is to test various natural and affordable materials to effectively contain oil spills on surface water. Which materials can prevent oil spreading, and which can absorb or repel it?

Introduction:

We chose this topic because oil spills harm marine life, including birds and mammals. We need affordable, biodegradable materials to avoid exacerbating the problem with plastic. The materials should contain or repel oil for reuse and must float.

Method:

Four experiments were conducted. Each time, a basin was filled with a measured volume of fresh tap water. A barrier made of the chosen material (grass, cotton wool, or hair) was built in the middle of the basin using two rectangular pieces of wood. In each experiment 5.0 mL of synthetic oil was carefully poured from the rim of the basin, avoiding turbulence. Pictures were taken at regular time intervals.

Figure 1 Experiment 1:
grass preparation (left) and final results (right)

Figure 2 Experiment 3: Cotton wool at timer start (left) and after (right)

Material	Oil Contained?	Absorption	Oil Repelled
Dry Grass	yes	partially	Partially
Fresh + dry grass	yes	no	yes
Cotton wool	partially	yes	no
Hair	yes	no	yes

Table 1 Summary of observations

The experiments successfully contained the oil. Longer experiments and more oil would improve accuracy. Repeating experiments with salt water and multiple trials would yield better results. Fresh and dry grass combined worked well to contain oil without absorbing too much. This combination is cost-effective and readily available for real spills.

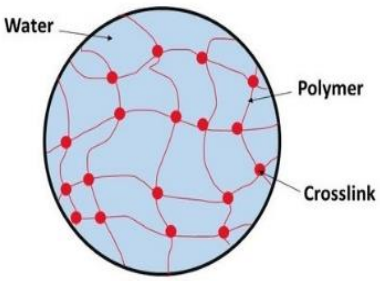
J-21

Biodegradable Hydrogels: "A Solution for Watering and Growing Plants"

Mario NESHEVSKI, Kaloyan GEORGIEV (S2BGA), ES Brussels IV

Problem: Water is a crucial requirement for plant growth. Therefore, both during the school term and vacations, we are exploring innovative and efficient irrigation methods to sustain the school garden and support plant development.

Possible solution: For the past five decades, hydrogels have been widely utilized in agriculture due to their ability to retain water and facilitate nutrient distribution when incorporated into soil. This project aims to identify an effective solution for watering plants over extended periods, such as vacations, to promote healthy plant growth.



Experiment:

Part I. The first part of the project will be production of a nontoxic and biodegradable hydrogel using the same compounds to produce it, but in different ratios.

Chemicals to create hydrogels:

- agar
- hydroxyethyl cellulose [HEC] reagent grade powder
- sodium carboxymethyl cellulose [CMC] powder
- citric acid

Exp. 1 - Which ratio of the hydrogel components can release and then reabsorb the highest percentage of water?

1. Preparation of three different biodegradable hydrogels.
2. Preparation of 3 mixtures of the hydrogels in different ratios.
3. Testing the biodegradable hydrogels and finding which ratio of components can release and then reabsorb most water.

Part II. Extreme environmental conditions are often found, such as rapid heating from the sun and large temperature changes. There are a lot of places without access to water sources. These factors present great challenges in sustaining plant growth.

Exp. 2- Can plants grow in biodegradable gels?

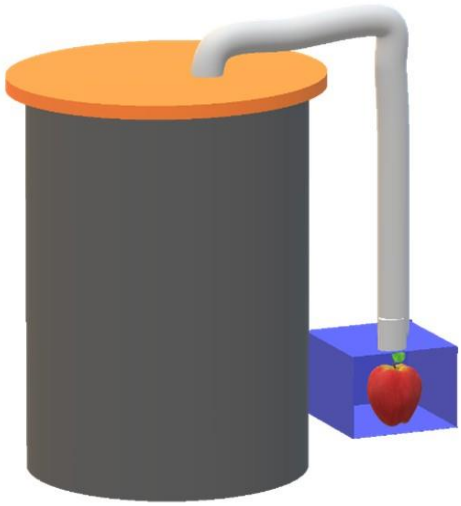
1. Usage of 3 different plants from the school garden to test the growth of the plants: spearmint, kalanchoe and geranium (pelargonium).

Objective: Our team is exploring new and efficient ways to water the plants by using hydrogels. We aim to find a reliable way to water the plants during long periods and ensure they continue to grow strong and healthy.

J-22

WHAT HAPPENS TO AN APPLE IN SPACE?

Sara Pascual, Sonia Vallejo (S1ES), Luxembourg I



Our project studies what would happen to an apple in space. We think this is interesting because space is something complex and still under exploration, so this examples, may tell us what other things may have to face when going to space.

To find the answer to our question we did some research in the internet. Our goal is to approximate what happens in the space with things we have in earth but we found is not so easy. We have to reproduce the sudden change of pressure, temperature, and oxygen from earth conditions to space.

To reproduce the vacuum conditions we built up a pump based on two chambers, one of them cooled. We tried to model everything with gas laws.

For temperature we have cooled down the apple with the means we could reach.

For oxygen, we compared an apple with different pressures.

We found out is not so easy to reproduce the space conditions, but it is a fascinating field.

J-23

Organic Waste Fuel Cell (Energy from dirt)

ZIORKIEWICZ Karol, APOSTOLOU Apostolos, MOLA Francesco(S2EN)
EN Warsaw

Our project is to generate energy with Soil Fuel Cell.

- The goal is to harvest the energy from the organic waste and soil to gain electricity.
- The method that we will use is collecting material (different types of organic waste), putting it in a container, and we are adding 2 electrodes of different materials (steel, zinc, cooper) that will harness the electrons that are found in the material. This will make a circuit that will give us electricity.
- We will connect the energy to a multi meter to see the amount energy that we produce
- Our project is to generate green energy. This is a way to help the world during the energy shortage as it is a renewable energy source, so it will never stop producing energy.
- This way of producing energy will also not harm the environment like fossil fuels as it will not produce emissions
- The energy is produced by chemical reactions and a special bacteria called electrogenic bacteria. This kind of bacteria is found in many places including dirt. It generates energy by eating the nutrients and sugars that are found in the soil, they release electrons. The bacteria that are found in dirt, Shewanella and Geobacter.
- In our dirt we will add 3 types of compost that will each play different roles to the bacteria. We will add, Homemade compost, Grass compost and store-bought compost
- After doing more research, we could power a battery using an MFC.

J-24

THE PROPER USE OF REDUCED MOBILITY SPACES. PROPOSAL FOR SIGNAGE IN THE EVENT OF MISUSE

MAURO PAIS ÁLVAREZ (S1ES),EN Alicante

Disabled parking spaces are special spaces designed for people who have difficulty walking long distances or who need closer access to buildings. These people have a special card that allows them to use these spaces. However, when other people occupy them without having that card, they are causing a serious problem.

This project seeks to show why it is essential to respect these spaces and how the incorrect use of these spaces negatively affects those who really need them. I am doing this project because, having a sister with reduced mobility, I have experienced first-hand how the misuse of these spaces affects her daily life, and our daily life. With this project I want these spaces to be used correctly. Therefore, I want to design a system so that a red light turns on when the space is misused. To do this, an Arduino needs to be used in each space to identify whether the car using the space has or does not have the corresponding card. The card is identified with a microchip that all cards should have in the future. Therefore, when the parking car does not have a card, the Arduino turns on a red light that is charged by sunlight. I have started by locating the disabled parking spaces within a radius of approximately 2 km around my house and the European school in Alicante

J-25

Early detection of mental health conditions through text analysis and biometric signals with AI

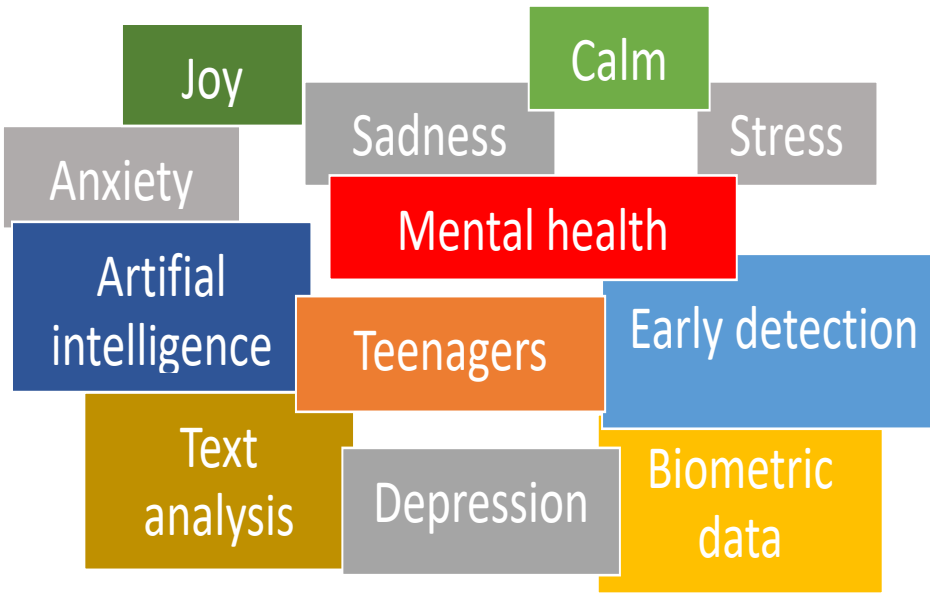
Catalina Valero Peces, EEB3 Brussels

Objective: The problem of mental health conditions is particularly affecting teenagers; with this work I will investigate how AI can prevent mental health conditions before they become worse and be able to offer early support.

Approach: I will explore how by analysing text and biometric signals such as sleep patterns could lead us to problems such as depression, anxiety, and others. I will gather anonymous information from a group of students (between 5-10) asking them to write a daily diary for a week on how they felt or did every day and used to identify words about stress, sadness, joy and calm. And I will ask them to reply to a questionnaire on how they have slept, if they have palpitation or nerves and I will see if there is any link between these data and the emotions written in the diary. For example: if one of the students reports to be very tired and stressful and his sleep data show that this lasted little could be a sign of stress or anxiety.

Analysis: For the analysis, I will use a basic artificial intelligence application that analyses the texts.

Conclusions: Once you analyse the data, I will reflect on whether AI succeeds in identifying emotional problems, whether the biometric data in the questionnaires confirms the textual analysis of the diary and what are the limitations such as maintaining privacy or not having written everything they felt. Although the result expected is that AI can help us detect mental health problems, it is important to remember that it does not replace health professionals.



J-26

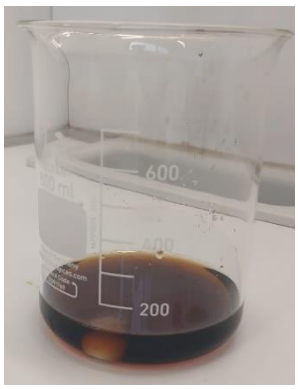
Reaction between Coca-cola® and Mentos®

Luna Bosir Scek Mohamed, Joanna Sweeting (S1EN),), EN Karlsruhe

The aim of this experiment was to investigate the factors causing the reaction that occurs when Mentos are dropped into Coca-Cola.
Why did we choose this experiment? After watching several YouTube videos, we were curious about the reaction between Mentos and Coca-Cola

1.It was investigated if the **volume and shape** of the Coca-Cola container has an influence on the gas formation. The experiment was repeated using different glassware e.g. 800 mL beaker, 400 mL beaker, 100 mL volumetric flask, 100 mL conical flask and 100 mL measuring cylinder.

2.It was investigated if the **surface area** (or particle size) of the Mentos has an influence on the reaction of fast gas formation. The experiment was repeated using full-size Mentos, crushed Mentos and finely crushed Mentos.



Conclusion: The reaction caused by Mentos in Coca-Cola is a physical reaction called *nucleation*, not a chemical reaction. We now know that the reaction that Mentos causes when added to Coca-Cola is not a chemical reaction, it is instead a physical reaction called NUCLEATION. Coca-Cola contains a gas called carbon dioxide ($C0_2$) which is dissolved under pressure in the bottle. The surface of the Mentos is not as smooth as it appears and under a microscope it shows cracks that offer a point for the carbon dioxide gas bubbles to form. Further investigations will be carried on to find other variables that can enhance this phenomenon.

ESSS

J-27

VERTICAL FARM

VETISAN Larisa Stefania (S2RO), ES Brussels IV

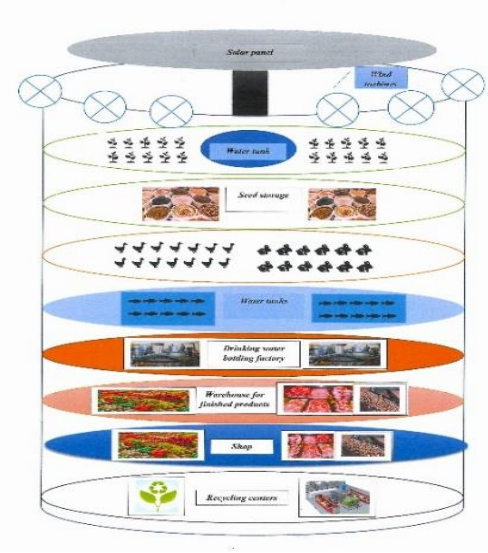
CONTEXT:
In 2050 the world's population will reach nearly 9.5 billion people. Currently, about 80% of the world's farmland is already being cultivated. In about 20 to 30 years, there will not be enough farmland to feed everyone on the planet.

IDEA:
"***People are increasingly thinking of moving farms into the heart of big cities, into huge ultramodern towers***" Although it seems impractical at present, it could soon become the only hope for feeding the world's population.
Vertical farms will allow people to farm vertically in the future, rather than horizontally as it is done at present.

ADVANTAGES OF VERTICAL FARMING:

- No more crops destroyed by hail, tornadoes or drought: the weather will always be ideal and no crops will be lost.
- By producing locally everything that people in cities need, we will reduce greenhouse gas emissions: there will be no need to transport food from remote farmland to the city.
- By moving crops to urban centers, we will be able to give back to the land the opportunity to restore the natural habitats we have turned into farmland. Entire forests will be able to grow back and turn the CO2 we release into the atmosphere into oxygen.
- To feed the inhabitants of the big cities, about 100 vertical farms will be needed for each city. These will not only feed the inhabitants of the city, but will also produce water and energy.
- No soil is needed to grow the plants.

FARM STRUCTURE:



EXPERIMENTAL SECTION:
growing plants without soil (hydroponics)

METHOD:
Hydroponics is a cultivation method that stimulates plant growth without the use of soil. Hydroponic vegetables are planted in an inert environment and are fed with nutrient-rich solutions, oxygen and water.

OUTLOOK:
Using this method we hope to demonstrate that different plants can be grown in a vertical farm without the need for soil.

J-28

The Plant-Caring Robot: Feeding Our Planet and Mars!

Raphaël SNITER REVEST, Raphaël NEWTON, Luxembourg I

By the year 2050, there will be 10 billion people on Earth. With more droughts because of climate change, less water, and lots of soil and water pollution, it's going to be tough to feed everyone in a way that's good for the environment. Farming needs to change and become more efficient while causing less harm to the planet.

We wanted to see how the Internet of Things (IoT) could help with precision farming. So, we built a cool robot using Arduino that measures important things in the environment like light, water, and nutrients. This robot gives plants exactly what they need to grow strong and healthy. By using the right amounts, plants grow faster and healthier, and we use less water and cause less pollution.

Our robot collects data from sensors (a photoresistor and a ComWinTop humidity and "NPK" sensor, which measures Nitrogen, Phosphorus, and Potassium). We send this data to the ThingSpeak website to see how different levels of light, humidity, and nutrients affect plant growth.

We think our robot can be used in many ways, like in precision farming, science experiments to find the best ways to grow plants, helping lazy home gardeners, and maybe even in space for future missions to Mars!

SENIOR Projects

S-01

Triggers Affecting Crayfish Burrowing Behaviour

Arnav Dhole (S5EN), EN Bergen

The Netherlands is home to several crayfish species, including one native species (*Astacus astacus*) and multiple invasive ones. Among the invasive species are the red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and spiny-cheek crayfish (*Faxonius limosus*), all of which have become well-established in Dutch waters. These invasive crayfish significantly impact ecosystems: their burrowing behaviour, which destabilises riverbanks, canal banks, and dikes, leading to erosion and potential flooding threats for nearby populations. They also compete with native species by consuming available food sources, causing a loss of aquatic vegetation and biodiversity. This investigation explores the environmental triggers affecting crayfish burrowing behaviour. Groups of six crayfish (three males and three females) from different species will be collected from nearby canals using an eight-way foldable fish trap. After acclimating to water conditions in a large tub, the crayfish will be introduced into experimental setups to observe their responses under controlled conditions. The experiments will be conducted in three 60-liter plastic tubs, each containing a sediment layer to simulate natural conditions and minimize stress for more accurate results.

Two PVC pipes (⌀60mm) with removable caps will be connected to each tub, blocked at the back. One will be filled with ~1.5cm^3 foam cubes (simulating burrowing area) and one empty (simulating shelter area)
There are 5 treatments the crayfish will go through:

Treatments

- Burrowing Control (Only burrowing pipe open)
- Shelter Control Treatment (Both the burrowing and shelter pipes are open)
- Increased Water Temperature (Gradual temperature increase of 2 °C per day for three days, reaching 26 °C)
- Increased Ammonia Concentration (Natural waste accumulation raises ammonia concentration to 2 mg/L)
- Increased Crayfish Density (Introduction of additional same-sex crayfish after a 1-hour acclimation period separated by a transparent barrier)

Each crayfish will have a 2-day recovery period between each treatment, to remove any changes in behaviour due to environmental change.
Results will be analysed using Fisher's Exact Test to identify statistically significant behavioural changes. This study aims to shed light on how environmental stressors influence invasive crayfish behaviour, offering insights to mitigate their ecological and infrastructural impacts.

S-02

Agatha: The App for the Mind

Verónica Jara Gómez (S5ES), ES Brussels III, Brusels

Dementia is one of the only sicknesses that kills the mind before it kills the body. Yet, there is no cure. As the scientific community strives to mitigate the impact of the illness on the brain and body, digital tools are becoming more popular. But, can a digital tool help people with dementia? Possibilities seem endless, but there exists little scientific research that proves whether or not digital tools could rise up to the level of current practices to treat and diagnose such diseases. The project's aim is to develop a tool that implements neuropsychological tests and cognitive behavioral therapy, to track cognitive abilities, detect early signs of dementia, and avoid misdiagnosis.

Logo Reference Image

Agatha:
The mobile game is structured so first an inquiry is filled. It collects basic information, such as age; but also other data, such as cognitive abilities and mental health information. Subsequently, the app will synchronize itself to its user and their needs. Depending on the person, the app might recommend daily, weekly, or monthly mystery challenges. The mystery includes two aspects: neuropsychological tests and cognitive behavioral therapy, both hidden in the narrative. The app analyses the answers with an algorithm, and after doing so, it will report on trends and medical recommendations, as well as send an update to the person's doctor. The app will be interactive, and interesting, utilizing a point system to create enjoyment for the user, as for them to enjoy something that might have otherwise been daunting.

Methodology

- Flutter and Godot as development engines.
- Experimental Trials
- AI tools
- Biometric Trackers
- Scientific Reviews

Objective:

To create an accessible tool with the potential to help people at risk of suffering dementia improve their mental and cognitive health.

S-03

Plastic-eating Bacteria: Investigating bacteria that can break down plastic and assessing their potential for large-scale waste management

Shradda Vijaya Kumara, Amelia Wood (S5EN), EN Karlsruhe

Aim:

The aim of this experiment is to put the plastic eating bacteria, Ideonella Sakaiensis, in different conditions, such as different pH levels, oxygen levels, or temperatures, to speed up the rate at which Ideonella Sakaiensis breaks down PET, so that it is useable in the environment.

Introduction:

We chose this topic because of how much pollution is present in the environment, and how currently the way it is being disposed of ends up harming the environment in another way. Ideonella sakaiensis is not being used for the solution to plastic pollution at the moment, because of how slow the rate is at which it breaks down plastic.

Method:

The experiment will take place over a span of 31 days.
On the first day, 8 growth mediums will be prepared. 1 cm^2 of PET plastic will then be added to all of them before 1mL of Ideonella Sakaiensis culture will be introduced to sterile petri dishes. The growth mediums will be kept in varying conditions. 6 will be kept in lower or higher temperatures, pH levels and oxygen levels containing the bacteria. One will contain the bacteria, but be kept in normal conditions (room temperature, etc.) and one will be containing only the growth medium and the PET for control.

Observations will then be made over the following days, and our findings will be noted down regularly on how their activity has progressed.

Unfortunately, due to multiple postponements in the shipment of the bacteria, our experiments have been delayed, and our results are too preliminary to be significant yet.

S-04

Notre drone samare : quand la nature tombe, l'innovation décolle !

Mona Benkhabecheche, Mona Sonck, Arno Bonnamy (S7FR), FR Brussels IV

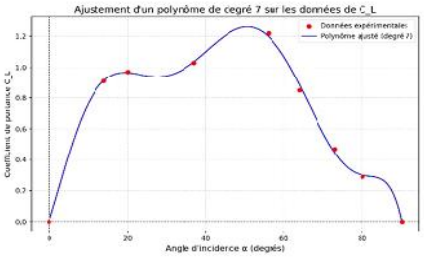
Afin de dimensionner un drone monoptère basé sur une samare, nous avons collecté un très grand nombre de données expérimentales sur le vol de ces graines fascinantes. Nous souhaitions parvenir à prédire la portance en fonction de la masse, la surface et la vitesse de rotation de notre drone. Les résultats n'étant pas concluant nous nous sommes tournés vers cette publication... que nous nous sommes appropriée et ensuite, nous avons adapté la démarche et contourné certaines sources d'imprécisions.

En particulier :

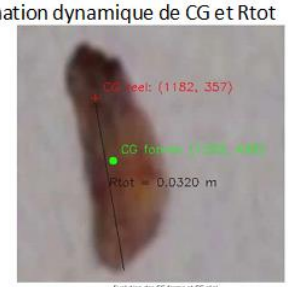
Le profil aérodynamique utilisé pour établir Cl = f(alpha) provient de la NASA pour un nombre de Reynolds de 50000 peu compatible avec une samare (RE = 2000)
La détermination cruciale du centre de gravité car elle conditionne Rtot qui est une approximation.
Le profil d'angle d'attaque en fonction du rayon est établi par découpage et par photoshop.

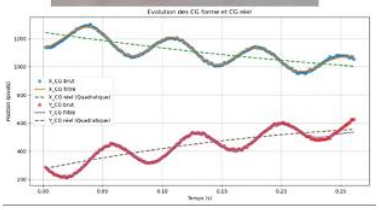
Avec des expériences (soufflerie avec modèle de samare), chutes de samares filmées à 1000 images par secondes, des scans 3D des graines et l'aide de programmes python pour exploiter les images, les fichiers et les données, nous avons réduits les sources d'imprécision et amélioré la précision pour dimensionner l'équipement de notre drone.

Avec soufflerie



Détermination dynamique de CG et Rtot





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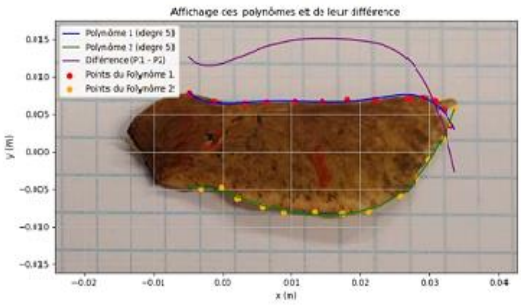
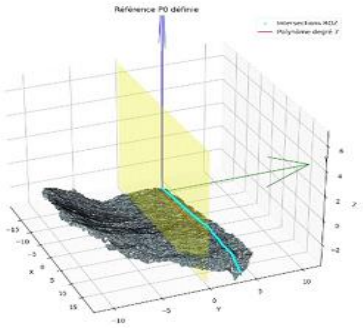


Exploitation scan 3D des samares



S-05

Investigating Psychopathy: A Novel Enzyme-Based Treatment Targeting MAOA Gene Dysregulation

Léa Guérard (S6FR), FR Luxembourg 1

Psychopathy is a neuropsychiatric condition marked by emotional deficits, lack of empathy, and impulsivity. Current treatments focus on mitigating symptoms rather than addressing underlying biological factors. This study proposes a novel enzyme-based therapeutic approach targeting the low-activity variant of the monoamine oxidase A (MAOA-L) gene, implicated in psychopathic behavior. The MAOA gene regulates the breakdown of neurotransmitters like dopamine and serotonin, essential for emotional regulation and impulse control. Variants like MAOA-L reduce enzymatic activity, causing neurotransmitter imbalances and disrupted neural connectivity between the prefrontal cortex and the amygdala.

Using insights from genetic and neuroimaging studies, the project involves in-vitro testing of recombinant MAOA enzymes to restore neurotransmitter balance. Preliminary theoretical modeling shows that introducing the high-activity MAOA-H enzyme variant could reduce excessive neurotransmitter levels and improve neural pathways critical for emotional regulation. A small-scale psychopathy trait analysis on 13 participants provides initial data for identifying individuals with potential MAOA-L variants.

DIFFERENT PATIENT WITH AGE AND SEX/ RESULT FOR 1ST AND 2ND TEST	TEST 1 (LOW-MEDIUM OR HIGHT)	NUMBER FOR PRIMARY & SECONDARY TYPE
PERSON 1, female, 16	LOW	2,5 and 2,7
PERSON 2, female 16	LOW	2,9 and 3,1
PERSON 3, male 16	LOW	1,9 and 2,4
PERSON 4, male 17	LOW	2,4 and 3,7
PERSON 5, female 16	LOW	1,7 and 2
PERSON 6, male 15	LOW	2,9 and 2,4
PERSON 7, female 16	LOW	1,9 and 2,1
PERSON 8, male 15	LOW	2,3 and 1,8
PERSON 9, male 16	LOW	1,7 and 1,7
PERSON 10, female 15	LOW	3,3 and 3,3
PERSON 11, female 17	LOW	2,3 and 2,6
PERSON 12, female 16	LOW	2,7 and 3
PERSON 13, male 56	LOW	1,5 and 2,3

This enzyme-based intervention could address core aspects of psychopathy, offering a shift from symptom management to root-cause treatment. However, challenges such as ethical considerations, immune responses, and accessibility remain. Further research is needed to refine enzyme delivery systems and evaluate the approach's safety and efficacy

S-06

LIQUID SOAP SPHERIFICATION

Maeve BOUCHEZ (S7FR), FR Luxembourg II

Spherified soap balls in olive oil

Liquid hand, hair and body soap are commonly stored in polluting plastic containers for retail and wholesale.

- ➔ This project was conducted to determine whether liquid soap could be contained within an algae gel membrane as an alternative form of natural and biodegradable packaging.
- ➔ The molecular gastronomy technique of spherification involving sodium alginate *(a polysaccharide extracted from brown algae)* and calcium chloride was employed. Both basic spherification and reverse spherification were tested to examine their ability or inability to gel liquid soap by the cross linking of calcium ions with alginate polymer chains.

The basic spherification method having produced no gelation of the soap, the following experiments and measurements were therefore performed using only reverse spherification.

➔ Small-scale samples of liquid coloured neutral soap 3% enriched with calcium chloride were placed in a mould in order to be frozen into spherical-shaped balls. Once frozen, the spheres were dropped into a 0.5% sodium alginate bath and left to spherify for specific amounts of time *(1 to 10 minutes)* to evaluate the optimal reaction duration. Mass and volume variations were also recorded based on this. Furthermore, the spherified balls' preservation was assessed through three mediums ('open air', distilled water and olive oil) under refrigeration.

➔ Results found that effective spherification of the soap balls occurred from 3 minutes onwards. Regardless of the duration of their spherification, the spheres all underwent an average increase in mass and volume of 56%. As for preservation, solely those in olive oil retained their shape and soap content, whereas the 'open air' balls shrivelled *(without loss of soap content)* and the distilled water balls lost their entire soap content *(without change to spherical shape)*.

Additional tests addressing use and preservation are yet to be run.

S-07

Self-Sustained Moisture-Involved Electricity Generation

Arnav Gupta, Matvey Nikonorov, Oberon Johnson (S7EN) EN Mol

"It is estimated that water absorbs and releases up to 60 PetaWatts of energy per year, three orders of magnitude more than the annual global energy consumption."

Self-Sustained Moisture-Involved Electricity Generation (SMIEG) is an emerging technology which produces continuous electrical power using moisture from the air. By mimicking the Earth's natural water cycle on a smaller scale, it generates electricity through differences in ionic charge caused by differences in water content across the generator. SMIEG devices require porous, hydrophilic materials with two electrodes attached along its length.
So far, we have experimented with prototype SMIEG designs from household materials. We have used a cotton slab as our porous material, and a saturated salt solution as our hydrophilic solution. We used two aluminium electrodes for the movement of charges through the generator.

Our experiments utilised household materials to create a prototype SMIEG device. A cotton slab served as the porous material, a saturated salt solution acted as the hydrophilic medium, and aluminium electrodes facilitated charge movement. The cotton slab (4x2x2 cm) soaked in saltwater was placed between areas of differing moisture gradients. Charged water particles travelled from the high-moisture side to the low-moisture side, generating approximately 0.3V and 1.2μA continuously through the electrodes from ambient indoor moisture differences. However, the cotton's high resistance limited the current output. By attempting to make this device using porous copper sponge instead, we estimate that we will be able to generate far more current.

Our ultimate aim is to develop a SMIEG device using accessible materials like copper that can generate constant power comparable to solar panels and wind turbines in terms of efficiency, cost, and scalability.

S-08

GESTEUERTER MÜLLEIMER

Von Ciccarese Damiano (S5IT), Hazebrouck Stephan (S7FR), IT/FR Munich

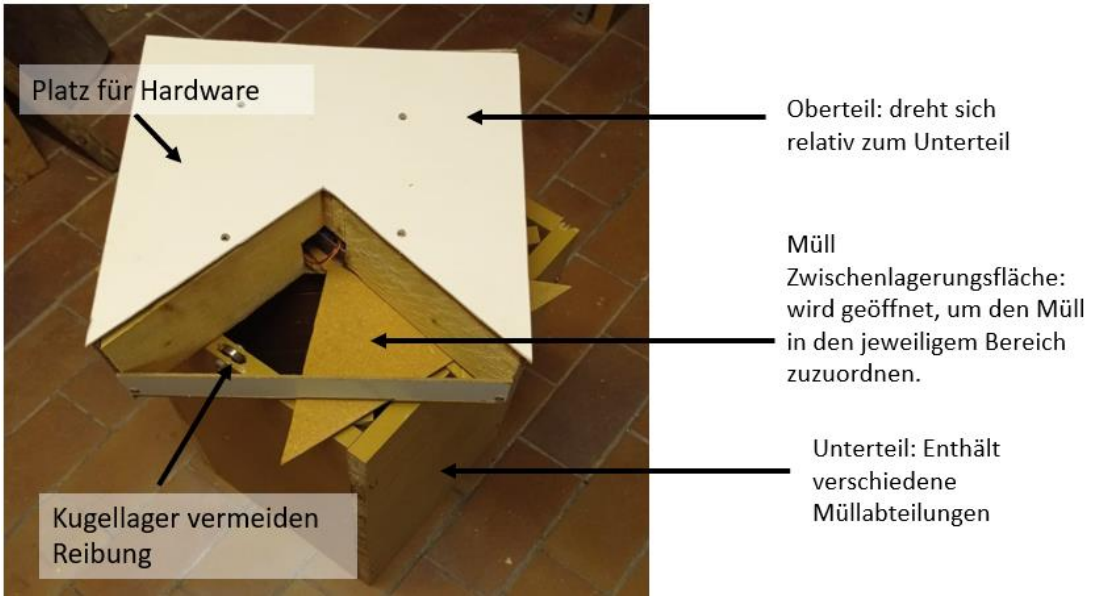
In unserer Schule achten viele Schüler nicht auf die Mülltrennung. Wenn sie zum Beispiel einen Plastikbecher haben, aber nur einen Mülleimer für Restmüll in der Nähe sehen, werfen sie den Becher wahrscheinlich in den Restmüll.

Um dieses Problem zu lösen, haben wir mit Hilfe von Python und Tensorflow ein KI-Modell programmiert, das den Müll in die vier häufigsten Kategorien - Restmüll, Plastik, Papier und Biomüll - trennen kann.

Der Prototyp wird jedes Mal aktiviert, wenn jemand Müll in den Mülleimer wirft. Dann wird ein Bild des Mülls gemacht und mit Hilfe der KI in die verschiedenen Kategorien sortiert. Im letzten Schritt werden die Motoren entsprechend der Müllkategorie gesteuert, um den Müll zu trennen. Zum Schluss werden die Motoren wieder in die Ausgangsposition gedreht, so dass der ganze Prozess von vorne beginnen kann.

Die KI funktioniert dank zahlreicher Datenbanken, die wir auf Kaggle gefunden haben. Sie standardisiert die Kamerabilder im gleichen Format dank OpenCV und anderen Bibliotheken. Die KI wird auf einem PC trainiert und ist sehr einfach zu bedienen.

Wir hoffen, dass die Mülltrennung durch unsere Maschine einfacher und sicherer wird. Obwohl die Idee ursprünglich für unsere Schule gedacht war, könnte die Maschine in Zukunft auch in anderen Szenarien, wie z.B. in Haushalten, eingesetzt werden, überall eine klimafreundlichere durch sicherere Trennung zu ermöglichen.



[1] Bild unseres Prototyps

S-09

POLLUTION CATCHER

Lena Moussaoui Chenot (S5FR), Nadia Quaye (S5EN), FR/EN Parma

Air pollution is a major problem that affects human health. Parma is one of Italy's most polluted cities, due to several factors including industry and agriculture, as shown in Fig.1. Over the years, many efforts have been made to address this issue, but there is still room for innovative solutions.

With our project we aim to create solar panels that will be placed in the city to monitor air quality and absorb pollutants with a TiO_2 coating. The solar panels will be made in the physics lab using 5 photovoltaic cells (5"x 5" and 3Wp). We will install two panels at the school and two in the center of Parma, connecting them to a transformer with a USB output providing 5 V and 3A, as required by the power supply system of the chosen monitoring station. These panels will be used to recharge a probe that measures concentrations of PM1, PM2.5 and PM10 as well as temperature and humidity.

Two of the panels will be coated with titanium dioxide (TiO_2) to capture pollutants and increase the efficiency of the panel. When exposed to light, TiO_2 helps break down pollutants in the environment, thus reducing air pollution. (Fig.2). Once the solar panels are installed, we will collect air quality data from the probe and send it to an international data platform (sensor.community) for analysis and dissemination.

We will also conduct visible opacity analysis to assess the panels' efficiency. In the chemistry lab (under the hood), we will perform tests using TiO_2 powder and 2,6-dichloroindophenol (DCIP) dye in petri dishes. UV lamp observations of color changes will help evaluate the efficiency of the process. Based on the results, we will prepare TiO_2 solutions to cover the solar panels and compare their efficiency with the panels that do not have the TiO_2 coating.

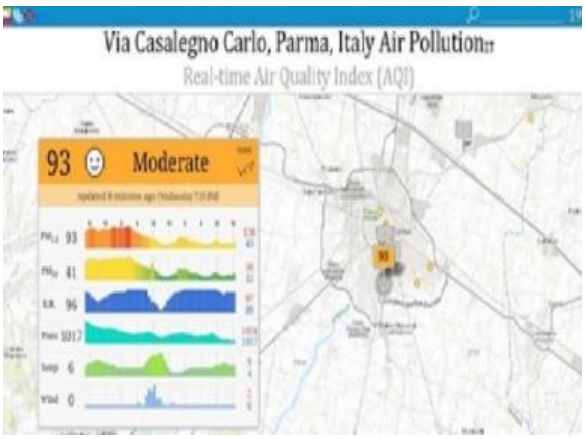


Fig.1: Air quality index in Parma

Fig.2: Solar panel and monitoring station

S-10

Swallow (*Hirundo Rustica*) Eggs as an Indicator of Female Quality

Klára Levrincová (S6EN), EN Warsaw
LLUTION CATCHER

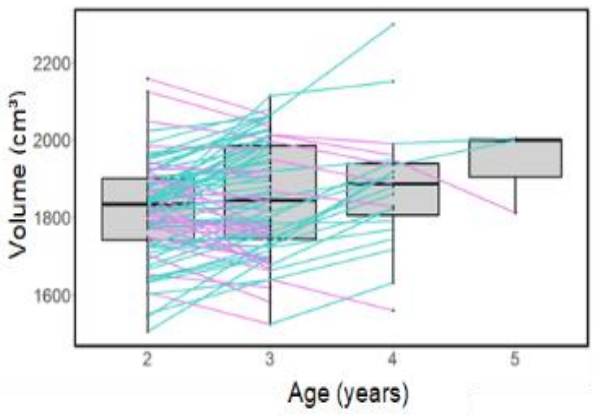
The appearance of bird eggs, such as their size, color, and spotting, plays a significant role in avian reproduction. Larger eggs increase the survival of hatchlings, while coloration, driven by pigments protoporphyrin and biliverdin, provides protection against predators and brood parasites, strengthens the eggshell, and protects from harmful UV radiation. This study investigates whether egg characteristics, particularly size, coloration, and spotting patterns, indicate the physical and physiological condition of female birds and correlate with their reproductive success (fitness traits).

I will study this question in a long-term study population of barn swallows (*Hirundo rustica*) breeding in the Třeboň region (Czech Republic), which is an ideal system because I can investigate the same individuals repeatedly over multiple years. Data were collected from 2019 to 2022.

All birds were captured, color-ringed, measured, and blood sampled. Female body condition was assessed using the body mass-to-wing length ratio, while physiological condition was estimated through the heterophil-to-lymphocyte (H/L) ratio, blood glucose levels, and plasma corticosterone concentrations.

Fitness metrics of individual females included clutch size, total number of eggs, total number of fledglings, laying date, age, and survival to the following year. Female identity at the nest was determined using color rings, and all their eggs were photographed using a UV-sensitive camera with a standardized method. Egg coloration, spotting pattern, and egg size were analyzed with ImageJ software.

Preliminary results indicate that older females lay larger eggs than younger females, but with similar coloration. This project integrates multiple indicators of female quality to explore the potential of egg appearance as a proxy for assessing the condition of female birds, providing a novel approach to avian ecological studies.



S-11

Microplastics in the food chains: The effect of microplastics in the growth of photosynthetic organisms (Elodea canadensis)

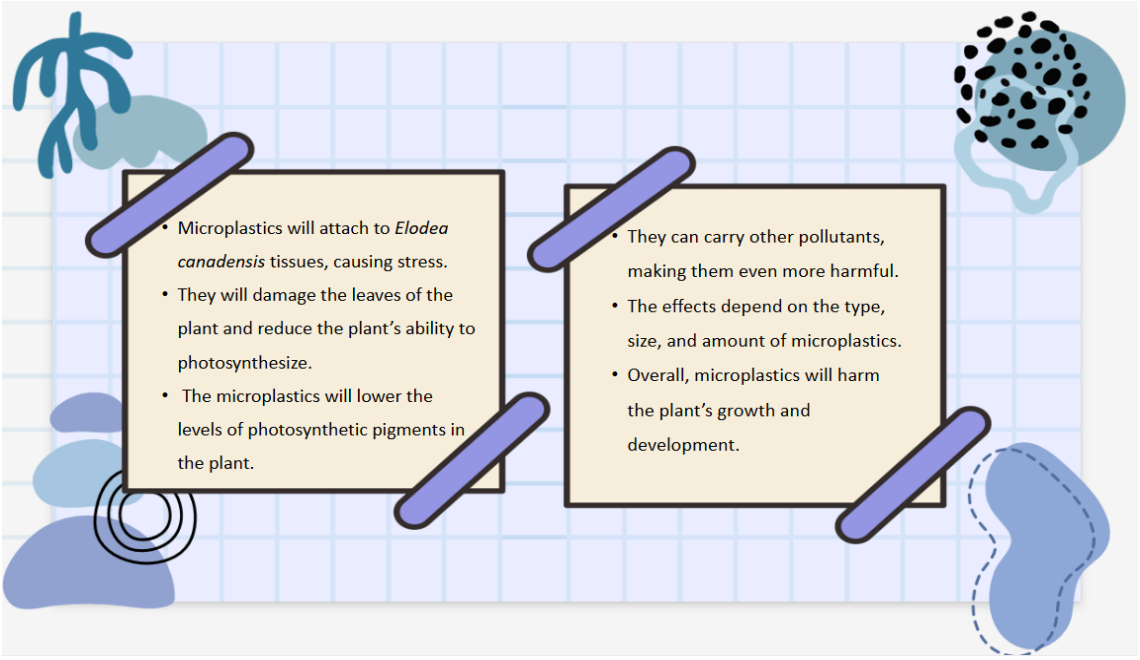
Iakovidou Iliana, Patri Eleni , Kremezis Dimitris, EEB3 Brussels

Microplastics have increasingly infiltrated ecosystems worldwide, impacting living organisms at various levels of biological organization. However, the mechanisms by which microplastics affect organisms and ecosystems, particularly through food chains, remain poorly understood. This study investigates the effects of microplastics on the photosynthetic activity of *Elodea canadensis* (a common aquatic plant) and aims to provide insights into the broader ecological implications.

The experiment spans one week, during which the photosynthetic performance of *E. canadensis* will be evaluated by measuring oxygen release under controlled conditions of constant light and temperature. Two treatment groups will be established: one exposed to microplastics and one without microplastics, allowing for comparative analysis.

Additionally, protein electrophoresis will be conducted to analyze potential biochemical changes induced by microplastic exposure. By combining physiological measurements (oxygen release) with molecular-level analysis (protein profiling), this study aims to assess the impact of microplastics on the primary productivity of aquatic ecosystems.

The findings of this research will contribute to a deeper understanding of the consequences of microplastic pollution and its potential ramifications on ecological dynamics and food chains.



S-12

Cleaning Products: Helpful or Harmful?

Mathilda von Fürstenberg, Janka Hugelmann S5/ ES Karlsruhe

We regularly use cleaning products to remove pathogens from our environment. However, studies show that long-term use of cleaning agents can promote antimicrobial resistance (AMR) in the environment and in the human gut microbiome. The gut microbiome is crucial for our health and performs numerous essential functions. Our goal is to investigate the impact of various household products on bacterial growth. In doing so, we compare aggressive and natural cleaning agents in terms of their effects on bacterial growth and biofilm formation, with a particular focus on the development of AMR due to disinfectants.
We hypothesize that long-term use of aggressive cleaning products may promote the growth of resistant bacteria, particularly through the formation of biofilms.

Methodology:

• **Cultivation of Bacteria:**
Samples from microbiomes (from the pharmacy), as well as from hair, nose, saliva, and hand palms, are swabbed onto MRS and LB agar plates and incubated at 37°C with 5% CO2. In parallel, liquid cultures of the same samples are incubated under the same conditions to promote bacterial growth.

• **Testing Household Products:**
During bacterial cultivation, we add various household products (e.g., soaps or disinfectants) directly to the liquid culture or apply them to the agar plates using filter paper. We then examine the optical density of the liquid culture or the colony size in the presence of the products to analyze their effect on bacterial growth.

We have already successfully cultured bacteria from microbiomes as well as from skin, saliva, and hair on agar plates (MRS and LB). In preliminary experiments, we observed inhibition zones after applying different cleaning agents, indicating reduced bacterial growth.

In the next phase, we plan to further investigate the bacteria in liquid cultures and measure their optical density to analyze growth in the presence of cleaning agents. Additionally, we aim to identify surviving bacteria using API galleries and check whether they can form biofilms.

These experiments will help us better understand the effects of cleaning products on bacteria and promote the responsible use of these products

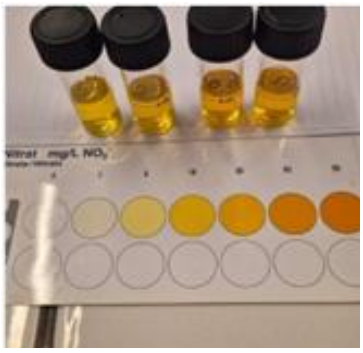
S-13

Impact of polyethylene plastic (PE) on plant growth and nitrogen cycle

Izabela Ninu (S6FRA), Maia Pasca (S6ROA), Cristian Hogas (S7ROA), ES Brussels IV

The impact of microplastics (MP) on water quality has been well observed for years. Yet new research shows their growing impact in terrestrial ecosystems: the presence of microplastics in the soil triggers physical, chemical and biological changes. All of these alter biogeochemical cycles such as the nitrogen cycle, which is crucial to plant growth. MP-polluted waters are used for agricultural watering, resulting in the pollution of the agricultural soil.

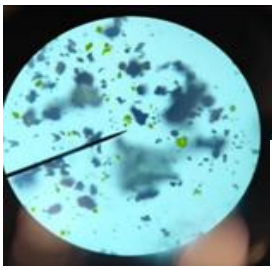
With this experiment, we are aiming to understand the response of plants when growing in polyethylene (PE) polluted soil, as well as the disruptions in the nitrogen cycle that PE causes. We have chosen watercress for this project due to its fast growing and well-defined root development characteristics. We hypothesise that the plants are going to show visible signs of stunted growth in high plastic concentration soil, due to disruptions in the nitrogen cycle.



From October to December, we've been taking care of the plants twice a week, watering them when needed, taking pictures and measuring the nitrate, nitrogen and ammonium levels in the soil (therefore all the parameters in the soil nitrogen cycle). The project's setup is simple: 60 cups with watercress and 4 different categories of soil with different plastic concentrations (0%, 0.5%, 2% and 5%). PE plastic was

sourced from water bottles and cookware utensils, two representative categories of plastic products. To test the nitrate, nitrite and ammonium concentrations, we took 1.5 grams of soil samples of the 4 categories. Each time, we mixed the soil with 30ml of water and filtered it using Whatman filter paper. We then proceeded to perform coulometric tests using the VISOCOLOR reagent set for the determination of Ammonium, Nitrate, Nitrite, Phosphate, pH and total hardness by Macherey-Nagel.

On initial results, concentrations of nitrogen-derived compounds vary significantly between the four categories of soil. All follow the same template: 0% and 0,5% show a stable increase in nutrient concentrations whereas 2% and 5% show a decrease in these concentrations, due to plastic presence. Interpretations are still in progress.



S-14

Un filtre, de l’eau pour tous

Clémentine Samson Zilliox, Maya Funamizu , Leon El Assadi (S5FR), FR Luxembourg II

Selon L’Unicef, 2,1 milliards de personnes n’ont pas ou très peu accès à l’eau potable et le double ne dispose pas d’un traitement de l’eau sûr. L’accroissement de la population et le changement climatique modifiant le cycle de l’eau ne vont qu’aggraver ce problème au cours des décennies à venir. Une des solutions à ce problème serait d’avoir un filtre compact, efficace, réparable et peu coûteux. Notre projet vise donc à développer ce filtre destiné à potabiliser de l’eau insalubre.

Nous avons tout d’abord listé les principales catégories de polluants impactant les humains, soit les hydrocarbures, matières organiques, métaux, microorganismes et particules en suspension, qui, même sans danger pour les humains, participent à la création du biofilm. Les hydrocarbures, comme le pétrole, proviennent de déversements accidentels et causent des cancers et des troubles respiratoires. Les matières organiques sont surtout d’origine animale, agricole et ménagère, notamment sous forme d’ammonium, et dangereuses pour la santé en grandes doses, catastrophique pour les écosystèmes aquatiques. Les métaux, originant de pollutions industrielles, par exemple le mercure et le plomb, dégradent l’environnement et causent des maladies cardiovasculaires. Dernièrement, les microorganismes infectant l’eau tels que les virus, les bactéries et les protozoaires entraînent souvent des maladies gastro-intestinales chez l’être humain.

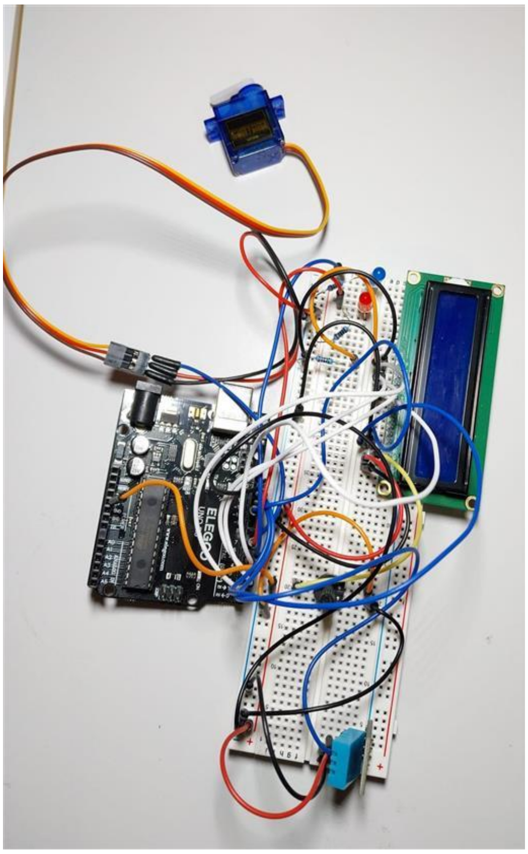
Après avoir déterminé cette liste, nous avons défini trois catégories de filtration : filtration mécanique (médium filtrant destiné à éliminer les impuretés), biologique (plantes et microorganismes pour fixer les polluants et effectuer le cycle de l’azote) et chimique (élimination des microorganismes pathogènes). Nous avons créé un prototype fonctionnel, qui aidera à apporter une avancée, même si mineure, dans ce domaine.

S-15

Optimal sleeping conditioner

Nicolás Fernández, Diego De Santos (S7ES), ES Munich

The purpose of our project is to reach optimal sleeping conditions. This will lead to more rest with the same amount of sleep, so you can be fully productive during your daily life. This will help companies, workers, kids or anyone to be more productive and save time in their lives. We do this by having a perfect amount of CO_2, temperature and humidity in the room. How does it work?



(The Arduino circuit used to measure and display the values)

Firstly, calculate the CO_2, the temperature and the humidity in the room. These are the factors that could produce some incommodities while sleeping. When these are calculated and then shown in a screen, in case the user wants to check the actual values as the screen is showing them at all moments. Then, the project must be connected to the air conditioner or any other type of temperature regulator that reduces the temperature, the windows and the radiator or any other type of temperature regulator that increases the temperature to reach the optimal values.

If the CO_2 is too high, then the windows must be opened. If the temperature is too high, an air conditioner must turn on, and if the temperature is too low, the radiator must turn on. At last, if the humidity in the room is too high, then the air conditioner must turn on, because one way to return the amount of humidity back to normal is through the air conditioner also ventilating the room is going to reduce the levels of humidity. Therefore while changing the temperature you are also reducing the levels of humidity.

S-16

Can Yeast Cells Adapt? A study of how yeast adapts to antifungal medication

Allegra Gross, Emily Bach (S7EN), EN RheinMain

The development of a resistance to antifungal medications poses a threat when treating fungal infections. Our experiment investigates whether *Saccharomyces cerevisiae* (baker's yeast), a model organism which has been extensively used in molecular and cellular biology, can adapt to and build resistance against the antifungal medication terbinafine. Terbinafine is an antifungal agent used to treat ringworm, athlete's foot, and fungal nail infections. It works by inhibiting the synthesis of an essential component of the fungal cell membrane called ergosterol.

In the experiment, *S. cerevisiae* is cultured in a liquid medium and supplemented with a sugar solution to ensure that the yeast has stable growth conditions. Once the yeast has reached a sufficient growth phase, a terbinafine solution is added to a culture. A spectrophotometer is used to measure the optical density of the cultures and observe changes in growth. The appearance of the yeast cells will also be checked under a light microscope. This is monitored over time.

If the culture density decreases following the exposure to the terbinafine solution, it would indicate that the yeast cells were unable to adapt to the antifungal agent. However, if the density remains stable or increases after some time it would suggest that the yeast was able to adapt or build some sort of resistance to it.
All yeast cultures will be sterilised before disposal to make sure that no resistant strains are released into the environment.

S-18

The Tipping Point: Environmental threats to Biodiversity

How Environmental Conditions affect Fungi, Animals and Plants

Lauren Christensen, Rachel Christensen(S5EN), EN Frankfurt

In 2022, we presented our project 'The Effect of Climate Change on Crickets' at the European School Science Symposium in Strasbourg as juniors. Our project was inspired by Damian Carrington's article 'Plummeting insect numbers 'threaten collapse of nature' published by The Guardian. Still deeply interested in this topic, we are continuing our research three years later, but as seniors, examining the effect of climate change on different organisms.

Instead of studying just 12 conditions affecting crickets, we are investigating 72 different conditions across six diverse organisms: crickets, worms, aquatic snails, basil, chives and oyster mushrooms. This study seeks to further understand the impact of environmental factors including light exposure, nutrient availability and varying temperatures on a wide range of organisms. We hope to draw connections to the broader implications of climate change and contribute to/ create a digital platform – Student Ecology Archive – to support data-sharing and collaboration between motivated students by conducting similar experiments.

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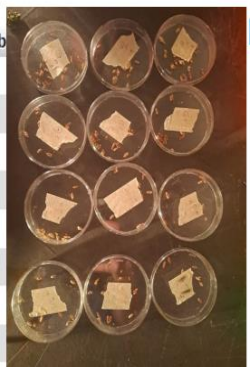
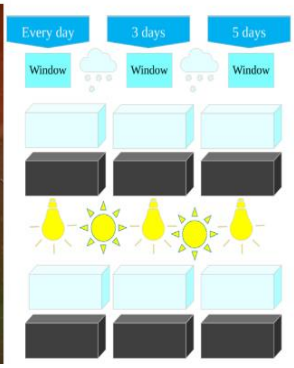
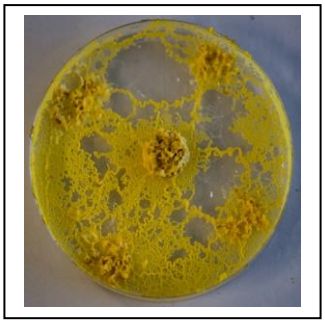




S-19

Using the Blob as a Navigation System

Ana Marija Kukovec, Mariana Waicman Gonçalves, Nicolò Broom (S6EN), EN Luxembourg II

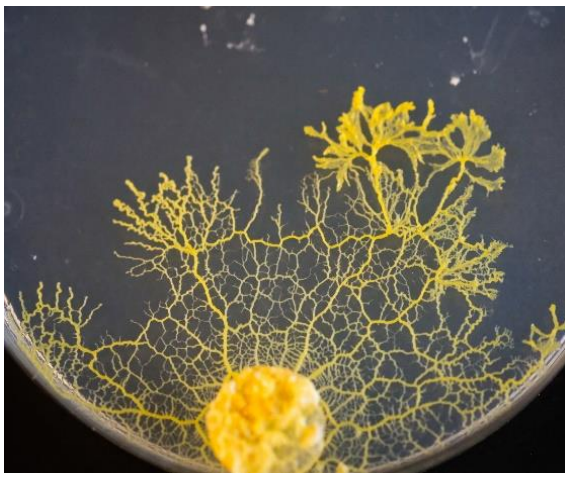


Many European schools have students that come to class late which poses problems with learning and frustration amongst teachers. In 2023/24 our school had 1618 students. In that year students were marked late a total of 14987 times (this would mean each student was late around 9 times). It is common knowledge that one of the important causes of these delays is congestion on the main staircase. Finding one's way around the school is vital to avoid lateness as well as in case of an emergency evacuation.

Our project aims to use a slime mold called *Physarum Polycephalum* (i.e. Blob) that acts as a navigation system to help guide pupils throughout the grounds of secondary school. The Blob can find the fastest way to get to a destination by sensing the surfaces around it. The key question of the research is to find the optimal conditions for the blob to function and navigate. A series of experiments, such as how the Blob reacts to temperature, color and light intensity will be fundamental to building a scaled model of the school in which the Blob will provide alternative and more efficient routes that students can use to move from class to class.

This project will contribute to our understanding of the functioning and usage of the Blob as a navigation system. By using this to navigate the school efficiently, we can improve the wellbeing of both students and teachers.

2023/2024		
Year	Number of students	Number of lates
S1	227	894
S2	221	758
S3	228	1806
S4	258	3422
S5	248	3058
S6	235	2322
S7	201	2727
Total	**1618**	14987



S-20

Waste to Watt

Riya Kalka, Yijin Wang (S5EN), EN RheinMain

Today, our world faces two major challenges: Food loss and battery pollution. 13 percent of food is wasted in transportation and 1.6 billion tonnes are wasted in grocery stores. Meanwhile, huge amount of harmful elements such as lithium are used in the production of batteries. This is increasingly problematic because of the pollution it causes: for every tonne of mined lithium, 15 tonnes of CO_2 are emitted! You may be wondering how the issue of food loss is connected to one of battery pollution? While they seem like separate issues, they could potentially resolve each other as creating a food electrolyte battery could offer an eco-friendly alternative.

In our project "Waste to Watt", food waste will be used to design an eco-friendly battery. This way, the food that is "wasted/spoiled" will become "useful", and dependency on non-eco-friendly batteries will be reduced. This will be achieved by utilizing the electrolytes in wasted fruits or vegetables, specifically those rich in electrolytes: lemons, oranges, potatoes etc. to design an eco-friendly battery for minimal household uses like LED lights (approximately 1.5 - 2.0 V). We aim to reduce reliance on non-eco-friendly batteries while maximizing resource use. We will explore the potential of creating a greener battery by testing out the efficiency of different electrolytes in a simple galvanic cell, first. Then, we will develop a battery design and test the application of our battery in minimal household uses. Any leftover materials will be used as plant fertilizer.

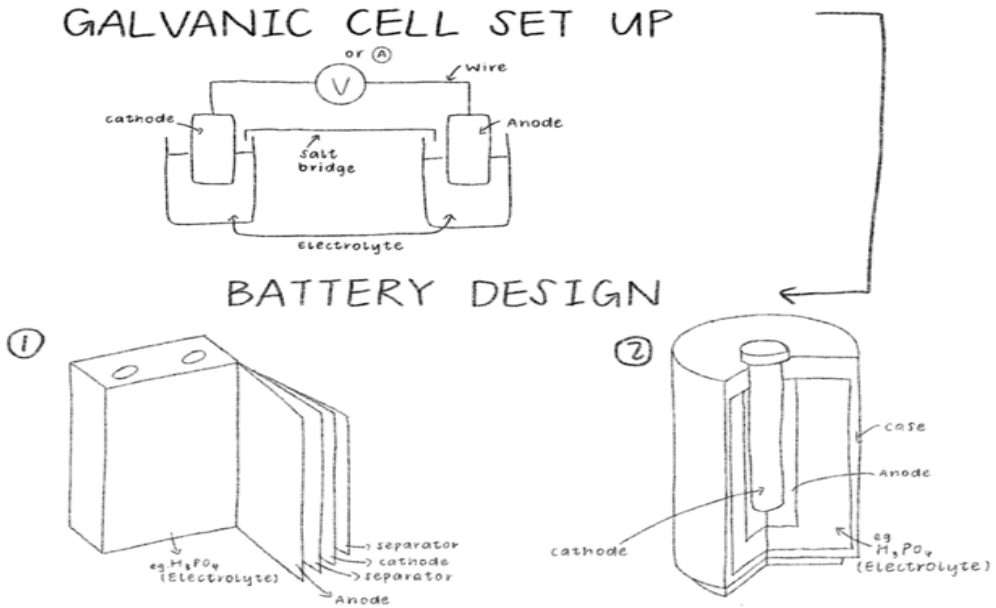


Figure: experimental setup of galvanic cell and possible designs for batteries

S-21

How Do Screens Affect Memory?

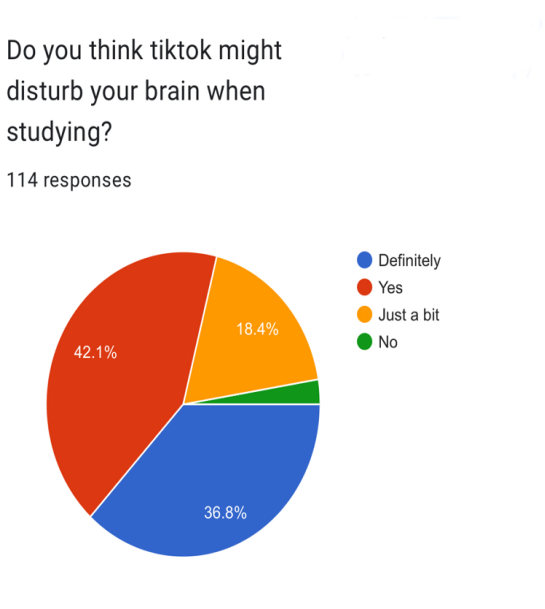
Karolina Kusmierz, Magda Drozdz (S5PL) PL EEB1 Brussels

In the current school year, European schools implemented a new policy banning phones on campus. While some teachers and students supported the rule, many opposed it. The main justification for this decision is the belief that screen usage negatively impacts memory.

Our project set out to test this claim. Initially, we focused on a single experiment where students watched a short, humorous video before taking a memory test. To our surprise, their results were similar to those who did not watch a video at all. This led us to question whether the video's emotional tone—being lighthearted and engaging—might have influenced memory retention.

To further investigate, we are now expanding our research to test different variables, including videos with varying emotional tones (e.g., serious or neutral) and different durations. By doing so, we aim to determine whether the impact on memory depends on the type and length of screen exposure rather than the mere presence of screens.

Our research is student-centered, emphasizing active participation and curiosity-driven learning. By involving students directly in the experiment, we hope to engage them in critical discussions about technology's role in education.



So, who is actually right?

S-22

Calorie deficit and lifespan

Rishikaa SIVASHANKAR (S5EN) LESC—Clervaux—Luxembourg

A calorie deficit occurs when you consume fewer calories than your body needs to maintain its current weight. Research indicates that calorie restriction can offer benefits such as increased lifespan and a reduced risk of various diseases.

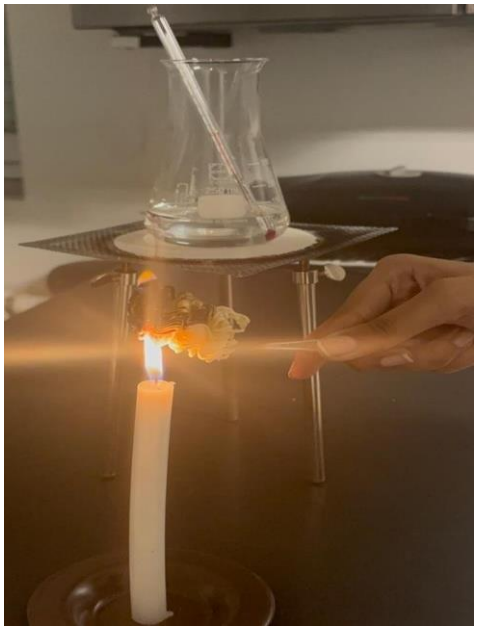
When approached in a balanced and sustainable way, calorie restriction can be beneficial without negative effects. However, extreme calorie deficits may lead to adverse consequences. In this project, I will explore what calories are, the reasons people pursue a calorie deficit, methods for counting calories, and the regions of the world where people tend to live longer, along with the factors contributing to their longevity.

I will also talk about which foods are recommended to eat for a fit and healthy body and what are the benefits and drawbacks of a lower calorie intake. In my experiment, I demonstrate how to determine the number of calories in a single piece of food. Additionally, through my quiz, I aim to explore how many people are interested in following a calorie deficit and gain insights into their dietary habits.

In conclusion, my project explores what is a calorie deficit, its benefits, and potential risks. It examines what calories are, why people aim for a calorie deficit, and how to count calories effectively.

Through an experiment, I demonstrate how to calculate the calorie content of a piece of food, and with a quiz, I investigate people's interest in calorie deficits and their dietary habits.

Additionally, I look into countries with a high percentage of longevity to understand how lifestyle and diet contribute to living longer.



S-23

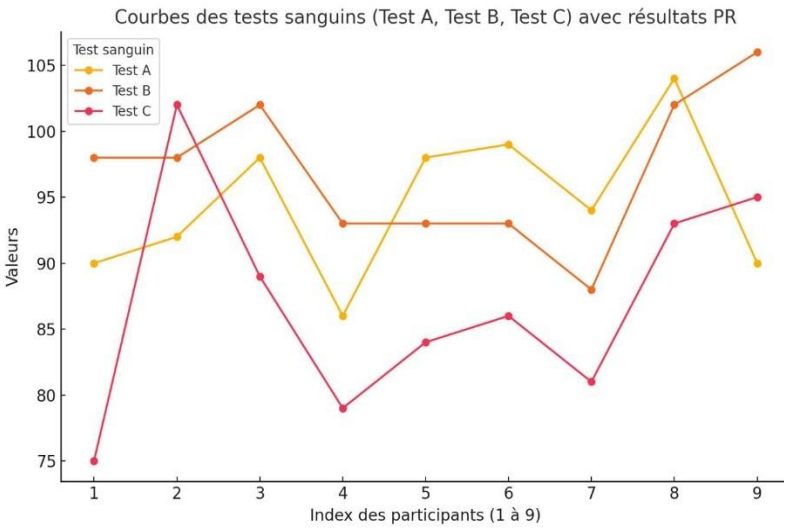
Le gâteau marbré du futur

Julia Ardiaca Guidi, Sophia Fischer (S5DE), DE Luxembourg II

Notre projet a pour bout de vérifier l'hypothèse selon laquelle la consommation d'un gâteau avec un indice glycémique plus faible entraîne une réduction du pic de glycémie ainsi qu'une chute plus douce de la glycémie, ce qui pourrait avoir des effets potentiellement positifs sur la capacité de concentration.

Un gâteau marbré classique de la cantine scolaire, fabriqué avec de la farine de blé de type 405 et une quantité de sucre standard, a été comparé à un gâteau alternatif préparé avec une quantité de sucre nettement réduite et des céréales telles que l'engrain et le millet brun qui présentent des avantages importants dans le cadre des apports nutritionnels et de culture durable.

Pour notre étude, un échantillon d'élèves de notre école a été répartis dans un groupe de contrôle et un groupe d'étude. Le groupe d'étude a mangé le gâteau alternatif, tandis que le groupe de contrôle a reçu le gâteau de la cantine. Tous les sujets étaient à jeun au moment de la première mesure de la glycémie. Après la consommation du gâteau, la glycémie a été mesurée la deuxième fois et, environ deux heures plus tard, une troisième mesure a été effectuée en combinaison avec le test d'attention D2. L'objectif était d'évaluer les réactions glycémiques ainsi que les effets éventuels sur les performances cognitives



Test A : Niveau de glycémie avant le gâteau
Test B : Niveau de glycémie immédiatement après le gâteau
Test C : Niveau de glycémie 2h après le gâteau n = 9

En raison du défi que représente le recrutement de participants volontaires et de la taille très réduite de l'échantillon qui en résulte, il n'est pas possible d'obtenir un résultat fiable et valide. Par conséquent, l'hypothèse ne peut être ni confirmée ni rejetée.

S-24

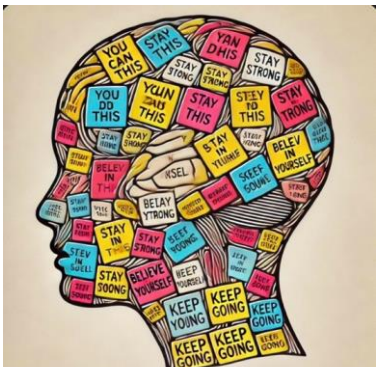
From Dogs to Humans: The Role of Motivation speeding up the Learning process

Zofia Roszak, Maria Gardy, Emilia Staniszewska (S5PL), PL EEB1 Brussels

The discovery of classical conditioning by Ivan Pavlov is one of the most important discoveries in the history of psychology. It does not only apply to animals but also to humans.

In the first part of our experiment, we found 6 volunteers, each one with 1 dog and we asked them to learn 3 tricks in a time of 3 weeks. We checked their behavior, activeness, their reactions to different weather and the time of their exercise. Everyday our volunteers sent us information showcasing their progress on dance choreography.

In the second part of our project, we are developing this fascinating topic to a higher-level species- humans! In our daily lives, we perform a range of learned actions, such as turning off the lights when leaving a room, locking the doors, or even engaging in a regular morning jogging.



We are exploring how the habits we are familiar with are formed and how self-discipline influences this process.

In order to developed a positive habit for humans we decided to focus on mental well being.
We gathered a group of people, approximately the same age, and ask them to write a motivational affirmation every morning. We will observe how their attitude will change during the experiment. What do you think? How big of an impact will the positive affirmations have on our well being?

Therefore, we invite you to discover more deeply this fascinating topic.

S-25

Does the method of isolation of aloin affect its content in the sample?

Agnieszka Darmos (S5PL), PL Warsaw

While googling a tutorial on how to prepare aloe gel/cream etc. you can find yourself lost in a sea of videos claiming they have the best and most successful recipe. You never know which one to choose! My project will see which one of them brings out the best qualities of the Aloe vera plant.

My thesis is that different ways to prepare the aloe vera plant extract have an impact on the amount of active ingredient in the aloe gel.

I will focus on how to prepare aloe vera to maximise its abilities. Using spectrophotometry I will measure the amount of active ingredient after every method. Aloe vera has a lot of active ingredients but the one I will be checking is called aloin.

Aloin has been proven: anti-tumour, anti-inflammatory, anti-osteoporotic, organ-protective, antiviral, anti microbial, anti-parasitic, with laxative activities, glucose regulation, neuropathic pain improvement. (source: National institute of health) The methods I will be checking are: cutting, blending, soaking in water and then scooping with a spoon, blending, scooping and then soaking.

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The East Poland House (Dom Polski Wschodniej – DPW) in Brussels.

The East Poland House (Dom Polski Wschodniej – DPW) in Brussels has been actively promoting regional cooperation and investment opportunities for Eastern Poland since its establishment in 2009. Representing the five regions—Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie, and Warmińsko-Mazurskie—DPW strengthens international partnerships, supports EU initiatives, and fosters cultural ties.

As part of its commitment to international engagement and community initiatives, East Poland House is proud to organize the 9th edition of the Polish Run, which will take place on September 6, 2025, in Brussels. This prestigious sporting event aims to promote Poland, encourage a healthy and active lifestyle, and strengthen ties between Polish and international communities.

The previous edition of Polish Run gathered over 700 participants, including representatives of Polish and EU institutions, diplomats, local residents, and members of the Polish diaspora. This year's program will include a 10 km main race and a 1,300 m children's run.

We invite you to take part in this exciting event and experience the joy of running together!

Register now at:

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General help	CDE	students EEB1
Bands	The Anti-lovers The Friday Glories The Watermelons Next Door The Cicadas	students EEB1, S4-7 students EEB1, S7 students EEB1, S6 students EEB1, S5-7 EEB1 teachers' band

The European School Brussels 1 Secondary Choir

Conductor: Joanna Musko
Piano: Agnieszka Zywert
Choir members : students and teachers EEB1

The European School Brussels 1 Secondary Choir unites over 100 singers — students and teachers representing around 20 nationalities — who share a deep passion for music and singing. Under the direction of dr Joanna Musko since 2015, and accompanied by professional pianist Agnieszka Zywert, the choir has collaborated with numerous distinguished artists over the years.

The choir regularly organizes vocal workshops and performs in Germany, and actively participates in international choral festivals and competitions. Highlights include the Cork International Choral Festival (2019), the Roma Music Festival (2023), and earning international recognition through the following awards:

– 1st Prize in the Choral Singing category at the International Contest – American Edition – 1st and 2nd Prizes at the Golden Voices of Montserrat (2024) in Academic Singing and Sacred Music categories – Three Gold Awards at the Bratislava Spring Music Festival (2025): in the Youth Choirs and Folk Music categories, including the Gold Prize as overall category winner

The choir is also regularly invited to perform at official EU ceremonies, including the European Commission Presidents' Annual Reception, the European Remembrance Day for Victims of Terrorism, and major conferences at the European Parliament.
In Brussels, the choir has performed at prestigious venues such as Flagey and the Royal Conservatory. Its international concert history includes acclaimed venues such as the Municipal Conservatory of Barcelona, the Primatial Palace in Bratislava, The Holy Trinity at Monte Pincio in Rome, and the Basilica of Montserrat.
Its diverse repertoire includes a wide range of musical styles and languages, reflecting the multicultural spirit of the group.

The Symphony Orchestra of the European School Brussels I

EEB1 Symphony Orchestra, created in 1976, has been conducted for 20 years by the Armenian violinist and conductor Arman SIMONYAN. Today, the orchestra has around 68 young musicians between 9 and 18 years old, coming from 11 different countries of the European Union and whose common language is music.
These young gifted and enthusiastic musicians, play in different formations: the large orchestra, the chamber music orchestra and small ensembles.
The orchestra usually organises one big concert trip every year. The latest trips of the orchestra went to Italy, France, Austria and Germany.

Last year, the young musicians gave some concerts in the Jean Monnet House in Bazoches in France and in The Madeleine in Paris in February and went on a concert trip to Armenia in the summer.
The EEB1 Symphony Orchestra has been invited to perform several times at receptions by the President of the European Commission, at the European Parliament and at the Open Days of the European External Action Service.

"The important thing is not to stop questioning.
Curiosity has its own reason for existing."
– Albert Einstein