



Thailand International Science Fair

PROCEEDINGS

Mahidol Wittayanusorn School, Thailand

January 8-11, 2019

Sufficient Economy for Sustainable Future

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Message from the Chairperson of the Executive Board of Mahidol Wittayanusorn School

On behalf of the Thailand International Science Fair Organizing Committee, it is my pleasure to extend a warm welcome to all of you to Mahidol Wittayanusorn School, host of the 2019 Thailand International Science Fair, which will be held during January 8-11, 2019.



It is indeed an honor to have many very talented delegates from various countries with us. Aside from our international guests, we have many top young scholars from leading high schools from all over Thailand attending this special event. We are pleased to welcome all of you.

We are gathered here not only to share and exchange our students' scientific findings and results, but our young scientists also get to know each other and work together in the future. We are in the process of nurturing the innovators of tomorrow in the era of technological revolution. It is our challenge to prepare our students for a constantly changing world. They should be able to acknowledge and adjust to this dynamic global environment along with the potential to be valuable citizens who will make significant contributions to our societies and the future of mankind.

I wish the Thailand International Science Fair 2019 every success and would like to express my gratitude to our friends who have travelled great distance to be here. I encourage you to take the time to share knowledge with us. I believe this event will be a productive collaborative learning experience to our future aspiring scientists, researchers, and innovators.

Associate Professor Dr. Sakarindr Bhumiratana
Chairperson of the Executive Board
Mahidol Wittayanusorn School

Message from the Principal of Mahidol Wittayanusorn School

It gives me great pleasure to welcome distinguished guests, principals, teachers and students to the Thailand International Science Fair 2019 (TISF 2019).

TISF 2019 with the theme “Sufficient Economy for Sustainable Future” is an international event designed especially for high school science students that will be held from January 8-11, 2019, at Mahidol Wittayanusorn School. We are deeply honored that Her Royal Highness Princess Maha Chakri Sirindhorn will graciously preside over the opening ceremony.



TISF 2019 will bring together young talents from 26 schools in 16 countries and 38 science high schools throughout Thailand, to share and exchange their research findings in an exciting and supportive environment. Amongst the highlights of this occasion are numerous science project presentations, science activities, a science zone, and cultural excursions for students. Teachers and educators will benefit as well with opportunities for them to share their expertise and collaborate in an exchange of ideas.

With the rapid changes in technologies and society, the need for the younger generations to learn to globally collaborate has increased. We believe that it is our responsibility to ignite their curiosity and passion for science and technology as well as a sense of global civic responsibility through comprehensive learning that builds and reinforces lasting commitment to their societies.

We wish to extend you a warm welcome to Mahidol Wittayanusorn School for the TISF 2019 and we hope you will have an enjoyable and pleasant stay in Thailand.

Wiwat Ruenglertpanyakul, Dr. *rer. nat.*
Principal
Mahidol Wittayanusorn School

Keynote Speaker

Mr. Chatchawas Wuttisirisart

Topic

"The Sustainable Economy in a Researcher's Life"



Profile

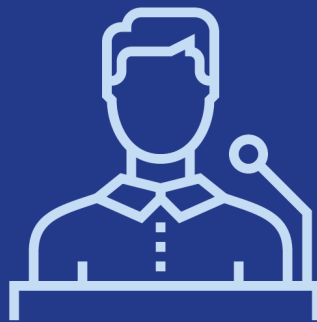
8 year experience in research and engineering on energy efficiency, energy saving and energy conversion. 2 year experience in energy business strategy and finance.

Experience

- Strategy and Business developer, Banpu Infinergy Company Limited, Bangkok, Thailand (June 2017 - present)
- Commissioning engineer, Banpu Public Company Limited, Bangkok, Thailand (May 2014 - May 2017)
- Energy researcher, Iron and Steel Institute of Thailand, Bangkok, Thailand (May 2011 - May 2014)
- Subcontracted analyst, Banpu Public Company Limited, Bangkok, Thailand (August 2012 - March 2013)
- Teaching assistant, Chulalongkorn University, Bangkok, Thailand (May 2010 - October 2011)

Education

- Master of Engineering (Mechanical Engineering), Chulalongkorn University
- Bachelor of Engineering (Mechanical Engineering), Chulalongkorn University
- HIGH-SCHOOL, Mahidol Wittayanusorn School, Nakhon Pathom, Thailand



Principal & Teachers' Sharing Session

Principal Panel Discussion & Teacher Sharing Session Schedule

Wednesday, January 9, 2019
at Virtual Reality Theater

Time	Program
Principal Panel Discussion	
13.00 - 14.15	“Nurturing Our Youth for Sustainable Future” • Dr. Miki Horie, Principal, Ritsumeikan High School, Japan • Dr. Yoon Chung, Principal, Korea Science Academy of KAIST, Korea • Dr. Christine Yu, Head of Science and Mathematics, G.T. (Ellen Yeung) College, Hong Kong • Dr. Wiwat Ruenglerpanyakul, Principal, Mahidol Wittayanusorn School, Thailand
14.15 - 14.30	Coffee Break
Teacher Sharing Session	
14.30 - 14.40	“Enhancing Teaching and Learning Using Cooperative Learning Strategies” Mrs. Lim Soh Ngo Chemistry Department, Duli Pengiran Muda Al-Muhtadee Billah, Brunei
14.45 - 14.55	“Teaching with TiME Project” Dr. Uri Shanas Department of Biology and Environment, Faculty of Natural Science, University of Haifa, Israel
15.00 - 15.10	“Pyramids and Prisms” Dr. Khamphouth Phommasone, Principal School for Gifted and Ethnic Students, National University of Laos, Dongdok Campus, Vientiane, Lao P.D.R.
15.15 - 15.25	“The Future of Students is Our Responsibility: Reality and Expectation” Ms. Saripah Binti Embong Sekolah Menengah Agama (Atas) Sultan Zainal Abidin, Malaysia
15.30 - 15.40	“Mathematics Modelling” Assoc. Prof. Dr. Vladimir Dubrovsky Department of Mathematics, Kolmogorov School of Moscow State University, Moscow, Russia
15.45 - 15.55	“Experiences from Student Research Collaboration between NJC and MWIT” • Ms. Lim Wei Li, HOD/ Research (Acting), National Junior College, Singapore • Dr. Sarote Boonseng, Department of Chemistry, Mahidol Wittayanusorn School, Thailand
16.00 - 16.10	“Implementation of the International Young Physicists' Tournament Role and the TED Talks Presentation in the “Integration of Knowledge” Class at Mahidol Wittayanusorn School” Mrs. Kwansakul Ouppaphan Department of Liberal Arts, Mahidol Wittayanusorn School, Thailand
16.15 - 16.25	“Vermicomposting from Organic Waste (Leaves) by Earthworm” Ms. Tin Tin Aung No(1) Basic Education High School Dagon, Myanmar

Enhancing Teaching and Learning Using Cooperative Learning Strategies

Lim Soh Ngo

Chemistry Department, Maktab Duli Pengiran Muda Al-Muhtadee Billah, Jalan Pasar
Gadong BE 1318

E-mail : sohngo.lim@gmail.com

Cooperative learning is a teaching strategy that can be used to motivate students to take active role and responsibility for their own learning. It is widely recognized as a pedagogical practice that promotes students' social skills, communication skills, problem solving skills and academic achievements from pre-school through to tertiary level and across different subject domains. Research often shows that for true learning to occur, students must take responsibility of their own learning and not depend solely on the teacher. The use of cooperative learning supports this outcome and provides the students with the opportunities to voice out their thoughts while listening to others' ideas. Despite the extensive research supporting the use of cooperative learnings, it is generally under-used in schools. The low implementation rates may be due to the teachers' limited understandings or exposure to cooperative learning strategie. To ensure successful implementation of cooperative learnings, teachers must focus on the five critical elements contributing to the desired outcomes (Johnson & Johnson, 2009).

Keywords: Cooperative learning

Teaching with TiME project

Prof. Uri Shanas

Department of Biology and Environment, Faculty of Natural Science, University of Haifa-Oranim

Email: shanas@research.haifa.ac.il

This is My Earth (TiME) is a new voluntary NGO that uses crowd funding and a democratic voting system to save privately own lands in biodiversity hotspots. Because membership fees are very affordable (as low as \$1 a year) and 100% of all fees and donations are directed to fund land purchase and protection, TiME becomes an educational as well as a practical tool children and adults use to become actively involved in biodiversity protection. We show how using the TiME platform in class children become aware and express affinity towards activism, while educators use it to explain basic conservation concepts and involve classes in discussions on decision-making and associated ethical dilemmas. TiME provides a hands-on tool to learn about biodiversity hotspots that urgently require international attention. Classes of all ages and levels can use TiME to discuss decision-making, prioritization and practical ways to protect wildlife.

Keywords: Biodiversity, Hotspot, Problem-Based learning (PBL)

Pyramids and Prisms

Khamphouth Phommasone

School for Gifted and Ethnic Students, National University of Laos, Dongdok Campus,
Vientiane, Lao PDR.

Email: khamphouthp@gmail.com

The largest of all man-made geometric solids was built in about 2600 B.C it is the Great Pyramid in Egypt, the only one of the “seven wonder of the world” still in existence. This Pyramid, one of about eighty such structures built by the ancient Egyptians, was put together from more than two million stone blocks, weighting between 2 and 150 tons each.

The Great Pyramid is one member of an unlimited set of geometric solids called *regular pyramid*.

A regular pyramid is a solid that has a regular polygon for its base and triangles that are identical in size and shape for the rest of its faces.

A pyramid is named according to the shape of its base. Because all of the faces of a regular tetrahedron are equilateral triangles identical in size and shape, the tetrahedron is also a triangular pyramid.

A right regular prism is a solid that has a pair of regular polygons for the bases and rectangles that are identical in size and shape for the rest of its faces.

The bases of a prism are always parallel to each other, and a prism, like a pyramid, is named according to the shape of its bases. Because all of the faces of a cube are squares identical in size and shape, the cube is also a square prism.

Prisms are frequently found in nature. An awesome display of them is the Devil’s Post pile is a group of tall columns of rock, some of which are 60 feet high. Many of these columns have the shape of right regular prisms, most of them hexagonal and others pentagonal. Many geologists find mathematical formulas in their study of the earth.

The Leonhard Euler’s formula in Pyramids and Prisms in 1752, the Swiss mathematician Leonard Euler stated a formula relating the numbers of faces, corners, and edges of certain geometric solids. So the formula is: $F+C=E+2$; F=represent the number of faces ; C= represent the Number of corners ; E= represent the Number of edges.

Conclusion of the Pyramids and Prisms: A regular pyramid is a solid that has a regular polygon for its base and triangles that are identical in size and shape for the rest of its faces. A right regular prism is a solid that has a pair of regular polygons for its bases and rectangles that are identical in size and shape for the rest of its face.

Pyramids and primes are named according to the shapes of their bases.

Keywords: Pyramids-prism

The Future of Students is Our Responsibility: Reality and Expectation

Saripah Embong

Sekolah Menengah Agama (Atas) Sultan Zainal Abidin, 20 400, Kuala Terengganu, Terengganu, Malaysia.

E-mail: saripah3577@gmail.com

Higher education institutions, industrial sectors even the parents and teachers are expecting their kids and students to be readily prepared at current school education system to gain further success at higher learning or industrial works. The school education system should be triggered if the teachers themselves are lacking of interest, effort and passion to move from their comfort zone in order to make sure new effective teaching methods can be implemented. This topic will be targeted to detail up on teaching approaches by Problem-Based Learning (PBL). PBL means “Any learning environment in which the problem drives the learning” (Woods,2005). Robert Delisle, (1997) stated that, students learn best by doing and by thinking through problems. The principle role of the teachers in PBL is that of a facilitator or educational coach. In other hand, in order to ensure the students can be more successful and able to compete globally, teacher should facilitate and coach the students to solve the real-world problem; where at this stage, a critical thinking skill, thinking out of box and certain soft skill will be very important. Therefore, the teaching and learning culture of PBL should be nurtured and practiced at all times. Undoubtedly, through these effective teaching approaches, students are becoming more innovative, creative, independent and excellent problem solvers.

Keywords: Problem-Based learning (PBL), Soft Skill

High School Competitions in Mathematical Modeling

Vladimir Dubrovsky

Department of Mathematics, Kolmogorov School of Moscow State University, Moscow,
121357, Russia

E-mail: vndubrovsky@gmail.com

Mathematical modeling is being increasingly recognized as one of the most important elements of modern mathematical education. One of the ways to promote it in schools all over the world is various competitions, a form of activity readily accepted by students. We will describe two competitions in this area, both quite young. The first one is the International Mathematical Modeling Challenge (IMMC) was established in 2015 by Consortium of Mathematics and Applications (Boston, USA). Currently, it embraces about 30 countries represented by 55 teams. The second one is the Mathematical Modeling Tournament, first conducted in the Kolmogorov School in October-November 2018 under support of Huawei company. The tournament is a novel form of competition, combining two individual and two team rounds with tasks of different nature: traditional math problems based on real-life situations, open-ended questions, experimental computer activities, etc.

Keywords: Mathematical modeling, Applied mathematics, ICT

Experiences from Student Research Collaboration between NJC and MWIT

Lim Wei Li¹ and Sarote Boonseng²

¹National Junior College, 37 Hillcrest Road, 288913, SINGAPORE

²Mahidol Wittayanusorn School, 364, Salaya, Phutthamonthon, Nakhon Pathom, 73170, Thailand

E-mail: ¹lim_wei_li@moe.edu.sg ²sarote@mwit.ac.th

National Junior College (NJC) has worked in collaboration with Mahidol Wittayanusorn School (MWIT) in student research projects since 2014. Working on such projects develop students' content knowledge, creativity, critical thinking and problem solving skills. In collaborative projects, our students share and communicate experiences, knowledge, skills with one another to become effective academic collaborators. We will share our experience and ideas on inspiring students in their scientific explorations. Learning points from the collaborative research projects between NJC and MWIT will be presented and how we deal with problems arise.

Keywords: Academic collaboration, Inspiring students

Implementation of the International Young Physicists' Tournament Role and the TED Talks Presentation in the “Integration of Knowledge” Class at Mahidol Wittayanusorn School

Kwansakul Ouppaphan

Department of Liberal Arts, Mahidol Wittayanusorn school, Thailand
E-mail: kwansakul@mwit.ac.th

At Mahidol Wittayanusorn school, the subject “Integration of Knowledge” is co-taught by a team of teachers from science, social science, and language department. This course requires students to analyze a case study and propose their original plan or project to solve the problem. Previously, the class format involves presentations and open-discussions. This year, for each topic, students are assigned one specific role similar to the stage of the International Young Physicists’ Tournament (IYPT), which are reporter, opponent, reviewer and observer. This IYPT format is implemented in order to increase students’ active participation in discussion and to widen the perspective on the case study from the opponent’s point of view. The reporter teams use the debate issue to polish their understanding of the case study, which then culminates in an individual 5-minute short talk and an essay. The best individual talk from each section is selected to be the presenters in the MWIT Talk, a 10-minute TED Talks on the final week assemble of all grade-12 students. This presentation will describe the process of using classroom action research cycle to facilitate the introduction of new learning activities as well as to foster a learning community where teachers grow alongside students.

Keywords: Integration of knowledge, International Young Physicists' Tournament, TED Talk, Gifted education, 21st century learning

Vermicomposting from organic waste (leaves) by earthworm

Tin Tin Aung

No(1) Basic Education High School, Dagon Township, Yangon Region, Myanmar

The organic wastes (leaves) are converted to compost by the action of earthworm, which was environmentally safe. The present study was made in the formation of vermicompost from the leaves of almond, water hyacinth and colocasia by using earthworm *Perionyx excavatus* which produce a natural fertilizer compatible with the environment.



Students' Projects



Biochemistry

Antioxidant activities of γ -oryzanol rich extracts from riceberry rice bran

Panatorn Chiaranai¹, Jaggaiah N. Gorantla², Peeranat Jatooratthawichot² & James R. Ketudat Cairns²

¹Ratchasima Wittayalai School, Nakhon Ratchasima, 30000, Thailand.

²School of Chemistry, Institute of Science & Center for Biomolecular Structure, Function and Application, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand.

Gamma-Oryzanol is a mixture of phytosteryl ferulate esters with antioxidant properties that can be found in rice bran. In this study, we aimed to research the anti-oxidative properties of riceberry type rice and to develop a method for extracting γ -oryzanol from rice bran. Crude riceberry rice hexane: ethyl acetate (7:3) extract was concentrated with a rotary evaporator and loaded onto a packed silica gel column equilibrated and eluted with 100% hexane. Through a combination of proton and carbon-13 nuclear magnetic resonance spectroscopy (NMR), we were able to identify the two nonpolar compound fractions. (P1) to be composed of triglycerols and (P3) to be composed impure γ -oryzanol. From the DPPH (2,2- diphenyl-1-picryl-hydrazyl) assay we were able to show that the P1 fraction displayed no free scavenging, which is not surprising for a pool of triglycerols. However, the P3 γ -oryzanol fraction had a free scavenging rate of 16%, which is comparable to ascorbate. The purification of the non-polar compounds through column chromatography resulted in impure compounds, as evidenced by the complex proton and ¹³C NMR spectra, which nonetheless were able to discern the presence of triacylglycerols and γ -oryzanol in the P1 and P3 fractions.

Keywords: Gamma-Oryzanol, Antioxidant, Riceberry rice

Comparison of dye durable raw cultivated banana peels

Benyapha Sudthanom, Nantanat Korsakul & Pattarin Natirutthakorn

Satthasamut School, Samut Songkhram ,75000, Thailand.

Color fastness properties of dyeing color with green banana peel (*Musa sapientum* L.) solution. This project aimed to study the effect of green banana peel solution on the color strength and color fastness properties of dyed fabric. The green banana peel solution in this study can be divided into three types, that was prepared from fresh green banana peel, squeezed green banana peel, and dried green banana peel (to produce solution, green banana peel and water for extraction with the ratio of 1:30). In the experimental, the dyed fabric were soaked in green banana peel solution. The color strength of dyed fabric between before and after soaking in green banana peel solution, were measured by Image J program. The results showed that the color of L* (CIE color system) of sample soaked in squeezed green banana peel was 16.416 (the highest value). For the color fastness properties of samples after soaking in green banana peel solution and washing with detergent, it was found that the difference of the color of L* (CIE color system) of sample soaked in squeezed green banana peel was 3.067 (the lowest value).

Keywords: Cultivated banana, Dyeing color, The lasting dye

Actylcholinesterase inhibitory activity analysis of potent chemicals in coffee ground

Kornkan Meejak¹, Parintorn Eiamsa-ard¹, Uthai Wichai² & Wandee Wathanachaiyingcharoen³

¹Naresuan University Secondary Demonstration School, Phitsanulok, 65000, Thailand.

²Department of Chemistry, Faculty of Science, Naresuan University, Phitsanulok, 65000, Thailand.

³Department of Biology, Faculty of Science, Naresuan University, Phitsanulok, 65000, Thailand.

One of many causes of Alzheimer's disease is Acetylcholinesterase (AChE) overdose making a memory ineffectiveness. Modern medical treatments are achieved by some medicine, but these drugs have disadvantages. This project aimed to extract the potent chemicals in the coffee ground such as caffeic acid. Follow method of *Wentao Bi et al.*, 2010 by heating solid-liquid extraction and ultrasonic extraction, used solvent ratios are water, ethanol 60%, ethanol 80% and ethanol 100%. Then, the extracts were tested with TLC essay and NMR essay. The ratio 100% ethanol using ultrasonic extraction has the best inhibitory effect which is 42.85%, and the best efficient chemical is a polar group whose %inhibition = 67.39%. The TLC results shows the main active compound is an oil substance which can be a group of fatty acid. This low cost process is a guideline for extracting an organic substance for curing Alzheimer's disease from wasted materials.

Keywords: Alzheimer's disease, Acetylcholinesterase inhibition, Caffeic acid

In vitro selection of salt tolerant *Citrus nobillis*

Huong XT Tran¹, Bach X Nguyen¹, Tu TT Luu² & Thu B Tran²

¹Honor class of Mathematics, High School for the Gifted, VNU-HCM, Ho Chi Minh City, 700000, Viet Nam.

²University of Science, VNU-HCM, Ho Chi Minh City, 700000, Viet Nam.

Correspondence should be addressed to TBT (tbthu@hcmus.edu.vn).

Saline soils affect plant growth at various stages leading to decreasing yield of crops. Thus, the loss of farmable land due to salinization directly reduce the food supply for the world population which is estimated to increase by roughly 8.5 billion over the next 25 years. Since the uncultivated land belongs mostly to salt affected area, there is need to increase salt tolerance in plants. Most plants tolerate salinity to a threshold level, being defined as the value of salt concentration below which plant growth is generally not affected. In this research, effects of salinity stress were evaluated in the roots of orange trees (*Citrus nobillis*) (an important fruit tree in Vietnam). Orange seeds were placed in MS medium supplemented with NaCl salt (2g / 4g / 6g / 8g / or 10g / l) to figure out the salinity threshold level of this orange. In another setting, we selected the in vitro salinity resistant shoots derived from callus to investigate the genetic background of salt tolerance in orange trees. We induced hypocotyl of orange seeds to form callus in MS medium supplemented with 0.1 mg / l BA, 0.25 mg / l IBA, 40 mg / l Adenine sulfate, 50 g / l sugar, 0.05 g / l Malt extract. Shoot derived callus were regenerated after 4 weeks on the same medium. Shoots were continuously cultured in MS medium containing 20 g / l sugar, 0.05 mg / l malt extract, 2 mg / l BA, 10 mg / l adenine sulfate for multiple shoots production. The post-emergent shoots were inoculated in MS supplemented with NaCl (2, 4, 6, 8, 10 g / l) to screen of salinity tolerance by selecting the live shoots under these salted conditions. Shoots surviving in the salt medium continue to be cultured in this medium, maintaining a stable salt tolerance. The proline content and random amplified polymorphic DNA (RAPD) analysis of salinity resistant and control shoots were studied. Taken together, these results will help us to choose stable salinity resistant orange.

Keywords: Salt tolerance, Salinity stress, Proline content, RAPD, *Citrus*

Development of air filter with gold nanoparticles

Pongphak Kanwinphruet, Yutthapichai Aiadthum, Thitirat Chantorn,
Supaporn Klabklaydee, Kanokpitch Sawang, Sutap Nusen & Sasitorn Bunkard

Princess Chulabhorn Science High School Nakhon Si Thammarat, Nakhon Si Thammarat,
80330, Thailand.

Correspondence should be addressed to P.K. (pet-pongphak2011@hotmail.com).,
Y.A. (A.yutthapichai265@gmail.com).

This project aims to study the air filter prepared with coating gold nanoparticles and hydrochar, significantly for exchange monoxide in to carbon dioxide by using gold nanoparticles as catalyst which synthetic from gold leaf and absorbing carbon dioxide by hydrochar. The result of the air filter that coating gold nanoparticles was found that gold nanoparticles size from gold leaf is around 90-100 nm. The porosity is higher than normal about $45.6 \pm 3.4 \%$ The volume of CO₂ and CO when passed air filter after coating with Au nanoparticles the volume of CO was decreasing and left about 16.47 mg. and the volume of CO₂ was increasing and left about 66.83 mg. By using t-test statistics analyzer the reusability doesn't effect to the oxidation reaction of CO₂ that The volume of CO₂ were similar in each time that about 74.81 mg. ,70.89 mg and 67.45 mg respectively The result of the air filter that coating gold nanoparticles and hydrochar was found The volume of CO₂ and CO was decreasing when flow through air filter that coating with AU nanoparticles and Hydrochar that CO₂ left about 31.23 mg. and CO left about 14.85 mg.

Keywords: Gold nanoparticles, Gold leaf, Hydrochar, Catalyst

Anti-tyrosinase and antioxidant activity of crude protein extract from bean seeds

Jirayut Daunsuk¹, Napat Nuramsum¹ & Sompong Klaynongsruang²

¹The Demonstration School of Khon Kaen University, Khon Kaen, 40002, Thailand.

²Department of Biochemistry, Faculty of Science, Khon Kaen University, Khon Kaen, 40002, Thailand.

Correspondence should be addressed to N.N.(napatnuramrum@gmail.com)

Tyrosinase inhibitors play a crucial role for hyperpigmentation treatment and use as an effective ingredient contained in skin lightening cosmetic products. Most of tyrosinase inhibitors, however, displayed highly cytotoxic causing mutagenic effect against human cells. Therefore, finding the new effective natural compounds is still needed. Whereas, antioxidant compounds were reported to indirectly decrease melanin production. Hence, this research aims to investigate anti-tyrosinase and antioxidant activity of crude protein extract from bean seeds including soybeans (KKU 35, NS 1, SJ 5 and Chiang Mai 60), long beans (Ner and Rai-Kang), cowpea (KVC7) and mungbean (Kamphaeng Sean 2). The results indicated that Chiang Mai 60 crude protein extract at a concentration of 0.375 mg/ml exhibited highest tyrosinase inhibitory activity by $26.72 \pm 3.34\%$ while KKU 35 crude protein extract at a concentration of 0.125 mg/ml showed the highest antioxidant activity against DPPH $\cdot$ and ABTS $\cdot^+$ by $21.59 \pm 2.12\%$ and $48.43 \pm 4.03\%$, respectively. Based on the highest tyrosinase inhibitory activity, Chiang Mai 60 crude protein extract was selected for further partial purifying using 10 kDa membrane cut off. The results demonstrated that the smaller proteins (<10 kDa) exhibited higher anti-tyrosinase than that of bigger proteins (>10 kDa). Overall, the results suggested that bean crude protein extract might be used for hyperpigmentation and other related-diseases treatments.

Keywords: Tyrosinase inhibitory activity, Bean seeds, Antioxidant activity

A study on factors affecting hair color from dyeing with the leaf of Henna (*Lawsonia inermis* L.) extract

Thanachot Dongruangsri, Ketsarapohn Donwichai, Chayapa Namro & Nanthiya Chaleanphon

Kalasinpittayasan School, Kalasin, 46000, Thailand.

Correspondence should be addressed to N.C. (Nanthiya@kkumail.com).

The purposes of this study were to investigate the optimum solvents of extracts from the Henna (*Lawsonia inermis* L.) leaves and to study the factors that affect on hair dyeing. The study on absorbance at 478 nm wavelength by spectrophotometer was selected for the first aim. The solvents used in the study were water, 40% sodium hydroxide solution, 95% ethanol and acetone. On the other hands, pH (3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5), dyeing temperature (35 °C, 40 °C, 45 °C and 50 °C) and dyeing duration (1, 2, 3 and 4 hours) were tested for the study on the last aim. The results show that water was the most suitable solvent, followed by 2.725 respectively. The 3.5 pH at 45 °C for 3 hours was the most appropriate conditions in the hair dyeing. Moreover, irritational test of extracts was used to study by apply on the upper arm for 6 hours with 30 samples. The result show that 30 subjects had no symptoms.

Keywords: Henna, Conditions in the hair dyeing, Optimum solvents of extracts from the Henna

The effect of sericin protein from waste cocoons on reducing pupa's duration and increasing amount of silk fibers

Siwaraya Sanbandit, Sahathai Mongyen & Kornwalai Tadpring

Uttaraditdaruni School, Uttaradit, 53000, Thailand.

Correspondence should be addressed to K.T. (kornwalai.tad@gmail.com).

Decreased time of silkworms entering the pupa stage and increased quantity of the silk fibers will support the silk products. The first objective of this study was sericin protein extraction from waste cocoons. The effect of sericin protein on time that silkworms enter the pupa stage and weight of the cocoons was a secondary objective. Sericin protein from waste cocoons was extracted by boiling the cocoons in 300 ml. of rice husk ash at 100 °C of temperature. The extracted protein was used for the secondary objective. Sixty silkworms were divided in two groups: the control group and the experimental group. Thirty worms in the control group were fed with mulberry leaves. In the other hand, thirty worms in the experimental group were fed with mulberry leaves coated with sericin protein. The worms in the two groups were weighed and observed everyday for 11 days. The result found that both the fourth and fifth stages of silkworms and their cocoons were fed with mulberry leaves coated with sericin protein (the experimental group) had significantly more weight than the worms in the control group. Moreover, the worms in the experimental group entered the pupa stage faster than the control group. Therefore, the sericin protein extracted from waste cocoons enhanced the silkworms growth and their silk fiber production.

Keywords: Sericin protein, Silkworm growth, Silk fiber production

An examination of glucose in urine with KMnO_4 for the indication of diabetes mellitus

Sangkhakorn Duangjaidee, Porramapon Kaewsujarit & Dallachawan Boonsorn

Sirindhorn School, Surin, 32000, Thailand.

Correspondence should be addressed to S.D. (sangkhakorn36@gmail.com).

“An examination of glucose in urine with KMnO_4 the for the indication of the diabetes mellitus” is the study which proposes to indicate glucose in urine with KMnO_4 via comparing the ability of KMnO_4 solution to change the color with different glucose solutions. This can be completed by using 0.25%w/v, 0.5%w/v, 0.75%w/v, 1%w/v, 1.25%w/v, 1.5%w/v, 2%w/v and 3%w/v concentrations of KMnO_4 solutions and 0.05%w/v, 0.1%w/v, 0.3%w/v, 0.5%w/v, and 1%w/v concentrations of glucose solutions. There were 2 steps to the experiment. Step 1 Preparation of each concentration of KMnO_4 solution. Step 2 The Experiment of reaction between urine and different concentration of KMnO_4 solutions. The experimental results show that the reaction between urine and different concentrations of KMnO_4 solutions provided different colors. The most efficient concentration of KMnO_4 solution was 0.25%w/v because it provided the most identifiable color. The less concentrated the KMnO_4 solution, the faster the reaction was. The experiment of the reaction between KMnO_4 solution and urine or glucose solution provides a similar result. The advantage of this study is the simple examination of glucose in urine using KMnO_4 for indicating diabetes.

Keywords: Glucose, Diabetes mellitus, KMnO_4

The optimization of firefighting protein foam from water hyacinth by nano-zinc oxide

Supakarn Kotwong , Sirikan Thongraar, Yanisa Petsang & Mekha Deesongkeam

Sakonrajwittayanukul School, Sakonnakhon, 47000, Thailand.

Correspondence should be addressed to M.D. (Krumakskr@gmail.com).

This research aimed to optimized Firefighting Protein Foam from the Water Hyacinth by Nano-Zinc Oxide and Compare Protein Foam formulas of Firefighting Protein Foam from the Water Hyacinth and Firefighting Protein Foam from the Water Hyacinth by Nano-Zinc Oxide with the following parameters 1) Stability of Foam 2) Density of foam and 3) Surface tension. Including firefighting efficiency of the oil type of foam protein, which is compared with the duration of fire extinguishers. Results of this experiment demonstrate that Firefighting Protein Foam derived from the Water Hyacinth optimized by Nano-Zinc Oxide, has better bonding properties with alkali catalysts. Physical characteristics are consistent, as well as cover the area of fire. In addition, Nano-Zinc Oxide makes the foam proteins maintain the foam well and long lasting. The results of the study of the physical properties of Firefighting Protein Foam derived from the Water Hyacinth which contains Proteins: Sodium bicarbonate: Acetic acid in ratio 100:5:5 and Firefighting Protein Foam derived from the Water Hyacinth optimized by Nano-zinc oxide which contains Proteins: Sodium bicarbonate: Acetic acid: Nano-Zinc Oxide in ratio 100:5:5:10. Compared the Firefighting Protein Foam derived from the Water Hyacinth optimized by Nano-zinc Oxide has a stability 23.17% which is higher than Firefighting Protein Foam derived from the Water Hyacinth. Firefighting Protein Foam derived from the Water Hyacinth optimized by Nano-zinc oxide has density 0.34 g/mL and the surface tension 0.00517 N/m lower than Firefighting Protein Foam from the Water Hyacinth. Based on the above physical properties, Firefighting Protein Foam derived from the Water Hyacinth optimized by Nano-zinc oxide is more suitable for extinguishing.

Keywords: Firefighting protein foam derived from the water hyacinth, Nano-Zinc Oxide, Water hyacinth

Delaying the ripening of guavas using polyethylene film and silica gel with potassium permanganate

Charlotte Foong Shi Qi¹, Kelly Foo Xin Hui¹, Kittipat Chansri², Sarita Kongmuang² & Sirikorn Chusri²

¹National Junior College, 37 Hillcrest Road, Singapore, 288913, Singapore.

²Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to F.S.C.Q.C. (cfsq2002@gmail.com).

During the ripening process, large amounts of ethylene are produced in the guava — a climacteric fruit transported all over the world — which alter the guava's taste, aroma, skin colour, and firmness of pulp. Consequently, many guavas have short shelf-lives after being purchased. Potassium permanganate reacts with ethylene to decrease the rate of ripening in the guava and is commonly used by producers to extend the guava's shelf-life. Other common methods that can be combined together include the use of polyethylene films and silica gel. The aim of this project is to determine the most effective combination of polyethylene film, silica gel, and potassium permanganate in extending the shelf-life of guavas. The hypothesis is that a combination of all three methods will be the most effective in decreasing the rate of ripening in guavas, extending the guavas' shelf-lives. The colour determination, weight loss determination, firmness determination, Vitamin C determination, titratable acidity and pH determination and conductivity of guava tests were conducted to track the ripening of the guava and analyse the effectiveness of each combination of the three methods.

Keywords: Guava, Delay ripening, Ethylene



Biology

The relationship between regeneration of planaria and density effect

Tatsu Hayakawa & Naoya Okada

Aichi Prefectural Handa Senior High School, Handa City, 475-0903, Japan
Correspondence should be addressed to (handassh@handa-h.aichi-c.ed.jp)

Planaria, which affects the development of iPS cells, has been applied to research on regenerative medicine. We wanted to contribute to regenerative medicine with farther research about planaria. Therefore, in order to examine the optimum breeding environment of planaria, we studied the relationship between planaria's regeneration and density effect. First, we bred the cut planarias in different density environments and observed how they regenerated. As a result, it was found that the regeneration is higher in the low density environment than in the high density environment. Next, to find the cause that regeneration speed varied, we experimented the difference in the concentration of oxygen in water, the difference in water quality and the correlation between area and volume. As a result, it seems that the area of breeding container is not very related to the regeneration speed of planaria, but the volume of breeding container is related. By breeding under the best condition to regenerate that we found, the planaria 's regeneration speed will be faster and research on regenerative medicine can be done more efficiently.

Keywords: Planaria, Density effect, Regeneration speed

Aromatic light trap for rove beetle prevention

Thanaphat Khemniwat¹, Sutthichet Phonglopisit¹, Pitchakorn Usaha¹ & Duangthip Kantha²

¹Kasetsart University Laboratory School, Center for Educational Research and Development, Kamphaeng Saen, Nakhon Pathom, 73140, Thailand.

²Department of Entomology Kasetsart University Kamphaeng Saen Campus, Nakhon Pathom, 73140, Thailand.

Correspondence should be addressed to T.K. (g.khemniwat@gmail.com).

This study to investigate the light trap which the one of the modifying sources of artificial light for attract the rove beetle, *Paederus fuscipes* (Coleoptera: Staphylinidae) that make a skin condition is call Dermatitis linearis. The different types of lamps which in four light traps were modified (LED lamp, compact lamp, fluorescent lamp and fluorescent lamp with aroma of fermented fruit) and tested to attract the rove beetle. This experiment was conducted from 4 to 30 September, 2018, 18.00-22.00 pm ($27.5 \pm 2^\circ\text{C}$, $65\% \pm 2$ RH). at the dormitory of Kasetsart University Laboratory School, Center for Educational Research and Development, Kamphaeng Saen, Nakhon Pathom, Thailand. The different lamp of light traps treatment (LED lamp, compact lamp, fluorescent lamp showed that the population density of rove beetle were significantly different when compared with aromatic light traps treatment (fluorescent lamp with aroma of fermented fruit), mean $\pm$ SE = 1 ± 0.0 , 1.22 ± 0.14 , 3.66 ± 0.57 and 7.0 ± 0.28 , respectively ($p < 0.05$), $F = 71.21$ and Sig. of $F = 0.00$). The aroma of fermented fruit can urge the rove beetle attract to the light trap therefore this invention have to develop on the next stage.

Keywords: Rove beetle, Light trap, *Paederus fuscipes*

Are there sex based behavioural differences in common tortoises (*Testudo graeca*)?

Naomi Faiger¹, Hadas Matalon¹, Shani Ron¹ & Uri Shanas²

¹Department of Biology, Leo Baeck Education Center, Haifa, 31062, Israel

²Department of Biology and Environment, University of Haifa-Oranim, Israel.

Correspondence should be addressed to U.S. (shanas@research.haifa.ac.il).

Under climate change, sex ratio in the common tortoise (*Testudo graeca*) may bias towards females, as females are produced under high incubation temperatures. However, there are no tools to distinguish morphologically between males and females until the age of 6 years. This scientific obstacle hinders the climate change effect research of this species. To overcome this obstacle we decided to search for behavioral sex differences. During mating male tortoises (*Testudo graeca*) mount the females from behind, and thus may become vulnerable and easily flipped on their back. In addition, male tortoises roam more than females, thus are more likely to flip over when they climb rocks and other obstacles. Thus we hypothesized that if males will flip back to their feet faster than females we can use this behavior to distinguish between the sexes even when they are young. We used 15 females and 9 males tortoises in this research (Ages 3-5years). We layed each tortoise on its back for 5 minutes and recorded and filmed its behavior. We also collected morphological data of all individuals that included body mass and curvature of armor. Results show that there are no significant differences between males and females flip back frequency. However, there is a difference between males and females in rear legs movements when correlated to curvature of the armor. Males increase their rear legs movements, contrary to females. Adult male and female tortoises use their rear legs for different purposes in addition to walking. While male tortoises use their rear legs to turn over when flipped, females use their rear legs also to dig nests. We will discuss the origin of this behavioral difference.

Keywords: *Testudo graeca*, Behavior, Dimorphism

The preliminary examination on oil accumulation in seedling-induced callus of *Jatropha curcas* L.

Thammarat Jirasukprasert, Pittawat Somvanapanich, Kritapas Smiththithiti & Pimphen Tainsittipong

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to T.J. (aithammarat06@gmail.com).

Jatropha curcas L. is a species of flowering plant that produces oil-rich seeds. The main goal of cultivating *Jatropha* worldwide is to obtain the seed oil which can be used as an alternative high-quality biodiesel to run engines. However, the *Jatropha* seeds do not ripe synchronously and their plantations consume enormous lands - which might be costly and promote the deforestation. We aim to use the tissue culture technique, which is an effective method to produce plant material in vitro, to induce the *Jatropha* callus and to explore its oil reserve. The seedlings of *Jatropha* were first induced on MS medium without plant growth regulator (PGR) for 14 days. For callus induction, the seedlings were cut into two equal parts (the upper hypocotyl with cotyledons and the lower hypocotyl with root), and cultured on MS medium added with 0.5 mg L⁻¹ 2,4-D. As investigated at 28 days after cultured, the upper and lower parts respectively developed into friable and compact calli. After stained with Sudan III and viewed with light microscope, more oil droplets could be observed in the compact than the friable callus. Unfortunately, the oil droplets found in both types of callus were lower than those found in their original explants.

Keywords: *Jatropha*, Seedling, Callus

De – Fluoridation: A study on fluoride toxicity of drinking water

Arnav Sethi, Sachin Yuvaraj Dinesh Babu & Rithwick Sethi

Vasant Valley School, India

Correspondence should be addressed to A.S. (arnavsethi2412@gmail.com).

In a pilot study, a group of 100 school children in Israna, Panipat District, Haryana were screened for evidence of dental fluorosis. Simultaneously, samples of water were taken from the residence from. Initial analysis at All India Institute of Medical Sciences by ion selective electrophoresis showed that most of the samples showed high fluoride levels much above the WHO standard of 1.5 mg/l. (Values had a range from 0.915 mg/l to 7.33mg/l) Subsequent visits to the same school showed that 30 to 40 per cent of children were suffering from dental mottling and evidence of dental fluorosis. Since this is an ongoing project, urinary estimation of samples of these children can be undertaken to further corroborate the findings. Interventions akin to Nalgonda technique, bio char technique, bone char technique have been planned at individual, family and community level have been planned along with health education, community talks and necessary funding to introduce low cost filters in every household.

Keywords: Dental Fluorosis, Nalgonda Technique, Selective Electrophoresis

The production of carboxymethyl cellulose films from giant mimosa barks for cropping

Gasanapoth Thossarost, Sirawit Paaium & Taksaporn Namwong

Phayaophittayakhom School, Phayao, 56000,Thailand.

Giant Mimosa is invasive weed that can destroy agricultural lands because it can easily grow and spread rapidly. In addition, it is resistance to floods and arid conditions. On the contrary, the giant mimosa barks have high quantities of cellulose which it can be used to produce a carboxymethyl methyl cellulose or CMC as a viscosity additive. With the CMC's binder ability, thus, it can be used as a stability substance for plants' growth. This study extracted cellulose from the giant mimosa barks to produce CMC films for coating RD6 rice for a cropping purpose. It was found that a yield of extracted cellulose powders is suitable for synthesizing the CMC films. In addition, the percentage of yield depends on the amounts of cellulose in the giant mimosa barks. The study of some properties of the CMC films shows that the CMC films mixing with concentrated glycerol 1.5 ml are in good conditions for cropping in terms of thickness, a rate of permeability of water vapor and an absorption ability of water. Furthermore, soaking the RD6 rice coating with the CMC - glycerol films in an extract from root tip water hyacinth solution has a greater effect on the RD6 rice growth than other experiments. In addition, it can help to increase the percentage of germination and root lengths. In conclusion, the CMC films from the giant mimosa barks mixing with the glycerol help the rice seeds have greater abilities to absorb water and nutrients. With soaking the coated-rice seeds in the extract from root tip water hyacinth solution, it can be said that the germination and the growth of their seeds are increased.

Keywords : Giant mimosa, Carboxymethyl cellulose, RD6 rice

Testing efficacy: *matK* primers for DNA amplification of *Eucalyptus* and *Corymbia*

Zachary Bushby, Saahir Mamun, Megan Robinson, Yoshiyuki Takeya & Gabriel Waterson

John Monash Science School, 39 Innovation Walk, Monash University, 3800, Australia.
Correspondence should be addressed to Adriana Abels (adriana.abels@jmss.vic.edu.au)

Eucalyptus are the world's most widely planted hardwood trees. Their adaptability to drought and low soil-quality, diversity, growth and high atmosphere carbon removal rates have made them a global renewable resource. This plant group was originally used as tools, food, and medicine by the indigenous Australians and they are important in our current ecological and economic climate – for example *Eucalyptus globulus* is an Australian plantation timber. The understanding of plant DNA is lacking due to such a variation in their genetics so morphology is used as a form of classification, where the plant is classified according to observation. It is clear that there is a need for a quantitative method to form classifications rather than using traditional morphological data. The five species of trees sequenced were *Eucalyptus diversifolia*, *Eucalyptus polyanthermos*, *Eucalyptus globulus*, *Corymbia ficifolia*, and *Corymbia maculata*. DNA was extracted using the 2006 QIAGEN DNeasy Plant Mini Kit. From the extracted DNA we ran a PCR with various primers sequenced, then the cleaned up DNA was sent to Monash University for DNA Sequencing. Finally, the analysis of results. The findings of the study supported the hypothesis of the *matK* mix being the most successful. This new level of technology could be used to move botany away from morphology to quantitative, DNA based classifications due its ability to barcode a great number of plants.

Keywords: Eucalyptus, Primers, Morphology

CRISPR/Cas9-mediated genome editing of *LvCHC* in juvenile *Litopenaeus vannamei*

Thanakit Suebsaicharoen¹, Phatrapol Tinmanee¹, Warudom Boonsongsup¹,
Orawan Piyaboon¹, Alisa Tupsuwan² & Pongsopee Attasart²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Institute of Molecular Biosciences, Mahidol University, Nakhon Pathom, 73170, Thailand.
Correspondence should be addressed to P.T. (phatrapoltin@gmail.com).

CRISPR/Cas9 genome editing technology is the breakthrough in genetic engineering that has now been applied in various species. However, there is no successful use of this technology for genome editing reported in juvenile Pacific white shrimp (*Litopenaeus vannamei*). To study the potential of CRISPR/Cas9 technology for genome editing in *L. vannamei*, *LvCHC* (clathrin heavy chain) gene-targeted sgRNAs and pCMV-Cas9 plasmid were injected into juvenile *L. vannamei*. Experimentally, *L. vannamei* were separated into three groups. In the first injection, two control groups were separately injected with NSS (150 mM NaCl) (A) or pCMV-Cas9 plasmid (B) whilst experimental group (C) was injected with pCMV-Cas9 plasmid. Three days later, the shrimp were treated with the second injection: NSS into control groups (A and B), and a mix of sgRNAs into the experimental group (C). The relative level of *LvCHC* mRNA expression, measured by RT-PCR at 48 hours after the second injection, compared to the *LvActin* of the experimental group was lower than that of the control groups (A and B) but not statistically different ($p > 0.05$). Additionally, T7 endonuclease I assay illustrated digested DNA fragments corresponding to the expected pattern, indicating that there was an indel mutation in the *LvCHC* genomic DNA. In conclusion, the CRISPR/Cas9 technology might be plausible in genome editing in juvenile *L. vannamei*.

Keywords: Clathrin heavy chain, CRISPR/Cas9, Genome editing, *Litopenaeus vannamei*

The study of mosquito repellent activity of *Calotropis gigantea* flower extracts against *Aedes aegypti*

Tawinan Jan-in, Navarat Sompaw, Benyapa Rapukhiaw, Anuthin Payungwong & Meenarad Wongsanae

Princess Chulabhorn Science High School Mukdahan, Mukdahan, 49000, Thailand.
Correspondence should be addressed to N.S. (navaratwork@gmail.com).

The Staff have studied ways to repel mosquitoes by using *Calotropis gigantea* flower extracts, which is a common natural plant. And have well qualified against *Aedes aegypti* in the appropriate concentration. Results of our study indicate that the flower extracts of *C. gigantea* have higher repellent efficacy against *Aedes aegypti*. Study on flower extract *C. gigantea* chasing mosquito finds flower extract with different concentrations effective in repelling mosquitoes pattern differs significantly. 0.05 level of statistical by the intensity of the *C. gigantea* flower extract 10% have the ability to chase away the mosquito best.

Keywords: *Calotropis gigantea* flower, *Aedes aegypti*, Against, *Calotropis gigantea* flower extracts.

The impact of antioxidants on the self-renewal of human mesenchymal stem cells

Ekaterina Lyublinskaya¹, Kirill Brilliantov¹ & Yulia Ivanova²

¹ St.-Petersburg Lyceum Physical Technical High School affiliated with the Russian Academy of Science, 194021, St.-Petersburg, Russia.

² Institute of Cytology of the Russian Academy of Science, 194064, St.-Petersburg, Russia.

Correspondence should be addressed to E.L. (katena.lyublinskaya@mail.ru)

A large number of pathological processes in human body, such as cardiovascular and neurodegenerative diseases, cancer and aging, are currently associated with the increase of reactive oxygen species (ROS). Therefore, a wide variety of antioxidants with different action mechanisms have been introduced for prevention and therapy of these pathologies. According to published data, antioxidants provide an exclusively positive effect on cells with modulated pathological state, which is accompanied by the ROS level increase. However, in the majority of clinical trials, the application of high-dose antioxidants does not improve the patient's state, but even worsens it. Hence, the aim of our work was to investigate the impact of high-dose antioxidants (Tempol, resveratrol, N-acetyl-L-cystein, Diphenyleneiodonium and α -lipoic acid) on the proliferation process of normal cells maintaining the physiological level of ROS. Human endometrial mesenchymal stem cells (eMSC) were the direct object of our study. To estimate the proliferation activity, we analyzed the dynamics of the cell cycle in synchronized eMSCs, exposed to antioxidants, with the usage of flow cytometry. Our experiments showed that high-dose antioxidants acted as stressors and caused the prolonged cell blocking in the presynthetic phase of cell cycle. Based on the obtained data, we assume that the failure of clinical trials may be caused, among other things, by the side effect of antioxidants on the self-renewal of healthy proliferating cells of the human body.

Keywords: Mesenchymal stem cells, Reactive oxygen species, Antioxidants

The effects of anticancer drugs on the motility of Cholangiocarcinoma cell lines

Supanat Tangjairakkarndee¹, Meentada Wattanarak¹, Pattara Pattaravoratham¹, Sataporn Wantanawijarn¹, Parinyachat Somchai², Supawan Jamnongsong² & Somponnat Sampattavanich²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Department of Pharmacology, Faculty of Medicine Siriraj Hospital, Bangkok, 10700, Thailand.

Correspondence should be addressed to S.T.(pondsupanat@gmail.com)

S.S. (somponnat.sam@mahidol.edu)

Cholangiocarcinoma (CCA) or bile duct cancer is considered a rare cancer type worldwide, with the highest incidence rate in the Northeastern part of Thailand. CCA is considered incurable, showing very aggressive presentation with very short life expectancy after diagnosis. To gain more insight on the contribution of cellular migration during cancer treatment, we examined the impacts of anti-cancer treatment on the motility of different CCA subtypes. We used three CCA cell lines: KKU-055, KKU-D131 and KKU-213. All three CCA cell lines are engineered to express the nuclear fluorescent reporter protein mCherry. We were able to quantify changes of cell motility by monitoring cells after drug treatment for 12 hours. Parameters such as 2D diffusivity, cell velocity, and directionality were used to develop Custom MATLAB code and used to perform cell tracking along with comparing cell motility. Cells were treated with drugs that inhibit F-actin, ARP 2/3, PI3K, VEGFR, JNK and p38. Our results show that only specific drug targets F-actin, VEGFR and p38 significantly affect cell motility (p-value < 0.05) whereas inhibitors of ARP 2/3 showed minimal influence towards cell motility. This study illustrates the potential influence of anticancer drugs on cancer aggressiveness although a more comprehensive study is still needed to distinguish effects on different CCA subtypes.

Keywords: Cholangiocarcinoma, Cell motility

Easy Check, Easy Go, Blood Glucose!

Chun Fung Leung, Tsun Hei Wang & Tye Chu

G.T. (Ellen Yeung) College- Secondary Section, Hong Kong

Diabetes is a metabolic disease characterized by a high blood glucose level caused by lack of insulin or low insulin sensitivity in the body. It affects millions around the world, and it is becoming more and more common. It can be life-threatening as diabetic patients break down lipid for energy instead of glucose which produce ketone bodies in blood and they turn blood acidic, this phenomenon namely diabetes ketoacidosis (DKA). The symptoms of DKA, such as vomiting and nausea, might be confused with that of other diseases. This puts many patients at risk of not knowing if they have a potentially life-threatening disease. Blood glucose level can be determined by a direct blood test. It is also positively correlated to breath acetone concentration. Common test for diabetes is finger-prickling blood tests. However, it is invasive, causes physical discomfort, and has a risk of contamination. The purpose of this study is to investigate the use of 2,4- Dinitrophenylhydrazine (DNPH), more commonly known as Brady's reagent, which reacts with ketone bodies, acetone this case, and forms a pale yellow precipitate, to test for breath acetone concentration. During the experiment, different concentrations of liquid and gas acetone are added to a constant volume of DNPH solution. The solutions are then observed to see if pale yellow precipitates are formed. The findings of this study supports the theory of acetone sensitivity towards Brady's reagent as an indicator of breath acetone detection of diabetic patients. Further development of this breathalyser device and detection system can be investigated as to provide an alternative test for diabetes which is not invasive, inexpensive and requires no physical punctures.

Keywords: Blood Glucose, Diabetes, 2,4- Dinitrophenylhydrazine (DNPH)

Spiders get drunk on coffee

Kiyoshi Ishida, Satoru Kazamatsuri & Rintaro Kishimoto

Senior High School at Komaba, University of Tsukuba, Ikejiri, Setagaya-ku, Tokyo, 154-001, Japan.

Correspondence should be addressed to K.I. (konnchuu@gmail.com).

According to some existing researches, scientists have perceived spiders after ingesting caffeine via drinking water exhibit abnormal patterns in their behaviors. Moreover, their webs showed conspicuously distinct geometric features in comparison to unaffected webs, as these webs could be characterized by less density and degraded quality in its entirety. We questioned the scientific factors that lead to these deviated patterns in their webs, and this brought us to our research. Our research consists essentially of two steps: First, to closely observe and record the web-rigging sequence, and second, to examine the potential impacts caffeine brought about on the animal as well as its product. We conducted an experiment in which we hydrated *Arginope bruennichi*, species known to build spiral round webs, with either water or aqueous solution of caffeine and observed its web-building process. Spiders which performed their web construction around midnight were provided with either substance at 0:00am, while spiders that conducted their process during the afternoon hours were provided with either substance at 2:00pm. Pipettes were used to deliver water/solution by droplets. We will analyze the products by collating them with some of our previous hypotheses.

Keywords: Spider web, Caffeine

Effect of glucose concentration in culture medium on Human Dermal Fibroblasts (HDF) migration

Aunchisa Krabounsaeng¹, Prodpran Pin-in-ta ¹ & Siriwadee Chomdej²

¹Chiangmai University Demonstration School in affiliation of Chiangmai University, Chiangmai, 50200, Thailand.

² Department of Biology, Faculty of Science, Chiang Mai University, Chiangmai, 50200, Thailand.

Correspondence should be addressed to A.K. (aunchisa_44@hotmail.com)

The main symptom of diabetes is high blood glucose and it is generally known that diabetic wound healing process will take longer time than normal. This research aimed to determine whether blood glucose concentration correlated with wound healing time. The wound healing process is complex and includes multi steps. One step that is very important is cell migration, which cells move to the right position before next step begins. The speed of cell migration determines time the wound healing will take. Thus, in this study, we chose cell migration as a measure of the speed of wound healing. The purpose of this study was to study the effect of glucose concentrations in cell medium culture on cell migration of human dermal fibroblast. The technique used to measure cell migration was an in vitro scratch assay. First, cell monolayer cultured in a 6-well plate was scratched in the middle. Then, the culture medium was changed to the medium with varied glucose concentrations, from 1.00 to 6.01 mg/mL, and further cultured in a 37°C incubator with 5% CO₂ and 95% relative humidity. Data were then collected as pictures of the cleavages at 3 different time points – immediately after the media change, 24 hr and 48 hr after scratch. Finally, the width of 400 sites, per treatment, along the cleavages was measured using ImageJ software and calculated for the average migrated distance. The result showed that the migrated distance decreased as media glucose concentration increased and the glucose concentration of 6.01 mg/mL nearly inhibited the migration of cells. In conclusion, cell migration of human dermal fibroblast cells had an invert relationship with the concentration of glucose in culture medium, suggesting a reason for slow wound healing in diabetic patients.

Keywords: Wound healing process, Cell migration, Diabetes

The effect of ethanol pre-treatment on survival, growth, and ion accumulation in Thai and Japanese rice seedlings under salt stress

Karin Shima, Yuki Tamada & Tomoya Morita

Ritsumeikan High School, Kyoto, 617-8577, Japan

Correspondence should be addressed to T.M (zalt1415@gmail.com).

We are doing collaborative research with MWIT students. In both countries a staple food is rice, and it is grown mostly in our own countries. One of the common problems both countries face during cultivation is the impact of salt damage. The Great East Japan Earthquake occurred in 2011. It caused tsunamis, which carried salt water into rice fields resulting in significant damage to crops. To solve this reoccurring problem, we started to research this topic. First, to find the difference between Japanese rice and Thai rice using alcohol pretreatment under salt conditions, we performed the same experiment using each rice line. The seedlings were treated with 0.3% EtOH in distilled water for one day. After that, they were put on culture mediums with or without 50mM of NaCl for two weeks. The survival rate was checked, and the length of shoots and roots were measured. In the results, the survival rate did not improve after EtOH pretreatment. The shoots in NaCl solution became shorter. While the length of the shoots was shorter in the NaCl solution, EtOH pretreatment led to roots of longer lengths. In addition, the roots of samples which underwent EtOH pretreatment for 3days had some bacteria. So, it was suggested that EtOH pre-treatment increased the plants tolerance of abiotic stress but decreased biotic stress tolerance. Other researchers have reported that there is an inverse relationship between tolerance of biotic and abiotic stress. At this fair, we will report about our findings from analyzing collected data of Na⁺ and K⁺ accumulation in each sample under NaCl conditions with or without EtOH pretreatment using an atomic absorption spectrophotometer (AAS) at MWIT.

Keywords: Rice, Salt stress, EtOH pretreatment

Diversity of stalked barnacles and acorn barnacles (Crustacea: Cirripedia) in Eastern Thailand

Pisit Sanjan¹, Salinee Khachonpisitsak² & Woranop Sukparangsi²

¹Piboonbumpen Demonstration School, Burapha University, Chon Buri, 20131 Thailand

²Department of Biology, Faculty of Science, Burapha University, Chon Buri, 20131 Thailand
Correspondence should be addressed to W.S. (woranop@go.buu.ac.th)

Stalked barnacle and acorn barnacle (Cirripedia) is a sessile crustacean, distributing around the intertidal areas of tropical and temperate regions worldwide. In Thailand, at least 10 species of acorn barnacles have been reported in Family Chthamalidae, Tetraclitidae, and Balanidae. However, diversity of stalked barnacles in Eastern Thailand (the Gulf of Thailand) is still under investigated. Also, diverse shell plate patterns and detailed arthropodal characters of Chthamalids make it difficult for taxonomic identification by using simple light microscopy. Therefore, in this study we aimed to use scanning electron microscope (SEM) to identify new records or even new species of both goose barnacles and Chthamalids along coastline of Eastern Thailand including Chon Buri, Rayong, Chanthaburi, and Trat. Based on both shell plate morphology and ultrastructure of arthropodal characters including cirri and mouth parts, we identified two new records of stalked barnacles and three new records of Chthamalids. Thus, this study highlights the diversity of barnacles and provides more records of barnacles in Thailand.

Keywords: Cirripedia, Goose barnacle, Acorn barnacle, Eastern Thailand

The study of antibacterial efficiency on egg white and eggshell membrane and the application of egg white and eggshell membrane as a material for medical uses

Rujeerada Wirojjananuwat, Praon Thareeboonchai & Sataporn Wantanawijarn

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to R.W. (rujeerada.44@hotmail.com).

Large amounts of egg white and eggshell membranes are left from food industries. Egg white has an ability to inhibit growth of microorganism and provide important growth factors. Eggshell membranes can be a wound healing material and filtrate out bacteria. The purpose of research was to study the antibacterial efficiency of egg white and eggshell membranes and apply them as material for medical use. To investigate the antibacterial efficiency, air dried egg white and sterilized eggshell membranes were plated on oral microbes and *S. aureus* for 48 hours. The egg white showed the positive effect on inhibition of some oral microbe and *S. aureus*, but the membrane presented no effect on both. To study the efficiency of medical material in terms of absorption and inhibition, the egg whites were mixed with gelatin solution to form gelatin sheets. The results illustrated, with 15 %w/w gelatin solution that minimum concentration of gelatin making sheets stayed solid at 38.5 °C. After testing material, raw egg white gelatin sheets and dried egg white gelatin sheets showed positive effect on oral microbes and *S. aureus*. The absorption ability was detected from both sheets. To create more stable sheets, glucose was added to cross-link with gelatin by UV light into raw and dried egg white sheets. The results show that four types of gelatin sheets had antibacterial efficiency and had no statistically significant difference at $\alpha = 0.05$.

Keywords: Egg white, Eggshell membrane, Antibacterial efficiency, Medical material

An analysis of the penetration and functions of photoreceptors in roots

Shiori Morita

Ritsumeikan High School, Kyoto, Japan, 617-8577

Correspondence should be addressed to M.S (shiorino1221@gmail.com).

This study includes two purposes: (1) measuring the penetration of Japanese radish (*Raphanus sativus* var. longipinnatus) roots, and (2) identifying the function of phototropins in the root of *Arabidopsis thaliana*. For the former, an experiment was conducted to reveal the growth of Japanese radish roots in different levels of firmness of agar mediums. All sample roots penetrated through 0.6% and 1.6% agar mediums, and most of them penetrated the 2.6% agar medium as well. The motivation for the second purpose of this research is that the functions of photoreceptors such as phototropin and phytochrome in the stem or shoot apex are well-known but the role of these photoreceptors in the roots has had little research conducted. Phototropin1 (PHOT1) controls the elongation of roots of *Arabidopsis thaliana*, and PHOT1 expression was higher in darkness than in light (Moni A, 2015). The second experiment inspired by this study was carried out to see how the number and length of lateral roots vary while the roots are exposed to different colour lights such as blue, red and white. The one conducted in total darkness was the control group. In addition, the result of the experiment using *Arabidopsis thaliana* will be reported at this fair.

Keywords: Penetration, Phototropism, Phototropin 1, Auxin

The studying of raw *Carissa Carandas* Linn. which can inhibit bacteria *Micrococcus* spp.

Virin Sovaratanapong, Benjanooch Pamorn & Kullataya Netmugda

Chitralada school , Bangkok ,10303, Thailand

Carissa Carandas L. is a species of flowering shrubin in the dogbane family Apocynaceae. It produces red berry-sized fruits which full of antioxidant, vitamin C, Tannin, Bioflavonoids, Antocyanin. The ripe *Carissa Carandas* L. has black purple colour and raw *Carissa Carandas* L. has light pink colour. It is Monocotyledon. It has a lot of advantage a lot of nutrient and it's popular in Thailand but it has a few research. Tannin is polyphenol that have big molecule and complex structure. Molecular formula of tannin is $C_{75}H_{52}O_{46}$. Tannin is weak acid that includes nine of galic acid molecule and a glucose molecule. Tannin is sold in the form of tannin acid. Most of tannin can not crystallize but can silt with potassium dichromate, chromic acid, ferric chloride and is good at coagulate with protein of animal skins. Moreover tannin has the ability to inhibit gram-positive bacteria. The feet's smell is mainly caused by sweat and bacteria is the factor that could make either a bad smell or no smell. The sweat that could cause a bad smell comes from apocrine sweat gland which makes a stickiness of sweat containing a lot of fat. This can be found in various parts of the body. For example, an armpit or a groin. On the other hand, the sweat that does not cause any smell comes from eccrine sweat gland which makes it clear as a liquid sweat. Likewise it can commonly be found in human body and feet. The main cause of a smell comes from degradation of bacteria in sweat for energy. Degradation becomes methanethiol gas that has a smell. For example of bacteria from skin, Brevibacterium Micrococcaceae Corynebacterium and *Micrococcus* species. All of them are gram-positive bacteria. When extracting *carissa carandas* by using solvent extraction method in a different ratio which is 1: 0, 1: 1, 1: 2 (*carissa carandas*:acetone 80%) we'll take the extract to check the existence of tannins with solution $FeCl_3$. The result showed that when dropping $FeCl_3$, the extraction colours were dark green, indicating the presence of tannin. After inspection of efficacy for inhibiting the growth of *micrococcus* sp in *carissas carandas* by using Pour-Plate method. The results of the experiment showed that around the disk that have dropped the extraction in ratio 1:0 with has a clear zone with a diameter of 2 centimeters. It can be concluded that the extract of *carissa carandas* can inhibit the growth of *Micrococcus* sp.

Keywords: Tannin, $FeCl_3$

Bees

Anatsaya Phongsavath, Chanthaly Sanaphaiphon & Thatsaphone Khemkham

Vientiane Secondary School, Lao P.D.R.

This abstract is about bees. It is a research for students and teachers who are interested. Also, we based our research on the work made by our seniors from year 2015-2016. They presented their research and got a third rank in a competition in China. We are interested in bees because bees are social insect and all bees have their work to do just like human and we continued their research adding more information.

Bees are insects closely related to wasps and ants. Bees are scientifically named Anthophila. Bees live in organized groups called “colonies”. The home of a bee colony is called “a hive”. Bees are social insects and each bee has its own role such as:

1. The Queen: Its jobs are to mate and lay eggs.
2. Drones: Their job is to mate with the queen.
3. Workers: Workers carry out the main tasks of the colony. They also forage and return to the nest with nectar and pollen to feed the young larvae.

Bees colonies consist of a single queen, hundreds of male drones and 20,000 to 80,000 female worker bees. Each bee colony also consists of eggs, larvae and pupae. In the picture below, you can see the three type of bee in colony.

- What are the benefits of bees?
 1. Pollination
 2. The environment
 3. Honey
 4. Wax
 5. Candle
 6. Royal jelly

We hope you will find it interesting and useful. Lastly, we would like to apologize for any mistakes and we would appreciate your advice and feedback.

Keywords: Bee

The effect of cross-breeding between silver barb with redtail tinfoil barb and silver barb with fancy carp on mating rate and hatching rate

Theerapad Chamnanrad¹, Nuengruethai Srisai¹, Wanalee Chomthong¹, Bussarin Jitseng¹ & Wichan Chamnanrad²

¹Princess Chulabhorn Science High School Satun, Satun, 91140, Thailand.

²Fisheries and Aquaculture Department, Satun College of Agriculture and Technology, Satun, 91130, Thailand.

Correspondence should be addressed to B.J. (bus_biology@hotmail.com).

The objective of the study was to examine the effect of cross-breeding between silver barb with redtail tinfoil barb and silver barb with fancy carp on the mating rate and hatching rate. The experiment was started by accelerating fish hormone by using artificial insemination method between silver barb with redtail tinfoil barb and silver barb with fancy carp. Next, the breeding was in the fish tank and was randomly drawn to find mating rate and hatching rate. They were observed error and development of cell division by using microscope and recorded results by percentage. The study finding were as follows: every two hour mating rates of silver barb with redtail tinfoil barb were 87.85, 14.42, 13.40 respectively and silver barb with fancy carp were 86.28, 15.08, 6.45 respectively. The averages of hatching rate after mating of silver barb with redtail tinfoil barb and silver barb with fancy carp were 21.08 and 9.64 respectively. The finding showed that the fish of the same genus were more mating and more hatching than those of the different genus within the same family. Also, the most frequent error of cell division was the gastrulation phase.

Keywords: Artificial insemination, Silver barb, Redtail tinfoil barb, Fancy carp

The properties of recombinant enzyme DNase from the Hepatopancreas of *Litopenaeus vannamei* expressed in *Escherichia coli*

Ariya Phawadee¹, Thunyanun Limsoonthaku¹, Nitikarm Kim-ing¹, Tiwa Rotchanapreeda² & Jamorn Somana²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Department of Biochemistry, Faculty of Science, Mahidol University, Bangkok, 10400, Thailand.

Correspondence should be addressed to T.L. (thanyanun.nin.28@gmail.com).

In several molecular biology studies, the enzyme DNase I is commonly used to eliminate the DNA molecules to retain only the RNA in the reactions. However, the commercial enzyme DNase I is very expensive since it must be ordered from foreign companies. In this study, we aim to develop and produce the recombinant enzyme DNase I for use in laboratories. The source of DNase I gene is the hepatopancreas from whiteleg shrimp (*Litopenaeus vannamei*). From the total RNA sample of whiteleg shrimp hepatopancreas, we converted the first-stranded cDNA of DNase I gene. Then, the cDNA was amplified with PCR reaction. Afterwards, the PCR product of DNase I gene was inserted into the plasmid vector pET-28a(+) using the *in vivo* homologous recombination cloning. The recombinant plasmid was transformed into the *E. coli* cell to express the recombinant protein DNase I. The SDS-PAGE result showed that there was no band of recombinant DNase I. Consequently, we constructed the new version of recombinant plasmid by insertion of signal peptide sequence to the N-terminus of DNase I that would target the expressed protein to the periplasm of the cell. From the SDS-PAGE result, we still could not observe the band of recombinant DNase I. We assumed that the expressed DNase I immediately degraded the host chromosome or the condition was inappropriate.

Keywords: *Litopenaeus vannamei*, *In vivo* homologous recombination cloning

The antifungi activity test of the combination of durian skin and gambir extract toward the growth of *Candida albicans* on *Candidiasis vaginalis*

Astrie Asihai, Dewanti Agustira & Ribka Anastasya Regidianti

Center for Young Scientists, SMAN 2 Palangka Raya, Kalimantan Tengah, Indonesia

Natural pharmacotherapy that can be used as an antifungal is durian and gambier skin waste which is used by the Dayak Ngaju community as a medicine for vaginal discharge. The purpose of this study are: (1) To study the antifungal activity of a combination of durian bark extract and gambir extract on the growth of *Candida albicans* in Vaginal Candidiasis; (2) To analyze the antifungal classification of combination durian bark extracts and gambir extract inhibitory responses based on the Clinical and Laboratory Standard Institute (CLSI); (3) To learn how to apply a combination of durian bark extract and gambir extract to the growth of *Candida albicans* in Vaginal Candidiasis; (4) To know the antifungal bioactive compounds combination of durian bark extract and gambir extract on the growth of *Candida albicans* in Vaginal Candidiasis. This type of research is a pure experimental using diffusion method and Post Test Only Control Group Design. And this research also includes the type of exploration research by analyzing the content of bioactive compounds using phytochemical methods. Data analysis was carried out descriptively. The results of this study are: (1) Activity of combination of durian bark and gambir extract in vitro on the growth of *Candida albicans* in candidiasis vaginalis forming a clear zone in replication 3 at 23.5 mm; (2) Classification of antifungi combination of durian bark extract and extract of gambir inhibitory response based on CLSI included in the Susceptible interpretation, (3) Application of combination of durian bark extract and gambir extract on the growth of *Candida albicans* in Vaginal Candidiasis by oral (capsule and yogurt) and topical (pasta); (4) Bioactive compounds combination of durian skin extract and gambir extract are: terpenoids, flavonoids, alkaloids, phenolics, and tannins. It was concluded that the combination of durian bark extract and gambir extract had activity on the growth of *Candida albicans* in Vaginal Candidiasis Combination.

Keywords: Combination, *Candida albicans*, Vaginal Candidiasis



Chemistry

Chewing gum made from various Thai Herbs shown to decrease smoking rate

Chunyanut Arsaikrang & Kritsamon Tiatongjitman

Princess Chulabhorn Science High School Chonburi, Chonburi, 20170, Thailand.
Correspondence should be addressed to C.A.(nooncha@gmail.com).

Thai herb has a lot of health benefit. It has been reported to decrease a smoking rate. The purpose of this project is for examine a Thai Herbs chewing gum which offer a decrease in a rate of smoking. The Thai Herbs chewing gum were tested with satisfaction from smokers. In this study, several Thai herbs were considered for their health benefit focused on reduction of smoking rate. After that, those kinds of herbs were mixed with gum base for producing Thai herb chewing gum. Each type of Thai herb chewing gum were tested with a variable demographic of smoker. The 25 smoker who has been smoked for 3, 4, 5, 6 and 7 years, respectively will be a target. After used the Thai herb chewing gum for 2 weeks, the data were recorded. A questionnaire about smoking requirement were gave to each target. The obtained data were used to determine whether there were any changes in the rate of smoking. The result show that Little Ironweed has a highest rate for decreasing a smoking requirement. Moreover, *Clausena Heptaphylla*, Clove Tree, Gooseberry and lime can decrease a smoking requirement respectively. Besides, the satisfaction of smokers with Thai herb chewing gum were in a level of excellent.

Keywords: Chewing gum made from various Thai Herb(s)

Photocatalytic degradation of poly (methyl methacrylate) (PMMA) under UV irradiation

Koppong Ruangwattanakul¹, Jukkaprom Promsirinimit¹, Suttinee Kirdthep² & Sirihathai Srikwanjai¹

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Department of Chemistry, Silpakorn University, Nakhon Pathom, 73000, Thailand.

Correspondence should be addressed to K.R. (r.koppong@hotmail.com).

Photocatalytic degradation of the poly(methyl methacrylate) (PMMA) – TiO₂ composite film was investigated. The PMMA was loaded with TiO₂ at 1 wt%, which was carried out under ambient conditions under ultraviolet light irradiation at 369 nm in water. The properties of composite film were compared with the pure PMMA film by using the changes in weight loss, FT-IR spectroscopy, and the pH and turbidity of the solution. It was found that the weight loss of PMMA-TiO₂ (1 wt%) is 3.19 % under UV irradiation in 6 weeks, and the decreasing intensity of the FT-IR peak of the carbonyl group was found in PMMA-TiO₂ (1 wt%). The results indicate that TiO₂ was able to facilitate the degradation of PMMA under UV irradiation.

Keywords: UV radiation, PMMA degradation, Photocatalyst

Simulation of reversible reactions in gaseous phase: A Microscopic approach of chemical kinetics and equilibrium

Shin Young Park, Hye Ri Ryou & Min Jun Kim

Hana Academy Seoul, Seoul, 03305, South Korea

Correspondence should be addressed to S.Y.P. (8ppk12@gmail.com)

The theory of chemical kinetics and equilibrium in part depends on many underlying theories of chemistry, such as reaction mechanisms and the kinetic theory of gases. Often, the relationship between such theories are illustrated using insufficient descriptions and qualitative applications, leading to the poor understanding of all learners of various proficiency. This simulation rectifies such conceptual difficulties by providing an accurate and intuitive demonstration of the aforementioned relationship. Three reactions in the gaseous phase were modeled by employing a microscopic approach. To elaborate, the simulated physical and chemical interactions between the molecules are based on theories pertaining to the small scale, such as intermolecular forces, reaction mechanisms, and thermochemistry. The macroscopic properties of these simulated molecules, such as reaction rate and equilibrium, show good agreement with established laws, demonstrating the accuracy of the simulation in illustrating the frequently neglected relationship. The simulation also provides its users a multitude of ways to access and interact, from computers, tablets, phones, and VR headsets. With this simulation, we hope to aid its users in the attainment of a comprehensive understanding and connections of the various theories related to reversible reactions.

Keywords: Simulation, Chemical kinetics, Equilibrium

Development of paper-based sensor with portable device for real time fieldwork detection of arsenic in water resources by electrochemical technique

Boonsita Trongtokit¹, Foyfon Sensong¹, Nawan Pornananrat¹, Amara Apilux² & Kiattipoom Rodpun¹

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

² Department of Chemistry, Faculty of Medical Technology, Mahidol University, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to B.T. (lomaboonsita@hotmail.com).

In some water resources, the concentration of contaminated arsenic (As) exceeds the maximum permission level at 10 µg/L of the World Health Organization (WHO). As the standard methods that are normally employed for the determination of metal quantities require specialists to operate the instruments, a more convenient method was developed in this study. This work presents a paper-based sensor based on an electrochemical method by using anodic stripping voltammetry (ASV) technique. This method is easy to use and provides high sensitivity. The current peaks and applied potential were observed to measure the amount of As(V) in the samples. It was found that the square wave voltammetry (SWV) with deposition potential at -0.9 V is the most suitable condition for As(V) detection. The Working Electrode (WE) and the Counter Electrode (CE) were screen coated by the graphene ink whereas the Reference Electrode (RE) was screen coated by Ag / AgCl. In addition, gold ion (Au⁺) was modified on the surface of the electrode to enhance the efficiency of the paper-based sensor. The difference of current between the background and the arsenic solution was used to create the calibration curve of this experiment, which can then be used for calculating the unknown concentration of arsenic in water resources. Furthermore, the paper-based sensor can be connected to a portable device and laptop computer for real time fieldwork detection.

Keywords: Paper-based sensor, Arsenic, Anodic stripping voltammetry

Effects of titanium dioxide nano particle (TiO₂) for the quality of particleboard from tamarind seed coat

Pongsathorn Cherdchoo, Jinnawat Charoensin, Ponlapat Noumprom,
Khasemchat Intasing & Pimprakai Boonsa-ard

Petpittayakom School, Phetchabun, 67000, Thailand.

This science project is about the effects of titanium dioxide nano particle (TiO₂) for the quality of particleboard from tamarind seed coat. The research attempts to firstly reduce garbage and waste products after processing the sweet tamarind, which is a well known economic crop of Phetchabun province, secondly to minimize unwanted tamarind trees from growing on wasteland, and thirdly to provide an alternative material to replace hardwood and plywood. The method involves heating tamarind seeds and soaking in water, then peel the tamarind's pericarp and dry and crush it to get a powder to be mixed with plastic resin powder, in ratios of 2: 3. The result is then molded with dimensions of 15x15x1 cm³, with the temperature at 75 to 80 °C for 4 minutes and 65 Newtons of pressure. This research is to study the effect of Titanium Dioxide Nanoparticle towards the quality of particle board made from tamarind pericarp in respect to density, moistness, heat resistance, inflation, absorption of water, absorption of smoke and tensile strength. The results indicate that the effect of adding titanium dioxide nanoparticles at 2 grams can absorb water at a percentage of 0.004 ± 0.0001 , which is less than plywood, the ability to absorb smoke had a light density higher than smoke and other conditions, but less than no smoke condition. Heat resistance had the best outcome of 97.2 ± 0.3 and had a density of $1.00 \pm 0.02 \text{ gram/cm}^3$, moistness at a percentage of 19.1 ± 1.1 , inflation at a percentage of 17.3 ± 1.3 and coefficient of tensile strength was $449 \pm 41 \text{ kgF/cm}^2$. The results show that the effect of titanium dioxide nanoparticle can increase the quality of a particle board made from tamarind pericarp, especially in regards to absorbing smoke, heat resistance and absorption of water, which is good for future development as a pollution hood, for example a restroom wall, kitchen, smoking area or developing it to be roof insulation, a wall lining or in the hallway. Further study should be done to develop the strength of this product to increase its efficiency.

Keywords: Titanium dioxide nano particle, Tamarind seed coat

New C⁴-alkyloxyamino derivatives of thymidine with antibacterial activity

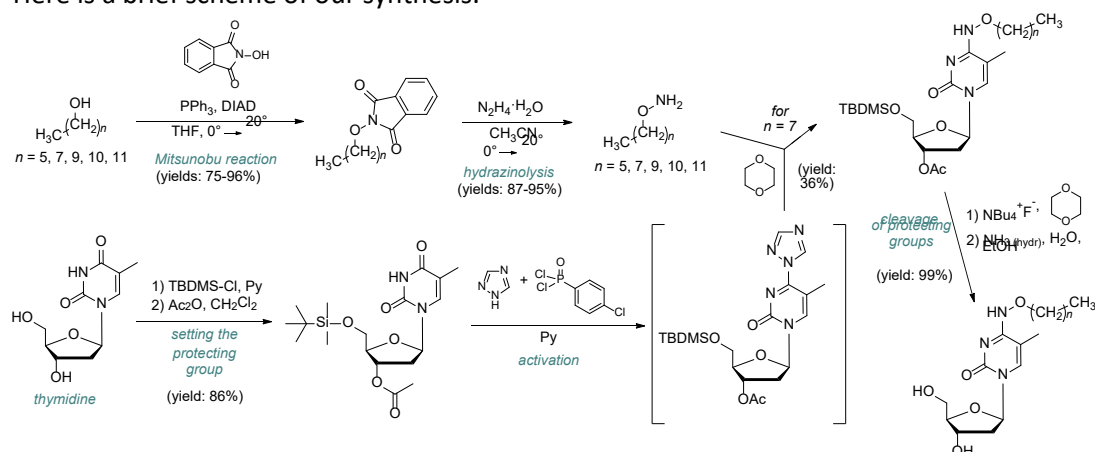
Aleksey K. Grebennikov¹ & Dr. Pavel N. Sol'yev²

¹ Moscow South-Eastern school named after V. I. Chuikov, Russia

² Engelhardt Institute of Molecular Biology, Russian Academy of Sciences, Russia

In the 21st century most of pathogenic bacteria developed resistance to nearly every clinically used drugs, so there is an urgent need in absolutely new compounds, which can act with new targets and which are active against resistant strains. Antibacterial activity of nucleosides has not been discovered until recent years, when some nucleoside derivatives, which are used in antiviral and cancer therapy, demonstrated their antibacterial activity. For example, 5-substituted derivatives of 2'-deoxynucleosides with long alkyl- and alkoxyethyl (1,2,3-triazol-1-yl) methyl substituents on pyrimidine bases have been studied in our laboratory. They possess activity against two strains of *Mycobacterium tuberculosis* and gram-positive bacteria. In continuation of that research C⁴-alkylaminosubstituted thymidines are being investigated now. The objective of our research was synthesis of new C⁴-alkyloxyamino- derivatives and testing them for antibacterial activity towards a number of microorganisms.

We used classical organic synthesis methods (with some new findings) to obtain our compounds. Here is a brief scheme of our synthesis.



Cytotoxicity of our compounds was studied in cell lines as K562, *Jurcat* and *Vero*; products appeared to be low toxic. Antibacterial activity of our compounds was verified *in vitro* on gram-positive and gram-negative bacteria and fungi by our colleagues from Gauze Institute of New Antibiotics. According to the provided data compounds with alkyl length of n=9, 10 inhibited the growth of gram-positive bacteria with high efficiency (in concentrations lower than 20 µg/ml): *Bacillus subtilis* ATCC 6633, two pathogenic strains of *Staphylococcus aureus* MRSA: FDA 209P and INA 00761. They were also moderately active (in concentrations lower 50 µg/ml) against *Mycobacterium smegmatis* (VKPM Ac1339 and mc²-155) which are used to pre-verify activity to *Mycobacterium tuberculosis*. The compounds were ineffective against gram-negative bacteria and fungi.

We plan to increase solubility of final compounds by making their biodegradable 3' and/or 5'-carbonate prodrugs triethylene glycol.

Keywords: C⁴-alkyloxyamino, Antibacterial activity

The study efficiency to assist in the co-ordination of silk proteins with polyvinyl alcohol

Kanwaraporn Chuejanaud & Julaluck Sanghirun

Princess Chulabhorn Science High School Buriram, Buriram, 31150, Thailand.
Correspondence should be addressed to J.S.(noon.julaluck@gmail.com).

Silk threads can be used in various ways. Also used as a component in medical, cosmetic products. Silk consists of two proteins, sericin and fibroin. The fibroin is a long double strand at the core and is coated with sericin, fibroin is a direct polypeptide that contains amino acids. The features can be used in a variety of formats in the industry etc. In this project study It is designed to compare the efficiency of biodegradation with two types of natural enzymes, Bromelain and Papain, this enzymes are in the pineapple and papaya. The experiment was divided into two steps: Silk digestion with enzyme Papain and Bromelain by pre-treat silk and divided into 3 sets hairline, meat and silk were tested by microparticle and nanoparticle digestion. secondly, study of efficiency in the co-ordination of silk with Polyvinyl Alcohol, the experiment was conducted in micro-particles and in the nanoparticles. The data were analyzed by particle size measurement by Dynamic Light Scattering, DLS and Scanning Electron Microscope, SEM. This project can be adapted to a wide range of industrial applications. Whether it is medical, cosmetic or textile, it adds value to the product. And to promote and increase the quality of Thai products.

Keywords: Silk, Papain enzyme, Bromelain enzyme, Polyvinyl alcohol

A novel optical sensor for determining nitrate ions in water using polyvinylpyrrolidone and acid blue 22

Cholapat Varongchayakul, Chalida Haruehansapong, Ind Tungsatitchai & Usa Jeenjenkit

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to C.V. (cvarong@gmail.com)

Nitrate ions come from the nitrogen cycle and are very crucial to the environment. Though important, nitrate ions can build up to high amounts, causing nitrate toxicity in organisms. Methods commercially available for determining the amount of nitrate ions in water today involve dangerous chemicals and have a short range of detection. In this research, a simple colorimetric method for determining nitrate ions in water was studied. A water soluble dye, Acid Blue 22, was investigated in a water-soluble polymer medium, polyvinylpyrrolidone (PVP). The dye functions as a sensor to indicate the amount of nitrate ions. All chemicals used in this sensor are safer than the chemicals used in other proposed methods for nitrate detection. This proposed method showed high precision and accuracy in detecting nitrate ions, and linearity was achieved from 0 to 500 mg L⁻¹ nitrate ($R^2 = 0.9929$). The color change from blue to colorless of this proposed sensor was significant and was visible to observe with the naked eye. This test can be used in water with a pH range of 6.50 to 7.50.

Keywords: Nitrate, Optical sensor, Polyvinylpyrrolidone, Acid Blue 22

Enjoy thinking to defeat height

Chatcha Rongmali, Nannapat Pengpirom & Achiraya Priaowan

Saard Phaderm Wittaya School, Chumphon, 86000, Thailand

Correspondence should be addressed to Putcharee@saard.ac.th

Enjoy Thinking to Defeat Height is intended to study of factors that have an effect on the motion of carbon dioxide gas pressure rocket. The experiment was divided into two parts. The first part is to study of the pressure exerted on the bottle of vitamin C, PVC pipes and Salacca wood, which make bottle caps out of a bottle by using force sensor tie to a rope which ties with the bottle cap of vitamin C. The second part is to study of factors that have an effect on the motion of carbon dioxide gas pressure rocket divided into 6 steps are 1. The size of the bottle of vitamin C, that has an effect on the motion of rockets by using the bottle of vitamin C with different sizes, put eggs shell 3 g and fill the acetic acid, concentrate 1 M volume 10 cm³, close the bottle cap tightly, reckon time that uses in the reaction, record video while the rocket was moving. Then calculate the distance the rocket moves with Tracker program 2. The concentration of acetic acid that has an effect on the motion of the rocket by using a bottle of vitamin C ASCEE (bottle that use the most pulling force), put eggs shell 3 g and fill the acetic acid in different concentrated are 1 M, 2 M, 4 M and 6 M volume 10 cm³ 3. The proportion between the egg shells and acetic acid that has an effect on the motion of rockets divided into 2 steps are. First step, when using constant amount of eggs shell (3 g) and filling the acetic acid, concentrated 6 M by using different volume are 5 cm³, 10 cm³ and 15 cm³. Second step, when using constant amount of acetic acid (6 M volume 10 cm³) and different amount of eggs shell are 3 g, 5 g and 7 g. 4. The shape of the rocket that has an effect on the motion of the rocket by using card paper with same size fold with different shapes (conical, toothpaste and tornado shapes) by control the height, base area and weight of the rocket to equal 5. Types of acids that have an effect on the motion of the rocket by using acetic acid and hydrochloric acid from bathroom cleaning liquid react with eggs shell 3 g by control the concentrated of acid to equal (1 M volume 10 cm³). The third part is to study of motion of carbon dioxide gas pressure rocket by using different height of PVC pipes that have hydrochloric acid, concentrated 4 M volume 12 cm³ and eggs shell 12 g. Based on this study, it was found the results that the movement of the rocket-pressure carbon dioxide is more or less depending on the size of the container substrate (gas pressure), concentration of reactant, The proportion between the substance using in a reaction the shape of the bottle rockets (vitamin C and pipe PVC) type of substances use to react to the beginning.

Keywords : Enjoy , Height , Carbon dioxide

Study of the removal efficiency on methylene blue under visible light by using Cu₂O precipitation with ZnO catalyst in photocatalysis method

Patchariya Chawalitjinda¹, Preravit Laothanasin¹, Sirihathai Srikwanjai¹ & Cheewita Suwanchawalit²

¹ Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

² Department of Chemistry, Silpakorn University, Bangkok, 10200, Thailand.

Correspondence should be addressed to P.C. (patchariya114@gmail.com).

A Cu₂O - ZnO catalyst was synthesized by the co-precipitation method for removal of methylene blue under visible light. The pH of the solution and the concentration of glucose were investigated in order to synthesize the coupled complex catalyst. The catalysts were characterized by Fourier-transformed infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), and X-ray powder diffraction (XRD). The efficiency of methylene blue removal was measured by a UV-visible spectrophotometer. From the characterization, a transmission peak was found at around 605 cm⁻¹, which can be attributed to the Cu (I) -O vibrations and octahedral Cu₂O shape. The results show that the highest methylene removal efficiency is 98%, and the most efficient catalyst was prepared at pH condition 14 and concentrations of glucose at 0.18 M.

Keywords: Co-precipitation, Methylene Blue, Methylene Blue removal, Copper (I) Oxide

Computational study of copper(II) complexes as a model of active sites in catechol oxidase reactions

Yeo Shi En¹, Teo Kelly¹, Tassaphon Tirasutt², Paris Nilthalak² & Poompat Laohavirojana²

¹ National Junior College, 37 Hillcrest Road, Singapore 288913, Singapore.

² Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to Y.S.E (shien106njc@gmail.com).

Copper (II) complexes are an essential part of the human biological system as they are required for the metabolic processes that take place in our body. Additionally, these complexes are involved in activities such as electron transfer, oxygen binding, and substrate activation. The objective of this research is to find out how the mechanism proposed for the oxidation of catechol by catechol oxidase can be used, to rationalize the activity of the synthetic copper (II) complexes. This research will be a combination of both the kinetics of the reaction between the copper (II) complexes and the substrate as well as the computational study of the copper (II) complexes. A comparison between the activity of the synthetic copper (II) complexes to that of the actual complexes will be made while the crystal structure of the copper (II) complexes will be synthesised, with the crystal structure being analysed afterwards, by UV-vis spectroscopy.

Keywords: Copper (II) complexes, Kinetics, Computational study



Engineering & Technology

Development of an image recognition algorithm for classifying Anthozoans into subclasses Ceriantharia, Hexacorallia, and Octocorallia

Juris Hannah G. Adorna, Brian Gabriel B. Juat, & Kyle Joshua A. Ozo

Philippine Science High School, Quezon City, Metro Manila, Philippines 1101
Correspondence should be addressed to J.H.G.A. (jh.adorna@gmail.com)

An image recognition algorithm was developed in order to classify Anthozoans into their three respective subclasses: Ceriantharia, Hexacorallia, and Octocorallia. This is in order to automate coral reef monitoring, which, when done manually, has been proven to be risky, time-consuming, costly, and inefficient. This process is done in order to protect the coral reefs and secure the benefits they offer to both us and the ecosystem. Corals play a vital role in sustaining coral reef productivity and marine ecology, automating its monitoring will further improve data collection and protection of the said coral reefs. In order to create the algorithm, 1000 unique photos of each subclass were collected from data sets acquired from external sources such as marine institutes and the Internet. These photos were then set to a standard resolution, and afterwards was taken as input by a convolutional neural network through the use of the TensorFlow for Poets codelab. This allowed the convolutional neural network to use machine learning, through features including object detection and pattern recognition, to create a classifier that can output likelihoods of an image of a coral belonging in a certain subclass. In the first of two iterations of the project, the algorithm was tested using photos from the data set used from training to which it yielded a 100% hit rate. Next, it was tested with photos not included in the initial data set. Similar to above, a sample set of 60 photos not included in the initial data set. It yielded an average of 92.45% hit rate. It also exhibited a higher accuracy in detecting photos with Ceriantharia and Octocorallia as compared to Hexacorallia. In order to merit statistical significance, the F-score from each test was computed with a functionality score of 1 and efficiency score of 0.833. This study successfully produced a fully-functional, highly-efficient image recognition algorithm.

Keywords: Anthozoans, Image recognition, Tensorflow

Detection of abandoned objects in surveillance video using machine learning to prevent bombing situations

Nattamon Polvichai¹, Wisarut Udomsilp¹, Senangkabordee Maneesilp¹,
Laokhwan Ngamprasit¹ & Dr. Krikamol Muandet²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

² Department of Mathematics, Faculty of Science, Mahidol University, Bangkok, 10400, Thailand.

Correspondence should be addressed to N.P. (joppy.pgh@gmail.com).

Bombings are one of the most frequent terrorist acts of the current era. In each serious bombing situation, the cause of the explosion is usually placed at the scene of crime before the incident, but is not detected in time thus causing a large amount of damage and loss. It would be possible to combat this problem by assigning authorities an around-the-clock observation of surveillance videos, but excessive manpower would be needed for efficient operation. We propose a solution by developing a system that is capable of automatically detecting objects that have a probability of being dangerous, defined as suspicious objects. The video input is analyzed frame by frame. The system consists of 2 parts, which are 1) Object Detection, where abandoned objects are detected, and 2) Object Classification and Risk Assessment, where the detected abandoned objects are assessed to determine each object's risk of being a suspicious object. The user is notified according to an object's risk. Feedback about the object's actual risk is collected from the user, and Bayesian Machine Learning is used to adjust the parameters of each object. By testing the system on self-taken videos, the Object Classification and Risk Assessment part can assess risk of objects with 77.5% accuracy and 73.9% precision.

Keywords: Abandoned object detection, Bayesian network, Computer vision,
Machine learning

Driver drowsiness detection with alarm system

Harith Adam Bin Khairul Amri, Nur Qhalisa Binti Nor Izwan & Ilham Juliana Binti Adri Kamal

Kolej Yayasan Saad Melaka, 75450 Ayer Keroh, Melaka, Malaysia.

Correspondence should be addressed to Harith Adam (1877.16@kysm.edu.my).

Careless driving due to drowsiness can be avoided by understanding the vehicle behavior. This research proposed an integrated system to detect and aware the driver from being drowsy. A device is built to detect driving lanes by using light sensors and detect any vehicle in front of the driver by using ultrasonic sensors. The device will detect any lane departure and delaying at green light behind a car. Driving pattern can be corrected by the driver by alerting the driver via sound and perfume scents.

Keywords: Drowsiness, Sensor, Perfume

Tapian Sealer

Woradech Uenglumpsum, Korawish Thanasit & Komed Najang

Chulalongkorn University Demonstration Secondary School, Bangkok, 10330, Thailand.

The waste problem in water resources along the length around the university, which will find garbage, plastic bags, water bottles and leaves from trees also oil slicks from the factory. These waste and oil slicks are floating on the surface of the water. If these wastes are accumulated will result in deterioration of water sources which affect the lives in the water source. If we want to solve the problem in the main water sources, the small water source should be taken care first, therefore, the robot ship named "Tapian Sealer" is designed to help preserve the environment of the water sources in university or communities. We use IoT technology reduces human labor. This project aims to 1) Invent Tapian Sealer to collect garbage and oil floating on the surface of the water with an automated system. 2) To test the effectiveness of Tapian Sealer. This 40x60 sq.cm. sized Tapian Sealer controlled with IoT technology use the sensor to check the distance between itself and the edge of the bluffs. It moves in linear motion or the motion based on the characteristics of individual canals to store trash and leaves, by entering through the front of it. Incoming trash is stored in the net. It can also absorb oil with buoys in front of it. Tapian Sealer use energy from solar cell and move with hydraulic turbine which can add oxygen to the water source.

Keywords: Water pollution, IoT, Automatic cleaning water machine

White light communications

Dayrius Tay Jiale¹, Fu Tianyi¹, Alexander Goo Zong Han¹ & Wulf Hofbauer²

¹NUS High School of Math and Science, Singapore 129957

²CRADLΣ, Science Centre Singapore, Singapore 609081

Correspondence should be addressed to D.T. (h1510030@nushigh.edu.sg)

Li-Fi is described as the eventual successor to Wi-Fi for its ability to double up as illumination and its higher maximum bandwidth. Visible Light Communication solutions are currently under development. Existing open source Li-Fi solutions are limited at 1kbps at close range. We aim to prototype a DIY set-up for moderate bitrate Visible Light Communication using primarily discrete components, as a proof of concept of Li-Fi. Our primary challenges were overcoming harmonic interference from ambient lighting and modulating a LED at high speeds. We designed and constructed circuits to accomplish this. AM was chosen as a modulation method for its simplicity. A photodiode was chosen for its low response time in photoconductive mode and a high pass filter was used to remove interference from fluorescent bulbs. We achieved stable data transmission at 307.2kbps at 80cm. Besides being a curiosity, we envision applications of our work in EM interference sensitive environments. We aim to transfer our setup onto a PCB to reduce size and EM interference. Eventually, we hope to create an Arduino shield for simple and straightforward use.

Keywords: White light communications

Alzheimer's patient care assistant application (One4Alz)

Krit Chanpornpakdee & Laokhwan Ngamprasit

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to K.C. (yothinpeace@gmail.com).

Alzheimer's disease is the most common dementia. It slowly destroys memory, thinking skills, and eventually the ability to carry out the simplest tasks. In 2006, there were 26.6 million people worldwide with Alzheimer's disease and estimated that it will increase 4 times by 2050. The current treatment is only a little symptomatic help and there is still no treatment that can really stop the disease. Therefore, assistance in the area of rehabilitation and care for Alzheimer's patients is vitally important, especially for the caregivers. This application is built to help Alzheimer's caregivers in the basics through the use of mobile phones.

This application consists of 5 main functions.

1. Daily Schedule for Daily Reminders (such as reminders to give medicine to the Alzheimer's patient)
2. Alzheimer patient's symptoms record system.
3. Brain Skills Training Game for Alzheimer's Patients and enhance the interaction between caregivers and patients.
4. IOT (Internet of Things) system that sends an alarm to the caregiver's phone when leaving behind the home utilities.
5. IOT (Internet of Things) system that sends an alarm to the caregiver's phone when detecting the RFID tag attached to a wrist band of an Alzheimer's patient when a patient passes through a door.

We would allow 10 users of the application (Alzheimer's caregivers) to make an assessment after one week of use. Then we would use problems and suggestions to improve the application.

Keywords: Alzheimer, Caregiver, Application, IOT

Cooking by the sun

Parlisa Thoummavongsa, Santi Keomixay & Khamphouth Phommasone

School for Gifted and Ethnic Students, National University of Laos, Dongdok Campus, Vientiane, Lao PDR.

Correspondence should be addressed to khamphouthp@gmail.com

The purpose of this research is to discover the power of the sun by transferring its radiant energy into heat energy in solar oven, thereby cooking a snack. The concepts of reflection, refraction, and absorption are fundamental to creating a solar oven. To create an efficient solar oven, a black surface is important to absorb light to create heat. The additional panels of reflective material increase the amount of light that gets absorbed by the black surface. Insulation of a solar oven is another important concept. The materials used for the basis for the oven may vary, so additional layers of material and/or of material with air in between its layers can increase the efficiency of an oven. Finally, solar ovens work only when the sun is shining. The sun is at the center of our solar system, and the Earth rotates around the sun on its orbit, while also rotating on its own axis. This rotation of the Earth on its own axis is what creates night and day. The sun provides radiant energy only on the Earth's surface which is experiencing 'day time'. Clouds can refract the light waves thereby minimizing amount of light reaching the actual surface of a solar oven.

Keywords: Solar oven

Automatic recyclable waste separator

Thanawan Phoaauthai, Thapakorn Threeraket & Chutikan Chalerykam

Princess Chulabhorn Science High School Lopburi, Lopburi, 15120, Thailand.

Correspondence should be addressed to C.C. (chalerykam@gmail.com).

This project is scientific project category artefact is automatic recyclable waste separator aims to 1. To study performance of the sensor in Detection waste. 2. To build the Automatic recyclable waste separator. 3. To bring recyclable waste go back to privatization more convenient. Which is automatic recyclable waste separator have action by microcontroller to be a commander operation of the sensor 2 Type is 1. Inductive Proximity Sensors (Metal Detect) 2. Module load cell (Weight Detect) in to measure use the intensity metal values and weight values respectively. And send information continue to microcontroller again to for processing and separation recyclable waste for 3 type is plastic bottle glass bottles and tins. From the experiment 5 time found think performance percent 100

Keywords: Plastic bottle, Glass bottles, Can, Inductive Proximity Sensors, Module load cell
Microcontroller

Brainwave authentication program using proper visual stimulation and deep learning algorithm for processing

Teerapath Sattabongkot¹, Supawich Puengdang¹, Boonnatee Sakboonyarat¹ & Wudhichart Sawangphol²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Faculty of Information and Communication Technology, Mahidol University, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to T.S. (teerapaths@gmail.com).

Biometric authentication methods used nowadays still have numerous potential security concerns and can be forged physically. This causes many problems in privacy risks from criminals around the world. As the brain signal has been found to be unique for individuals, electroencephalogram (EEG) signals are potentially utilizable as an identity discrimination tool, especially since EEG reflects the delicate difference in individuals' mental characteristics. However, the existing EEG-based authentication methods apply to only one or few techniques to stimulate the signal and there are some vulnerabilities in the limited scope of the study. Also, the EEG data is one of the most complex biometrics which can take advantage of deep learning techniques. Therefore, we propose to combine steady-state visual evoked potential (SSVEP) and event-related potential (ERP) features to enlarge the distinction between individuals and apply the Long Short-Term Memory (LSTM) network for the analysis. The proposed methodology is divided into three stages. Firstly, we collect raw EEG data from the 20 human subjects, whose brains were stimulated by 7.5 Hz square SSVEP with targeted and non-targeted Snodgrass-Vanderwart's set of images as ERP stimulus. Then, the raw data is pre-processed by a notch filter, band-pass filter, and eye blink artifacts removal. The deep learning based recurrent neural network (RNN) architecture is used to pre-process data of individuals for predicting the results. After prediction, the performance is evaluated based on False Acceptance Rates and False Rejection Rates according to Biometric Evaluation Standards. The EEG-based authentication method with visual stimulus demonstrates high verification accuracy and can be applied with some improvement in the future through the use of brain connectivity techniques.

Keywords: EEG, Personalized authentication, Deep learning

An innovative design for low cost cleaning robots

Yurui Shao, Nicholas Zhi Jie Chia & Jonathan Qi Quan Lee

Anderson-Serangoon Junior College, Singapore

The work is focused on design for low-cost housekeeping hovering robot. The project's aim was to implement random movement of autonomous (or semiautonomous) vacuum cleaner without a microchip nor sensors, that would be able to work inside of a flat, but not free of obstacles workspaces. Experimental validation of efficiency of the proposed approach have not been done yet.

Keywords: Mobile robotics, Low cost, Without sensors and microchips

Identifying box

Rith Virakyuth, Houg Lyheang & Nil Nun

New Generation School of Preah Sisowath High School, Phnom Penh, Cambodia
Correspondence should be addressed to R.V. (virakyuth2500@gmail.com)

In everyday life, there are an increasing amount of fraud objects, some are easy to identify some are hard to identify. I have come up with a solution by creating an identifying box. The purpose of this box is to determine which object is fake or real and if the object is real the box will determine the type and name of the object. Inside this box will be 3 sensors module. These sensors will be used to measure the height weight and colors of the object and determine exactly what the object is. These 3 sensors will be used to gathered data from the object. By using all the gathered data we can create a relation. In order to analyses the object.

Keywords: Fraud, Sensors

Developing program to detect humans using information in videos with deep learning

Rawisara Lohanimit¹, Thanpimon Buamanee¹, Sarita Yokul¹, Boonnatee Sakboonyarat¹ & Suppawong Tuarob²

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

² Faculty of Information and Communication Technology, Mahidol University, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to R.L. (rawisaraloha@gmail.com).

As more security cameras were installed for safety purposes, a lot of videos were made and it required much time and effort to identify faces from it. To solve the problem, we developed the program to detect faces in videos and find the target among those faces. We developed new methods to differentiate between faces so we could train model beforehand and save time. Our program will detect faces in video and segment facial parts (left eyes, right eyes, nose, and mouth)' structures. The program will prioritize parts in 4 methods and subtract from the searched images. The difference will be sent into the model to identify if the person is the same or not and the result will be returned to the user. After training with the model, the results showed that the accuracy of differentiating 2 people is about 86% on training examples and 74% on testing examples.

Keywords: Tracking surveillance system, Face detection, Machine learning, Parallel programming



Environmental Science

Development of lightweight concrete by using biomass ash

Nuttaya Pittayachunnapong, Neerachar Gooramasuwan & Arisa Thangpaibool

Darunsikkhalai Science School (Engineering Science Classroom), Bangkok, 10140, Thailand.

Correspondence should be addressed: kritthana_k@outlook.com

This research is aim at studying the developing concrete by using biomass ash as fine aggregate. As biomass can decrease the weight of brick and amount of using concrete. Consequently, the concrete bricks were improved to be lightweight. According to the first part of this the experiment, the mixing ratio of OPC (Cement) and Biomass were 1:1, 1:3 and 1:5 (v/v) gave us the normal consistency by using manual cement vicat. The result of 1:1, 1:3 and 1:5 were 48%, 63% and 70% respectively. Afterthat, normal consistency was employed in order to produce 6 cubes of each ratio. To clarify, the cubes were kept for 7, 14 and 28 days. Later on, the physical property, consisting of strength, density and water absorption were tested. Regarding to the result of study, it can be concluded that biomass has got the properties to produce that the highest strength of 1:1, 1:3 and 1:5 were 470.515, 348.446 and 296.674 ksc. The highest density 28 days of 1:1, 1:3 and 1:5 were 1.293, 0.995 and 0.873 g/cm³. The highest water absorption 28 days of 1:1, 1:3 and 1:5 were 33.59%, 39.45% and 25.19% respectively. From the result, we can conclude that biomass can produce lightweight concrete in the future.

Keywords: OPC, Biomass, Lightweight concrete

Status of mosquito larvae and water qualities in shrimp ponds in Trang province

Prangnapas Kongneam¹, Annop Sangkamanee¹, Mullica Jaroensutasinee²,
Anantanit Chumsri², Jaruwan Chootan¹ & Patchara Pongmanawut¹

¹Princess Chulabhorn Science High School Trang, Trang, 92000, Thailand.

²Walailak University, 222, Thai Buri, Tha Sala, Nakhon Sri Thammarat, 80160, Thailand.
Correspondence should be addressed to P.K. (prangnapas.k@hotmail.com).

Mosquitoes are responsible for various diseases in human beings. Shrimp ponds could be used as breeding sites by mosquitoes. The objective of this research was to study the mosquito larvae and water qualities in shrimp ponds in 3 districts (Palian, Yantakhao and Hatsamran) of Trang province. A total of 31 shrimp ponds were sampled in January - February 2018. We identified the mosquito larvae up to genus level and counted the numbers. The results show that mosquito larvae (only *Culex* spp.) were present only in 9 ponds among 31 ponds, and mosquito larvae numbers did not differ among these 9 ponds. Salinity and temperature were higher in the ponds with mosquito larvae than in the ponds without mosquito larvae (Salinity: $t = 3.03$, $P < 0.01$; Temperature, $t = 0.88$, $P < 0.05$). Other parameters did not differ between ponds with and without mosquito larvae. Salinity, conductivity and temperature were positively correlated with the numbers of *Culex* spp. A total of 283 mosquito larvae were recorded belonging to 4 types in households near shrimp ponds, which included *Culex* spp. (185), *Aedes albopictus* (91), *Aedes aegypti* (7), and *Toxorhynchites* spp.. We conclude that only *Culex* spp. were found in shrimp ponds.

Keywords: Shrimp ponds, Mosquito larvae, Water quality

Green energy: Thanks to water

Muhammad Adlan Bin Azizuddin, Muhammad Zharfan Bin Zulfikri,
Muhammad Khairul Izdiyar Bin Wahiri & Rama Letchumy Athimoolam

Alam Shah Science School, Kuala Lumpur, 56000, Malaysia.

Correspondence should be addressed : smsaskl@yahoo.com Website: <http://asiskl.org>

We depend on energy for almost everything in our life. We wish to make our life comfortable, productive and enjoyable. Hence even if the outside temperature rises a little, we immediately switch on the air conditioner to keep our house cool. This is again using up of energy. Solar cells are popping up on rooftops everywhere these days and are a model for clean, renewable energy. Do you ever look at these solar panels and wonder how we can obtain energy produced by solar cells when the sun is not shining. There are tons of other projects that stores energy for usage when the sun is not shining in the form of electricity. The electricity that must be used and needed in order to split water can be obtained by the solar cells that are made from sunlight by solar panel. However, in this project we will store the energy in the form of fuel. The strategy to overcome this challenge is to store the energy produced by solar cells during the day in the form of fuel that can be used at the later time. Our method of transforming the solar cells to fuel is by breaking up water molecules into hydrogen and oxygen. Of course, water is widely available and can be found everywhere in the world, hence water will make excellent material for the project. Water, H_2O is covalently bonded, which is made up two hydrogen atoms and one oxygen atom. The hydrogen atoms will merge and become gas. 75% by mass in the universe is hydrogen. The hydrogen and oxygen are fuels that can be burned in devices such as fuel cells to produce clean electricity when it is dark.

Keywords: Green energy, Water

Oil absorbent material based on natural rubber

Punpom Sukjuntra¹, Apisara Chaisawat¹ & Nabil Hayeemasae²

¹Demonstration School of Prince of Songkla University, Prince of Songkla University, Pattani Campus, 94000, Pattani.

²Faculty of Science and Technology, Prince of Songkla University, Pattani Campus, 94000, Pattani.

Correspondence should be addressed to N.H. (nabil.h@psu.ac.th).

In recent years, oil spills and chemical leakage from industrial accidents have had catastrophic effects on marine and aquatic ecosystems. Therefore, the removal or collection of organic pollutants from water surfaces has attracted worldwide attention. Traditionally, oil spills are cleaned by a variety of methods, but the interesting way to remove oil spill from water surface is using oil absorbent materials. Natural rubber latex foam (NRLF) made from NRL gives ultra-comfort to consumers due to its open cell structure and evenly distributed fine cells. Furthermore, NRLF has many more advantages compared to other synthetic sponge materials such as polyurethane foam (PUF). This work is on the application of natural rubber latex foam sorbent in the oil spill cleanup from surface waters. Here, a series of natural rubber latex sorbents are prepared and their sorption capacities for crude oil and petroleum products are determined. The results are compared with the performance of a commercial sorbent based on PUF. The result from this research showed that foaming volume affected on the oil absorbency of rubber oil absorbent.

Keywords: Natural rubber, Natural rubber foam, Oil absorbency

Classification of the upper Paleozoic Trilobites from Doi Tu Pu, Chiang Rai Province, Northern Thailand : Preliminary result

Siwakorn Maneethein¹, Pitaksit Ditbanjong² & Watcharaporn Chalad¹

¹Yupparaj Wittayalai School, Chiang Mai, 50200, Thailand.

²Department of Geological Sciences, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand.

Correspondence should be addressed to S.M. (Pondd35@gmail.com)

Upper Paleozoic successions sparsely crop out in Northern Thailand. Most of them are Permian carbonate rock while fossiliferous siliciclastic strata with continuous successions are rare and not widely distributed. The study area, Doi Tu Pu, is an about 110x120 m² old quarry, located at Taweerat Community, Rimkok Sub-district, Muang Chiang Rai District. According to previous works, this area was mapped as Carboniferous (Braun and Hahn, 1976), Permian (DMR, 2007). Sedimentary succession is dominantly composed of mudstone/siltstone interbedded with very thin- to thin-bedded sandstone. Sedimentological study suggests a relatively shallow environment. Fossil remains commonly include brachiopods, gastropods, crinoids, corals, bryozoans, plants and trilobites. Trilobites were found in silty mudstone, at least from three different beds. Totally, 109 specimens were randomly collected from those three fossiliferous mudstone beds. Trilobite sample consists of 24 cephalons, 1 thorax and 84 pygidiums. The majority of specimens are incomplete and/or disarticulated. A preliminary analysis of the systematics identified them as order Proetoida. Pygidiums can be classified into 6 different forms. Wide and complete pygidia allow an analysis of their size (length over width, number of axial rings and pleural lobes). This study highlights the presence of several ontogenetical instars. Consequently, a geometric morphometrics analysis will be performed in order to describe precisely their developmental trajectory. Moreover the presence of Proetoida suggests that Doi Tu Pu succession is possibly aged in Middle-Upper Carboniferous around 330 - 296 Ma.

Keywords: Trilobite, Upper Paleozoic, Doi Tu Pu, Chiang Rai province, Northern Thailand

Study on the efficiency of adsorption of heavy metal ions with magnetite resin in induced magnetic field

Watsamon Trakulsirisak, Lakana Tangwattanawong & Warisaya Tobdan

Siyanusorn School, Chanthaburi, 22000, Thailand.

Correspondence should be addressed: thaowannee@gmail.com

This project has objective to remove heavy metal ions by the use of magnetite synthesized in a laboratory mixed with corn cob. In this project called magnetite resin. In the experiment, the magnetite resin was placed in a water filter. Then remove the synthetic wastewater contaminated with metal ions through a water filter. Then bring the waste water through this. Measure the concentration of heavy metal ions with spectrophotometer. And in this project also. Increase the magnetic field induced by the solenoid coil. For heavy metal ion treatment to enhance absorption more. The results of this study are as follows. Magnetite resin that will result. Effect of metal ions adsorption. And the magnetite resin produced at a ratio of 100 g of corncob to 10 g of magnetite will give the best absorption efficiency. And from the study. Experimental results of heavy metal ions adsorption with magnetite resin by inducing an induced magnetic field of different sizes and directions. It was found that the size of the magnetic field will result in better absorption of heavy metal ions. Because of the magnetic field that will help in the arrangement of the magnetite resin is more organized. Inductive magnetic field with different direction (up-down), the efficiency of adsorption of heavy metal ions is not different. In the study of the optimum conditions for adsorption of heavy metal ions, it was found that at 30 degree celsius, pH 4 and flow rate of 41.96 liters per minute were the best adsorption conditions. To study the adsorption efficiency. Various metal ions, such as cobalt copper, nickel, respectively, appeared in the heavy metal ion treatment system. This will have different types of metal ion adsorption capacities. And heavy metal ion therapy. Magnetic resonance in induced magnetic field. It is best to absorb iron metal ions.

Keywords: Magnetite, Metal ions, Magnetic field

Removal of phenol catalyzed by peroxidase from water hyacinth

Watcharapong Wongkaew, Pariyakorn Kanchanawat, Piyamon Songpanich & Nuchutha Thamsumet

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to W.W. (northy-bcc@hotmail.com).

Municipal and industrial wastewater is often contaminated with phenol, an organic compound found in household products and used in many manufacturing processes. Due to phenol toxicity, it needs to be eliminated from water. In this study, crudely extracted peroxidase from water hyacinth, another water pollutant in Thailand, was utilized as a catalyst in phenol removal by polymerization and precipitation. Peroxidases from stolons, roots and leaves of water hyacinth, were extracted and tested for enzyme activity according to the standard protocol, and it was found that the enzyme from the roots provided the highest activity. The peroxidase from roots was then used in phenol removal from the synthetic phenol-contaminated water containing 1.0 mM phenol. The remaining phenol concentration was analyzed by the total phenol assay in which phenol reacts with 4-aminoantipyrine (4-AAP) in the presence of potassium ferricyanide reagent to form quinoneimine dye detected by UV-VIS spectrophotometer at 510 nm. It was found from the results that the phenol removal efficiency up to 90% could be obtained by using 4:1:3 by volume of phenol: H₂O₂: peroxidase at 25 °C, pH 7.4 for 15 minutes as the optimum conditions. In addition, the extracted peroxidase from water hyacinth's roots showed the promising results in phenol removal up to 80% from the synthetic resin industrial effluent containing interference ions.

Keywords: Phenol, Water hyacinth, Peroxidase

Absorption of waste phosphate using biochar and chitosan gel beds for *Portulaca grandiflora* growth

Natnicha Techaamnuyaporn, Puttaranun Boonchit, Thanawut Wilairatanadilok & Arjaree Thirach

Kamnoetvidya Science Academy, Rayong, 21210, Thailand.
Correspondence should be addressed to N.T. (5900020@kvis.ac.th).

Nowadays, many people unintentionally pollute the water resources by releasing detergent and substances into the water. This project was conducted to reduce the concentration of phosphate ions in water by developing biochar and chitosan gel beds for phosphate absorption. The most efficient ratio between biochar and chitosan was determined, and mixed in different types of gel include pectin, agar and polyvinyl alcohol; then after absorbing phosphate ions in the water, these gel beds were used for planting *Portulaca grandiflora*. From spectrophotometry analysis, the result showed that the most suitable ratio between biochar and chitosan was 3:18 by weight, absorbing phosphate ions at 24.62 mgP/L from an initial concentration at 50 mgP/L. After absorption of phosphate, the gel beds were used for planting *Portulaca grandiflora*, which was observed for growth for 2 weeks. Only the gel beds produced from agar were found to be suitable for planting. After 10 days, new sprouts were found on the controlled soil set and gel beds with biochar and chitosan. In contrast, the set of agar gel without biochar and chitosan showed no change. However, other measurable criteria of the new sprouts could not be determined since the plants were eaten by insects and snail. In conclusion, using the proper ratio of biochar and chitosan with agar gel can produce the gel beds suitable for absorbing phosphate from wastewater, which can be subsequently used for small plant cultivation.

Keywords: Phosphate absorption, Biochar, Chitosan, Gel beds, *Portulaca grandiflora*

Bioplastic film from extract in banana peel and banana leaves

Kantarot Jeenkajorn, Pascha Homchun & Ariya Khamnuandet

Angthong Pathamaroj Wittayakhom School, Angthong, 14000, Thailand
Correspondence should be addressed: pornpimon@apw.ac.th

In Ang Thong province, there are a lot of Cultivated bananas. These Cultivated bananas often processed to various products but after all, the huge pile of banana peels and banana leaves were without using their benefit. The research found that cellulose in banana peels and banana leaves can be used to produce bioplastic to reduce the pollution. The production team has an idea to create the value of banana peels and banana leaves by making “Bioplastic film from cellulose extract in banana peels and banana leaves” project. This project purposes is to process banana peels and leaves to be bioplastic film instead of using high cost commercial cellulose bioplastic film for retarding the ripening of fruits. To extract the cellulose powder from banana peels and leaves, there are five steps which are; 1) Bake the slices of banana peels and leaves at 100 °C 2) blend them until smooth 3) remove fat by soaking 95% ethanol. 4) Eliminate protein by soaking with sodium hydroxide solution pH12. 5) Bleach immersing 15% hydrogen peroxide 6) bake all ingredients to get completed the cellulose powder and 7) Form it to bioplastic film by mixing glycerin, acetic acid and distilled water. Then test the performance of film by Vernier force sensor. After testing the performance, we found that Bioplastic film from cellulose extract in banana leaves performance is similar to bioplastic film from commercial cellulose but lower cost. Finally, wrap the Cultivated bananas, level 2 ripening, with bioplastic film from cellulose extract and record everyday till the ripening is at level 6. Comparing with unwrap Cultivated bananas, we found that bioplastic film from cellulose extract in banana peels and leaves has the quality to ripe for retarding the Cultivated bananas approximate to commercial wrap.

Keywords: Cellulose, Banana peel, Banana leaves, Bioplastic film

Charcoal pottery filter model

Sirapatr Treekul, Trissanan Pleekhum, Soichadapa Soithong & Ratchadaphorn Boonrangsee

Princess Chulabhorn Science High School Chiang Rai, Chiang Rai ,57000, Thailand.

Correspondence should be addressed to PCC_CR@hotmail.com

The charcoal pottery filter study was aimed to apply homemade charcoal and clay as an efficient filter in order to reduce toxic substances in water with low cost. The experiments showed that charcoal from *Leucaena* wood was the best absorbent on paraquat and Pb^{2+} ion whereas baked clay with zeolite at weight ratio 20:1 showed the best absorbent on Pb^{2+} ion. The model consisted of 4 cylindrical potteries with *Leucaena* charcoal inside showed 100% removal of those two toxic substances. The model presented ratio of benefit to cost at 10:1. Benefits of the filter were 1) cost reduction for water decontamination and declining accumulation of toxic residue in plants and animals and 2) easily to implement to agricultural land or drainage pipe.

Keywords: Homemade charcoal, Pottery, Filter

Removal of Pb^{2+} from consuming water using a fabricated water filter for home use

Pantaree Sodkhoksoong, Papidchaya Chanpong, Thanyarus Rodsawatchuchoke & Nuchutha Thamsumet

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.
Correspondence should be addressed to P.S. (pantaree26@gmail.com).

Lead contamination in water is a worldwide environmental problem. For example, lead leaking from corroded pipes and soldering has been found to contaminate potable water in many areas of the U.S. The uncontrolled release of effluents containing lead from various industries has also caused lead-contaminated water and potential lead-contaminated potable water in some parts of Thailand. Exposure to lead-contaminated water can lead to serious symptoms (e.g. fatigue, headaches, abdominal pain, irritability, depression, and seizures) or even death. Therefore, the elimination of lead ions (Pb^{2+}) from potable water or from effluents before releasing the water into the environment is necessary. The selection of adsorbents and the fabrication of a water filter used in households for Pb^{2+} removal from tap water were performed in this work. The efficiency of Pb^{2+} removal from water using different particle sizes of ground chicken eggshells (i.e. 20-63 μm , 63-125 μm and 125-500 μm) employed as adsorbents was studied. By passing 100 ppm Pb^{2+} solution at pH 4.4 through small scale columns packed with these adsorbents using a syringe pump, it was found that around 90% of Pb^{2+} ions were removed from water using 20-63 μm particle sizes of eggshells. The most finely ground eggshells, a cheap, natural source of CaCO_3 as a household waste, were then chosen as adsorbents and packed in a fabricated water filter that could be directly attached to a water tap. The Pb^{2+} removal efficiency and the adsorption capacity using this water filter design were investigated. To this end, this fabricated water filter could provide a promising homemade tap water filter for Pb^{2+} removal, in which a cheap and easily replaceable adsorbent is utilized.

Keywords: Lead (II) ion, Eggshell, Water filter

Innovative idea and basic concepts for water treatment

Myat Hpone Thaw, Myat Thi Ha & Phyu Sin Chanthar

No(1) Basic Education High School, Dagon Township, Yangon Region, Myanmar

This Project presents a concept method for new generation. Comparing the basic to the advance by the mechanical purification of water. Research and development of this project has been processed in Myanmar and is about to be a significant result. The project we present has profound implications for future studies of sustainable economic recovery. Environmentally-friendly and energy – saving water treatment and water disinfection with UV: treatment of ballast water, municipal and industrial sewage and water for animal husbandry, agriculture and horticulture. UV water treatment and water disinfection Water treatment and water disinfection with high-energy UV radiation is an environmentally-friendly method established for more than 100 years. It uses no chemicals, with no added chlorine or ozone. Special UV lamps destroy microorganisms such as bacteria, viruses and parasites and help decompose chemicals harmful to health.

Keywords: Water treatment, UV treatment



Mathematics

The study of alternating number-card positions from card permutation

Naruepachai Prairahongkun¹, Panithi Vanasirikul¹, Chaipattana Juntarapomdech¹,
Nongluck Apasut¹, Ratinun Boonklurb² & Jinnadit Laorpaksin³

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Department of Mathematics and Computer Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand.

³Department of Curriculum and Instruction, Faculty of Education, Chulalongkorn University, Bangkok, 10330, Thailand.

Correspondence should be addressed to N.P. (narupachai392112@gmail.com).

Presently, every card game needs a system of shuffling; therefore, shuffling systems have been one of the most interesting topics among players around the world. Some of the systems however, could be calculated. One of the most interesting shuffling that has been used in a lot of card games to randomize the cards is called "Pile Shuffle." So, we researchers want to prove that pile shuffling can be calculated too and shouldn't be used in games that need the right order of cards to play. This is how the pile shuffle works. Given a deck of n cards. We separate the cards into a groups by putting the first card to the first group, the second card to the second group until the last group a and then repeat the process. Collect the cards that are stashed in separated groups by putting the first group on the top of the second and the second on top of the third until the last group was collected. Using this process, we completed the shuffle once. Our problem is how many times the deck needs to be shuffled so the cards will rearrange to the initial position. The solution that researchers have is the case that $a|n$ which the result is to shuffle $ord_{n+1}\left(\frac{n}{a}\right)$ times and the case that n divided by a has a remainder of 1 which the result is to shuffle $ord_{\left(\frac{n(n-a-1)}{a}\right)}\left(\frac{n-1}{a}\right)$ times whereas ord_mk is the least positive integer that $k^{ord_mk} \equiv 1(mod\ m)$; k and m are positive integers. Moreover, under certain conditions of positive n and a , the deck of cards can be specifically identified the number of times for shuffling without using the function ord . For other cases would be considered as interesting open problems for other researchers to research the problem in the future.

Keywords: Shuffle, Card permutation

Matrix and security system

Prawit Janprathak, Piyarat Akotmee, Umaporn Kongmanee, Patcharaporn Chanpadtha & Sumalee Klaimuang

Princess Chulabhorn Science High School Loei, Loei, 42110, Thailand.

Correspondence should be addressed to P.C. (Chamnanprai_p@hotmail.com),
U.K.(Dream_fyre@hotmail.com).

This project presents, how to create security system, secret sharing scheme and password with matrix and use The Geometer's Sketchpad (GSP) Version 5.06 to check the calculation, when

- 1) t is a positive integer and t is greater than 1.
- 2) n is a positive integer and n is greater than or equal to t .
- 3) study only 2×2 , 3×3 , 4×4 , 5×5 and 6×6 matrix.
- 4) study polynomial function degree less than 6.

The results of this study, we found the way to create security system were as follows let $|f(k)|$ is a password, we have to divide $|f(k)|$ into n ordered pairs and give n ordered pairs into n people. We can use t ordered pairs to decode a password $|f(k)|$.

The attributes of security system

- 1) $n \geq t$, so unnecessary to use all of n
- 2) We can use t ordered pairs to decode a password $|f(k)|$
- 3) If we have ordered pairs less than t , we can't decode password $|f(k)|$

Keywords: Matrix, Security system, Polynomial function

Quasiharmonic functions on graphs

Vadim Gorev¹, Ruslan Kasimov¹ & Bashaev Nikita²

¹AESC MSU, Russia

²Faculty of Computer Science, Higher School of Economics, Moscow, Russia

Harmonic functions are a well-known family of functions that comes from analysis. Any harmonic function has the *mean value property*, namely, at every interior point x of its domain it is equal to its mean value over any ball with center x . This property can be carried over to the discrete case, namely, to functions defined on graphs: a function on a graph is called harmonic if for any node x of the graph, $f(x)$ is equal to the mean value of f on the nodes connected to x by an edge. It turns out that such functions are of a big importance in mathematics; e.g. such is the voltage in an electrical circuit or the probability of returning for a random walk. In fact, sometimes it is reasonable to consider functions that are not precisely harmonic, but are very close to harmonic functions in various respects. As an example, it is a very popular idea that a person is the “average” of his/her five closest friends. Moreover, it has been shown by different groups of researchers that peoples’ weights are highly dependent on that of their relatives and friends. This inspired us to consider *quasiharmonic functions* on graphs, defined as functions whose value at any point can differ from their mean value over adjacent points by at most ϵ , where ϵ is a fixed positive number. In this work we investigate quasiharmonic functions, their properties, their connection to harmonic functions, and related algorithmic questions.

Keywords: Harmonic function, Linear algebra, Graph, Quasiharmonic function

Devising the formula for finding the magic constant of complex magic square

Jeerwit Prasitvises¹ & Nittra Boonrod²

¹Princess Chulabhorn Science High School Phitsanulok, Phitsanulok, 65000, Thailand.

²Naresuan University, M.9, Tha Pho, Muang District ,Phitsanulok, 65000, Thailand.

This project presents, how to get the formula for finding the constant of complex magic square. Magic square which size “ n ” going to call as M_n that mean sorting n^2 numbers into the table square. When sorted the summation on each row, column and diagonal must be equal, we always call that constant as magic square constant. From research we know constant of normal magic square by the function $M_n = na_1 + \frac{n(n^2-1)}{2}d$.

When n is magic square's size, a_1 starting number and d is number spacing.

Today magic square has 3 types on 1) Normal magic square 2) Complex magic square 3) Special magic square. There are two thirds have a pattern for sort the number inside, normal magic square and complex magic square. The formula $M_n = na_1 + \frac{n(n^2-1)}{2}d$ it can get the magic square constant both together.

Keywords: Magic constant, Complex magic square, 3Dmagic square

On the group ring satisfying Nil clean property

Sehoon Eo, Seungjoo Hwang & Woonkyoung Yeo

Korea Science Academy of KAIST, Busan, 47162, Republic of Korea.

In 2013, Diesl defined the concept nil clean ring as a ring of which all elements can be expressed by the sum of an idempotent and a nilpotent in his paper [A.J. Diesl, Nil clean rings, *J. Algebra* (383) (2013) 197-211]. Furthermore, in 2017, Zhou applied nil clean property on group rings, coming up with each necessary condition and sufficient condition for a group ring to be a nil clean ring. Using these results, we have proposed a necessary and sufficient condition for a group ring to satisfy a stronger condition - uniquely nil clean condition. Additionally, we provided a theorem for nil clean group rings with nontrivial center and some examples of trivial-center groups of which group ring is not nil clean over any strongly nil clean rings.

Keywords: Nil clean, Uniquely Nil clean, Group ring

The image processing for computing the amount of sweet corn

Neeranuch Sudcharoen, Chanikarn Promphat & Pronchanun Mangmeethanapiboon

Princess Chulabhorn Science High School Phetchaburi, Phetchaburi, 76120, Thailand.
Correspondence should be addressed to N.S. (neerapatsorn12@gmail.com).

At the present, there are several steps for sweet corn processing industry and finding the amount of sweet corn is an important step of the process. If we have an easier way to find the amount of sweet corn, we will decrease the time of the processing. This project aims to find the amount of sweet corn with two methods. First, bring the structure of corn to create a relation with the amount of sweet corn. Another method is integration with the Washer method to find amount of sweet corn. The results indicated that the diameter of the ear is the most related with the amount of sweet corn. The equation of the relation as follows

$V = \frac{d-4.2161}{0.0054}$ (V is the amount of sweet corn and d is the diameter of the ear). An error of the amount of sweet corn from the computing is 6.48% while the error from integral with the Washer method is 2.24%. Then, we applied two methods to Image processing by simulating the motion of the sweet corn when passing belt by installing video camera to capture images. Then, measured the length and diameter of the ears to calculate and display the results which the error is 6.48%. This is one of the factors that affect the computing of the amount of sweet corn is the quality of the camera and light. If use the camera with high quality that can take photos of sweet corn crisp, it will decrease the error. So Image processing is more efficient method that can reduce the process and time to find the amount of sweet corn in the industry.

Keywords: Sweet corn, Relation, Washer method, Image processing

The application of rook polynomial for solving lottery problem

Supphachai Sonwai

Phitsanulok Phittayakhom School, Phitsanulok, 65000, Thailand.

Combinatorics is one of the most important mathematical fields which is greatly significant for many fields of pure mathematics. There are mathematicians who from create a polynomial by using chess idea. That is called Rook Polynomial which is related to permutation but some positions in the board that is prohibited. The objective of this research is to apply Rook Polynomial for solving counting problems. And the problem that the author is interested in is Lottery Problem. The problem is as follows: The lodge holds a weekly lottery for its n members, n an even number. Upon joining, each member is assigned a number, based on the order in which they have joined. In the weekly lottery drawing, each member is assigned randomly a number from 1 to n , such that each number is used once and only once, and winners are determined as follows: if Member i draws either i or $n + 1 - i$ for the week, he or she wins. The problem is the following: in how many ways can there be no winners in the first week of the lottery. The study found that if n is even number, Rook Polynomial of this case will be $R(x, S_{n,n}) = (1 + 4x + 2x^2)^{\frac{n}{2}}$, and in addition, if n is odd number, Rook Polynomial will be equivalent to $R(x, S_{n,n}) = (1 + 4x + 2x^2)^{\frac{n-1}{2}} \cdot (1 + x)$. Therefore the problem can be applied, but it must be under certain conditions.

Keywords: Combinatorics, Rook polynomial, Lottery

A ρ -labeling of the graph L_p -ladder $\cup L_q$ -ladder

Chanatiwat Nillaphat¹, Yanisa Pisalayon¹, Jirath Putthammawong¹, Ratinan Boonklurb², Jinnadit Laorpaksin³ & Chidchalerm Kongpradit¹

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

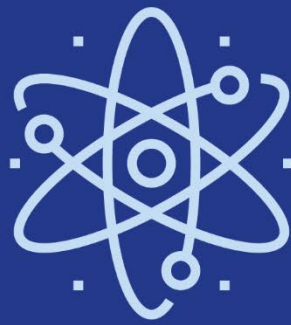
²Department of Mathematics and Computer Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand.

³Department of Curriculum and Instruction and Education Technology, Faculty of Education, Chulalongkorn University, Bangkok, 10330, Thailand.

Correspondence should be addressed to J.P. (jpw2204@gmail.com).

Graph Labeling is a method of assigning integers to the edges or vertices, or both, of a graph under certain formats. One of those interesting formats is called ρ -labeling, which can be applied to help with data management. Our project focuses on finding the ρ -labeling of the union graphs of two ladder graphs. The first step was defining the graphs, L_p -ladder $\cup L_q$ -ladder, and finding a set of functions to be ρ -labeling of those graphs by letting S be a graph of size n with the vertex set $V(G)$ and edge set $E(G)$. The ρ -labeling of S is a one-to-one function $f : V(G) \rightarrow \{0, 1, 2, \dots, 2n\}$ such that induced mapping $\bar{f} : E(G) \rightarrow \{1, 2, 3, \dots, n\}$ defined by $\bar{f}(uv) = \min\{|f(u) - f(v)|, 2n + 1 - |f(u) - f(v)|\}$ is a bijection. The last step was proving that our functions had the correct formats of ρ -labeling. In this project, we defined that the graph L_p -ladder $\cup L_q$ -ladder admits ρ -labeling where $q < p \leq 5$, $3 < pq < 12$ and p, q were positive integers.

Keywords: Graph labeling, ρ -labeling



Physics

The study of distances between transducer and reflector in ultrasonic acoustic levitation using COMSOL simulation

Sakdipat Kongkaeo

Hatyaiwittayalai School, Songkhla, 90110, Thailand.

Correspondence should be addressed to S.K. (jaf160244@gmail.com).

Acoustic levitation, or the technique that use the sound, and its properties (create standing wave from the interference, thus form layers of high and low pressure), to achieve a levitation of small and light materials. Using the technique, I aim to study its properties, that is, the distances between the transducer and the reflector and the frequency of the sound. By setting the Acoustic Levitation with different heights and using different frequencies. And also simulated the same experiment (in 2D acoustic pressure graphs) with COMSOL program. The result is that when using the heights related to the wavelengths of the sound could lift most object (~5mm.spherical foam) and only some ranges of frequency could achieves the levitation.

Keywords: Acoustic levitation, Standing wave, Interference

Paper-based biosensor for detecting concentration of Bilirubin in the neonates by using absorption of light

Jidapa Jermjaroong¹, Chanisara Pawirunsiri¹, Chamras Prommas² & Pranee Disrattakit¹

¹Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

²Department of Biomedical Engineering, Faculty of Engineering, Mahidol University, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to J.J. (jadapa1034@gmail.com).

Neonatal jaundice is a common condition that requires medical attention in newborns. The yellow coloration of the skin in newborns with jaundice is the result of Bilirubin. In most infants, hyperbilirubinemia reflects a normal transitional phenomenon. However, in some infants, bilirubin levels may rise excessively, which is a cause for concern because bilirubin is neurotoxic and can cause death. For these reasons, the presence of neonatal jaundice frequently results in diagnostic evaluation. The objective of this research is to detect the concentration of Bilirubin by using absorption of light. In the first step of our work, filter paper that could absorb the most amount of plasma was investigated. Our study suggested that MF1 was the most appropriate paper to be an absorbent. Secondly, a programming RGB color sensor and assembling microcontroller devices for detecting RGB were developed. Standard Bilirubin solution concentrations 0.5, 1, 2, 4, 6, 8, 10, 15, and 20 mg/dl were prepared for finding a corresponding RGB color. The relation between detected RGB color and standard Bilirubin concentration was analyzed. Our result showed that the relation between Bilirubin concentration and B color value can be used to calibrate our sensor as shown in an equation; $y = y_0 + Ae^{-(x-x_0)/c}$, x is the concentration of standard Bilirubin, y is the B color value, $y_0 = 236.0 \pm 2.5$, $A = 50.1 \pm 0.8$, $x_0 = 1 \pm 9$ and $c = 5.5 \pm 0.8$. Our biosensor can detect the concentration of Bilirubin in a range of 0-10 mg/dl.

Keywords: Bilirubin, Neonatal jaundice, Hyperbilirubinemia

Creating micro hydroelectric generator suitable for river environment in Japan

Minami Uchida, Eri Inoue & Mio Nakagishi

Waseda University Honjo Senior High School, 239-3 Kurisaki, Honjo, Saitama, Japan 367-0032

Currently, it is needed for us to take the needs of the environment into consideration when we make energy. We have to make energy by clean and sustainable method to keep/save the environment of the world. In our research, we are focusing on hydroelectric power generator. Because it is clean and sustainable energy, and there are many and small fast flowing rivers in Japan, we can easily use it. We are going to make a small and portable water turbine with high power generation efficiency which we can use to charge a smart-phone/radio to get the information in case of the disaster. We have continued this research from 5 years ago. In prior research, my seniors focused on an association between the number and the shape of blades of waterwheel and efficiency of the potential spin rate of the waterwheel. After that, we researched the efficiency of hydrophobic coating on the blades. Now we are researching about the relationship between the shape of the blade and the efficiency of the generation of electricity. Using the 3D printer, we can make the blades with various shapes. We will search the shape of the blades that can make much electricity.

Keywords: Hydroelectric power generator, Sustainable energy, Water turbine

Development of wood density measuring instrument by determining the speed of stress wave in wood with piezoelectric effect

Pakteema Duriyapatsorn, Nuchanon Jariyanurut, Piramon Permsilp, Thawatchai Sudjai, Jatuporn Puntree & Thanyanan Phuphachong

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to P.D. (planpakteema2311@gmail.com).

According to wood industries, wood density is a mandatory parameter in indicating the quality of wood. To determine the density, a piece of wood should be cut into smaller pieces, soaked in the water until it is saturated, then dried. Finally, the density could be calculated by the ratio of the mass to volume. This method apparently wastes not only time but the wood as well. To avoid wasting them, this project aimed to develop an unconventional wood density measuring instrument by determining the speed of stress in the wood with the piezoelectric effect. The accuracy of the instrument was tested with uniform density of 210 cm-long wood specimens. A graph plotted between the distance and time of propagation had an R-square of 0.92 (R-square is a statistical measure of how close the data are to the fitted regression line). We calculated the density of 3 eucalyptus specimens by determining the speed of the stress wave and using the values of modulus of elasticity (MOE) of eucalyptus from the physical and mechanical properties of the Eucalyptus hybrid (I. LOULIDI, 2012). The resultants were 1,567, 1,862 and 2,006 kg/m³, which were far from the mass-volume densities that were 736, 771 and 842 kg/m³, respectively. Nevertheless, the densities obtained from stress wave speed and mass-volume ratio were correlated. The deviation of the results came from the incompatibility of MOE applied to our wood specimens in this project.

Keywords: Wood density, Eucalyptus, Piezoelectric effect

The efficiency of concrete railroad sleeper adding rubber

Nuttida Naknual & Sirinath Inthakul

PSU Wittayanusorn School, Songkhla, 90110, Thailand

Correspondence should be addressed to N.N. (nuttida13684@gmail.com)

Rubber is the common economic plant in the south of Thailand. Rubber has several characteristics that make it a valuable and widely-used. It's tough, resists water and chemicals, elastic and much more. This project aims to study about the efficiency of concrete railroad sleeper adding the different proportion of rubber. The study was done by creating 5 groups of railroad sleeper with the dimension of 15x15x10 cm, each group contains 3 samples. The study provided the regular concrete as a control group. The other groups were consisted of concrete and condensed rubber with proportions of 5%, 10% and 20% by weight, respectively. After that, test all the samples using the compression machine and the result have been compared. Based on the experiment, the conclusion is the higher proportion of rubber decreased the efficiency of pressure endurance of railroad sleeper. This study found that the most effective proportion is 5% by weight rubber contained group which is as pressure durable as the controlled group.

Keywords: Exogenous pectin, Salt stress, Thai rice

Stability and electronic property of M-Mo₂C under biaxial stress

Baramett Somtha, Naruepachai Prairahongkun, Athipat Aeidoui & Komsilp Kotmool

Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to B.S. (barametts@gmail.com)

MXene is a group of 2D materials known for their promising properties for industrial electronic devices and gas sensing behavior. The objective of this study is to investigate the electronic property of a MXene named dimolybdenum carbide (Mo₂C) under applied biaxial stress, and our problem is how will the material change when biaxial stress is applied. All the possible phases have been atomistically optimized by using GGA-PBE functional with energy cut-off 650 eV, in order to verify the thermodynamic stability. It was found that the most stable phase is $P\bar{3}m1$ (Mo₂C) with lattice parameters of $a = 3.054 \text{ \AA}$ and $c = 4.656 \text{ \AA}$. The $P\bar{3}m1$ phase has been cleaved to be the MXene structure and investigated for the relative properties. The biaxial stress has been reversely calculated with optimized atomic configuration of fixed biaxial stain varied up to 45%. The finding showed that Mo₂C is a non-magnetic material which is in good agreement with the previous calculation. By applying biaxial strain, the stress-strain relation indicates that elastic limit is at strain of 15%. The MXene structure is formed by ionic bonding between 2p-C and 4d-Mo states. We can conclude that there are certain changes from the normal in this material when applying biaxial stress. For further work, the electronic property will be carefully interpreted, as well as the superconductive behavior of this MXene when under biaxial stress.

Keywords: Biaxial stress, Superconductivity, Energy cut-off

Enhancing efficiency of zeer refrigerator by varying relative parameters

Lee Jia Jia¹, Tan Jing Yi¹, Natthaphon Suphansri² & Porama Rittibunlue²

¹National Junior College, 37 Hillcrest Road, Singapore 288913, Singapore.

²Mahidol Wittayanusorn School, Nakhon Pathom, 73170, Thailand.

Correspondence should be addressed to L. J. J. (domojiajia@gmail.com).

Hunger is a global problem and many of the developing countries, accounting to nearly 20% of the world's population, still do not have access to electricity. The annual loss of fruits and vegetables due to lack of proper storage accounts to about 35-50%. Hence, there is a strong requirement for cooling devices that can store fruits/vegetables for longer durations. A zeer refrigerator is a simple and cost effective means of food storage. The pot-in-pot system makes use of the evaporation of water from the wet porous clay surface into the ambient dry steam, allowing refrigeration in hot, dry climate. The objective of this research was to enhance the efficiency of the zeer refrigerator by varying different factors. In the preliminary stages of experimentation, where the sand was replaced by various materials (like charcoal, charcoal powder and gunny cloth), the average temperature difference between the innermost and ambient temperature was about 3°C. However, when water was replaced with different alcohols, methanol had a temperature difference up to 6°C. The temperature of the innermost pot, annular space and environment were measured to observe the effects of the changes on the cooling device.

Keywords: Zeer refrigerator, Evaporative cooling



Appendix

Participating Schools

No.	Country	School
1	Australia	John Monash Science School
2	Brunei	Maktab Duli Pengiran Muda Al-Mutadee Billah
3	Cambodia	Preah Sisowath High School
4	Germany	Droste-Hülshoff-Gymnasium
5	Hong Kong	G.T. (Ellen Yeung) College
6	India	Vasant Valley School
7	Indonesia	Center for Young Scientists
8	Israel	The Leo Baeck Education Center
9	Japan	Aichi Prefectural Handa Senior High School
10		Ritsumeikan High School
11		Senior High School at Komaba, University of Tsukuba
12		Waseda University Honjo Senior High School
13	Korea	Hana Academy Seoul
14		Korea Science Academy of KAIST
15	Lao P.D.R.	School for Gifted and Ethnic Students
16		Vientiane Secondary School
17	Malaysia	Alam Shah Science School
18		Kolej Yayasan Saad Melaka
19		Sekolah Menengah Agama (Atas) Sultan Zainal Abidin
20	Myanmar	No(1) Basic Education High School Dagon
21	Philippines	Philippine Science High School - Main Campus
22	Russia	Advanced Education and Science Center of Moscow State University (The Kolmogorov School)
23		Moscow South-Eastern School named after V.I. Chuikov
24		St.-Petersburg Lyceum Physical Technical High School affiliated with the Russian Academy of Science
25	Singapore	Anderson-Serangoon Junior College
26		National Junior College
27		National University of Singapore High School of Math & Science
28	Vietnam	VNU-HCM High School for the Gifted
29	Thailand	Angthong Pathamaroj Wittayakhom
30		Chiangmai University Demonstration School
31		Chitralada School
32		Chulalongkorn University Demonstration Secondary School
33		Darunsikkhalai Science School
34		The Demonstration School of Khon Kaen University
35		Demonstration School of Prince of Songkla University

No.	Country	School
36	Thailand	Hatyaiwittayalai school
37		Kalasinpittayasan
38		Kamnoetvidya Science Academy
39		Kasetsart University Laboratory School, Center for Educational Research and Development
40		Naresuan University Secondary Demonstration School
41		Petpittayakom School
42		Phayaophithayakhom
43		Phitsanulok Phittayakhom
44		Piboonbumpen Demonstration School
45		Princess Chulabhorn Science High School Chonburi
46		Princess Chulabhorn Science High School Loei
47		Princess Chulabhorn Science High School Lopburi
48		Princess Chulabhorn Science High School Mukdahan
49		Princess Chulabhorn Science High School Nakhon Si Thammarat
50		Princess Chulabhorn Science High School Phetchaburi
51		Princess Chulabhorn Science High School Trang
52		Princess Chulabhorn Science High School Buriram
53		Princess Chulabhorn Science High School Chiang Rai
54		Princess Chulabhorn Science High School Phitsanulok
55		Princess Chulabhorn Science High School Satun
56		PSU Wittayanusorn School
57		Ratchasima Wittayalai School
58		Saard Paderm Wittaya School
59		Sakonrajwittayanykul
60		Satthasamut
61		Sirindhorn
62		Siyanusorn
63		Uttaraditdaruni School
64		Yupparaj Wittayalai School
65		Mahidol Wittayanusorn School

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Mahidol Wittayanusorn School

364 Moo 5 Salaya,
Phutthamonthon, Nakhon Pathom 73170
Thailand

Tel.: +662 826 7291 or +662 826 7150
Fax: +662 826 7165
E-mail: school@mwit.ac.th