

EUROPEAN SCHOOL LUXEMBOURG I



ESSS 2017

European Schools Science Symposium

Luxembourg

26th March 2017 – 29th March 2017



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Welcome Note



WELCOME TO THE 14TH EUROPEAN SCHOOLS SCIENCE SYMPOSIUM.

It is not the first time that Luxembourg I school hosts and organizes the Science Symposium. We have the pleasure and honor to host it once more after 2010. We welcome all participants, pupils and their parents and teachers, honorable guests from all over Europe.

We consider science literacy as a key competence of young Europeans. We live in an era when science evolves very quickly and it becomes more and more difficult to follow its evolvement. Furthermore scientific achievements become very quickly part of our everyday life in terms of communication, data storage, astronomical research, computation and measurement methods, health and more areas of everyday life.

The European Union and the European schools have adopted scientific literacy as a key competence for European citizens and our school tries to implement this guideline with all its capacity. We do this by enriching the laboratory equipment, participate in science fairs, visiting places where science is produced or studied. A part of this effort is the organization of this science symposium.

We welcome the work of our students that, along with their teachers, devoted their free time to push scientific work and literacy one step further. Their work will be evaluated by distinguished members of the European Scientific community and will probably guide them to a scientific career in the future. We thank the parents that took part in this effort, as they always are ready to endorse school efforts towards the education of their children. We thank the teachers, the organizers, the judges and the numerous contributors that made this organization possible.

Dear students, teachers, external partners and parents, I wish you success for your work and a pleasant and fruitful stay in Luxembourg.

Toula Vassilacou

Director, European School Luxembourg I, Kirchberg

Inspector's Note



Chers élèves, chers jeunes scientifiques,

Chers participants aux Symposium des Sciences des Écoles européennes,

Cette 14^{ème} édition du **Symposium des Sciences des Écoles européennes** promet d'être un grand succès à nouveau. Plus que 150 élèves et enseignants des écoles européennes vont se rassembler du 26 au 29 mars 2017 à l'EE Luxembourg I pour présenter leurs projets scientifiques. L'attractivité du symposium se fait aussi remarquer par la participation accrue des écoles européennes accréditées.

Tout d'abord, je dois mon respect aux élèves qui se sont engagés, de manière exemplaire, bien avant d'arriver au Luxembourg. Mon respect parce que vous étiez prêts à fournir un travail supplémentaire, à vous investir, et ce, dans un domaine que d'aucuns ne portent pas dans leur cœur. Un mode d'analyse très précis, des réflexions logiques et un bon travail en équipe étaient indispensables pour arriver à un résultat convaincant.

Lors des qualifications au sein des différentes écoles, une approche stimulante des sciences a pu contribuer à l'épanouissement d'une majorité d'élèves. Vous avez dû faire preuve de curiosité, de créativité, d'esprit d'initiative et d'un mode de travail rigoureux. Au sein de vos équipes il fallait être capable de résoudre de multiples problèmes, avoir l'esprit critique et pratiquer une bonne collaboration afin de faire aboutir vos idées.

J'aimerais aussi 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 de l'Ecole hôte, Madame Panayota Vassilacou et Monsieur Arben Lufi, ainsi qu'à l'équipe organisatrice (Daniel Alcazar, Marcus Balloch, Martin Bennett, Emmanuel Couché, Arnaud Gos, Stefan Haubold, Monika Machula, Simon Maes, Jonathan Mallon, Daniel Montilla, Christophe Nobis, Manuela Pereira, Sven Spremberg, Justo Zambrana Cortijo) pour leur travail insatiable tout au long des deux dernières années. Aucun effort n'a été ménagé afin de recruter des sponsors pour combler le budget.



Et oui, il faudra aussi parler budget : merci à tous les sponsors (Commission européenne, Comité d’Action Social, Fonds National de la Recherche, Ministère de l’Éducation nationale, de la Jeunesse et de l’Enfance, Banque Européenne d’Investissement, Luxembourg Institute of Science and Technology) pour leur aide financière.

L’équipe qui remportera l’ESS ira représenter les Écoles européennes au prestigieux ***European Union Contest for Young Scientists***, qui aura lieu du 22 au 27 septembre 2017 à Tallinn en Estonie. Vous aurez l’occasion de vous mesurer à vos contemporains venant des quatre coins de l’Europe. Profitez aussi de l’occasion afin de vous laisser guides par des chercheurs européens de renommée.

Aussi suis-je très confiant pour l’avenir de l’ESSS. Quatre écoles se sont portées volontaires pour prendre la relève et organiser le symposium les années prochaines : Luxembourg II, Mol, Karlsruhe et Strasbourg.

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 !

Max Wolff

Inspecteur des Écoles européennes

Guest speakers

OPENING CEREMONY

Prof. Jules Hoffmann

Jules Hoffmann est professeur à l'Université de Strasbourg et directeur de recherche émérite au CNRS. Il a consacré ses travaux à l'étude des mécanismes génétiques et moléculaires responsables de l'immunité innée chez les insectes. Son travail a fourni de nouvelles informations sur les mécanismes de défense innée que les organismes, des anémones de mer à l'homme, emploient contre les agents infectieux. En démontrant la conservation marquée de mécanismes de défense innés entre les insectes et les humains, le travail initié par Hoffmann et ses collaborateurs a conduit à une réévaluation du rôle de l'immunité innée chez les mammifères. Plus généralement, le modèle de la drosophile a permis aux biologistes du monde entier de faire des progrès considérables, non seulement dans la génétique du développement et de l'immunité innée, mais aussi dans l'étude de certaines pathologies humaines et dans la compréhension des phénomènes de la mémoire, du comportement, du sommeil et de la nutrition. Avec Bruce A. Beutler et Ralph M. Steinman, Hoffmann a reçu le prix Nobel de médecine en 2011. Hoffmann a créé et dirigé le laboratoire CNRS « Endocrinologie et Immunologie des Insectes » au CNRS Institut de Biologie Moléculaire Cellulaire et à Strasbourg, où il a également dirigé de 1994 à 2006 et où il travaille toujours avec ses collaborateurs. Il a été président de l'Académie des sciences française en 2007 et des 2008, et est membre de l'Académie des sciences des États-Unis d'Amérique, l'Allemagne et la Russie. Il a reçu de nombreux prix prestigieux, tels que, ces dernières années, le prix Rosenstiel (avec Ruslan Medzhitov) pour ses travaux sur l'immunité (2010), le Keio Medical Science Prize (avec Shizuo Akira) (2011), le Prix 2011 Gairdner pour la recherche médicale (avec Shizuo Akira) et le 2011 Prix Shaw (avec Bruce Beutler et Ruslan Medzhitov) des sciences biomédicales, ainsi que la Médaille d'Or du CNRS. Hoffmann est Commandeur de l'ordre national du Mérite et Officier de la Légion d'Honneur en France et est Membre depuis 2012 de l'Académie française.



CLOSING CEREMONY

Dr. Steven Weinberg



Dr. Steven Weinberg (Pays Bas, 1946) plonge depuis l'âge de 8 ans et est passionné de photographie depuis l'âge de 11 ans. Spécialiste des Octocoralliaires de la Méditerranée (thèse d'État, 1979), il a enseigné l'écologie récifale à l'Université de Puerto Rico avant de retourner en Europe. De 1982 à 2010, il était professeur de biologie à l'École Européenne de Luxembourg. Hormis une trentaine de publications scientifiques, il est l'auteur de plus de 500 articles dans des magazines divers, la plupart traitant du monde sous-marin. Depuis 1992, il a signé plusieurs livres illustrés, dont la désormais populaire série des « Découvrir » ('Méditerranée', 'Atlantique', 'Mer Rouge', 'Caraïbes' et 'Pacific'), « Vie Océane », « Écologiquement vôtre ! », « Miniterranée », et, récemment, il a cosigné l'étonnante « Histoire de l'Image sous-marine – de 1856 à nos jours » et « Ar(t)cachon – les Joyaux du Bassin ».

Judging panel

PRESIDENT OF THE JURY

Prof. Paul Heuschling



Professor Heuschling is the dean of the Faculty of Science, Technology and Communication of the University of Luxembourg since 2008. As professor for cell biology he teaches several classes at bachelor and masters level. His research team focusses on cellular mechanisms in neuroinflammation. The team studies the differentiation and de-differentiation processes of glial cells during normal embryology and during inflammatory reactions as well as the signaling cascades linked to these events.

Prof. Stéphane Bordas

Born in Paris, France in 1975, Stéphane joined in 1999 a joint graduate programme of the French Institute of Technology (Ecole Speciale des Travaux Publics) and the American Northwestern University. In 2003, he graduated in Theoretical and Applied Mechanics with a Ph.D. from Northwestern University under the guidance of Professor Brian Moran. Between 2003 and 2006, he was at the Laboratory of Structural and Continuum Mechanics at the Swiss Federal Institute of Technology in Lausanne, Switzerland, working under the support of Professor Thomas Zimmermann. In 2006, he became permanent lecturer at Glasgow University Civil Engineering Department. Stéphane joined the Mechanics team at Cardiff University on 1st September 2009, as a Professor in Computational Mechanics and directed the institute of Mechanics and Advanced Materials from October 2010 to November 2013. On November 1st, 2013, he joined the University of



Luxembourg as a Professor in Computational Mechanics. He is the Editor of the series « Advances in Applied Mechanics » since 2013. His areas of expertise are: computational mechanics with an emphasis on moving discontinuities (mechanics of fracture, biofilm growth, etc.), Method development (enriched/extended finite elements, meshfree methods, smooth strain finite elements), Evolving discontinuities, Academic research/industrial applications. Stéphane has also been awarded an ERC Starting Independent Research Grant (RealTcut), (where Pierre Kerfriden is main collaborator) to address the need for surgical simulators from a computational mechanics angle.

Prof. Dr. Serge Haan

Prof. Dr. Serge Haan holds the chair for Biological Chemistry at the University of Luxembourg since September 2011. He studied Chemistry at the Rheinisch-Westfälisch Technische Hochschule (RWTH) in Aachen from which he graduated in 1996. He performed his PhD thesis at the Institute of Biochemistry of the RWTH-Medical School, where he subsequently stayed as a group leader and later adjunct professor from 2000 to 2006. His research activities focused on cytokine signalling and the molecular mechanisms of inflammation. Supported by a Marie Curie Individual Fellowship, he worked as a research associate in the department of Immunobiology at Queen's University of Belfast (2001/2002). After obtaining his professorial chair at the RWTH-Aachen, (*Venia Legendi* for Biochemistry and Molecular Biology), he joined the University of Luxembourg (2006). Serge Haan is now heading the Molecular Disease Mechanisms group within the Life Sciences Research Unit and is director of the Doctoral School in Science and Engineering. His current research activities mainly focus on the investigation of the molecular mechanisms underlying colorectal carcinoma and on the oncogenic signalling pathways of mutated kinases in gastrointestinal stromal tumours. The team uses *in-vitro*, *in-vivo* and bioinformatic techniques as well as primary tumour material to dissect the mechanisms underlying tumour initiation, tumour progression, treatment resistance and tumour/micro-environment interactions.



Prof. Simone P. Niclou



Simone P. Niclou is head of the **Norlux Neuro-Oncology Laboratory** (www.norlux.lu) at the **Luxembourg Institute of Health** (www.lih.lu), the major biomedical research center in Luxembourg. Trained as a biologist, Dr. Niclou gained her PhD at the Friedrich Miescher-Institut in Switzerland in 1996 and worked many years in developmental and disease-related neurobiology in the United States and The Netherlands. In 2005, she joined the Luxembourg Institute of Health to establish a new laboratory in **neuro-oncology**.

She became head of the laboratory in 2008 and established crucial animal models for brain tumour research to study the mechanisms of anti-angiogenic treatment in glioblastoma. Her current research interests focus on brain tumour metabolism, tumor angiogenesis and invasion, genetic and phenotypic tumour heterogeneity. Dr. Niclou is adjunct professor at the University of Bergen in Norway, where she is associated with the **KG Jebsen Brain Tumour Research Center** (www.kgjebsen-btrc.no). She is highly involved in the scientific community at an international level, e.g. within the *European Association for Neuro-Oncology* (EANO), the *European Cancer Organisation* (ECCO), and the *European Association for Cancer Research* (EACR). In 2015 Dr. Niclou became president of the board of directors of the **Laboratoire national de santé**, the national diagnostics laboratory in Luxembourg (www.lns.lu).

Dr. Brice Appenzeller

Brice Appenzeller is head and founder of the Human Biomonitoring Research Unit (HBRU) - Luxembourg Institute of Health, and associate Professor adjunct at the University of Luxembourg. He obtained his PhD in Biology-Health-Environment from the Faculty of Pharmacy of Nancy, France in 2002. After 6 years working in clinical and forensic toxicology with a special focus on biomarkers of alcohol consumption, he founded HBRU in 2008 and started the research thematic on the biomonitoring of human exposure to pollutants

such as pesticides, polycyclic aromatic hydrocarbons and endocrine disruptors and on the study of exposure-associated effects on human health. His research activity includes analytical development, application of biomarkers within epidemiological studies and animal experimentation. He is author of +50 publications in international scientific journals. He is expert member in the work group on "Endocrine disruptor" for the French Agency for Food, Environmental and Occupational Health and Safety (ANSES) and member of the scientific council of the French Ministry of Agriculture. He is member of Société Française de Toxicologie Analytique (SFTA), the Federation of European Toxicologists and European Societies of Toxicology (EUROTOX), the International Society of Exposure Sciences (ISES), and elected board member of the Society of Hair Testing (SoHT).

Dr. Georges Dahm

Dr. Georges Dahm pursued his secondary studies in Luxembourg before joining the University of Strasbourg to pursue a Bachelor's Degree in Chemistry and then a Master of Science in Molecular and Supra-Molecular Chemistry. He carried out his doctoral thesis on the medical applications of metallocarbenes in the laboratory of the Institute of Physics and Chemistry of Materials of Strasbourg (IPCMS) under the direction of Dr. Stéphane Bellemin-Laponnaz. During these years of doctoral studies, he carried out many teaching tasks in organic and inorganic chemistry for undergraduate students in Strasbourg. Currently, Dr. Georges Dahm is Deputy Head of the Laboratory of "Biological Monitoring and Environmental Hygiene" within the Department of Official Laboratories of Control Analyzes of the Health National Laboratory (LNS). Dr. Georges Dahm is the author and co-author of some fifteen publications. These fields of specialization are organometallic synthesis and the use of many organic and inorganic analytical techniques (GC-MS, ICP-MS, NMR, IR, LC-MS, HPLC, DMA, UV, Fluorescence, XRF). Dr. Georges Dahm is a member of the American Chemical Society, the French Chemical Society, the Deutsche Chemiker, the Deutsche Gesellschaft für Massenspektrometrie, the Royal Society of Chemistry



Dr. Emmanuel Defay



Dr. Emmanuel Defay has been leading the "Ferroic Materials for Transducers" group (20 people) in the Materials Research and Technology (MRT) Department of the Luxembourg Institute of Science and Technology (LIST)

since September 2014. He previously worked for 15 years at CEA LETI Grenoble in France to develop functional oxides for microsystems. From 2012 to 2014, he was Chief Scientist of the Microsystems section at CEA LETI. From 2010 to 2012, he spent two years as visiting scientist at the University of Cambridge (Pr Mathur) to study electrocaloric materials, where he was elected by-Fellow of Churchill College. He has been involved in academic and industrial projects for an overall budget of around 40 M€, published 118 scientific papers, 2 books and filed 31 patents. Besides, he has an extensive experience in training young researchers (16 PhD students and 6 post docs). Dr. Emmanuel Defay current research is on piezoelectric materials and devices. I am mostly interested in inkjet printing technique in order to fabricate functional devices as micro-sensors or actuators. He is also very much interested in the electrocaloric (EC) effect, which is a variation of temperature appearing in any EC material when a voltage is applied/removed. More generally, He is interested in developing materials exhibiting energy coupling.

Dr. Luc Zwank

Dr. Luc Zwank studied environmental sciences at the ETH Zurich, after a specialization in environmental chemistry he accomplished his master thesis at the Massachusetts Institute of Technology in Cambridge dealing with a historical pollution of the Aberjona Watershed. He then returned to Switzerland to the research group of Prof. Dr. René Schwarzenbach for his Ph.D. thesis on the use of stable isotope fractionation in the assessment of natural remediation of polluted groundwater aquifers. After a short stay in the environmental department of an engineering firm in Luxembourg, he joined the public research center Henri Tudor in Luxembourg where he led the water related research projects. Since 2009 he works for



the Luxembourgish Water Management Agency. He was nominated deputy director of the agency as of august 2014.

Mr. Frank Drews

Frank Drews, born in 1980, completed his Bachelor's degree in Mathematics and Applied Physics in 2002 at the Universities of Luxembourg and Strasbourg. He continued his studies in the field of theoretical physics at the Louis Pasteur University of Strasbourg and obtained his master's degree in 2004. After complimentary studies in the audiovisual field, he obtained his Master 2 in "production and documentary filmmaking" at the Marc Bloch University in Strasbourg in 2006. He then joined the teaching team of the "Neie Lycée" "high school (now: Lycée Ermesinde) as a physics teacher. He wrote his Candidature Work in 2011 in which he undertook research on "The Impact of Humor on Learning.



Mr. François Mersch

After studying chemistry at the Saarland University in Saarbrücken and an end-of-study work in organometallic chemistry, François Mersch pursued a course in Environmental Sciences at the Fondation Universitaire Luxembourgeoise d'Arlon where he wrote a memoire on human toxicology. Since 1996 François Mersch has been a professor of chemistry and in 2004 joined the European School of Alicante as a professor of chemistry and integrated sciences until 2013. During these years he took part in the symposiums of Sciences ESSS Varese in 2008 and Luxembourg in 2010, and was the coordinator of ESSS 2012 in Alicante. Currently, he is professor of chemistry at the Lycée Ermesinde de Mersch in Luxembourg and a member of the National Commission for Chemistry Programs. During his career, François Mersch held various posts and was a member of the jury of recruitment of chemistry professors in Luxembourg and participated in the working group within the SCRIPT (Central Service for Research and Educational Innovation).





Mr. Joseph Rodesch



Since 2009, Joseph Rodesch has been a scientific mediator at the National Research Fund and under his name "Mr Science" presents scientific programs on television and radio in Luxembourg. In this role, he gives training in "scientific mediation for young people and the public", for

different organisations in Luxembourg, including the university, the Script, and various youth organisations. Born in July 1978, he graduated in chemistry in 2004 from RWTH-Aachen University. During his studies, he combined his experience as a Science presenter, acquired with the National Youth Service, and with the knowledge in chemistry to create the non-profit organization "chemie.lu" (now "Pins"), whose aim was mediation through workshops and play shows. After his studies, he taught 2 years at the Lycée Robert Schuman and at the Lycée Technique de Bonnevoie in Luxembourg. From 2006 to 2009 he was a Civil Environmental Engineering Controller with AIB-Vinçotte.

Mr. John Watson



John Watson holds a Master of Science in Biology (MSc). He was professor of biology at the European School of Luxembourg I from 1976 to 2010 and member of the biology working party on the development of the biology programs of the European schools from 1980 to 2005. He participated on the development of the programs of Integrated Sciences from 2000 to 2016. Since 2010 he has been an expert in the Bachelor of Biology at the European Schools and a member of the Volvox project (www.volvox.lu), whose aim is to provide tested and confirmed experimental protocols, simulations and numerous resources for Secondary school teachers. John Watson chaired the publication of Eurobio 4-5 and Eurobio 6-7 of the European Schools. John Watson is a member of the Royal Society of Biology (MRSB).



Assessment Criteria and Running of the Competition

We kindly inform you of some details about our competition and the judging process.

The participants come from a range of scientific backgrounds – students (from S2 to S7 aged 13-18).

Students must enter their project in the appropriate age group:

Junior Projects: Years 2 – 4 (ages approx. 12-14)

Senior Projects: Years 5 – 7 (ages approx. 15-18)

Projects may be submitted by an individual or a group of maximum 3 students.

A project will be judged as a senior project if at least one member of the group is in years 5 – 7 (**ages approx. 15-18**).

Projects should demonstrate that the student(s) has/have undertaken some significant original work. Originality is exceptionnaly important. Examples must include a practically based experimental investigation carried out by the students, original design of an item or process, or survey based investigations involving the first-hand collection and processing of meaningful statistics.

Projects will be selected and evaluated in 2 preliminary rounds to select the 5 best junior and 5 best senior projects.

(1) PRELIMINARY ROUND

(A) 1st preliminary round: **REPORT WORK**

The students/groups will present their written scientific REPORT on their project. The jury members evaluate these papers by giving 50% of the total preliminary points.

Find below the information given to the participants about guidelines for writing their SCIENTIFIC REPORT:

The final report should be a document which describes the investigation carried out by your group. As a suggestion, you can go through the steps in the scientific process including a detailed description of your work and findings.

There is no minimum or maximum length of the report, but as a scientist you should be concise and very precise in what you write, so LESS is MORE, don't use more words than you really need. Don't be satisfied with a first draft. You can write your report in any language but you will need to provide a translation in English, French or German for the judges



SCORING SHEET for JURY MEMBERS on the REPORT WORK

Name of the jury member: _____

Title of the project: _____

Number of the project: _____

(Circle the point as you evaluate the project)

- | | |
|--|-----------------------|
| 1) Evaluation of the concept | |
| a) Motivation and ultimate aim for the project: | 1 2 3 4 5 |
| b) Originality: | 1 2 3 4 5 |
| 2) Evaluation of the process | |
| a) How well planned and organized is the project? | 1 2 3 4 5 |
| b) How well detailed is the research work on the theme? | 1 2 3 4 5 |
| c) How relevant experiments/data/statistics were used? | 1 2 3 4 5 |
| d) The level of Innovation and creativity in the approach of the topic | 1 2 3 4 5 |
| e) Variety of scientific skills used within the project work | 1 2 3 4 5 |
| 3) Outcome | |
| a) How well did the project achieve its aims? | 1 2 3 4 5 |
| b) How well the conclusion was drawn? | 1 2 3 4 5 |
| 4) Significance | |
| a) How wide the impact of the project? | 1 2 3 4 5 |

SHORT COMMENTS on the project if it is applicable:

TOTAL POINTS : _____ / **50** points - Signature of the jury member: _____



(B) 2nd preliminary round: ORAL PRESENTATION

The students/groups will present their scientific project orally to the jury (a panel of judges composed of two experts). The oral presentation could be supported with a slideshow presentation, and / or any technological equipment that the pupils have developed. A poster will be present in the classroom, which students may or may not wish to use in their oral presentation. However, 10 points (10% of the total point) will be given by the jury (a panel of judges composed of two experts) concerning the readability of the project through the poster. They are available to provide you additional information on their project work and answer questions. The oral presentation will be maximum 10 minutes and the panel of judges will be invited to pose questions **for a max of 5 min.**

The jury members evaluate the oral presentation by giving the rest 50% of the total preliminary points.

SCORING SHEET for JURY MEMBERS on the ORAL PRESENTATION

Name of the jury member: _____

Title of the project: _____

Number of the project: _____

(give the points as you evaluate the project)

1) Evaluation of the oral presentation

- a) How easily did student(s) express themselves? / 15
- b) Using of supports (slideshow and / or poster and / or equipment) has been done clearly to show and explain the aim of project? / 10
- c) How clear were there answers? / 15

2) Evaluation of the readability of project from poster

- a) How well planned and organized was the poster? / 2
- b) How well does the poster describe the aim of the project? / 4
- c) How well were the experiments/data/statistics presented? / 2
- d) Level of creativity / 2

Total of poster evaluation /10

SHORT COMMENTS on the project if it is applicable:

TOTAL POINTS : _____ / **50** points - Signature of the jury member: _____



The scores of written and oral presentations will be added and the highest scored demonstrations (*5 from each category*) will be qualified to participate in the final round. If the final points are equal, the panel of judges will make its common decision).

During this session, audience will be in an assembly hall to choose what is their preferred junior and senior project – The choice of best project will be based on the poster presentation. The vote will be carried out by electronic vote on the platform O365. Each category (junior and senior) will be awarded by one “*Poster Presentation -Student Prize*”. The students / groups will be located at their stand next their poster from where they will present their work to the audience.

(2) FINAL ROUND—PLENARY STAGE PRESENTATION

The very best **5 junior and 5 senior projects** (selected in the preliminary rounds) will be invited to present their work on stage for a **maximum of 10 minutes**. Audience and jury will be invited to pose questions **for a maximum of 5 min.**

The stage manager will indicate when the final minute of the presentation/questions-answers starts. The timing must strictly be kept for all the participants.

Previous points and rankings are disregarded for the final round.

The jury will give rankings for the projects. They will take into account of the following characteristics of the projects:

- *The concept* - what was the motivation behind your project and what were your aims? How original is your project?
- *The process* - how well did you plan and organise your work? What research did you do? What experiments did you undertake? Were you innovative or creative in your approach? What skills did you use?
- *The outcome* - how well did your project achieve its aims? What conclusions did you draw? Personal skills - how well did you deal with any problems or challenges you encountered, individually or as a group?
- *Presentation* - how well is your project communicated? Do you demonstrate understanding and reason clearly? Is your final report of high quality?
- *Significance* - What is the wider impact of your project?

Final rankings for each category will be added, the lower the ranking points, the better the score. In the event that projects have identical ranking scores, the panel of judges will arbitrate to reach a final common decision.

The three best entrants in each category (junior and senior) of the competition (according to the above mentioned criteria) will be received the “*ESSS 2017 prize*” (1st, 2nd, 3rd) – The 4th and 5th places will be rewarded with a “*finalist certificate of ESSS 2017*”.

The winner of senior project of ESSS2017 will be selected for the EUROPEAN CONTEST FOR YOUNG SCIENTISTS (EUCYS 2017) which will be occur in Tallin 22-27 September 2017.
[\(http://ec.europa.eu/research/eucys/index_en.cfm\)](http://ec.europa.eu/research/eucys/index_en.cfm)

The awarding ceremony will take place on the final day of the ESSS 2017.



Symposium Program

Sunday, March 26 th , 2017	
11:30 - 16:00	Arrival to Lux ville Auberge de Jeunesse. Registration at symposium.
16:00 - 16:20	Transfer from Youth Hostel to European School
16:20 - 17:00	Poster Set-up
17:00 - 19:00	Opening Ceremony Guest speaker: Prof. Jules Hoffmann – Medicine Nobel Prize 2011 winner <i>"Le système immunitaire inné : de l'insecte à l'homme"</i>
19:00 - 19:30	Bus transfer to Youth Hostel
19:30 - 21:00	Dinner at the Youth Hostel
Monday, March, 27 th , 2017	
7:30 - 8:30	Breakfast
8:30 - 8:45	Bus transfer to European School
8:45 - 9:00	Presentation of Jury
9:00 - 10:45	Qualification Phase Poster presentations including Individual Project presentations to Judges in classroom (<i>Junior Projects</i>) – Presentation poster in the "Salle des fêtes" to audience.
10:45 - 11:15	Café Pause
11:15 - 13:00	Poster presentations including Individual Project presentations to Judges in classroom (<i>Senior Projects</i>) – Presentation poster in the "Salle des fêtes" to audience.
13:00 - 14:00	Lunch packs for juniors (S2-S4) – Bus transfer to Minett Park of Fond-de-Gras Lunch canteen for seniors (S5-S7)
14:00 - 18:30	Minettpark for juniors (S2-S4) – Back to European School by bus. Guided City center visit with casemate for Senior (S5-S7) - Back to Youth Hostel – Bus transfer to European School at 18:30.
18:30 - 20:00	Dinner at the European School Canteen – Notification of Finalists.
20:00 - 20:30	Bus transfer to Youth Hostel
20:30 - 22:00	Animation for students at the Youth Hostel – Science Quizz



Tuesday, March, 28th, 2017

7:30 - 8:30	Breakfast
8:30 - 8:45	Bus transfer to European School
9:00 - 10:45	Final of the competition Slide presentation of five best Junior projects on stage
10:45 - 11:15	Café Pause
11:15 - 13:00	Slide presentation of five best Senior projects on stage
13:00 - 14:00	Lunch canteen
14:00 - 18:30	Excursion to Science Center of Luxembourg – Back to the Youth Hostel
18:30 - 20:00	Dinner at the Youth Hostel
20:00 - 20:30	Bus transfer to European School
20:30 - 22:00	Physikanten Science Show
22:00 - 22:30	Bus transfer to Youth Hostel

Wednesday, March 29th, 2017

7:15 - 8:15	Breakfast
8:15 - 8:30	Bus transfer to European School
8:30 - 9:00	Removing Posters & grouping the luggage by schools
9:00 - 10:30	Closing Ceremony Guest speaker: Dr. Steven Weinberg <i>"Underwater Photography: 160 years of Science, Technology and Adventure"</i>
10:30 - 11:00	Café Pause
11:00 - 12:00	Award Ceremony Distribution of awards to participants and winners by Mr. Arben Lufi – Head of Secondary school.



Opening Ceremony

SUNDAY, 26TH MARCH 2017

17:00 – Musical Introduction

The Chicken	Peewee Ellis	Jazz Band
		Mr. Stefano Agostini

17:15 – Speech of the Director of the European Schools Luxembourg I

Mrs. Panayota Vassilacou

Vuelie (From Disney's "frozen")	Frode Fjellheim / Christophe Beck	Chamber choir
		Mrs. Suvi-Kirsi Korhonen

17:30 – Speech of Inspecteur de l'enseignement secondaire des Ecoles Européennes.

Mr. Max Wolff

Agogo	John Scofield	Jazz Band
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17:45 – Scientific presentation

Guest speaker: **Professor Jules Hoffmann** – Medicine Nobel Prize Winner 2011 –
"Le système immunitaire inné : de l'insecte à l'homme"

Drive My Car	John Lennon / Paul McCartney	Jazz Band & Chamber choir
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Closing Ceremony

WEDNESDAY, 29TH MARCH 2017

09:00 – Musical Introduction

“Carmen” Overture	Georges Bizet	Orchestra
		Mrs. Suvi-Kirsi Korhonen

09:15 – Speech of Minister of National Education, Childhood and youth of Luxembourg
Mr. Claude Meisch

Chandelier	Sia Furler &	Choir
	Jesse Shatkin	Mrs. Louise Hottias

09:30 – Closing speech of General Secretary of European Schools
Mr. Giancarlo Marcheggiano

Hedwig's Theme (de Harry Potter) John Williams Orchestra

09:45 – Scientific presentation

Guest Speaker: Dr. Steven Weinberg –
“Underwater Photography – 160 years of science, technology and adventure”

10:30 – Café pause Jazz Band
Mr. Stefano Agostini

The Typewriter Leroy Anderson Orchestra

11:00 – **AWARD CEREMONY** – Distribution of awards to participants and winners by
Mr. Arben Lufi – Head of Secondary school

Poker face Lady Gaga & RedOne Choir

JUNIOR PROJECTS

The influence of music in the performance of cognitive activities

José Esteve Ronda

European School Alicante

Av Locutor Vicente Hipólito, s/n, 03540 Alicante, España

S4 ES

Abstract

Key Words: Studying with music, Mozart, Cognitive activities.

Some investigations suggest the possibility that music influences helping you to improve your mood and motivating you to continue improving your performance when you do any kind of cognitive activities. In addition, some others suggest other possibilities; in particular, there is a theory that states that if you hear classical pieces composed by Mozart, you get better results.

The main objective of this study is to determine if it is efficient to hear music while making any other type of cognitive activities.



3D Printing Bones

Samo Kobe, Ivor Langus

European School Brussels I

Avenue du Vert Chasseur 46, 1180 Uccle, Belgium

S2 EN

Abstract

Key words: Bones, 3D printing, rigidity measurements

In this project, we investigated the possibilities to create artificial bones using 3D printer. First, we explored the properties and structure of human bones. Artificial bones need to be biocompatible, tough but lightweight, and should preferably have internal structure to enable marrow growth. We then recreated it in a 3D model, using Fusion 360 computer-aided design (CAD) system, and 3D printed the models. We explored different structures: hollow, honeycomb and a Voronoi structure which most closely resembled the natural bone. To assess properties of the natural or artificial bone, we developed a stress test using items available at home and partially automated it using the Lego's Mindstorm.

Allergens in everyday food

Adrien Speight

European School Brussels I

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S2 Fr

Abstract

Keywords: allergens, labelling

This project deals with risks linked to allergies:

- Finding unexpected allergens in industrially prepared food,
- not being able to read the list of ingredients and not identify allergens due to low quality of labelling
- ignorance on how to react when facing an allergic reaction

These three factors combined make everyday life difficult and sometimes dangerous for seriously allergic people.

This project is mainly based on an internet survey I created to ask people about their general knowledge of allergies and what they would expect to find in basic industrial food (bread, ham, tomato sauce, minced meat, chips, stock cubes).

The objective of the survey was to demonstrate the gap between the ingredients that people expect to find in prepared food and the real composition of a sampling of products in shops. This gap may be dangerous because people do not know how to react when faced with an allergic reaction.

Another aim of this presentation was to explain some labelling deficiencies. To do so I went in some shops (Carrefour Delhaize...) and looked at some basic products (bread ham...) to see if there were allergens in them and at which frequency they occur.

A result of my project was that I remarked some gaps in EU Law that create problems for allergic people and proposed some technical solutions.

La luminescence au service de la sécurité

Rémi Lhermitte, Déborah Romain

European School Brussels II

Avenue Oscar Jespers 75, 1200 Bruxelles, Belgique

S4 FR

Abstract

Nous avons choisi de travailler sur la luminescence en raison des couleurs attrayantes et de sa facilité à reproduire en laboratoire. On a voulu trouver une application pratique à ce phénomène. Nous avons pensé au « gilet fluo » tellement répandu et si peu élégant. Notre objectif est de le remplacer. La première étape de notre travail a consisté à mettre au point « un vernis fluorescent ». Nous avons fait quelques essais que nous espérons améliorer.



La Roue à Energie Magnétique Eternelle (R.E.M.E)

FERRERI Filippo, LE MIGNANT Noé

European School Brussels II

Avenue Oscar Jespers 75, 1200 Bruxelles, Belgique

S3 FRA

Abstract

Notre objectif est de produire de l'énergie grâce à une méthode écologique (qui ne soit pas polluante pour l'environnement) qui marcherait quel que soit le temps (la lumière ou le vent ou, encore la chaleur). Nous avons pensé pour cela à utiliser l'énergie magnétique à partir d'aimants. Nous savons bien que la production d'énergie ne pourra être « éternelle » comme annoncée dans le titre mais c'est ce vers quoi nous voulons nous approcher. Nous n'avons pas de méthodes particulières, notre R.E.M.E n'est que le fruit de pensées innovatrices et intellectuelles. Nous sommes à la première étape de notre projet : faire tourner un système sur un pivot. Parallèlement, nous avons fabriqué un instrument susceptible d'avoir un mouvement de rotation : un radiomètre de Crookes.





Effects of stress on students in the European School system

Kimon Koussoulakos, Georgia Ktori, Nicole Stalios

European School Brussels III

Boulevard du Triomphe 135, 1050 Ixelles, Belgique

S2 GR

Abstract

Key words: stress, anxiety, heart pulse rate, digital pulse meter, statistics, questionnaire, bar plot, average, European School (ES)

The human heart is one of the organs that get a beating under stress experience. While under stress, our heart beat rate goes up, our blood pressure rises and blood is moved away from our midsection, going to our arms, legs, and head.

In this work, we measured blood pulse rates at different time periods of a school day and tried to use this heart beat rate relation with the stress state in order to identify if studying or working in an EU school multinational environment creates or not additional stress effects to scholars as well as to teachers. At first, we demonstrate if and how heart beat rate-blood pressure of a standard number of male and female students of 12-13 years old is influenced by some particularities of the ES not found in other ordinary national schools such as educational activities (during exams and /or presentations) in L1, L2 and L3 languages. We also take a small sample of measurements from teachers undergone the same particularities (in teaching) and use them for inter-comparison. As a next step, we assess via the distribution of a questionnaire to a large sample of students of different gender between the age of twelve and sixteen how different factors may affect the level of stress for boys and girls and whether any differences may be observed. The sample used for the questionnaire includes also a small number of teachers. Some of the questions we are trying to answer in our study include:

- How stress manifests itself in an ES environment?
- What are the effects? How is this influenced by gender and level of age?
- How this is dealt with and how it may be managed?

Main question to be answered

How stress presents in an ES environment, what is the effect on the heart pulse rate? Are there differences related to gender, age or the lecture language (L1, L2 or L3)?

The effects of exercise on lung capacity and short term memory

Rebecca Jowett, Reese Moriarty

European School Culham

Thame Lane, Culham, Abingdon, Oxfordshire OX14 3DZ, United Kingdom

S2 EN

Abstract

This project assesses the connection between both lung capacity and short term memory (“STM”) with physical activity in children and adults.

In the first phase, thirty-five children and thirty-nine adult volunteers completed a questionnaire about the frequency of exercise in the previous two-weeks. Volunteers’ weight and height was measured before participating in spirometry testing to calculate their forced vital capacity (“FVC”) as a percentage of expected vital capacity (“EVC”). The following calculations were made to assess whether participation in exercise effects lung capacity: mean and standard deviation for FVC percentage of EVC for age types and gender; and Pearson’s correlation of FVC against weight, height, BSA and BMI. In phase two, [thirty-two] children and [twenty-two] adult volunteers completed a visual STM test before participating in either an endurance or reading exercise. After the exercise, a second visual STM test was completed by the volunteers. Each test was scored on correctness of both sequencing and global positioning and scores analyzed to assess any change in visual STM.

Our results show that volunteers who were physically active in a two-week period before spirometry testing recorded a 13.56 to 15.82% higher lung capacity, across both age type and gender, than those who were inactive. Similarly, the mean correctness of both sequencing and global positioning in visual STM improved by 8.19% and 12.39% for physically active volunteers compared to those of inactive volunteers. We conclude from this project that there is a positive connection between exercise to both lung capacity and visual STM.

Organic vs. Non-organic

Laura Monka, Signe Lykke-Møller

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S3

Abstract

Key words: Organic, non-organic, nitrate levels, blind test, nutrients, money and taste.

Our project is on organic vs. non-organic food and soil. We wanted to find out if organic food is healthier than non-organic food and if the foods soil is also healthier. Another thing that we wanted to find out was if organic soil contains more nitrates than non-organic soil. The final thing that we wanted to find out is if people can taste the difference between organic and non-organic without knowing which is which.



Taste development throughout human life

Skye Fass, Elenor Munro

European School Culham

Thame Lane, Culham, Abingdon, Oxfordshire OX14 3DZ, United Kingdom

S3

Abstract

We would like to see the development of taste throughout the ages of 11-60. We also like to see if there is a difference in food preferences between boys and girls and if there is a difference between what they think they like and what they really like.



The Truth Behind Dizziness

Georgina Gibbons, Sheeya Purahoo

European School Culham

Thame Lane, Culham, Abingdon, Oxfordshire OX14 3DZ, United Kingdom

S2

Abstract

Our project is based around the effects of dizziness. We began by asking ourselves: Why do we get dizzy? Why do dancers and ice skaters spin without getting dizzy? Why don't you get dizzy when the earth orbits? How do height, gender and weight affect your dizziness? Does dizziness affect your intelligence? Some of these questions are already answered and so we focused on the last two questions.

Postur3

Henri Ahola

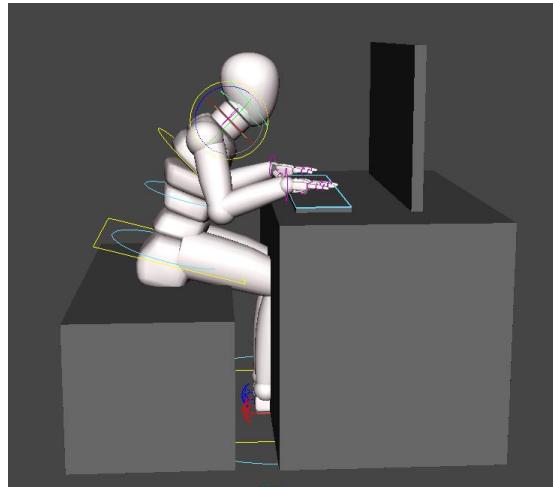
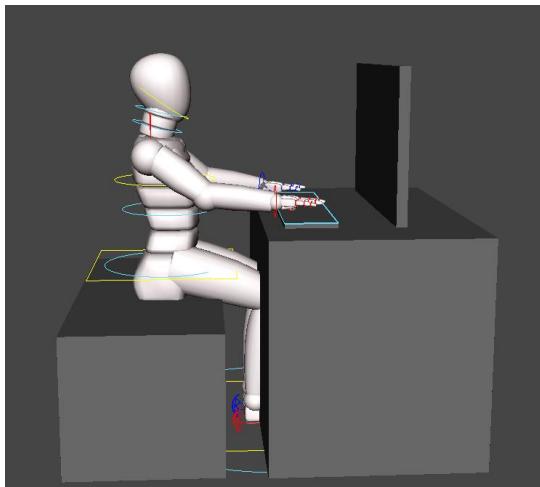
European School Luxembourg I

23, Boulevard Konrad Adenauer, 1115 - Luxembourg, Luxembourg

S2 Fl

Abstract

Nowadays, people sit too much. It can cause many different problems, for example neck or back pain if your upper back is tilted forward (Picture 1), as this causes stress on upper back and neck. So I wanted to find out how to measure this with technical equipment. The following images illustrated with Maya (a 3D modelling and rigging tool) show briefly how the upper back leans forward.



Picture 1, the upper back is tilted

The Deception of the Eye and the Brain

Elisa Lazzaroli, Abby Korter

European School Luxembourg I

Boulevard Konrad Adenauer, 23, 1115, Luxembourg, Luxembourg

S3 EN

Abstract

Key words: Optical illusions, brain, interpretation

Optical illusions can be defined as the images we see with our eyes but are not actually real. It can be any information that the eye gives to the brain that is not a physical reality. Optical illusions are an error or a false assumption of the brain. They widen the mental horizons and make it clear that things are a little different than they seem. Optical illusions can reveal remarkable vulnerabilities of human visual perception.

Optical illusions are particularly good adaptations of our visual system to standard viewing situations. These adaptations are ‘hardwired’ into our brains, and thus can cause inappropriate interpretations of the visual scene.

The brain is constantly constructing things, which helps you to survive. The phenomenon that our brain is constantly looking for known patterns in random structures with low information content is called pareidolia. Some of these constructions can be fiction: A theory a neurobiologist came up with to help explain why we see optical illusions is that they’re due to the brain’s attempt to “see” the future.

These optical illusions occur during the slight time lag after light reaches the retina in your eye, before your brain translates it into a visual perception. When the brain attempts to generate a perception, it is basically taking a guess at the near future by trying to fast-forward a tenth of a second. Due to this “neural delay”, you might not be perceiving an image as it actually is, but as you expect it might soon be. Illusions occur when the brain attempts to perceive the future, and those perceptions don’t match reality

Although there is no single reason illusions take place, another possible explanation is that the brain is a limited structure with limited resources, including its number of neurons, wires, and neuronal connections, so in some cases, illusions may be due to the brain’s need to take shortcuts. Simply put, the brain might need to quickly give more importance to some features in a visual scene than others.

L'effet des pluies acides sur les plantes aériennes et des micro-organismes aquatiques

William Dobney, Simon Vandenbussche

European School Mol
Europawijk 100, 2400 Mol, Belgique

S3 FR

Abstract

Nous voulions voir les effets des pluies acides sur des plantes aériennes et des micro-organismes aquatiques. Nous les avons arrosés avec des eaux à quatre pH différents et ensuite nous avons noté les effets sur la couleur, la taille pour les plantes et le nombre pour les Euglènes.



Welche Erkenntnisse kann man aus Messungen von UV-Strahlung gewinnen?

Gardella Cosimo

European School Munich
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S3 IT

Abstract

Ultraviolette Strahlung ist elektromagnetische Strahlung, die das menschliche Auge nicht wahrnehmen kann. Ihre größte natürliche Quelle ist die Sonne. Zu viel UV-Strahlung kann Hautschäden verursachen: Sie ist z.B. für Sonnenbrände verantwortlich.

Mithilfe eines mit ARDUINO UNO verbundenen UV-Sensor-Moduls wurde UV-Strahlung gemessen und ausgewertet. Das Foto zeigt den Autor beim Messen.



Als Erstes wurden die UV-Schutzeigenschaften von verschiedenen Kleidungsstücken und Sonnencremes ermittelt, indem die Kleidungsstücke und Sonnencremes durchdringende UV-Strahlung gemessen wurde. Es wurde festgestellt, dass Seide, Nylon und Polyester besser als Baumwolle und Leinen vor UV-Strahlung schützen, und dass Polyester seine UV-Schutzeigenschaften mit Gebrauch stark verliert. Sonnencremes mit einem höheren Lichtschutzfaktor gewährleisten einen größeren Schutz.

Als Zweites wurde ARDUINO UNO derart programmiert, dass die maximale Zeit in der Sonne anhand der gemessenen UV-Strahlung berechnet wird. Zuerst wird der UV-Index zum Zeitpunkt der Messung bestimmt und anhand dieses Wertes und der Uhrzeit der Messung der maximale UV-Index im Tag vorhergesagt. Nach Angabe des Hauttyps werden dann die entsprechenden Schutzzeiten berechnet. Bei Verwendung einer Sonnencreme werden der Lichtschutzfaktor betrachtet und die Schutzzeiten angepasst.

Als Drittes wurden verschiedene Beleuchtungslampen geprüft, indem der emittierte Anteil an UV-Strahlung gemessen wurde.

Als Viertes wurden die geographischen Koordinaten des Messorts bestimmt. Dazu muss man den Zeitpunkt, an dem der Messwert maximal ist, herausfinden. Aus diesem kann der Längengrad abgeleitet werden. Ferner muss man an dem o.g. Zeitpunkt die UV-Strahlung derart messen, dass der Sensor zuerst waagerecht und dann so ausgerichtet wird, dass der Messwert maximiert wird. Das Verhältnis zwischen diesen zwei Messwerten entspricht dem Cosinus des Breitengrads minus der Deklination der Sonne.



The Rebound Of Batteries (AA) Depending On Their Charge

Timothy Jacobi

European School Varese

Via Montello, 118, 21100 Varese VA, Italie

S4 DE

Abstract

Angeblich springen Batterien je nach Ladezustand höher auf, wenn man sie fallen lässt. Ich habe mich entschieden, genau das zu untersuchen. Ich werde Batterien (keine Akkus) verschiedener Marken und vor Allem Laduzustände aus einer bestimmten Höhe fallenlassen und die Sprunghöhe berechnen. Dazu benutze ich ein senkrecht aufgestelltes Lineal und eine Zeitlupenkamera, damit ich die Unterschiede möglichst genau herausfinde.

For my project, I researched if empty/used batteries really do bounce higher than full/new ones if dropped from a certain height, as you hear sometimes.

EASY CLEAN GUINEA PIG CAGE

Lorenzo De-Cesare, Oscar Williams

European School Varese

Via Montello, 118, 21100 Varese VA, Italy

S3 EN

Abstract

Key Words: conveyor belt, cleaning, guinea pig

As an owner of a guinea pig i can testify that they put out a lot of waste and it is very difficult to clean it all, so this idea comes from home as an easy way to solve that problem.

Our idea is simple enough not taking too many rare materials or complicated ideas we hope by keeping it simple there is less room for error. but at the same time we think whilst being quite simple it is still quite innovative and helpful doing what machines were originally made to do, making life easier.

The basic workings of the idea is that there will be a conveyor belt on the floor of the cage wrapped in an impermeable material so as not to be ruined. This conveyor belt using solar panels and a heat pump working using the heat of the fermenting faeces down below will charge up and make one rotation every hour, each rotation will be quite slow giving the guinea pig time to realize what is happening and react. On the underside of the cage there will be a container for the poop easily accessible through the side of the cage, a scraper that will be close to the side of the belt to get any poop that may have stuck as well as a brush for anything that can squeeze past that. So as to have efficient and less stinky fermenting for the heat pump when the conveyor belt makes a turn there will be a bar that essentially stirs the poop bringing more of it up to be exposed to fresh air.

Heating-up lunchbox

Marta Mercado, Francesca Leo

European School Varese

Via Montello, 118, 21100 Varese – Italy

S2EN

Abstract

Key words: Solar energy, heating lunch box.

Our project for the science symposium consists of a 100% renewable heating-up lunchbox. We had this idea because in our mensa there are no microwaves, so with this lunchbox we can heat up food without needing to use either microwaves or plugs. Also there are millions people without access to electricity, so this helps by heating food in an easy and renewable way. A heating up lunchbox has been developed; originally, it has been created to be connected to solar panels (or a dynamo in case of indoor use), but we have chosen an option with rechargeable batteries easier to transport, and so it is possible to use the lunch box in different time than charging moments.



How does plant life react to different pH levels?

Madeleine Burr, Arnaud de Smet

European School The Hague – Rijnlands Lyceum

Houtrustweg 2, 2566 HA Den Haag, Netherlands

S3 EN, S3 FR

Abstract

Plant life is affected by its surroundings, which include the materials it grows in. The aim of this experiment was to test to see how much a variance in Ph level would affect the germination process of plants. This experiment was designed by using cress seeds and various dilutions to create the necessary Ph levels.



Fruit flies experiment

Cecilia Radaelli, Flóra Murakeözy-Kis, Luna Beeloo

*European School The Hague – Rijnlands Lyceum
Houtrustweg 2, 2566 HA Den Haag, Netherlands*

S2

Abstract

In this experiment, the behaviour of fruit flies and the choice they make between different types of fruit is investigated.



The effect of hamster short eyesight on their orientation

Marco Di Vincentiis, Mathis Duguin

European School The Hague – Rijnlands Lyceum

Houtrustweg 2, 2566 HA Den Haag, Netherlands

S3 EN, S3 FR

Abstract

To influence a hamster's behavior in order to promote the hamster's speed and orientation skills to run through a maze.



How do animals transmit the zoonoses to humans?

Juliette Dalet, Elora Binther

*European School The Hague – Rijnlands Lyceum
Houtrustweg 2, 2566 HA Den Haag, Netherlands*

S3

Abstract

Under construction

Le Pouss'café

Giulia Vittorangeli, Lalie Vignais

European School Parma

Strada Aurelio Saffi, 8 - 43121 Parma, Italy

S2

Abstract

Notre projet consiste en la réalisation d'un nutriment à base de marc de café (en capsules) et de gélatine (pour le rendre compact) pour les plantes ; il est nommé Pouss'café.

Il a plusieurs avantages : il recycle les capsules de café usagées et économique car les matières utilisées sont peu coûteuses, il est biologique car il n'y a aucun produit chimique mauvais pour la santé.

Le pouss'café est fabriqué à partir de quatre capsules de café et d'une feuille de gélatine alimentaire qui elles, viennent chauffées dans une casserole. On a mis au point ces quantités en faisant plusieurs expériences avec des plants de basilic. Nous sommes arrivées à choisir une juste quantité de manière à ce que les plantes ne meurent pas et que le pouss'café ne soit pas trop compact.





LA REVOLUTION CHEZ LES PINCES A LINGES

Louis Salimbeni

European School Parma

Strada Aurelio Saffi, 8 - 43121 Parma, Italy

S4 Fr

Abstract

Faire sécher son linge permet de ne pas utiliser le sèche-linge, qui consomme beaucoup d'énergie et maltraite les vêtements. Bien étendre son linge permet aussi de diminuer le temps de repassage, gain supplémentaire d'énergie. Cet art commence par l'utilisation des pinces à linge, objet plus que simple avec un seul défaut celui de disparaître très facilement.

On passe trop de temps à cette tâche ingrate et répétitive. Aussi j'ai eu l'idée de développer un prototype pour mettre fin à l'utilisation des pinces à linge et faciliter le travail domestique.

Security Kids

Chiara Quaglia, Davide Quaglia

European School Parma

Strada Aurelio Saffi, 8 - 43121 Parma, Italy

S2 FR, S3 FR

Abstract

Les bébés oubliés dans la voiture... Ça n'arrive que trop souvent !

N'avez-vous jamais imaginé le bébé qui hurle à se casser la voix, seul, oublié, mais personne ne l'entend, les larmes, mêlées de sueur qui coulent à torrents sur son visage dodu. L'enfant qui arrête de pleurer, qui se débat de toutes ses forces contre la chaleur qui se fait insupportable, qui panique, affolé, qui recommence à pleurer, mais de désespoir cette fois. L'enfant qui perd peu à peu ses forces, qui devient trop faible pour bouger, trop faible pour respirer, puis trop faible pour vivre puis la mort qui l'emporte ? N'avez-vous pas déjà pensé qu'il fallait agir ?

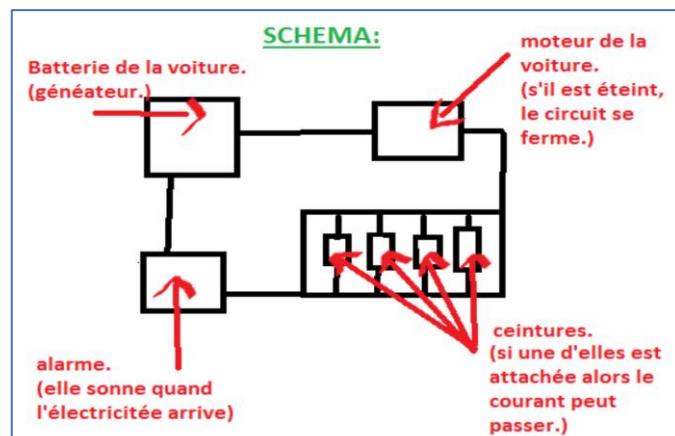
Pour nous, la réponse est affirmative, c'est pour cela qu'une solution inconnue mais simple et évidente nous est apparue :

-simple, car c'est seulement un circuit électrique dans la voiture avec une alarme pour avertir le parent quand il aura oublié son enfant dedans.

-évidente, car quand l'adulte en question oublie son enfant, il sortira de la voiture mais une des ceintures sera encore attachée, nous avons donc développé et utilisé la situation.

Dans la voiture, l'électricité part de la batterie qui lui sert de générateur, le courant continue jusqu'au moteur, mais seulement si celui-ci n'est pas en fonctionnement le circuit se ferme et il peut continuer son chemin. Il arrive chez toutes les ceintures, si une d'elles est attachée, il pourra passer et continuer vers une alarme qui sonnera.

Ce schéma avec cette brève explication illustre notre idée dans son principe, cependant il y a beaucoup de points particuliers techniques que nous avons hâte de vous expliquer et de vous montrer notre prototype !



Preiswerte Wasseranalyse mit einfachen Mitteln

Tobias Kolb, Benedikt Cresswell

*European School RheinMain,
Theodor-Heuss-Strasse 65, D-61118 Bad Vilbel, Germany*

S3 DE

Abstract

Wasser, welches durch den Einfluss von Plastik verkeimt wird, ist eine noch unterschätzte Gefahr welche Tieren und Menschen zum Verhängnis werden kann. Durch hochgradig verkeimtes Wasser kann ein Mensch zum Beispiel seine Fruchtbarkeit verlieren oder sogar falsche Hormone ausstoßen. Wenn wir eine Plastiktüte in ein Gewässer werfen würden, so würde sich diese soweit ausbreiten, dass sich Wasser in ihr sammelt. Durch das darauf fallende Sonnenlicht vermehren sich die Keime in der Tüte schlagartig. Weitere Daten hierzu findet man auf www.nachhaltig-sein.info. In einem Artikel auf der bereits angesprochenen Seite werden Tiere aufgezählt, die unter dem vermehrten Plastikmüll in den Meeren leiden (Schildkröten, Delphine und Vögel). So sterben bis zu 1.000.000 Seevögel und bis zu 100.000 Meeressäuger pro Jahr. Dies hat zwar kaum etwas mit der Keimzahl im Wasser zu tun, sondern mit dem ansteigenden Plastikmüll, dennoch wäre es auch ein positiver Effekt, wenn man sich gegen Plastikflaschen entscheiden würde. Unser Versuch soll dabei helfen noch mehr Nachteile von Plastikflaschen aufzuzeigen, da die jetzigen Zeichen noch nicht als Gefahr wahrgenommen werden.

Zuckerarme Gummibärchen

Luca Wilde, Bschoy Laban

Europäische Schule Rhein-Main

Theodor-Heuss-Straße, 65, D-61118 Bad Vilbel, Germany

S2DE

Abstract

Keywords: Zuckerarme, ballaststoffreiche Gummibärchen

Gummibärchen und Fruchtgummis sind bei uns Kindern eine der beliebtesten Süßigkeiten. Insbesondere die niedliche Form, die bunten Farben und der süße, fruchtige Geschmack sind sehr verlockend und so ist die Tüte dann auch sehr schnell leergegessen. Allerdings sind in diesen Naschereien sehr viel Zucker (ca. 78%) und sehr oft auch künstliche Zusatzstoffe enthalten.

Unsere Idee war es, gesunde Gummibärchen mit natürlichen Inhaltsstoffen selbst herzustellen; durch Austausch von Zucker und/oder Beimengen von Ballaststoffen. Wir wollten überprüfen, wie gut die neuen Rezepturen bei den Testern/Mitschülern angenommen werden.

Insgesamt haben wir 8 Versuchsreihen (davon 4 mit Tagatesse® als Zuckersatz sowie 4 mit Inulin & Tagatose) durchgeführt: 4 Versuche mit Mangopüree, 2 Versuche mit selbst hergestelltem Himbeermark, jeweils eine Versuchsreihe mit Erdbeer- bzw. Püree aus Waldbeeren. Die Kombinationen mit Inulin, Tagatose und Mangopüree bzw. Himbeermark erhielten von den insgesamt 14 und 8 Versuchspersonen im Durchschnitt die besten Bewertungen und waren vor allem in der Fruchtigkeit den original Gummibärchen überlegen.

Die selbst hergestellten gelb-orangen Mango-Gummibärchen enthielten neben einem Fruchtanteil von ca. 45%, einen Anteil von ca. 13% Proteinen (aus der Gelatine), ca. 9% Inulin (als Ballaststoff) sowie nur ca. 17% Kohlenhydrate. Durch die Verwendung von Tagatose, als einem Zuckersatz mit sehr niedrigem glykämischen Index, sind diese Gummibärchen sehr kalorienarm und erhöhen den Blutzuckerwert wenig. Die tiefroten Himbeer-Gummibärchen mit ihrem sehr niedrigen Fruchtzuckeranteil sind eine fruchtige „Süßigkeit“, praktisch ohne die negativen Effekte von Zucker. Dieses Experiment lädt dazu ein, weiter zu forschen: eine bessere Haltbarkeit und eine etwas festere Konsistenz, sowie die Verwendung von pflanzlichem Gelatine-Ersatz sind kommende Herausforderungen.

SENIOR PROJECTS

"TEMPUS FUGIT"

Different factor correlations affecting the time perception while running

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S5 EN & S6 EN

Abstract

Does a ten-minute jog feel like a never ending slog? Or does it fly by for you? Our project involves investigating people's time perception when running. It aims to explore the relationship between the study participants' individual time awareness and their responses to a questionnaire that covers variables such as gender, age, self-assessed punctuality, passion for running, frequency of running and previous experience of a tread mill. The overarching objective of the project is to confirm our hypothesis that motivation and enthusiasm speeds up one's perception of time passed.



The first phase of our project is data collection through the questionnaire. Phase two focuses on the testing itself, with each individual asked to run on a treadmill and estimate when three minutes has elapsed. All participants are allowed to adjust their speed but, since the display is covered, the actual speed and duration remain unknown to them. In phase three we analyse the data obtained, explore correlations, draw conclusions and develop graphic representations of the results.

The expected results could highlight the importance of motivation in tackling one of society's fundamental health problems - a lack of exercise. Another practical application is in education, where interesting, interactive and motivating classes can ensure students remain focused as time will seem to pass more quickly and concentration levels will be more easily sustained.

Studying complex movements

Enrique Uribe Arias-Paz, Alejandro Canals Romero

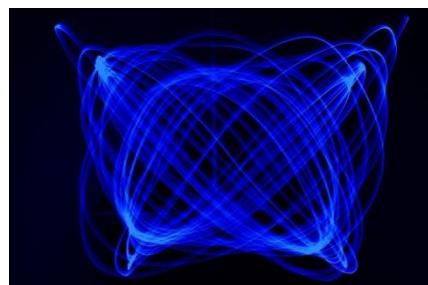
European School Alicante

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S6 ES

Abstract

What we want to demonstrate is if the mathematics that models some complex motions coincides with what in real life. We want to achieve this by making long exposure photographs of some complex motions and, by this way, get a “photograph of the motion”. In particular, we are going to study the spring pendulum.



Thermal Exoskeleton

Elžbieta Avsiukevičiūtė

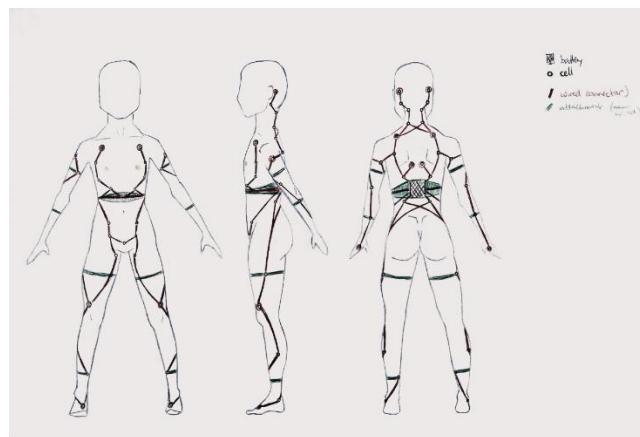
European School Alicante

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S7 EN

Abstract

The focus of the following project is to design and create an exoskeleton device that provides the wearer with external body-heat control. Using heat emitters and/or heat absorbing materials, located in points of highest heat-sensitivity, desired temperature variation can be achieved. Among other applications this would be useful in various fields of medicine, especially with patients who do not possess the capacity of autonomous body-heat control, due to, for instance, hormonal imbalance; or as a localised heat source as required in healing processes. Additionally, a possible use for the general public could be imagined in extreme weather conditions, to assist an optimal thermoregulation to an extent unavailable to the organism itself, in this way preventing hyperthermia or hypothermia, respectively.





La descomposición en diferentes tipos de alimentos

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S5 ES

Abstract

In this series of experiments, we have tried to see if the fame that hamburgers and chips from fast food chains remain "intact" after several weeks, while the homemade ones get bad right away. We tried to find relationships between the degradation process and the amount of preservatives it contains, as well as the amount of salt and moisture. We will focus on the burgers and the chips.

Qu'il y a-t-il dans ton verre?

Lorenzo Signore, Maria Cristina Pitteri

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S6 IT

Abstract

L'an dernier, en Belgique, 3024 viols ont été enregistrés. Un chiffre effrayant. Qu'en est-il des cas dus à la drogue du viol ? « Drink spiking » ou « drogue du viol », ces termes catégorisent la même chose : une drogue diluée dans une boisson lors d'un moment d'inattention de la victime. Cette dernière se sentira étourdie et subira des pertes de mémoire. Le but de notre expérience est donc de limiter ce phénomène, pour faire cela on se propose de déterminer la présence de drogues du viol, tel que GHB et le Flunitrazepam à l'intérieur de solutions tels que boissons (bière, eau, soda, jus d'orange), et la production d'un produit capable de les identifier (exemple : indicateur). L'indicateur, une fois mis à contact avec la boisson contaminée aurait le rôle de mettre en évidence la présence de la drogue. L'expérience conduite sur le GHB a été concluante en solution aqueuse et nous avons créé un indicateur, cependant l'expérience sur le Flunitrazepam a été concluante uniquement à sec, d'où l'impossibilité de produire un indicateur pour celle-ci.

Trajectory of a golf ball

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S5 FR

Abstract

The trajectory of a golf ball is something very interesting. We know, thanks to the Magnus and the Bernoulli principle that a ball spinning in the air in the opposite direction to the flight path has lift, so, goes up in the air. I wanted to study what affected the height and the distance of a golf shot. To answer my question, I needed a machine that could pick up data on golf shots I would hit. It is called a Flightscope. I hit two very different shots with a seven iron. The first one I hit, I reduced the loft and hit slowly. The second one, I added loft to the club and swung it hard. The Flightscope gave me data that showed that the first one I hit went lower and shorter and the second one higher and longer. I then needed to understand why and I found out that spin loft, which is the difference between the angle of attack and the dynamic loft (loft of club at impact) had a big influence for the trajectory of the golf shots.



An FTP-based cloud service

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S6 IT, S4 HU

Abstract

LaciCloud is a multi-user cloud-storage solution much like Google Drive or Dropbox, but based for the first time on the FTP(s) protocol. This provides it with some revolutionary new features - mainly advances in device compatibility (compatible with every device from 1971), user-privacy (like encryption), security (privilege separation, secure coding practices) and versatility (many synchronization, backup clients exist, and a lot more like file sharing). Starting from scratch, LaciCloud has been designed, developed, tested and is now operational in beta version that can be accessed at <https://lacicloud.net>! LaciCloud is also open-source, so you can see the source code at <https://github.com/lacicloud/LaciCloud> . The beta code for LaciCloud is 'hunter2', so if you want to sign-up please do so!



Les vers de farine : une solution durable pour le plastique ?

Alexander Lindberg, Sarah Mignot

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S7 FRA

Abstract

Selon un rapport de Greenpeace, 6.4 millions de tonnes de plastiques se retrouvent chaque année dans la mer, ce qui correspond à peu près à 17 500 tonnes par jour. À cause de cela des milliers d'oiseaux et de mammifères marins meurent sans arrêt.

En faisant des recherches sur le sujet, nous avons trouvé un article de l'université de Stanford décrivant la capacité récemment découverte des larves de Ténébrions meunier de manger et digérer du polystyrène expansé. Ils le convertissent ensuite en dioxyde de carbone et rejettent uniquement des déchets biodégradables et non toxiques. Nous avons donc décidé de travailler sur cette espèce pour observer leur capacité à manger différents types de plastiques.

Ainsi, nous les avons nourris avec de la farine et du polystyrène expansé, pour corroborer les expériences faites par les chercheurs américains, ainsi qu'avec des morceaux de bouteilles en plastique (PET-polyéthylène téréphthalate) et de sacs en plastique (polyéthylène basse densité).

Ces plastiques font en effet partie de ceux qu'on retrouve le plus souvent dans la nature.

Nous avons choisi d'étudier les variations de masse des vers et de la nourriture ainsi que le taux de mortalité. Ces données permettent de conclure sur leur capacité à se nourrir exclusivement des différents plastiques, et de déterminer si ces différents régimes modifient leur mode de vie. Nous avons également mesuré leur dégagement de dioxyde de carbone, pour voir si celui-ci augmente considérablement pour les régimes à base de plastiques. En effet, si le dégagement de dioxyde de carbone devient trop important, considérant les effets négatifs de ce gaz à effet de serre, cela pourrait devenir un désavantage.

Le cycle de vie du Ténébrion meunier se compose de 4 phases : l'œuf, la larve, la nymphe et l'adulte. Nous avons donc décidé de travailler à la fois sur les larves (plus communément appelés vers de farine) et sur les adultes. Les résultats obtenus sont prometteurs. Les vers de farine et les adultes peuvent en effet survivre avec un régime uniquement composé de polystyrène. Ils ne sont par contre pas capables de manger les autres types de plastique testés.





Effects and Implications of Ethylene Gas

Karmaker Luuk, Leal Mendo

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S5 NL

Abstract

In supermarkets, restaurants, canteens and households, an incredible amount of fresh fruit, is wasted because of spoilage and due to lack of proper storage and preservation. Do people realise that there are simple preservation methods for hard-earned food. We decided to take on the challenge of finding a way to save a lot of money and fruit, and at the same time reducing waste, which in turn results in less carbon emissions. With our experiment, we want to highlight that in addition to traditional cooling techniques which are very effective, adding a lemon to the fruit kept at room temperature especially on countertops was more effective in most cases. This means, millions of euros' worth of savings can be achieved with very simple techniques. This procedure saves money on cooling equipment, energy consumption and maintenance costs. Using lemons is a cheap and simple solution. In this paper, we present the result of our study of the effects of ethylene gas and how it accelerates the fruit ripening process.

Low cost underwater exploration vehicle

David O'Brien-Møller

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S6 ENA

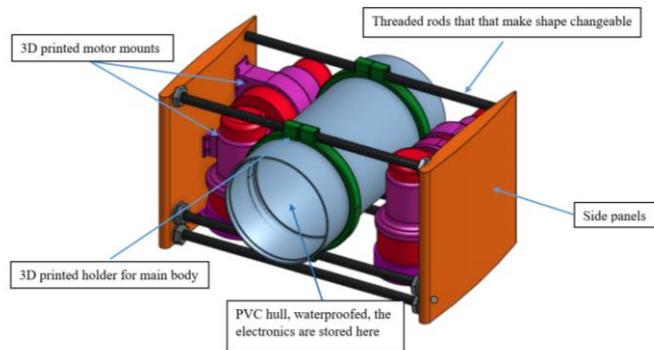
Abstract

Key words: Under Water robot, independent researchers

The purpose of my project is to construct a low cost underwater exploration vehicle. Using joysticks as controls the operator on land can manoeuvre the vehicle through the water while receiving a live feed from a camera mounted within it. This project will be Open-Source, all the files, such as the 3D printing files for parts, will be published letting any researcher anywhere construct their own robot, since it uses low cost easily available components.

It will cost 200 euros in comparison to the cheapest similar robot which costs 899 dollars. It can be used for observing wildlife, and gather temperature data. The robot can have a small waterproof camera mounted on it to take good pictures and can support sensors such as temperature sensors to gather data. The robot unlike other ROVs allows for easy modification of form and function as is later discussed.

The vehicle is easily converted to other uses, as its body is positioned on threaded rods, which allow for fast and simple shape changes and for easy swapping of any attachments the researcher wishes to add or remove from their robot. The attachment that I will construct for the robot is a grabbing tool that can be used to collect scientific samples or rubbish. My robot is ideally suited to these tasks as it is small (30cm width by 25 cm length by 15 cm height), in its current form, and can access places inaccessible to divers or larger submersibles. This robot is more a platform that allows anybody to modulate and change to suit their desires.



Free WLAN everywhere = Free Health Problems for everyone?

Christoph Pieber, Dorothea Klemt, Stella Kowalsky

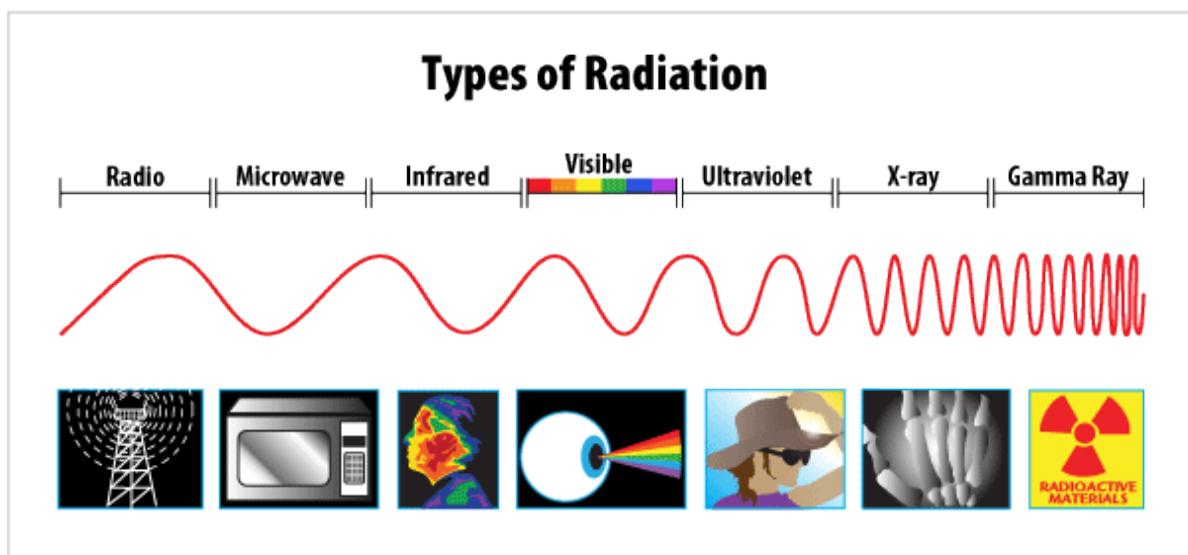
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S5 DE

Abstract

Free WLAN is a buzzword of our modern times. Wherever we go, be it at home, at work, in restaurants or cafes in hotels, in buses or trains, we expect to be connected to the internet with WLAN. We took this as a fact and asked ourselves, what does this mean for our health? WLAN uses electromagnetic rays and their effects on human health are not entirely clear. While the European Commission promotes WLAN throughout Europe, already in 2011, the Council of Europe adopted a resolution that strongly recommends not to install WLAN in schools, because of possible negative health effects. We wanted to make up our own mind and have set up a research design to assess possible effects of electromagnetic rays caused by WLAN electromagnetic rays/fields.



Graphène, fabrication et propriétés

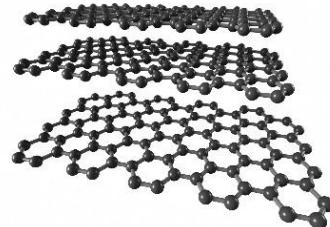
Elias Braun, Ennio Grammatica, Giulio Grammatica

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S6 FR

Abstract

En écrivant ou dessinant avec un crayon à papier, on laisse sur la feuille du graphite, plus ou moins pur, composé de couches superposées d'atomes de carbone en formation hexagonale. Une de ces couches isolée forme une molécule de graphène. Bien que théorisé dès 1947, il fut isolé pour la première fois en 2004 par l'équipe d'André Geim de l'université de Manchester, ce qui lui valut le Prix Nobel de chimie en 2010.



Ce matériau, outre à avoir une épaisseur d'un atome en une masse quasiment nulle, possède des propriétés surprenantes : il est le meilleur conducteur thermique connu, un excellent conducteur d'électricité et présente une résistance mécanique extrêmement élevée. De conséquence, il a été pensé pour une multitude d'applications pratiques, allant des écrans tactiles flexibles à la purification de l'eau. Le graphène présente cependant un inconvénient, qui est le prix de production. Il est en effet très coûteux en termes d'énergie de produire une unique couche de graphène.

Notre projet est ainsi centré sur ces deux aspects-ci du graphène : la fabrication et les propriétés. Nous tâcherons en un premier temps de synthétiser (bien que grossièrement) du graphène par nous-mêmes et d'en mesurer la conductivité thermique. En un second temps, nous transférerons une feuille de graphène sur du cuivre, pour en comparer avec équité la conductivité avec celle d'autres matériaux. Finalement, nous animerons la fabrication de graphène par exfoliation mécanique (la méthode dite du scotch) afin de mieux comprendre les difficultés que celle-ci pose.



The Arcade Machine

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S6 EN

Abstract

Key words: Arcade, Raspberry pi, entertainment, python, Woodwork.

During the course of the six months leading up to the Science Symposium we have invested a great deal of time and resources into constructing a tabletop arcade machine, to resemble the old game stations which were popular in the 80's. We built the foundations of this project on a raspberry pi single-board computer running the RetroPie operating system. In addition to making the hardware of the arcade, we decided it would be appropriate to program a game, to then be able to play on our arcade making it unique. The game relates the story of a firefighter saving children from a burning building, while dodging fires. We programmed the game using python-pygame. Additionally, we hand-cut, carved and painted each individual part for the casing and put it together using screws. Our intentions with this project are: to have created something fun and entertaining from a collection of loose parts, with our own bare hands; to bring back this entertainment system which has been almost forgotten and replaced by modern consoles; moreover, we chose to do this project to challenge ourselves and because we found it interesting not wanting it to simply be something that must be completed in order to gain access to the science symposium.



Sugars' Effect on Oral Bacterial Growth

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S6 EN

Abstract

The modern nutrition consists of a variety of different sugars, and for this reason we decided to further investigate the correlation between them and the amount of bacteria they help or prevent to grow, in order to understand more deeply which foods worsen our general dental hygiene. Using both simple and complex sugars commonly found in our diets, (glucose and fructose; sucrose and lactose respectively), we designed a protocol which would help us determine which sugar (or kind of sugar) is most nutritious for oral bacteria. The sugars and bacteria react together and go through a fermenting process, to ultimately form acids, which attack the teeth. Bearing in mind that complex sugars need to be broken down before metabolism, we hypothesized that simple sugars would grow more bacteria than complex ones, even though we are often warned against sucrose, found in products such as gummy bears, lemonade-drinks, and so on. Our results, to a great extent, confirmed this: overall, the petri dishes with glucose in the agar grew the most and largest colonies, covering the largest total surface area compared to the other sugars. However, the petri dishes containing no sugars grew even more, showing that sugars are actually inhibitors, which proves the effectiveness of traditional folklore conservation techniques that use sugar for food preservation.



Effects of music on student's concentration levels

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S6 EN

Abstract

The main aim of this study was to test how various genres of music would affect student's concentration levels. The experiment was conducted on 142 students of a variety of ages, from the youngest year to the oldest year in the secondary level of the European school Frankfurt (11 to 18 years old). The subjects were given a time limit of 2 minutes to memorise a list of 20 words with different background music. After this time they had 1 minute to write them down. The results obtained varied among the music genres and grades but overall it is clear that there are significant differences among them. Music types such as rap and pop worsened the performance of the subjects, whereas mediation and heavy metal did surprisingly well. The data obtained were statistically analysed with the Chi-square test of independence, giving p-values over 0.05, which means that we cannot reject the hypothesis that the studied variables are independent, and the differences observed can be due to chance. Further statistical analyses of the results, however, showed that age played a huge role in terms of memorization capabilities, giving p-values for the Chi-square test of 0.0178 and 0.03886.



Der Einfluss der Circadianen Rhythmis auf die Aufmerksamkeit und Konzentrationsfähigkeit im Schulalltag

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S5 DE

Abstract

Unser Ziel war es herauszufinden, zu welcher Tageszeit wir am aufmerksamsten und lernfähigsten sind, auch in Bezug auf den Schulalltag. Dafür haben wir über einen bestimmten Zeitraum Probanden (Mitschüler) sowohl morgens (8:10-8:30 Uhr) als auch mittags (12:00-13:30 Uhr) getestet. Wir nutzten dafür zwei Tests: zum einen den Stroop Test, bei dem die Testperson die Farbe in der ein Wort geschrieben ist benennen soll. Hierbei ist eine hohe Konzentrationsfähigkeit gefragt. Der andere Test den wir benutzt haben war der Quatember Maly Test, auch Vigilanz Test genannt, welcher die Aufmerksamkeit in monotonen Situationen testet.

Unsere Auswertung hat ergeben, dass die Probanden mittags jeweils aufmerksamer und konzentrierter waren. Allerdings gab es nur kleine Unterschiede zwischen den Ergebnissen, der am Mittag durchgeführten Tests, und denen der morgens durchgeführten Tests. Dieses Ergebnis konnten wir anhand des circadianen Rhythmus, der die Leistungsfähigkeit zu verschiedenen Tageszeiten beschreibt, bestätigen. Dies wird auch „Innere Uhr“ genannt, welche die Leistungsfähigkeit steuert. Physiologischer Hintergrund ist der Spiegel des Transmitters Melatonin, welcher nachts höher ist als tagsüber und den Wachzustand maßgeblich beeinflusst. Eine Hirnregion Namens Suprachiasmatischer Nucleus ist bei der Kontrolle des Melatoninspiegels ausschlaggebend. Zu unseren zwei Testzeiten, welche wir zunächst im Schulalltag nehmen mussten, verfügt man offensichtlich etwa über die selbe Leistungsfähigkeit, was auch dem Melatonininspiegel im Tagesverlauf etwa entspricht.



Optimization of the rotation speed of a wind generator

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S6

Abstract

Renewable energies are the key to our future. Nowadays, a lot of renewable energies are used, one of them being the wind power. To produce electricity out of wind power, humans have invented windmills that can convert this power into electricity. But to be able to convert this energy, these windmills need to rotate. But what influence the actual speed of its rotation?

During this project, we would like to try to find out some of the factors that influence the rotation speed of a windmill.

We will test some factors that we think might have an influence using a windmill within a box. Depending on the results, we will conclude about the factor's influence.

Our final objective is to make a hypothetical "perfect spot" on which the windmill would rotate at the highest speed. We know that above a certain rotation speed, the windmill decelerates, and this is why this perfect spot doesn't exist, but we always wondered how fast could a windmill rotate, so we decided to make the actual research in the frame of the European Science Symposium.

The role of materials and surfaces in the transmission of bacteria in public places: A case study of a school

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S6 EN

Abstract

This research project is a study into the bacteria found in schools and measures that can be taken to reduce the transmission from person to person. This project has been carried out in collaboration with the Luxembourg Institute of Science and Technology (LIST).

The first stage of the project identified the bacteria in the school with DNA sequencing. While the majority of the bacteria were harmless, *Staphylococcus saprophyticus* (a cause of urinary tract infections) was identified. We also found *Propionibacterium acnes*, and a bacteria belonging to the genus *Neisseria* (which might provoke meningitis, a sexually-transmitted disease, and other diseases).

The project continued with tests as to the survival of bacteria on a range of surfaces and in particular on various soft and hard woods, copper and plastic. The results show a very quick death rate for the bacteria on pine (nearly all gone after 15 minutes). Plastic, was the worst performer, with bacteria still present on the plastic surface after more than 10 hrs. The project attempted to identify the compounds in wood that might contribute to its antibacterial properties. Solutions of wood extracts were prepared by soaking sawdust in physiological serum and in ethanol. The water-based solutions had little effect, while the ethanol based solutions did reduce bacterial present in the test samples by approximately 10-fold over a 2 day period. The chemical composition of these extracts was analysed with High Performance Liquid Chromatography. This showed that there were more compounds present in the ethanol extractions, of which the predominant compound found is associated with plant defensive systems.

The mechanisms by which pine disinfects are complex and remain unclear. There is likely to be a physical effect where bacteria are absorbed in the wood. Pine is also antibacterial as we are using the natural defensive mechanisms of a tree when it is subject to bacterial invasion – namely resins that protect the tree from intrusions. This is a complex reaction that appears to depend upon the combination of the chemicals found in the resins.

Materials can be used to reduce transmission risks, for example by using untreated pine for work surfaces. However, door handles pose a particular problem due to the frequency with which they are touched. The only way to quickly remove bacteria from a door handles is through repeated cleaning. A prototype door handle was built that dispenses a small quantity of disinfectant each time it is used. This was well-received by a sample of users.

This work has been derived from a school environment, but is relevant for other public buildings such as hospitals, and care homes.

Creating a better Medical Emergency Alert Device - Watch Over U

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S6 EN

Abstract

Keywords: Arduino, Medical Alert Device, GSM, GPS

In this report, a new design for an inexpensive but comprehensive medical alert device is proposed, using an accelerometer, a heart rate sensor, and body temperature sensor for detecting accidents, and GSM to communicate user location and accident type to emergency services or an emergency contact. A first prototype has been built, which works, but needs further development.

The MiniSat

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S6 PTA

Abstract

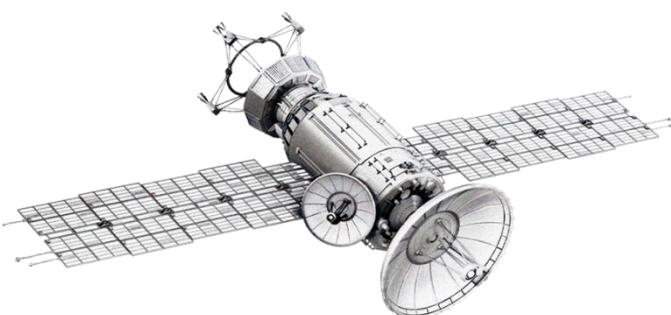
Key words: Arduino Uno, Raspberry Pi, Satellite

A satellite is a device designed to be launched into orbit around a celestial body. The first satellite to have been launched was *Sputnik* in 1957, ever since then more than a thousand satellites have been sent into Earth's orbit. The thing is, all of these satellites cost an extreme amount of money, but what if it was possible to make them cheaper and smaller?

The aim of this project is to develop a small and cheap observation satellite. In this case it will be launched up into the troposphere and collect data regarding various factors such as temperature, atmospheric pressure, humidity and light. The data will then be retrieved and analyzed using a computer program.

As the data handling unit of my MiniSat I will be using either a microcontroller, such as the Arduino Uno, or a microcomputer, such as the Raspberry Pi. These components will be in charge of getting data from the sensors. The power unit will be a 9v battery. To receive the data from the satellite to my computer I will either be using a 45Hz radio transmitter and receiver, a GSM module or simply store the data in a micro SD card and retrieve it once the MiniSat has landed. The payload is composed of a set of sensors. There are multiple sensors capable of getting the data I want so I will be using the cheapest ones.

I will be making a series of test in order to choose between all the options and the final product will be the cheapest, smallest and easiest to build satellite made from all these components.



Omega-3 alpha-linolenic fatty acid (ALA) in Chia seeds (*Salvia Hispanica L.*) and its influence on human performances

Inès Bahlawane, Lavinia Kadar

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S6 DE

Abstract

This project, led by Lavinia Kadar and Inès Bahlawane under the supervision of Eric Castanet (EE Lux2) is divided in two parts.

In the first part, we want to show that the very beneficial ALA in chia seeds can be used in the human body. Therefore, a simulation of the human digestive system will be made. The acid should be detectable after the experiments (conducted in school lab).

The objective of the second part is, to find out if chia seeds have an influence on human performances. We carried out a study where 19 students from 4th and 2nd year participated in a test, containing a memorization part, in which the students had to remember a quantity of numbers with time limit, pull-ups(with two attempts) and a 800m run. Then the students were given the recommended quantity of chia seeds on a daily basis for six weeks. After this they were tested again.

The most likely result would be an improvement in the long distance run and in memorization. The improvement of the female participants should be higher than the one of the male ones.

In conclusion, our project aims to show how beneficial the “super food” is in reality, and if Chia seeds are a good alternative for vegetarians (who don’t eat fish) to replace the essential omega-3 fatty.





CONSTRUCTING A CONDUCTIVE FLUID

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S6

Abstract

Our team set out to develop a viscous fluid (resembling a glue, paint or gel) that can conduct electricity. Our methods were to modify already conductive substances into liquid form, testing different concentrations and combinations to find the most conductive solution with the lowest possible resistance. Our intentions are to create a product that can replace the use of wires for a temporary electric circuit as it is more versatile and compact alternative.

Synthesizing oils paints from used cooking oil

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S6

Abstract

Since our school has fries every Thursday, and gallons worth of used cooking oil are gone to waste, we have set out to synthesize an oil paint from used cooking oil. By using our schools excess frying oil and pigment ground from charcoal and chalk, we are researching ways to mix together oil paint recipes that are identical in texture and quality to store bought paints, but without the harmful add-ins. While doing so, we are also researching polymerization, specifically looking into oil's transformation into plastic. Our paint will utilize and recycle excess frying oil in a far eco-friendlier manner. Some of the factors we will observe include drying time, consistency, smoothness and opacity of color.





The relationship between groceries and caries bacteria

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S6 DE

Abstract

We have measured the pH value of various groceries in order to be able to analyse the effects of these groceries, and eventually to link it, on the activity of caries bacteria. The pH value is a significant factor of the development of cavities. So is the sugar content, which we included as well in our researches. Our long-term goal is to be able to make recommendations that are as healthy as possible; if looked at from a dental point of view at least. Moreover, we want to create some kind of a diet plan – better said: to let everybody know which groceries are good for their teeth and which are not – that will improve an individual's oral health. In conclusion, our goal is to brighten the people's knowledge about how to take care of their teeth and to improve their caries prophylaxis.

How to increase running efficiency

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S5

Abstract

Our idea was to do an experiment where is tested the human body. More precisely we want to test how it adapt is given an input to improve the use of energy. To do it we will test the efficiency of the human body when running. The variable that we will insert is a new type of running shoe called Vibram Fivefingers. This shoe improves running efficiency by increasing the cadence. As a very efficient runner must have a cadence between 180-185, these shoes bring your cadence at that level. The difference between normal running shoes and the Vibram Fivefingers is that the Vibram do not have cushioning between the foot and the sole. This forces the person to run naturally because we evolved to run with the forefoot not with the hind foot. To test if the human body evolved to run with the forefoot really, a simple experiment can be done. Just take off the shoes and the socks and run for few meters. You will see that, to absorb the impact, the foot will land on the forefoot the cadence will be a lot higher because the contact time is less. This shows that we evolved to run in this way and not with the hind foot. With the normal shoe, there is no more attention to what part of the foot touches the ground, so there are higher risk of injuries. Instead, with the Vibram there is less probability of injury.



The Vibram running shoes

Getting Use to It

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S6

Abstract

How does putting our self into dangerous situations affect our heart rate? How does it then change after doing the same "dangerous" or "stressing" thing more times? These are the main two questions we will reply to in our research.

To try and reply to these questions, we tried **different methods**. **The main one was by** measuring the heart rates of different people before, during and after school examinations.

Even though this way we had a lot of material to work on, it was not enough. The next step was, trying the same procedure, but instead of examinations the subjects had to ride a motorbike.

This procedure gave us more to work on and helped us a lot since the evidence found was more supportable. With this is meant, even if there are some rare contrary cases, that generally people are more scared or stressed when asked to try a motorbike than when doing a test, except when the examination may be of such an importance as to change their life.

Analyzing our results we have come to a conclusion: people "get used to" doing the stressful activities. This causes their heart rate to lower after long periods of time in which the stressful activity is repeated. Another important discovery we made was that when before the activity, the subjects do something else which is stressful or dangerous, this will give them a greater initial heart rate. With this data, we have made a hypothesis; that the heart rate may also be calculated with a formula.

$$\text{IHR} = \text{RS} + \text{H}$$

Where **R** is the rest heart rate of the person, **H** is an increase in the start rate value depending on what was done before the stressful activity and finally the variable **S** is the importance or "stressfulness" of the activity that the subject will do. With this we could find **IHR** which is the initial heart rate of the subject.



Start rate	End rate
79	50
86	72
107	94

The image represents a small part of the data collected to show how we have arrived to our main results.

Study into the potential use of triglycerides for the creation of biofuel/biodiesel.

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S5

Abstract:

In this experiment, two different strains of algae were grown in two different media. The growth of *euglena gracilis* in commercially-purchased media was the most successful, in both media with the *botryococcus braunii* failing to grow significantly during the course of the experiment. Various separation methods were investigated, with the addition of a dichloromethane / methanol mix being the most successful. Extraction and isolation of material soluble in dichloromethane was completed and the product tested as a potential fuel.



*Microscope image taken of *euglena gracilis* algae*

RHINITE, VA-T'EN VITE !

Benjamin Heckmann, Elisabeth Mohnike, Katarina Nikolic

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S5 EN – S5 DE

Abstract :

Partout sur la terre, il existe des remèdes naturels contre le rhume. Dans chaque culture, dans chaque pays, les habitants ont leurs petits secrets de guérison. Pour notre projet, nous avons choisi trois traitements différents qui sont utilisés dans trois régions de l'Europe :

- France : Un sirop à l'oignon, à l'ail et au miel
- Allemagne : Une inhalation et infusion à la camomille
- Serbie : Une inhalation de pain de mie grillé

L'objectif de notre projet est de savoir si ces traitements ont un effet sur la guérison et si oui, de trouver celui qui fonctionne le mieux. Pour cela, nous avons fait des études sur des personnes enrhumées. Elles ont pris un des traitements pendant quatre jours et nous avons documenté l'évolution de leurs symptômes. Un quatrième groupe de contrôle n'a pas pris de traitement. Grâce à une analyse comparée de ces quatre groupes, nous pouvons montrer qu'il est bien possible d'accélérer la guérison d'un rhume de façon naturelle, sans médicament.



Brennpunkt Optik: Untersuchungen zur Prismenbrille

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S5 DE

Abstract

Die Brille: Im dreizehnten Jahrhundert wurden die ersten Vorläufer der Sehhilfe erfunden. Im Jahr 2011 tragen allein 67% der Frauen und 59% der Männer in Deutschland eine Brille. Anders als zur damaligen Zeit, gibt es heute verschiedene Arten von Brillen, da es leider auch viele verschiedene Augenkrankheiten gibt.

Eine der neueren Sehhilfen ist die relativ unbekannte, aber gleichzeitig umstrittene Prismenbrille. Der Unterschied zur normalen Brille ist, dass – wie im Namen genannt – ein Prisma in das Brillenglas eingearbeitet wird. Diese neue Technologie wird bei ausgeprägten Sehschwierigkeiten oder starken Einschränkungen der Sehschärfe unterstützend eingesetzt. Die auch mir bis dahin unbekannte Sehhilfe habe ich erst durch die Erkrankung meines Vaters kennen gelernt. Ich war erstaunt von der plötzlichen und deutlichen Besserung seiner Sehleistung. Ich habe es mir zur Aufgabe gemacht, diese Brillentechnologie in meinem Projekt zu untersuchen. Teil meiner Arbeit wird es sein, in Form von Recherche und Experimenten, die Funktion und Wirkung zu veranschaulichen. Als Grundlage für die Experimente kann das schuleigene Augenmodell herangezogen werden.

Ein weiteres Ziel von mir ist es, den Menschen die Technologie näher zu bringen und zu beleuchten, warum sie (in Deutschland) sehr umstritten ist. Im Zuge meiner Recherche möchte ich mir in Zusammenarbeit mit einer Optikerin ein eigenes Bild verschaffen, die Vor- und Nachteile darlegen und zur Aufklärung beitragen. Die statistische Ausarbeitung meiner Experimente sollen meine Arbeit und die erlangten Ergebnisse eindeutig unterstreichen, im besten Fall belegen.

Ich erhoffe mir, mit meinem Projekt auch andere Menschen auf diese Möglichkeit der Sehunterstützung aufmerksam zu machen.

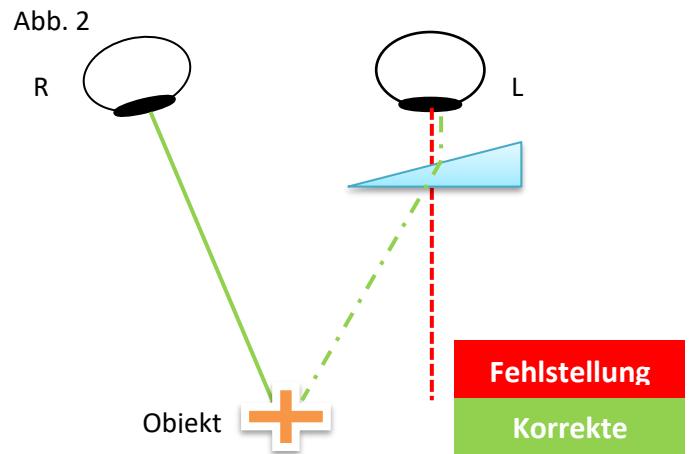


Abb. 1: Die Abbildung zeigt ein Prismenglas, welches in ein Brillengestell eingesetzt werden kann. Abb. 2: Die Abbildung zeigt die grundlegende Funktion eines Prismas, welches bei einer Winkelfehlsichtigkeit eingesetzt wird. Hierbei kann das rechte Auge (mit „R“ gekennzeichnet) korrekt auf das Objekt fokussieren, während das linke Auge (mit „L“ gekennzeichnet) ohne Prisma nicht richtig auf das Objekt fokussiert (rot gekennzeichnet). Das eingesetzte Prisma bricht das Licht und ermöglicht so ein problemloses Sehen.



Acknowledgements



DEAR PARTICIPANTS OF THE 14TH EUROPEAN SCHOOL SCIENCE SYMPOSIUM,

After 2010, this extraordinary scientific event found its way back to Luxembourg I. Almost 150 pupils, with their accompanying teachers from 16 schools, will valorise their scientific prowess here.

Its organization was the initiative of a dedicated group of teachers, who with support from the school management, have been working hard for the past two years to make this gathering of our young and promising scientific minds, a great success. The event is inspired by our students' thirst for science, as displayed in our classrooms, in our school laboratories, during exams, or in local and international competitions. We owe them this organization!

To arrive at the much expected success of March 26th to 29th, a team effort was put in place. Our science teachers rose exceptionally to the challenge: Manuela, Monika, Justo, Christophe, Stefan, Sven, Arnaud, Simon, Daniel M., Daniel A., Marcus – all in a group with Jon Mallon who started the preparations, and then under the skilled guidance of Emmanuel Couché, worked hard for months to care for every organizational detail of this event. We rediscovered in Emmanuel, a dedicated project leader, attentive and meticulous in every aspect of this organization. He and the whole team receive immense gratitude and appreciation from the whole school community.

Our team found particularly helpful throughout this time, the encouragement and support of the ES Science Inspector, Mr. Max Wolf. His insightful vision and ideas guided our team to arrive at an event that will surely mark positively our youngsters, and future organisations. We thank him wholeheartedly for his multifaceted dedication to ESSS 2017.

We thank the Parents' Association for their continued support for this project, as for every initiative we undertake together to enhance the educational experience of our youngsters.

Special thanks are due to our Executive Assistant, Gaby Olsem for the cared organization of many details, as are to the secondary secretariat - Nicole, Anna and Emilie. We thank Gerda, and the pupils who will facilitate the activities organized.



To further underline the team effort, I would like to thank our Music Department – Suvi, Louise and Stefano, for the preparation of a special repertoire dedicated to this event. Behind this all stands a great Team of Technicians – whose input is vital for the success of every event.

Events like this are made possible with support from sponsors, who backed without reserves the aims and the ethos of this science symposium. We thank them for their generous support, and can assure them that the objectives of promoting science among our youngsters will certainly be reached.

We thank wholeheartedly an outstanding panel of judges. We are humbled by their presence and support for this symposium. We are exceptionally honoured to have at the opening and closing ceremony of this event, presentations from Professor Jules Hoffman, Medicine Nobel Prize Winner 2011, and Dr. Steven Weinberg, returning to the school where he taught for many years. Their work will certainly leave a lasting inspiration for our pupils.

Thanks to everyone who participated, and enjoy the beauties of scientific achievement!

Arben Lufi

Head of Secondary School

Thanks for supporting our symposium



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