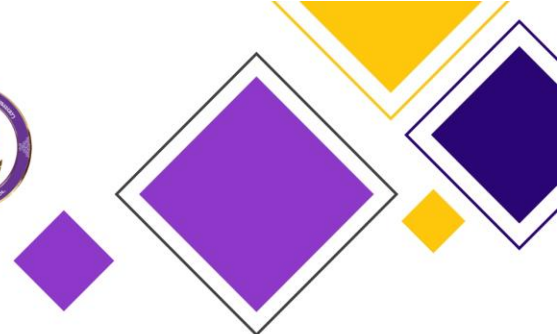




2025 ABSTRACT BOOK

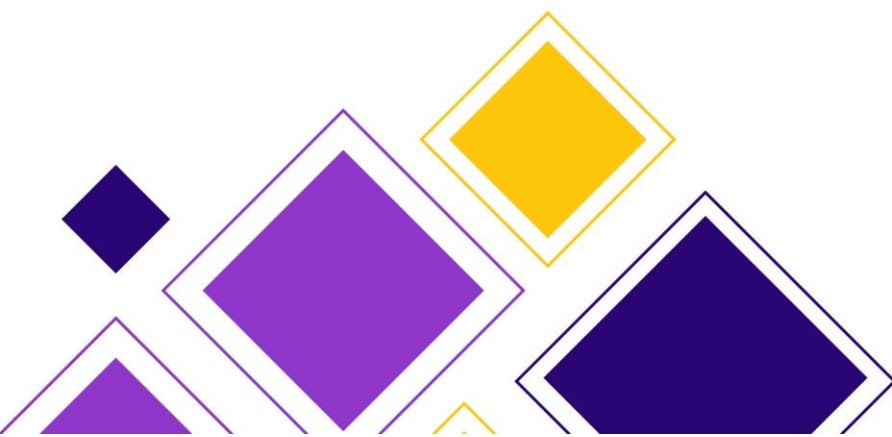
8th

25 OCTOBER 2025

at Tokai University Takawanadai
Senior High School, Tokyo, Japan

JAPAN-THAILAND

INTERNATIONAL HIGH SCHOOL
PROJECT CONFERENCE



Preface

On behalf of the Demonstration School, University of Phayao, I am pleased to participate in the 8th Japan–Thailand International High School Project Conference in 2025 at Tokai University Takanawadai Senior High School, Tokyo, Japan. The conference has been held since 2016 among the high schools in Japan and in Thailand. The purposes of the conference are (1) to encourage students to focus on research project and experiment in science, (2) to promote academic collaboration and culture tasks, and (3) to have companionship among the students and staffs in Japan and Thailand. Holding the conference eight times shows that we have been successful and have achieved our goals.

I hope that the Japan–Thailand International High School Project Conference will continue for many years, with more high schools from Japan and Thailand joining.

I would like to thank Tokai University Takanawadai Senior High School, the staff, and students for being wonderful hosts and making the conference a great success. Everyone had a great time and gained a lot of experience from the meeting.

We hope to join this meeting again next year at the 9th Japan–Thailand International High School Project Conference in 2026. Thank you once again.



Assoc. Prof. Dr. Chayan Boonyarak

Director of Demonstration School, University of Phayao

Preface

I am glad that we hold the 8th Japan-Thailand International High School Project Conference, 2025. Tokai University Takanawadai Senior High School has been designated as Super Science High School by MEXT (The Ministry of Education, Culture, Sports, Science and Technology) since 2004.

Originally this conference was held as the event in which our school reports the achievement of each goal we made of SSH activities. Later a few Japanese schools which our school has close ties with came to participate. Year by year the number of participating schools has been increasing. Since 2016 Demonstration School of University of Phayao has joined, in addition, in 2018 Mahasarakham University Demonstration School also became a participant. In 2025, these two high schools from Thailand and four Japanese high schools, [Niigata Prefectural Shibata High School, Fukui Prefectural Wakasa High School, Yamagata Prefectural Touhagakkan Senior High School, Tokyo Metropolitan High School of Science and Technology] gather and make presentations about their own projects.

I hope that all the participants will get a lot of meaningful things through this conference. Moreover, I would like the students to talk to one another and to make good friendship.

Lastly, I hope that the 8th Japan-Thailand International High School Project Conference will succeed and this event will continue.



Principal

Katagiri Tomomichi

TABLE OF CONTENT

	Page
BIOLOGY, BIODIVERSITY, ENVIRONMENTAL SCIENCE, LIFE AND HEALTH SCIENCE	
Bio-01 Coffee Beans Hot Pack: A Natural Material Innovation	1
Bio-02 Antibiotic Resistance of <i>Escherichia coli</i> Isolated from cattle feces in Phayao province	2
Bio-03 The Effect of Extraction Method on Total Phenolic Content and Total Flavonoid Content of Roasted Coffee Bean	3
Bio-04 A study on the anatomy and palynology of <i>Mammea harmandii</i> (Pierre) Kosterm. (Calophyllaceae)	4
Bio-05 The study of Antioxidant Property of <i>Eleutherine palmifolia</i> (L.) Merr Extract in Trophoblast Cells.	5
Bio-06 In Vitro Evaluation of Antioxidant and Antidiabetic Activities of <i>Bridelia ovata</i> Decne. Leaf Extract	6
Bio-07 Assessment of Chromosomal Aberration in Nile Tilapia (<i>Oreochromis niloticus</i>) from Water Sources in the University of Phayao	7
Bio-08 Phyto Stem Cells of Poisonous plants as innovation in Food & Drug's Learning System for the Future : Nodes & Stem tissue culture of Cassava (<i>Manihot esculenta</i>)	8
Bio-09 Generation of Reporter Plasmid with NF-KB Responsive Element for Screening Anti-Inflammatory Plants	9
Bio-10 Comparsion of Bacteria in Honeybees Using Gram Stain	10
Bio-11 The study of Phytochemical Contents and Cytotoxicity of <i>Eleutherine palmifolia</i> (L.) Merr Extract in Trophoblast Cells	11
Bio-12 Bioassessment of Water Quality by Using Aquatic Insects in Ang Luong Reservoir, University of Phayao	12
Bio-13 Study on Antioxidant Activities and Total Phenolics Content of <i>Prostheachea fragrans</i>	13
Bio-14 The Study of the Effects of Biochar on Plant Growth	14
Bio-15 The Study on Growth Pattern of <i>Vanda Coerulea</i> by Tissue Culture Technique	15
Bio-16 Growth and Developmental Stages of <i>Glyphoglossus molossus</i>	16
Bio-17 The Comparative Analysis of Chromosome Staining from Local Plants Extracts	17
Bio-18 The Bio Revolution of plants allergens for learning innovation platform	18
Bio-19 Isolation of lactic acid bacteria (LAB) from <i>Apis florea</i> bee bread	19

TABLE OF CONTENT

Page

BIOLOGY, BIODIVERSITY, ENVIRONMENTAL SCIENCE, LIFE AND HEALTH SCIENCE

Bio-20 Biocontrol Potential of Endophytic Bacteria from <i>Boesenbergia rotunda</i> (L.) Mansf. and <i>Alpinia galanga</i> (L.) Willd. against Major Phytopathogens of Tomato and Banana	20
Bio-21 Comparative Decomposition Rates of Food Waste by Black Soldier Fly Larvae	21
Bio-22 Triterpenoids and Antioxidant Evaluation of <i>Phellinus Rimosus</i> Mycelial Extract and their Application in an Innovative Orodispersible Film	22
Bio-23 Unlock Brain Shape Diversity in Thialand Crocodylians; A Geometric Morphometric Study of Cranial Endocast via CT Imaging	23
Bio-24 What's in Their Kiss? Unveiling the Oral Bacteriome of Dogs and Cats	24
Bio-25 The Effect Of Vitamin C On The Activity Level Of Killifish	25
Bio-26 To Help Lactic Acid Bacteria Reach the Intestines More Effectively	26
Bio-27 Vertical Position Change of Common Pond Snails According to Various Conditions	27
Bio-28 Growth Of Lesser Duckweed And Changes In Water Quality	28
Bio-29 Using Potassium Hydroxide (Koh) To Clear And Stain Fish Skeleton Specimens	29
Bio-30 Photosynthetic Response Of Tomatoes To Light Color	30
Bio-31 A Study On Turn Alternation In Pill Bugs	31
Bio-32 Observing The Effects Of Uv Irradiation On Planaria Stem Cell Regeneration	32
Bio-33 Can Used Tea Leaves be Reused to Grow Plants?	33
Bio-34 A Study On Pigment Cells In Medaka	34
Bio-35 Finding The Optimal Nutrient Ratio For Growing Japanese Parsley	35

CHEMISTRY

Chem-01 Green synthesis of Cu/Zn in catalytic activity and their applications	36
Chem-02 Influence of Non-Covalent Interactions in GH27 Alpha-Galactosidase Catalyzed Transglycosylation	37
Chem-03 Development of Protein Isolate from Indigenous Plants Using Clean Extraction Techniques and Nutritional Quality Evaluation	38
Chem-04 Preparation and Characterization of Activated Carbon from Banana Peels by Chemical Activation with KOH.	39

TABLE OF CONTENT

Page

CHEMISTRY

Chem-05	Investigating Non-Covalent Interactions in Enzyme-Substrate Complexes in GH51 arabinofuranosidase	40
Chem-06	Study of the antioxidant activity of Gardenia sootepensis Hutch by DPPH assay	41
Chem-07	Green Synthesis of Copper metal and their Applications in Catalytic Activity	42
Chem-08	Effect of gelling agents on the Characteristics of oral Mucoadhesive Gel of Chromolaena Odorata Leaf Extract	43
Chem-09	Formulation and Evaluation of A Herbal Cinnamon Jelly Incorporating Chlorpheniramine Maleate for the Relief of Allergy Symptoms	44
Chem-10	Determining A Substitute For Titanium Dioxide (Tio ₂) In Photocatalysis	45
Chem-11	Using Discarded Fruit Peels to Make Soap in Order to Promote Environmental Sustainability	46
Chem-12	Using Banana Peels To Purify Wastewater	47
Chem-13	Testing The Effect Of Different Ratios Of Sodium Thiosulfate And Urea On The Melting Rate Of Ice	48
Chem-14	Making And Comparing The Cleaning Efficacy Of Eco-Friendly Soaps Using Milk, Ash And Vegetable Oil (Marseille Soap)	49
Chem-15	Finding The Best Method To Protect Hair From Heat Damage	50
Chem-16	Making A Cream-Type Insect Repellent Using Spearmint	51
Chem-17	The Relationship Between Paper Deterioration and UV Rays	52
Chem-18	Investigating Extracted Pigments From Weeds And Their Potential As Natural Dyes And Ph Indicators	53
Chem-19	Examination Of Balloon Fuels Based On Differences In Flight	54
Chem-20	Extraction of CNF from Inedible Parts of Vegetables	55
Chem-21	Making Soap Using Lemons	56

PHYSICS, ASTRONOMY, COMPUTER AND TECHNOLOGY, ROBOTICS, STEM EDUCATION

Phy-01	Development of a Low-Cost Autonomous Prosthetic Arm Prototype for Assisting the Disabled	57
Phy-02	Effect of Magnetic Field on the Heat Transfer Performance of Ferrofluid	58
Phy-03	Determining physical conditions in NGC 40 with safe-written emission line tools	59

TABLE OF CONTENT

	Page
PHYSICS, ASTRONOMY, COMPUTER AND TECHNOLOGY, ROBOTICS, STEM EDUCATION	
Phy-04 Development of a Novel Deep Learning Algorithm for Predicting Fishman's Skeletal Maturity Indicators	60
Phy-05 Investigation of Blood Bilirubin Levels In Neonatal Jaundice for the Development of a Non-Invasive Light-Based Monitoring Device	61
Phy-06 SKY LAB	62
Phy-07 Brainwave-Based Communication aid using EEG sensor	63
Phy-08 The Effects of Plyometric Training on Two-Leg Vertical Jump Performance in Basketball Players	64
Phy-09 Machine Learning Modeling to Predict the Specific Heat Capacity Function of Concrete from its Constituent's Thermal Properties	65
Phy-10 Development of a Low-Cost Prototype Aircraft for Medicine Delivery in Remote Regions	66
Phy-11 Design and Development of a High-Intensity Ultraviolet Radiation and Fluctuating Magnetic Field System towards Advanced Experimental Applications	67
Phy-12 The Relationship Between String Sound And Accuracy In Japanese Archery (Kyudo)	68
Phy-13 Investigating The Effects Of A Building's Foundation Columns' Depths And Water-To-Soil Ratio During An Earthquake	69
Phy-14 Optimal Blade Angle for Wind Power Generation	70
Phy-15 Investigation Of Rainbow Generation Conditions Using Rainbow Beads	71
Phy-16 Exploring The Seismic Resistance Of Traditional Japanese Construction Methods	72
Phy-17 Impact Of Breakwater Angles On Tsunami Damage Minimisation	73
Phy-18 Flow Velocity Resistance In Gabions Of Different Shape	74
Phy-19 The Relationship Between The Temperature Difference And The Rotational Speed Of A Stirling Engine	75
Phy-20 Using Model Rocket and Taking Pictures from the Sky	76
Phy-21 Verification Of The Flight Path Of Japanese Archery Arrows Using High-Speed Cameras	77
Phy-22 A Preliminary Study on Developing a Furniture-Inspired Communication Robot for Natural Human–Robot Interaction	78

TABLE OF CONTENT

Page

MATHEMATICS AND STATISTICS

Math-01	Development of a Machine Learning Algorithm for Age Group Classification Using Dental Panoramic Radiographs	79
Math-02	Ai-Powered Thalassemia Risk Assessment: Leveraging Red Blood Cell Features For Precision Diagnosis	80
Math-03	Variations in Urinal Design and Spacing Across Academic Buildings: Evidence from Mahasarakham University	81
Math-04	Analysis of Factors Contributing to Population Change in Japan Using 'Random Forest'	82
Math-05	Convergence and Divergence: A Decade of "New Engel's Coefficient" in Beijing and Tokyo	83
Math-06	Solving Hit-And-Blow With Mathematics: The Quest For The Shortest Move Count	84
Math-07	Effective Positioning For Successful 3-Point Basketball Shots	85

Coffee Beans Hot Pack: A Natural Material Innovation

Viranpat Chaichanawirakun¹, Ampaphan Chonwattanakul¹, Monthinee Watthanasuwakul^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Department of Physical Therapy, School of Allied Health Sciences, University of Phayao, Phayao 56000, Thailand

*E-mail: monthinee.wa@up.ac.th

Abstract

This research aims to develop and evaluate the effectiveness of hot packs made from Robusta coffee beans (*Coffea canephora*) compared to traditional rice-based hot packs, providing an alternative method for muscle pain relief and relaxation. Five standard formulations were prepared: 100% coffee beans, 75% coffee beans + 25% rice, 50% coffee beans + 50% rice, 25% coffee beans + 75% rice, and 100% rice. Each pack was heated in a microwave at 400 W and 500 W for 3, 5, and 7 minutes. The surface temperature was recorded before heating, immediately after heating, and at 5-minute intervals until it returned to room temperature. The results showed that the hot packs containing 100% coffee beans and those with higher coffee proportions retained heat more effectively than rice-based hot packs. The maximum temperature was reached within the first three minutes, and the coffee-based hot packs-maintained warmth for over 30 minutes. These results demonstrate that coffee beans possess superior heat-retention properties compared to rice, positioning coffee-based hot packs as a promising and effective alternative for alleviating muscle soreness and promoting relaxation. Moreover, the findings of this study offer valuable insights into the future development and commercialization of natural hot pack products.

Keywords: Heat therapy, Hot pack, Coffee beans, Robusta coffee

Antibiotic Resistance of *Escherichia coli* Isolated from cattle feces in Phayao province

Ajcharyawit Sonkham¹, Phukawin Ngoenchan¹, Phuriphop Quansuwan¹,
Payungsuk Intawicha² and Nitsara Boonkerd^{3*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Division of Animal Science, School of Agriculture and Natural Resources, University of Phayao, Phayao 56000, Thailand

³ Division of Microbiology and Parasitology, School of Medical Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: nitsara.bo@up.ac.th

Abstract

Antimicrobials are used on livestock farms to treat and prevent infectious animal diseases and to promote the growth of livestock. We monitored the prevalence of antibiotic-resistant *Escherichia coli* isolates from beef cattle and calves on a livestock farm in Phayao, Thailand. Fecal samples from 25 beef cattle and 25 calves were collected monthly in May 2025. A total of 100 isolates were obtained from fecal samples collected from adult cattle and calves. MacConkey agar was used for the enrichment of all the samples and EMB agar was used as the selective media. This was followed by the confirmation of isolates using API 20E. A total of 100 *E. coli* isolates were obtained from cow and calf fecal samples, tested for susceptibility to 5 antimicrobials, and classified as resistant or non-susceptible to the antimicrobials for which breakpoints were available. The results showed that 99 *E. coli* isolates (99 %) were resistant to penicillin G (P). It was found that the resistance rate to Streptomycin (S), tetracycline (TE) and Trimethoprim sulfamethoxazole (SXT), which is equal to 6, 4 and 2 % in the isolates from calves, respectively. However, it wasn't found that the resistance rate to Enrofloxacin in all isolates from adult cattle and calves. MDR *E. coli* was observed among 3 of 100 (3%) isolates. Whereas two different multidrug-resistant profiles were observed, P-TE-S and P-SXT-S. These drug resistance patterns were found in isolates from calves. These findings highlight the concerning prevalence of antibiotic-resistant *E. coli* in cattle. Further description of the associations between resistance and how resistance spreads within farms was required. In addition, it can be used as a guideline for the selection of antibiotics in adult cattle and calves.

Keywords: *Escherichia coli* (*E. coli*); Antibiotics resistance; Cattle; Calves

The effect of extraction method on total phenolic content and total flavonoid content of roasted coffee bean

Boonyisa Kamthongkeaw¹, Keawkanlaya Panjarak¹, Komsak Pintha²,

Payungsak Tantipaiboonwong² and Wipasiri Soonthornchai^{1,3*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Division of Biochemistry, School of Medicine Sciences, University of Phayao, Phayao 56000, Thailand

³ School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: payungsak.t@gmail.com

Abstract

The research scope is the determination of total polyphenol content and total flavonoid content of roasted coffee bean extracts using two different extractions. Light, medium, and dark roasted coffee beans were extracted by hot water (90°C for 10 minutes) and 95% ethanol (for 12 hours). The findings revealed that light roast coffee bean extract with hot water had the highest total phenolic content, followed by medium roast coffee bean extract with hot water, dark roast coffee bean extract with hot water, light roast coffee bean extract with ethanol, medium roast coffee bean extract with ethanol and finally, the lowest was dark roast coffee bean extract with ethanol. Similarly, light roast coffee bean extract with hot water exhibited the highest total flavonoid content, followed by medium roast coffee bean extract with hot water, dark roast coffee bean extract with hot water, light roast coffee bean extract with ethanol, medium roast coffee bean extract with ethanol and lastly, dark roast coffee bean extract with ethanol. These results will be useful for the development of the coffee-based drink, food and antioxidant product.

Keywords: Roasted coffee; Phenolic; Flavonoid; Antioxidant

A study on the anatomy and palynology of *Mammea harmandii* (Pierre) Kosterm. (Calophyllaceae)

Donratda Plukpetpisan¹, Thaksaporn Whansiang¹, Sirikorn Punkui¹ and Boonchaung Boonsuk^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Plant Biology Research Unit, Program in Biology, School of Science,
University of Phayao, Phayao 56000, Thailand

* Corresponding author email: boonchuang.boonsuk@up.ac.th

Abstract

Mammea harmandii is a plant species in the family Calophyllaceae. It is found in evergreen forests across Thailand, Laos, and the Malay Peninsula. Anatomical and palynological data on this species remain limited. This study aimed to examine the anatomical structures and pollen morphology of *M. harmandii*, using plant specimens collected from the University of Phayao. For anatomical analysis, the paraffin method was used to prepare cross sections of the stem, petiole, midrib, leaf margin, and leaf blade. The results showed that the stem contains numerous parenchyma cells. The petiole has a heart shaped vascular bundle, with several accessory vascular bundles. The leaf exhibits a thick cuticle layer, with clearly differentiated internal tissues. There are three layers of palisade mesophyll and a spongy mesophyll with many intercellular air spaces. The leaf margin is rounded and curves downward. Resin ducts are present in all plant parts, and many cells contain accumulated substances. For palynological analysis, the acetolysis method was used. Pollen grains from male flowers were single, with tricolporate apertures and a subprolate shape, measuring 36-38.5 µm in polar axis length. Pollen from hermaphroditic flowers were single, with more variable shapes, ranging from 28.5-37 µm in polar axis length. This study provides foundational anatomical and palynological data for *Mammea harmandii*, which will be useful for future botanical, taxonomic, and ecological research within the Calophyllaceae family.

Keywords: *Mammea harmandii*, Calophyllaceae, Plant anatomy, Palynology, Resin ducts

The study of antioxidant property of *Eleutherine palmifolia* (L.) Merr extract in trophoblast cells.

Kalyarat Mahawan¹, Nachariya Wongnor¹ and Wittaya Chaiwangyen^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Division of Biochemistry, School of Medical Sciences, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: wittaya.ch@up.ac.th

Abstract

Trophoblast cells play a crucial role in the development of the embryo of the placenta. If there is inflammation of the placenta, it will affect the functioning of trophoblast cells, which may be caused by several factors such as the increase of free radicals, inflammation, or infection, etc. *Eleutherine palmifolia* (L.) Merr is a local medicinal plant with diuretic and laxative effects. Pharmacological studies have found that this plant has antioxidant properties, antibacterial effects, and enhances the immune system. The research focuses on studying the antioxidant effects of *Eleutherine palmifolia* (L.) Merr extract on trophoblast cells. This study aimed to analyze the antioxidant properties of *Eleutherine palmifolia* (L.) Merr extract boiled in hot water for 5 and 10 minutes at 90 °C, using the DPPH radical scavenging assay and the ABTS radical scavenging assay. The findings revealed that the ABTS radical scavenging assay demonstrated significantly different antioxidant activity and greater efficacy in radical inhibition. However, the DPPH radical scavenging assay showed no significant differences and required considerably higher concentrations relative to the standard substances to achieve effective inhibition. Future research will focus on investigating the anti-inflammatory effects of *Eleutherine palmifolia* (L.) Merr extract on trophoblast cells to elucidate its cellular activity and assess its potential for development into pharmaceutical and cosmetic products.

Keywords: *Eleutherine palmifolia* (L.) Merr; trophoblast cells; antioxidant

***In vitro* evaluation of antioxidant and antidiabetic activities of
Bridelia ovata Decne. leaf extract**

Kasideth Boonpa¹, Khanesorn Phetpinit¹, Noppakorn Piromplad¹ and Amnart Onsaart^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Division of Biochemistry, School of Medical Sciences, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: amnart.on@up.ac.th

Abstract

Diabetes mellitus is a global health challenge characterized by impaired insulin production or action, leading to chronic hyperglycemia and serious complications including nephropathy, neuropathy, and cardiovascular disease. A major underlying mechanism of these complications is the formation of advanced glycation end products (AGEs), which promote inflammation and cellular injury. In search of natural therapeutic agents, this study evaluated the phytochemical composition, antioxidant, and antidiabetic activities of *Bridelia ovata* Decne. leaf extract. The leaves were extracted with water and 70% ethanol, and the extracts were assessed for total phenolic content (TPC) and total flavonoid content (TFC). Antioxidant activity was measured using DPPH and ABTS radical scavenging assays, while antidiabetic potential was determined by α -amylase inhibitory activity. The ethanol extract exhibited higher TPC, TFC, and stronger antioxidant activity compared to the aqueous extract. In addition, it demonstrated significant α -amylase inhibition, suggesting a capacity to reduce postprandial hyperglycemia and delay AGEs formation. These findings indicate that *Bridelia ovata* Decne. leaf extract is a promising natural source of antioxidants with potential benefits for managing diabetes and its complications.

Keywords: *Bridelia ovata* Decne, Diabetes mellitus, Chronic Hyperglycemia, Advanced Glycation End Products (AGEs), α -amylase

Assessment of Chromosomal Aberration in Nile Tilapia (*Oreochromis niloticus*) from Water Sources in the University of Phayao

Motanapond Kantiphan¹, Supalak Yaiwong¹, Wipasiri Soonthornchai¹ and Kriengkrai Seetapan^{2*}

¹Demonstration School University of Phayao, Phayao 56000, Thailand

²Technology and Innovation for Fisheries, Faculty of Agriculture and Natural Resources

University of Phayao, Phayao 56000, Thailand

*E-mail: kook82@hotmail.com; Kriengkrai.se@up.ac.th

Abstract

The wastewater from numerous buildings at the University of Phayao is discharged into a waterway that drains into the university's water sources, resulting in contamination from chemicals and heavy metals. These contaminants might have an adverse impact on the living organisms in the water. Therefore, the objective of this study was to investigate and compare the chromosomal aberrations in Nile tilapia (*Oreochromis niloticus*) from Huai Thap Chang and the Sufficiency Economy Learning Center within the University of Phayao's water sources. Nile tilapia samples were collected from both areas to observe chromosomal aberrations, which were studied using kidney tissue. The results indicated that the diploid chromosome number of *O. niloticus* was $2n = 44$. At the Sufficiency Economy Learning Center, the percentage of cell aberrations was $4.88 \pm 0.84\%$, with 4 types of chromosomal aberrations, including single chromatid break (SCB), deletion (D), dicentric (DC), and fragmentation (F). In contrast, at Huai Thap Chang, the percentage of cell aberrations was $24.58 \pm 1.61\%$, with 9 types of chromosomal aberrations, including single chromatid gap (SCG), single chromatid break (SCB), iso-chromatid gap (ISCG), deletion (D), dicentric (DC), centric fusions (CF), fragmentation (F), centromere gap (CG), and ring chromosome (R).

Keywords: wastewater, heavy metals, *Oreochromis niloticus*, chromosomal aberration

Phyto Stem Cells of Poisonous plants as innovation in food & drug's learning system for the future: Nodes & Stem tissue culture of Cassava (*Manihot esculenta*)

Panattapong Areesomboon¹, Pantharee Songkhamchum¹ and Dr.rer.nat Chatchawal Wongchai ^{2*}

¹Demonstratiom School University of Phayao , Phayao 56000, Thailand

²Division Biology, School of Science, University of Phayao, Phayao 56000, Thailand

*Chatchawal.wo@up.ac.th

Abstract

Cassava (*Manihot esculenta*), a perennial shrub in the family *Euphorbiaceae*, is an important food crop widely cultivated in tropical and subtropical regions. The plant contains cyanogenic glycosides, primarily linamarin and lotaustralin, which undergo enzymatic hydrolysis upon tissue disruption, releasing hydrogen cyanide (HCN), a toxic compound that poses significant health risks when ingested at high levels. This has led to the conceptualization of utilizing the preliminary toxin and cell for metabolomics and genomics applications. Nodal explants of Cassava were cultured under aseptic conditions to assess the effects of surface sterilization on survival rate of nodal cultures. There are 4 treatments (10%,15% clorox(v/v) , 10 mins soak / 10%,15% clorox(v/v),15 mins soak) with 3 replications (9 bottles per replications) were used in this experiment. The results demonstrated that the highest (26.36%) and the lowest (4.55%) survival rate discovered at 15% clorox (v/v) /15 mins soaked and 10% clorox (v/v) / 10 mins soaked. This finding appropriates for further plants cell culture experiments and development of callus culture which will use to support plant genomics and plant gene transformation.

Keyword: Cyanogenic glycosides, Callus, Cassava, Phyto stem cell

Generation of Reporter Plasmid with NF-KB Responsive Element for Screening Anti-Inflammatory Plants

Papitchaya Phankaew¹, Pavarisa Chumkomon¹, Premnaphat Phumchan¹, Chutamas Thepmalee ^{2*}

¹ Demonstration School, University of Phayao, Phayao 56000, Thailand

² Division of Biochemistry, School of Medical Sciences, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: chutamas.th@up.ac.th

Abstract

Inflammation is a fundamental biological response to harmful stimuli; however, when it becomes chronic, it plays a pivotal role in the pathogenesis of numerous diseases, including cardiovascular disorders, diabetes mellitus (DM), and cancers. Natural products have garnered increasing attention as sources of anti-inflammatory compounds, owing to their wide availability and generally favorable safety profiles compared to synthetic drugs. Conventional methods for evaluating the anti-inflammatory effects of plant extracts, such as nitric oxide (NO) production assays, reactive oxygen species (ROS) assays, and cytokine quantification, are often labor-intensive, time-consuming, and sometimes lack specificity. To overcome these limitations, the present study aims to establish a more efficient and specific reporter system for real-time monitoring of NF-KB activity associated with inflammatory responses. The NF-KB response elements F1, F2, and F3 were designed based on published sequences and amplified by PCR. The amplicons were subsequently cloned into the pCDH lentiviral plasmid, downstream of the mCherry reporter gene, enabling the expression of red fluorescent protein in cells upon LPS-induced NF-KB activation. Recombinant plasmids containing F1, F2, and F3 were verified by Sanger sequencing, which confirmed that F1 clones 23, 58, and 59; F2 clones 13, 26, 31, 41, and 44; and F3 clones 35, 42, and 43 possessed sequences identical to the corresponding NF-KB response element templates. For future studies, stable NF-KB-mCherry reporter cell lines will be generated via lentiviral delivery, enabling long-term monitoring of NF-KB signaling and evaluation of the effects of anti-inflammatory drugs and plant extracts. These stable reporter cell lines will provide a powerful in vitro platform for the high-throughput screening of plant extracts, pharmaceutical compounds, and cytokines that modulate NF-KB activation.

Keywords: NF-KB, Reporter system, Anti-inflammatory screening, Lentiviral delivery

Comparsion of Bacteria in Honeybees Using Gram Stain

Peeradon Aupkaeo¹, Nara Sasaki¹, Plainaphat Saenban¹, Tipwan Suppasat²
and Sirikarn Sanpa³

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Biology Program, School of Science, University of Phayao, Phayao 56000, Thailand

³ Program in Microbiology, School of Medical Sciences, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: tipwan.su@up.ac.th

Abstract

Microorganisms, especially bacteria in the gut of a honey bee, are essential for the bee's health. This research aimed to characterize the gut bacteria of honeybees using the Gram stain method, a microbiological technique that differentiates bacteria into Gram-positive and Gram-negative categories. The study investigated bacterial colonies from the gut of five *Apis cerana* (N = 5) and *Apis florea* (N = 5) individuals. In the experimental procedure, the whole gut of the bee was dissected and kept in normal saline. Then, the gut sample was serially diluted and cultured on Plate Count Agar (PCA). The PCA plate was incubated for 24 hours and screened for bacterial colonies on agar. Then, the bacterial colonies were photographed under a stereo microscope, and distinct colonies were selected for a Gram stain procedure. Finally, the stained bacteria were observed and photographed under a 1000 magnification compound light microscope. The results revealed that the bee gut microbiota was predominantly composed of Gram-positive bacteria, rather than Gram-negative bacteria. In terms of morphology, coccus-shaped bacteria were more abundant than rod-shaped bacteria. These findings suggest that the diversity of gut bacteria in bees reflects the relationship between the bee's intestinal structure, its environment, and diet, all of which are crucial for maintaining the health and survival of the bee.

Keywords: gut microbiota; gram stain; gram positive; gram negative; morphology

The study of phytochemical contents and cytotoxicity of *Eleutherine palmifolia* (L.) Merr extract in trophoblast cells

Phitchapha Sangphet¹, Jenisa Khenaphum¹, Thanyapinya Kanti¹ and Wittaya Chaiwangyen^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Division of Biochemistry, School of Medical Sciences, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: wittaya@up.ac.th

Abstract

Eleutherine palmifolia (L.) Merr., commonly known in Thailand as Wan hom daeng, has been traditionally used in Thai traditional medicine. Previous reports have indicated that extracts of *Eleutherine palmifolia* possess anticancer and antioxidant properties. Trophoblast cells are essential placental cells during pregnancy, and their dysfunction may lead to a range of complications in both the mother and the fetus. Identifying bioactive phytochemicals from natural plant sources that are non-cytotoxic to trophoblast cells may contribute to the prevention or mitigation of potential physiological abnormalities in humans. This study aimed to: (1) analyze the phytochemical constituents, and (2) assess the cytotoxic effects of *Eleutherine palmifolia* extract on human trophoblast cells. The phytochemical content was comparatively analyzed between extracts obtained through hot water extraction for 5 and 10 minutes. Total phenolic content in the *Eleutherine palmifolia* extract was determined using the Folin-ciocalteu assay and total flavonoid content was measured using the aluminum chloride colorimetric assay. The results showed that the total phenolic content in the extract obtained by hot-water extraction for 10 minutes was higher than that from 5 minutes extraction, whereas the total flavonoid content did not differ significantly between the two extracts. In the next phase, the project will focus on investigating the cytotoxicity of the extract on trophoblast cells to further assess its safety.

Keywords: *Eleutherine palmifolia* (L.) Merr., phytochemical, phenolic, flavonoid, trophoblast cell

Bioassessment of Water Quality by Using Aquatic Insects in Ang Luong Reservoir, University of Phayao

Pipatra Palidwanon¹, Thanpitcha Kuna¹ and Chayanant Jitmanee^{1,2}

¹ Demonstration School, University of Phayao 56000, Thailand

² School of Energy and Environment, Program in Energy and Environmental Management, University of Phayao

* Corresponding author email: chayanant.ji@up.ac.th

Abstract

This study aimed to evaluate the water quality of the Ang Luong Reservoir at the University of Phayao by analyzing through BMWP score of aquatic insects and physicochemical parameters such as pH, conductivity, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD), and total dissolved solids (TDS). Aquatic insects were collected from five sampling sites on April 2025, and identified using stereo microscopes. Aquatic insect was carried out using the Biological Monitoring Working Party (BMWP) score and the Average Score per Taxon (ASPT) index. The results from aquatic insect diversity indicating that the water quality is moderate to poor. These findings were consistent with physical-chemical parameters. The water quality of Ang Luong Reservoir was found under class 2 of Thailand's surface water quality standards which suitable for general consumption after treatment, aquatic life conservation and some recreation activities. From the results of this study, the use of aquatic insects as bioindicators can be used to monitor and follow up the water quality of Ang Luong Reservoir, University of Phayao. The study underscores the reliability of biological indicators in freshwater quality assessment and emphasizes the importance of ongoing conservation efforts to preserve aquatic ecosystem health.

Keywords: Aquatic insects, ASPT, BMWP Score, Physical-Chemical Parameters

Study on Antioxidant Activities and Total Phenolics Content of *Prostheachea fragrans*

Pranisara Maneejak¹, Preedaporn Suksumran¹, Paphitchaya Puttha¹ and Thanyaporn Thangjaroenchai^{1,2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Department of Biology, School of Science, University of Phayao, Phayao, 56000, Thailand

* Corresponding author email: thanyaporn.bo@up.ac.th

Abstract

Orchids are regarded as plants of aesthetic value and are also recognized as reservoirs of phytochemicals with significant biological activities. *Prostheachea fragrans* is an epiphytic orchid characterized by pseudobulbs elongated dark-green leaves, and whitish-green flowers with a distinctive fragrance. Previous studies have reported the presence of several bioactive compounds in this species including flavonoids alkaloids tannins terpenoids and phenolics. These compounds are known to exhibit anti-inflammatory antimicrobial analgesic and antioxidant properties. The objective of this study was to determine the total phenolic content and antioxidant activity of extracts from *Prostheachea fragrans*, measured with a spectrophotometer at 765 nm and 517 nm, respectively. The Folin–Ciocalteu method was employed to quantify the total phenolic content, expressed as gallic acid equivalents (GAE), which was found to be 12.49 ± 0.43 mg GAE/g extract. The highest antioxidant activity (56%) was observed at 1.0 mg/mL, while antioxidant activity was assessed using the DPPH radical scavenging assay. This research provides fundamental data for future phytochemical investigations and offers opportunities for further development of bioactive compounds from orchids. Moreover, it underlines the importance of sustainable utilization of plant resources in advancing innovative applications of natural products.

Keywords: *Prostheachea fragrans*, Phenolic compounds, Antioxidant activity

The Study of the Effects of Biochar on Plant Growth

Tanadon Buasang¹, Tapanawat Boonwong¹, Pongsakorn Yeamphuang¹ and

Chayanan Jitmanee^{1,2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Energy and Environment University of Phayao, Phayao 56000, Thailand

*Corresponding author email: chayanan.ji@up.ac.th

Abstract

This study investigated the effects of biochar on the growth of mung bean plants (*Vigna radiata*). Biochar, a carbon-rich material produced from biomass through the process of pyrolysis, is recognized for enhancing soil properties by improving water retention and nutrient availability. In this experiment, mung beans were cultivated in soils containing 0%, 10%, 30%, 50%, and 70% biochar. Plant height, stem diameter, leaf length, and number of leaves were measured over a four weeks period. Among the treatments, 30% biochar yielded the greatest improvements in all measured growth parameters, whereas the control (0%) exhibited the poorest performance. In contrast, the 70% biochar treatment suppressed growth, likely due to excessive water drainage or nutrient imbalance. These findings indicate that biochar can enhance mung bean growth when applied at optimal rates, with 30% emerging as the most effective concentration under the conditions of this study.

Keywords: biochar; *Vigna radiata*; Plant growth; planting material; Pyrolysis

The study on growth pattern of *Vanda coerulea* by tissue culture technique

Tanarak Pradubsri¹, Paphawarin Promachot¹, Hathairat Laksuk¹ and

Thanyaporn Thangjaroenchai^{1,2*}

¹ Demonstration School, University of Phayao 56000, Thailand

² Department of Biology, School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: thanyaporn.bo@up.ac.th

Abstract

The objective of this study was to investigate the growth and development of *Vanda coerulea* orchids and to develop an appropriate culture medium for seed germination, in order to address the declining population of this species in its natural habitat due to significant deforestation in Thailand. Seed capsule of *Vanda coerulea* were collected from Pang Mapha District, Mae Hong Son Province. The capsules were surface sterilized using 30% NaCl (sodium chloride) solution for 15 minutes. Subsequently, the seeds were transferred to Murashige and Skoog (MS) medium under aseptic conditions. The germination and development were monitored and recorded until the protocorm stage. Protocorms were then transferred to Vacin and Went (VW) medium supplemented with a 21-21-21 NPK fertilizer. The results indicated that the seed germination pattern of *Vanda coerulea* could be divided into six stages for 16 weeks. The highest growth performance was observed in the VW medium, with an average of 3.00 ± 0.82 leaves/plants, an average width of leaves 0.42 ± 0.08 cm/plants, an average leaf length of 1.10 ± 0.32 cm/plants, an average 3.00 ± 0.94 root/plants, and an average plant height of 1.29 ± 0.36 cm/plants.

Keywords: *Vanda coerulea*, Seed germination, Tissue culture

Growth and Developmental Stages of *Glyphoglossus molossus*

Wachirawit Kaewkantho¹, Wipasiri Soonthornchai² and Kriengkrai Seetapan³

¹ Demonstration School University of Phayao, Phayao 56000,

²Program in Biology, Faculty of Science, University of Phayao

³ School of Agriculture and Natural Resources, University of Phayao,
Tumbol Maeka, Muang, Phayao 56000, Thailand

* Corresponding author email:kook82@hotmail.com

Abstract

The truncate-snouted frog (*Glyphoglossus molossus*) is widely distributed in northern and northeastern Thailand. It is economically important to the community in the monsoon season, which is when the people collect them for eating and selling, leading to the reduced population of this frog. Therefore, the objective of this study is to investigate the development of *G. molossus* for general information about normal morphological changes during metamorphosis. In this study, embryos and larvae of *G. molossus* were observed from hatching until complete metamorphosis, focusing on two main periods: the tadpole stage (stage 1–19) and the metamorphic stage (stage 20–25). The results showed that the morphological development of *G. molossus* progressed continuously and throughout these stages. The rate of somatic development of *G. molossus* was relatively rapid compared with other anurans. These findings provide essential information for further biological studies and applications of *G. molossus* in various fields of research.

Keywords: developmental period, tadpole, metamorphosis, *Glyphoglossus molossus*,

The Comparative Analysis of Chromosome Staining from Local Plants Extracts

Wannaporn Sungpankao¹, Pharitporn Saatdee¹, Paweenapa Pinsaimoon¹ and Puntitra Kamol^{1*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

* Corresponding author email: puntitra.ka@up.ac.th

Abstract

Chromosome staining is an essential technique in cytology, commonly performed with synthetic dyes such as Aceto-carmine. Although effective, these dyes may be costly, less environmentally friendly, and potentially hazardous for regular use in educational laboratories. Natural pigments from plants provide a promising alternative, offering eco-friendly and accessible options. In this study, extracts from four local plants *Carissa carandas*, *Basella alba*, *Clitoria ternatea*, and *Oryza sativa* var. *glutinosa* were prepared and applied to onion root tip cells to evaluate their staining potential. The performance of each extract was assessed in terms of color intensity, chromosome visibility, and the clarity of mitotic phases under a light microscope. Among the tested plants, *Carissa carandas* and *Basella alba* produced results most comparable to Aceto-carmine, while *Clitoria ternatea* and *Oryza sativa* var. *glutinosa* showed weaker staining efficiency. These findings demonstrate that specific plant extracts can serve as low-cost and sustainable alternatives to chemical stains. Future work will include testing additional candidates, such as *Eleutherine bulbosa* (Mill.) Urb, to expand the potential applications of natural dyes in cytology.

Keywords: chromosome staining; plant extracts; cytology; natural dye

The Bio Revolution of plants allergens for learning innovation platform

Yannaphat khiaocha-oom¹, Poonnanant Hansamut¹, Peerapon Promwangkwa¹, Chatchawal Wongchai²

¹Demonstration School University of Phayao, Phayao 56000, Thailand

²Division Biology, School of Science, University of Phayao, Phayao 56000, Thailand Chatchawal.wo@up.ac.th

Abstract

This study investigates plant-derived allergens, most of which are proteins capable of binding to human antibodies and eliciting allergic responses such as rhinorrhea, skin rashes, and other related symptoms. Since these proteins are encoded by plant genes, the research focuses on identifying the genes responsible for allergen production. Nucleotide sequences of the target genes were first retrieved using BLAST (Basic Local Alignment Search Tool), and the resulting data were subsequently employed to construct phylogenetic trees with MEGA (Molecular Evolutionary Genetics Analysis) for comparative analysis across plant species. The phylogenetic tree revealed that profilin genes from *Zea mays* clustered closely with those of other monocot species such as *Sorghum bicolor*, *Setaria italica*, *Oryza sativa*, and *Triticum aestivum*, indicating strong evolutionary conservation within the Poaceae family. In contrast, profilin sequences from dicot species such as *Raphanus sativus*, *Hibiscus syriacus*, and *Citrus sinensis* formed distinct clades, reflecting their divergence from monocot lineages.

In addition, amino acid sequence comparisons demonstrated that the maize allergen protein *Zea m 4* (profilin, 131 amino acids) shares high sequence identity with homologous profilins in a wide range of plants. The highest similarity was observed in monocots such as *Miscanthus floridulus* (92.37%), *Sorghum bicolor* (88.55%), and *Oryza sativa* (85.38%), while substantial homology (approximately 80–83%) was also found in several dicot species including *Lactuca sativa*, *Hibiscus syriacus*, and *Citrus × Clementina*. These results highlight the widespread distribution and evolutionary conservation of profilin across both monocots and dicots. However, it remains uncertain whether proteins with such high homology share equivalent allergenic potential, as this may be influenced by post-translational modifications or differences in three-dimensional protein structures affecting antibody recognition.

Keywords: Plant-derived allergens; Allergenic proteins; BLAST (Basic Local Alignment Search Tool); Phylogenetic analysis; Post-translational modification (PTM)

Isolation of lactic acid bacteria (LAB) from *Apis florea* bee bread

Aphichaya khodna¹, Anyarat Luangthepnimit¹ and Wipasiri Soonthornchai^{*2}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Biology Programs, Schools of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: wipasiri.so@up.ac.th

Abstract

Bee bread is a widely consumed beneficial bee product, with the latter produced through the fermentation of bee pollen mediated by a specific group of lactic acid bacteria (LAB), which play essential roles in food, agricultural, and clinical applications. Therefore, this study aims to isolate the LAB and identify the Gram of these bacteria. The LAB were isolated from the *Apis florea* bee bread using the MRS AGAR supplemented with the 1% calcium carbonate (CaCO_3). The formation of a clear zone around colonies was used as a primary indicator of LAB. Consequently, all isolates were subjected to Gram staining for preliminary classification. The results revealed a total of 36 LAB isolates were initially obtained, with 30 remaining viable after storage. Bee bread with a semi-liquid appearance yielded the highest number of isolates ($n=13$), followed by bee bread with a firm texture ($n=9$) and a reddish appearance ($n=8$). The lowest number of isolates ($n=6$) was obtained from bee bread with a normal appearance. Specifically, plate C3, containing a sample from the third hive with a semi-liquid appearance, yielded the highest count of 11 isolates. These findings suggest that selecting bee bread based on its appearance could be an effective strategy for sourcing beneficial LAB for future applications, such as evaluating their antibacterial properties.

Keywords: Bee bread; *Apis florea*; Lactic acid bacteria (LAB); Gram staining; Fermentation; MRS agar

**Biocontrol Potential of Endophytic Bacteria from *Boesenbergia rotunda* (L.)
Mansf. and *Alpinia galanga* (L.) Willd. against Major Phytopathogens
of Tomato and Banana**

Rungphailin Wanlanon¹, Rujisaya Pontri¹, Anitta Kongsuk¹ and Aphidech Sangdee²

¹Maharakham University Demonstration School (secondary), Maharakham, 44150, Thailand,

²Maharakham University, Department of Biology, Faculty of science, Maharakham, 44150, Thailand

Email: aphidech.s@msu.ac.th

Abstract

Endophytic bacteria are increasingly recognized as promising sources of biocontrol agents against destructive plant pathogenic fungi. In this study, bacterial endophytes were isolated from *Boesenbergia rotunda* (L.) Mansf. and *Alpinia galanga* (L.) Willd. and evaluated for their antagonistic activity. Several isolates, including BRR1-1, BRR2-2, BRR3-3, and BRKS1-2, exhibited strong inhibitory effects against major phytopathogens. In dual culture assays, these isolates suppressed the growth of *Fusarium oxysporum* f. sp. *lycopersici* (Fol) and *F. oxysporum* f. sp. *cubense* (Foc) by more than 70%, while isolate BRKS1-2 achieved up to 80% inhibition against Foc. Notably, BRKS1-2 also inhibited *Sclerotium rolfsii* isolate snpo1, with 31.6% growth reduction. Among the tested isolates, BRKS1-2 exhibited the highest antifungal activity. Furthermore, culture filtrates of BRKS1-2 collected at 24, 48, and 72 hours were tested against all fungal pathogens. The results demonstrated that the culture filtrates inhibited the mycelial growth of all pathogens in a time-dependent manner. These findings highlight the potential of endophytic bacteria as effective biocontrol candidates for the sustainable management of soil-borne fungal diseases. Further studies will focus on the taxonomic identification, genomic features, and functional characterization of isolate BRKS1-2.

Keywords: Endophytic bacteria, Biocontrol, Pathogenic fungi.

Comparative Decomposition Rates of Food Waste by Black Soldier Fly Larvae

Chayangkool Sinthukhot¹, Natthawut Chantason¹, Peeranat Nachanthong¹ and Nakorn Pradit^{2*}

¹Maharakham University Demonstration School (Secondary), Maha Sarakham 44150, Thailand

²Walai Rukhvet Botanical Research Institute, Maharakham University, Maha Sarakham 44150, Thailand

* Corresponding author email: nakorn.p@msu.ac.th

Abstract

Black soldier fly larvae (BSF), *Hermetia illucens* L., are widely utilized for converting organic waste, especially food waste, into a protein-rich source for animal feed. In this study, the efficiency of BSF larvae in decomposing different types of food waste from our school was examined. Three major food wastes, including rice, cabbage, and watermelon peel, were prepared in seven treatments: single types (only rice, only cabbage, and only watermelon peel), three mixtures of two food wastes, and a mixture of all three. To reduce excess moisture, rice bran was added to every condition (2 food waste: 1 rice bran by weight). The total weight of each treatment is 100 grams. Each treatment was placed in a plastic container (12 × 17 × 8 cm) with three replications, and one hundred newly hatched BSF larvae were introduced into each container. The reduction of food waste weight was recorded daily, along with the time required for larvae to reach the pupal stage. The highest reduction rate of food waste was in the mixture of rice and watermelon peel (-10.352), whereas the lowest reduction rate occurred in rice only (-1.09048). The mixture of three wastes had the shortest pupation time (9 days), compared to the others (12 days). These findings suggest that the types of waste strongly influence the decomposition efficiency of BSF larvae. In future studies, environmental factors (e.g., light conditions) will be evaluated for their effects on the efficiency of BSF decomposition.

Keywords: Black soldier fly; Food waste; Decomposition efficiency; Rice bran; Pupal development

Triterpenoids and antioxidant evaluation of *Phellinus rimosus* mycelial extract and their application in an innovative orodispersible film

Apitchaya Poltue¹ Phailin Seedao¹ Pornnapat Pantarit¹

Asst.Prof.Dr. Wanwisa Khunawattanakul², Assoc.Prof.Dr. Prasoborn Rinthong²,

Assoc. Prof. Dr. rer. nat. Panida Loutchanwoot³

¹Maharakham University Demonstration School (Secondary), Maha Sarakham, 44150, Thailand

²Faculty of Pharmacy, Maharakham University, Maha Sarakham, 44150, Thailand

³MSU & ARDA *Phellinus* Research and Innovation Unit, Faculty of Science, Maharakham University, Maha Sarakham, 44150, Thailand

*Corresponding author email: panida.l@msu.ac.th

Abstract

This study aimed to analyze total triterpenoid content and antioxidant activity of *Phellinus rimosus* mycelia extracts and to develop an innovative orodispersible film. Spectrophotometric analysis showed that methanol extract had the highest total triterpenoid content at 37.31 ± 2.31 mg UAE/g extract, which was significantly higher than ethanol extract (21.12 ± 1.78 mg UAE/g extract) and hot water extract (6.61 ± 0.01 mg UAE/g extract). The antioxidant activity, as evaluated by DPPH and ABTS assays, demonstrated that ethanol extract exhibited the strongest antioxidant activity with IC₅₀ values of 90.38 ± 2.04 µg/mL and 53.46 ± 0.98 µg/mL, respectively. Using the solvent casting method, an orodispersible film formulation based on the ethanol extract was successfully developed, consisting of hydroxypropyl methylcellulose, propylene glycol, sucralose, and sodium starch glycolate. Two different solvents, hot water extract from butterfly pea flowers and pandan leaves, were used. The films had thicknesses of 0.15 ± 0.02 mm and 0.22 ± 0.01 mm, respectively. Both formulations demonstrated excellent folding endurance, withstanding over 300 folds. The disintegration times were 8.11 ± 0.77 min and 3.41 ± 0.06 min for films formulated with butterfly pea flower extract and pandan leaf extract. Considering the disintegration time, the pandan leaf extract formulation was deemed more suitable for further product development in accordance with pharmaceutical standards. This research is the first to demonstrate that ethanol extract from *Phellinus rimosus* mycelia is a rich source of effective triterpenoids with potent antioxidant activity, making it a promising candidate for application in an antioxidant orodispersible film.

Keywords: *Phellinus rimosus*, Mycelial extract, Antioxidant activity, Triterpenoids, Orodispersible film

Unlock Brain Shape Diversity in Thailand Crocodylians; A Geometric Morphometric Study of Cranial Endocast via CT Imaging

Narawadee Tuisimma¹, Sirikorn Sungchawake¹, Suchanyaon Manochat¹, Parinya Thanoi²,
Komsorn Lauprasert^{2*}

¹ Mahasarakham University Demonstration School (Secondary), Mahasarakham, 44150, Thailand

² Departments of Biology, Faculty of Science, Mahasarakham, 44150, Thailand

* Corresponding author email: komsorn.l@mau.ac.th

Abstract

The results revealed distinct interspecific differences. *C. siamensis* exhibited a relatively large and moderately broad brain cavity, while *C. porosus* possessed a smaller, more slender brain but disproportionately large olfactory bulbs. In contrast, *T. schlegelii* had the most elongated and slender brain with reduced olfactory bulbs, consistent with its longirostrine skull morphology. Principal Component Analysis (PC1 + PC2 = 53.54% of variance) clearly separated the three taxa: the two *Crocodylus* species clustered apart despite their congeneric status, whereas *T. schlegelii* diverged strongly along PC2. These findings highlight how crocodilian brain morphology is tightly constrained by cranial anatomy yet reflects ecological adaptations and sensory specialization. The combination of CT-based endocast analysis and geometric morphometrics provides a robust framework for understanding the evolutionary neuroanatomy of living reptiles.

Keywords: CT Scan, Endocast, Crocodylan, Geometric morphometrics

What's in Their Kiss?

Unveiling the Oral Bacteriome of Dogs and Cats

Nisachon Chaowang¹, Phimchaya Srisomporn¹, Phiramada Anu-an¹, Nuchsupha Sunthamala^{2*}

¹Maharakham University Demonstration School (Secondary), Maha Sarakham, 44150, Thailand ²Department of Biology, Faculty of Science, Maharakham University, Maha Sarakham, 44150, Thailand

*Email: nuchsupha.s@msu.ac.th

Abstract

Close living arrangements between domestic dogs and cats can facilitate microbial exchanges, yet the influence of such cohabitation on their oral microbiota remains insufficiently characterized. This study analyzed buccal mucosa swab samples from 20 healthy companion animals, categorized as dogs housed alone (Group A), dogs cohabiting with cats (Group B), cats cohabiting with dogs (Group C), and cats housed alone (Group D). Microbial communities were profiled using 16S rRNA gene sequencing targeting the V3–V4 region. Significant differences in microbial richness and diversity were observed across groups, with cats, particularly those housed alone, exhibiting greater microbial diversity. Beta diversity analysis revealed distinct segregation between canine and feline microbiota. Taxonomic profiling identified *Pasteurella*, *Fusobacterium*, and *Porphyromonas* predominating, alongside detection of pathogenic species such as *Porphyromonas* *gulae* and *Fusobacterium* *russii* in both species. Dogs cohabiting with cats displayed increased abundance of facultative anaerobes and Gram-negative taxa. Predictive functional analyses suggested elevated biofilm formation, mobile genetic elements, and pathogenic potential in cohabiting dogs and cats housed alone. These findings indicate that interspecies cohabitation may modulate oral microbiota composition and facilitate transmission of potentially pathogenic bacteria, underscoring the need for targeted oral health management in multi-pet environments.

Keywords: Oral microbiota, Companion animals, Microbial diversity, Pathogenic potential, Cross-species transmission

The Effect Of Vitamin C On The Activity Level Of Killifish

Eishal Qamar

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Maintaining the health and activity of aquarium fish is essential in both research and aquaculture environments. The purpose of this experiment was to investigate the effect of vitamin C on the activity level of killifish. This study aimed to determine whether dietary vitamin C could increase movement frequency, indicating a higher level of activity. Two groups of killifish were tested over a 15-week period. Group A was fed regular fish food with added vitamin C (sodium ascorbate), while Group B was given the same food without vitamin C. Every two weeks, the fish were individually placed in observation containers, and the number of pectoral fin movements per minute was recorded. The results showed that the killifish in Group A consistently exhibited more fin movements than those in Group B. This suggests that vitamin C may enhance fish activity by supporting metabolic processes and possibly reducing cellular stress. Therefore, vitamin C supplementation could be beneficial for maintaining the health and liveliness of killifish in controlled environments.

To Help Lactic Acid Bacteria Reach the Intestines More Effectively

Haruka Irokawa

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In recent years, the intestinal health benefits of lactic acid bacteria have gained attention, leading to increased consumption of fermented foods such as yogurt. However, when ingested orally, many lactic acid bacteria may be destroyed by the strong acidity of gastric juice. This study explored methods to help lactic acid bacteria reach the intestines more effectively using familiar, everyday materials. First, the impact of gastric acid on lactic acid bacteria was tested by adding them to a solution containing hydrochloric acid and observing the results under a microscope. The findings confirmed that the number of bacteria decreased significantly in the acidic environment. Next, two substances were tested for their potential to improve the bacteria's resistance to acid: orange juice, which is acidic, and baking soda, which is alkaline. Although orange juice has a pH of 4 - an environment where bacteria typically struggle to survive - mixing it with the acidic solution appeared to neutralize the pH, resulting in a higher survival rate. In contrast, when baking soda was added, the bacteria appeared smaller in size, likely due to osmotic pressure caused by the high concentration of the substance. Overall, the results suggest that combining lactic acid bacteria with acidic liquids like orange juice may help protect them from gastric acid and improve their chances of reaching the intestines. On the other hand, the use of baking soda requires careful concentration adjustment. In the future, I would like to focus on refining the acidity and concentration levels, as well as improving staining methods for more accurate observation

References

1. Microscopic observation of lactic acid bacteria in yogurt <https://bestidea4u.com/yogurt/>
2. Liao, R. Z., J. G. Yu, F. M. Raushel and F. Himo. Chem. Eur. J. 2008, 14(14): 4287-4292.

Vertical Position Change of Common Pond Snails According to Various Conditions

Nozomi Soma

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

The common pond snail often breeds in fish tanks containing aquatic plants. When they increase in numbers, the appearance of the fish tank becomes unsightly, and it is very difficult to clean it. I conducted this experiment to clarify the relationship between the vertical position of common pond snails and temperature, humidity, air pressure, and weather conditions, in order to be able to clean the fish tanks using nets without using special equipment. The experiment was conducted by placing 15 common pond snails in fish tanks, placing them in areas exposed to sunlight, and measuring the number of common pond snails in each area once an hour from 6 am to 12 pm using a pet camera. The fish tanks were marked every 4 cm from the bottom of the water and divided into upper, middle, and lower levels above the water surface. In the same way, room temperature, humidity, air pressure, and weather were also measured. The results showed that weather may be related to the vertical movement, but it was not clear what factors were related to the change in weather. There was also a possible relationship with atmospheric pressure, but the small number of trials made this difficult to determine. I would like to conduct experiments to clarify the relationship with air pressure, which could not be determined in Experiment 1, and to investigate the relationship with light intensity. Also, I want to conduct experiments examining the relationship with light of other colors, ultraviolet light, and infrared light. Furthermore, I want to investigate positional changes not only in an environment like this one with nothing placed inside the fish tank, but also in fish tanks actually housing other organisms.

Growth Of Lesser Duckweed And Changes In Water Quality

Ryo Okubo

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

I researched the growth of lesser duckweed (*Lemna aoukikusa*) and changes in water quality. I wanted to check whether the water quality is related to the growth of duckweed or not. Second, I wanted to check whether duckweed can purify the water, and if so, how much it can reduce pollutants such as ammonia and phosphoric acid. Four beakers labelled A, B, C, and D, were filled with Hyponex fertilizer solution. Soil was added to two of these beakers (B and D). Duckweed was placed in only two of the beakers (C and D). The duckweed in beaker D grew well with green leaves, while in C, the leaves were pale and growth was minimal. The pale leaves in C are presumed to be caused by iron deficiency. Phosphoric acid decreased in beakers B and D. This is thought to be due to fixation in the soil. In D, phosphoric acid decreased more than B. This may be due to absorption by the duckweed. Ammonia levels remained unchanged. It is presumed that components contained in Hyponex influenced this. Nitrite increased in B. It is thought to have been present in the soil or generated by microorganisms.

Using Potassium Hydroxide (Koh) To Clear And Stain Fish Skeleton Specimens

Sana Aoki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Clearing and staining fish skeleton specimens make it possible to observe the skeleton of the animal. However, specimen preparation procedures are very difficult and require a lot of chemicals, which can lead to many failures and damaged specimens. Another problem is the excessive cost; the enzyme called “trypsin”, used to make samples transparent, is very expensive. In this work, I looked for a way to make transparent skeleton specimens without trypsin. Instead of trypsin, I used potassium hydroxide (KOH). By doing so, transparent specimens could be made inexpensively. However, the use of potassium hydroxide for making transparent samples has not been established. After repeated experiments, I found that the concentration of potassium hydroxide and the temperature are important variables. The process was tested at potassium hydroxide concentrations of 1% and 5%, and the specimens became more transparent at higher concentrations. When the specimens were made at temperatures of 15°C, the specimens did not become transparent, but at 30°C, the specimens were damaged. Therefore, I found that a temperature of about 20°C is necessary for successful specimen creation. In this research, I only investigated a small number of temperature and potassium hydroxide concentration combinations; therefore, in the future, I would like to determine more precise ideal conditions by testing more combinations.

Photosynthetic Response Of Tomatoes To Light Color

Seitaro Matsumoto

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study investigated the effects of red, blue, and green light on plant photosynthesis and growth. Plants were cultivated under each light condition for 1 to 2 weeks, and growth was evaluated by measuring plant height. Furthermore, changes in oxygen and carbon dioxide were measured within sealed containers to compare photosynthetic rates to allow us to examine the relationship between photosynthesis and growth as influenced by light color. Green light resulted in the tallest plants, red light showed little growth in the first week, but plants grew significantly in the second week and absorbed more carbon dioxide, and blue light resulted in slower growth and shorter plants, but showed high carbon dioxide absorption. This showed green light is good for stem elongation, and blue light likely influences leaf thickness and pigment formation more than stem elongation. Red light may lead to increased yields over the long term. The results showed that plant growth characteristics and photosynthetic efficiency vary depending on light color, highlighting the importance of selecting light according to cultivation objectives. In conclusion, it is best to use a combination of different colored lights to grow tomatoes.

A Study On Turn Alternation In Pill Bugs

Takamune Ueki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

I conducted an experiment on the turn alternation response of pill bugs. This response is a behavior that helps pill bugs avoid dead ends. I hypothesized that by using this response, they may be able to reach the goal in a maze more easily. In the experiment, I used five pill bugs and one maze. The maze was handmade using graph paper and cellophane tape. Approximately 60% of the trials resulted in the turn alternation response. The results showed that this response did not always occur. When we tried cutting off one of the pill bug's antennae, the probability of this response decreased further, suggesting that the antennae may play a role to some extent. Some pill bugs repeatedly took the same path, which may indicate that they have some ability to remember the route.

Observing The Effects Of Uv Irradiation On Planaria Stem Cell Regeneration

Takato Utsumi

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Using planaria, a type of flatworm, we sought to identify factors that alter stem cell functions related to regeneration. Planaria possess stem cells throughout their bodies and exhibit the characteristic that each severed fragment can regenerate. We examined the growth rate required for severed segments to return to their original size under different environmental conditions. Anticipating that exposure to UV irradiation immediately after dissection might affect regeneration or growth rate, we exposed individuals to one hour of UV light. All individuals died within 24 hours. This suggests that UV light affects planarian regeneration by halting cellular functions. Future research will focus on determining the specific UV dose required to halt these functions. We also plan to explore and study other factors that may enhance regeneration such as foods like bonito flakes.

Can Used Tea Leaves be Reused to Grow Plants?

Tomoyuki Murata

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study explored the possibility of reusing used tea leaves (oolong tea, green tea, and barley tea) and coffee grounds for plant cultivation. In particular, I examined how potassium (from tea) and caffeine (from coffee) influence the growth of spinach. Plants were grown by mixing each material with soil. I watered the spinach plants twice a week, and measured their growth weekly. The results revealed that oolong tea had a positive effect on stem growth, while green tea hindered growth, possibly due to excess potassium. Coffee grounds showed that caffeine could suppress growth in certain plants. These findings underscore the importance of both nutrient type and balanced amounts in successful plant cultivation. This experiment demonstrated that caffeine content in used tea leaves and coffee grounds can significantly influence plant growth. Green tea and coffee, both high in caffeine, tended to suppress growth, especially in liquid extract form. In contrast, barley tea leaves, which contains no caffeine, supported stable and healthy plant development. These findings suggest that while some tea leaves may be harmful due to their chemical composition, caffeine-free options like barley tea can be safely and effectively used as organic fertilizer. Therefore, careful selection of tea leaf waste is essential when considering its use in sustainable gardening.

A Study On Pigment Cells In Medaka

Yuto Mikami

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Medaka are familiar organisms to us, and we see them in various situations. I had the opportunity to learn that the diffusion, aggregation, and types of chromatophores (pigment cells) are factors that affect the body color of medaka. Therefore, I decided to focus on these chromatophores in my research. I used two types of medaka fish, an adrenaline rush, a plastic bottle, and colored paper. I tested the effects of the external environment on the aggregation of chromatophores. I conducted an experiment to determine whether differences in chromatophore aggregation occur when medaka are reared under different light environments (covered with blue, green, or red cellophane). My results showed that pigment cells contracted in the blue and green light environments, but not the red light environment. This demonstrates that medaka understand the color of their environment and contract pigment cells accordingly. This is thought to be because it blends into the bright light on the water's surface when viewed from underwater. When confirming the aggregation reaction of pigment cells, it is necessary to be aware that there is a difference in the speed of aggregation between weak and active individuals, and that the results include individual variation.

Finding The Optimal Nutrient Ratio For Growing Japanese Parsley

Yuuki Saito

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study aims to develop a new method for calculating nutrient ratios and to determine the optimal nutrient ratios for growing Japanese parsley (commonly known as mitsuba). Five Japanese parsley sprouts were grown with: 100 mL rice water, 5g bone meal, 5g eggshells, or 5g banana peels, as well as one control with nothing added. Root length, leaf size and plant height were measured after two weeks, and the optimal nutrient ratio was calculated. The results suggest the optimal nutrient ratio is expected to be 31 nitrogen : 43 potassium : 125 phosphorus. However, as the values obtained this time show considerable variation, further research will be necessary to determine the optimal nutrient ratio for growing Japanese parsley.

Green synthesis of Cu/Zn in catalytic activity and their applications

Tanachot Chaiwong¹, Waratchaya Wichajaroen¹ and Suttasinee Katanyoo^{1,2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: Suttasinee.ka@up.ac.th

Abstract

This project investigates the comparative efficiency of zinc (Zn) and copper (Cu) nanoparticles in degrading and adsorbing methylene blue (MB), a common dye found in industrial wastewater. The nanoparticles were synthesized using a green synthesis method that employs *Curcuma Longa* extracts to promote environmental sustainability. After synthesis, the materials were tested for their catalytic activity and dye adsorption capacity using UV-Visible spectroscopy to measure changes in the dye's absorbance. Additional analyses using FTIR and XRD confirmed the formation and purity of the nanoparticles. The experimental results highlight the need to compare the performance between green-synthesized copper and zinc nanoparticles, both in terms of their ability to break down and adsorb dye molecules.

Keywords: *Curcuma Longa*, Copper/Zinc, nanomaterial, methylene blue (MB)

Influence of non-covalent interactions in GH27 α -galactosidase catalyzed transglycosylation

Keawalin Puntupin¹, Kocchaphan Thaya¹, Jitrayut Jitonnorn² and Wijitra Meelua^{1,2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Unit of Excellence in Computational Molecular Science and Catalysis, and
School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: wijitra.me@gmail.com

Abstract

α -Galactosidase, which belongs to family 27 glycoside hydrolase (GH27), plays an important role in the hydrolysis of α -1,6-glycosidic bonds. This study aims to explore non-covalent interactions (NCIs) essentially responsible for an enzyme-substrate complex of a GH27 α -galactosidase catalyzed transglycosylation. Three disaccharide substrates namely melibiose, lactose, and sucrose were considered for both wild type (WT) and mutant enzymes (W188A and F235A). NCIs analysis is performed to study how NCIs such as hydrogen bonds, van der Waals forces, and steric effects help stabilize or destabilize substrate binding in the active site of WT and mutant enzymes. The NCI workflow includes reprocessing simulation data, viewing molecular structures in VMD, and examining interaction plots through NCIweb. Using 2D and 3D NCI plots based on electron density calculations, different NCI patterns were observed between the WT and the mutants, showing that WT forms stronger and more favourable interactions that support efficient catalysis. In contrast, the alanine mutations weaken key interactions, increase energy barriers, and lower substrate binding stability. These findings highlight the importance of NCIs in substrate recognition, binding stability, and enzyme activity, offering useful insights for future enzyme engineering and drug development.

Keywords: α -galactosidase, GH27, NCIs, transglycosylation, protein-carbohydrate interactions

Development of Protein Isolate from Indigenous Plants Using Clean Extraction Techniques and Nutritional Quality Evaluation

Napanwit Chumpol¹, Choondhi Nirannoot¹, Chidsanupong Phakdeenarong¹,
Sorachai Khamseen^{2*}, and Rawissara Ruenwai²

¹Demonstration School, University of Phayao, Phayao 56000, Thailand

²School of Science, Division of Chemistry, University of Phayao, Phayao 56000, Thailand

*Corresponding author email: sorachai.kh@up.ac.th

Abstract

The search for sustainable protein alternatives highlights the potential of indigenous crops as promising nutritional sources. This study focuses on producing protein isolates from winged bean (*Psophocarpus tetragonolobus*), oats, black sesame, and sunflower seeds using a clean extraction process involving defatting, alkaline solubilization, isoelectric precipitation, and drying. The isolates were evaluated for protein yield, nutritional composition, and functional properties. Winged bean showed high protein content of 27.8–36.6%, with extraction efficiency of 85.6–94.4%, yielding 24–35% protein on a dry weight basis. The isolates are expected to provide high purity, balanced amino acids, and desirable functional properties. These results can be further applied to the development of safe, nutritious prototype plant-based health foods and beverages, promoting sustainable food innovation and reducing dependence on imported proteins.

Keywords: protein isolate, indigenous plants, winged bean, clean extraction, nutritional quality, functional foods

Preparation and characterization of activated carbon from banana peels by chemical activation with KOH.

Nitiphum Panson¹, Pongpumpun Wungkawan¹ and Supachai Wanprakhon^{1,2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: supachai.wa@up.ac.th

Abstract

Activated carbon is a porous material with a high surface area and strong adsorption capability, widely applied in water purification, air treatment, and various industrial processes. However, commercial activated carbon is often costly, creating the need for alternative sources derived from renewable and low-cost biomass. Among agricultural residues, banana peel has drawn significant attention due to its abundance, availability throughout the year, and rich composition of carbon-based materials suitable for activated carbon production. In this study, banana peel was selected as the sole raw precursor for the preparation of activated carbon through chemical activation using potassium hydroxide (KOH). The objective of the research was to evaluate the iodine number of the obtained activated carbon, which serves as an important indicator of micropore content and adsorption efficiency. The experiments were conducted at different activation temperatures of 600, 700, and 800 °C in order to investigate the effect of thermal conditions on pore structure development. The preparation process involved two main stages: initial carbonization of banana peel biomass, followed by chemical activation under controlled heating. The iodine number of each sample was measured and compared to determine the influence of activation temperature on adsorption capacity. The results indicated that the iodine number increased with higher activation temperatures, suggesting enhanced pore development and greater surface area. This demonstrates that banana peel biomass can be effectively transformed into activated carbon with promising adsorption characteristics. Overall, the findings highlight banana peel as a sustainable, low-cost precursor for activated carbon production while providing valuable insights into the relationship between activation temperature, micropore formation, and adsorption performance.

Keywords: Activated carbon; Agricultural residues; Banana peel; Iodine number; Adsorption capacity

Investigating non-covalent interactions in enzyme-substrate complexes in GH51 arabinofuranosidase

Thunsinee Duangdao¹, Nichanan Meesri¹, Thanattha Suchatsutatam¹,
Wijitra Meelua^{1,2} and Jitrayut Jittonnom^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² Unit of Excellence in Computational Molecular Science and Catalysis, and
School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: jitrayut.018@gmail.com

Abstract

α -L-arabinofuranosidase (GH51) is an enzyme involved in the degradation of plant carbohydrates by cleaving glycosidic bonds. It is found in both bacteria and fungi, including *Thermobacillus xylanilyticus*, which shows high thermostability and broad pH stability. In this study, non-covalent interactions (NCIs) between enzyme and substrates were analyzed using VMD and the web-based NCI analysis. A series of synthetic substrate and natural substrates of mono- and di-substituted arabinosylated xylooligosaccharide (AX and $XA^{2+3}X$, respectively). Results show that para-nitrophenol-arabinose (pNP-Ara) forms stronger attractive hydrogen bonds than a trisaccharide A^3 , with more repulsive forces. The disaccharide A^3X also exhibits stronger attractive forces than a disaccharide A^2X . The *cis* form of arabinosyl-disubstituted trisaccharide $XA^{2+3}X$ creates similar hydrogen bonds with the *trans* form. These findings highlight the importance of NCIs in substrate binding, with potential applications in drug design, enzyme engineering and biomolecular recognition.

Keywords: α -L-arabinofuranosidase; GH51; enzyme-substrate interactions; non-covalent interactions (NCIs)

Study of the antioxidant activity of *Gardenia sootepensis* Hutch by DPPH assay**Pichamon Inpunya¹, Suphapitch Khumtua¹, and Rattiya Na Ubol²**¹ Demonstration School University of Phayao, Phayao 56000, Thailand² School of Science, University of Phayao, Phayao 56000, Thailand* Corresponding author email: rattiya.si@up.ac.th**Abstract**

The present study was conducted to evaluate the antioxidant activity of *Gardenia sootepensis* Hutch. by comparing the extraction efficiency of two solvents, ethanol and methanol. A dried flower sample (1 g) was subjected to extraction for three different durations: 1 hour, 3 hours, and 24 hours. Antioxidant activity was assessed using the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay, a standard method for determining free radical scavenging capacity, and absorbance was measured with a UV-VIS spectrophotometer. The results demonstrated that ethanol consistently produced higher antioxidant activity than methanol across all extraction periods. After 1 hour of extraction, the percentage inhibition of free radicals was 99.23% for ethanol and 95.09% for methanol. At 3 hours, ethanol yielded 98.29%, whereas methanol yielded 95.25%. After 24 hours, ethanol maintained superior activity at 97.50%, compared with 94.33% for methanol. These findings indicate that ethanol is a more effective solvent for the extraction of antioxidant compounds from *Gardenia sootepensis* Hutch., thereby highlighting its potential as a valuable natural source of antioxidants.

Keywords: *Gardenia sootepensis* Hutch., Antioxidant activity, Free radical, DPPH assay

Green Synthesis of Copper metal and their Applications in Catalytic Activity

Kanokwan Somwan, Athicha Sutthawong, Natnicha Fongfoo and Suttasinee Katanyoo

Demonstration School University of Phayao, Phayao 56000, Thailand

*Corresponding author email : Suttasinee.ka@up.ac.th

Abstract

Copper nanoparticles (Cu-NPs) have high catalytic activity and are useful in environmental remediation, such as removing pollutants from water and soil. However, they are expensive, and excessive use may cause environmental contamination, harming ecosystems, living organisms, and human health. Nanoparticles can be synthesized through various methods. Conventional synthesis techniques often involve the use of toxic chemicals, which may pose risks to human health and the environment. Consequently, green synthesis approaches have been adopted as a safer and more sustainable alternative. In this study, ginger powder was employed as a catalyst for the green synthesis of copper nanoparticles. The objectives were to investigate the green synthesis process using ginger as both a capping agent and a reducing agent, and to characterize the structural and functional properties of the resulting copper nanoparticles. Following the synthesis of copper nanoparticles using ginger, the crystal structure, functional groups, and dye decolorization capability were investigated using X-ray diffraction (XRD) and Fourier-transform infrared (FTIR) spectroscopy.

Keywords : Green Synthesis, nanoparticles, catalytic, ginger, copper

Effect of gelling agents on the characteristics of oral mucoadhesive gel of *Chromolaena odorata* leaf extract

Naphatsawan Jampalee¹, Nuttapat Yindee¹, Patcharatheera Meethaisong¹, Catheleeya Mekjaruskul^{2*}

¹Maharakham University Demonstration School (secondary), Maha Sarakham, Thailand 44150

²Faculty of Pharmacy, Maharakham University, Maha Sarakham, Thailand 44150

*Email: catheleeya.m@msu.ac.th

Abstract

Recurrent aphthous ulcers or trauma-induced buccal lesions, are common oral conditions encountered in daily life. Current treatment approaches often rely on corticosteroids or synthetic anti-inflammatory agents, which may be associated with undesirable side effects and limitations in long-term use. *Chromolaena odorata* (Siam weed) is a medicinal plant widely found in Thailand, with several studies supporting its anti-inflammatory properties. The objective of this study was to develop an oral ulcer gel containing *C. odorata* leaf extract and to investigate the effects of different gelling agents on the physical properties and mucoadhesive characteristics of the formulations. Two gelling agents, sodium alginate and sodium carboxymethylcellulose (SCMC), were incorporated at varying concentrations. The formulations were evaluated for pH, spreadability, disintegration time, and textural properties using a texture analyzer. Results showed that the ethanolic extract (95%) of *C. odorata* leaves contained a total flavonoid content of 44.52 ± 3.55 μg quercetin equivalent per gram of extract. The formulations containing 3% w/w sodium alginate with 1% w/w SCMC and 2% w/w sodium alginate with 1.5% w/w SCMC demonstrated suitable spreadability (2.63–3.03 cm), appropriate disintegration time (8.12–8.37 min), and acceptable pH values (4.83–4.91). Texture analysis revealed optimal mucoadhesive strength, with adhesiveness values ranging from -0.202 to -0.146 N-s, compared with other formulations. These findings suggest that combining sodium alginate and SCMC improves the physicomachanical properties and muco-adhesiveness of the gel, highlighting its potential for further development as a herbal oral ulcer treatment.

Keywords: *Chromolaena odorata*, Oral gel, Sodium Alginate, Sodium Carboxymethyl Cellulose, Adhesiveness

Formulation and Evaluation of A Herbal Cinnamon Jelly Incorporating Chlorpheniramine Maleate for the Relief of Allergy Symptoms

Ainthira Malithong¹ Bussiri Srisupat¹ Paiya Martluplao¹ and

Asst. Prof. Bunleu Sungthong, Dr.rer.nat.^{2*}

¹Maharakham University Demonstration School (Secondary), Maha Sarakham, 44150, Thailand,

²Faculty of Pharmacy, Maharakham University, Maha Sarakham, 44150, Thailand

*Corresponding author email: bunleu.s@msu.ac.th

Abstract

Allergic reactions occur when foreign substances, known as allergens, are taken into the body and stimulate the release of histamine, which triggers various allergy symptoms such as a runny nose, itchy eyes, or rashes. The administration of antihistamines inhibits the release of histamine, thereby alleviating allergic reactions. Cinnamon, a spice obtained from the inner bark of the cinnamon tree, is commonly used to enhance the aroma and flavor of foods and beverages. It also possesses numerous medicinal properties. Several studies have demonstrated that cinnamon contains bioactive compounds, including cinnamaldehyde and phenolic compounds, which reduce histamine release and inflammation. The purpose of this research is to develop a jelly incorporating the antihistamine drug chlorpheniramine maleate, along with cinnamon extract containing high phenolic compounds and cinnamaldehyde, in order to facilitate drug administration for children. The process began with extraction using different solvents, including water, 50% ethanol, and 95% ethanol. The total phenolic content (TPC) was analyzed using the Folin-Ciocalteu method. The results showed that cinnamon extracted with 50% ethanol exhibited the highest phenolic content, with a TPC value of 30.38 µg GAE/ml extract. Furthermore, the cinnamaldehyde content was also determined using HPLC. The results indicated that extraction with 50% ethanol also yielded the highest cinnamaldehyde content, at 214 µg/g extract. Therefore, this extract was selected for preparing the prototype jelly formulation. The best jelly formulation consisted of 38.86% water, 9.33% gelatin, 32.11% sugar, and 19.70% glucose syrup. Thereafter, 0.35% cinnamon extract and 2 mg of chlorpheniramine maleate per jelly piece were incorporated into the prototype formulation. The results revealed that the jelly could be molded properly, with good taste and stable texture. Once the prototype product was obtained, further study on the physical and chemical stabilities of the jelly formulation will be conducted.

Keywords: Allergy, Cinnamaldehyde, Cinnamon, Phenolic compounds

Determining A Substitute For Titanium Dioxide (TiO₂) In Photocatalysis

Koki Fukagawa

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Photocatalysis is the process where light and a photocatalyst are used together to speed up a chemical reaction. Titanium dioxide (TiO₂) is commonly used in photocatalysis. However, it is expensive and difficult to use in large quantities. Therefore, this experiment was conducted to find an inexpensive photocatalyst to replace TiO₂. Titanium dioxide (TiO₂), iron oxide (Fe₂O₃), and zinc oxide (ZnO) were compared as photocatalysts for this experiment.

The objective of the experiment was to measure the differences in the photocatalytic reactions of each of the three catalysts using methylene blue in an oxidation-reduction reaction. A mixture of methylene blue (0.2g), vaseline (10g), and a catalyst (3g) was irradiated with UV light for 24 hours. After irradiation, 30 ml of ethanol was added to the mixture to create a transparent solution. The solution was then left to stand until the catalyst precipitated. After precipitation was completed, the solution was measured for transmittance using a spectrophotometer to determine the effectiveness of the photocatalyst used. The catalyst with the higher transmittance was determined to be a possible substitute for titanium dioxide (TiO₂) in photocatalysis.

Using Discarded Fruit Peels to Make Soap in Order to Promote Environmental Sustainability

Kotomi Yamaguchi

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study aimed to reduce food waste by making soap from discarded fruits and peels affected by natural disasters or left unused. By adding fruit extracts to a soap base, I created soaps with natural colors and fragrances. The soap base, made from alkaline salts of fatty acids, was mixed with fruit extracts and hot water (around 40°C), then molded and dried. Heating both the extract and soap base improved texture and reduced air holes. Cleaning tests showed that lemon extract soap was most effective for pen stains, while orange extract worked best for oil-based paint. However, orange soap sometimes caused color transfer to fabric. I also used grape skin extract, which contains anthocyanins that change color under alkaline conditions. Adding glucose helped stabilize the color. Grape soaps with glucose appeared whiter and showed strong cleaning power, especially for water-based paint, though some color transfer occurred. In the future, I would like to test other fruits, improve shelf life and texture, and enhance the fragrance of the soap.

Using Banana Peels To Purify Wastewater

Mayumi Makino

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Banana peels, a commonly generated household waste product, were tested to evaluate their effectiveness in purifying wastewater containing copper (II) chloride. Copper (II) chloride is a contributor to heavy metal pollution. Banana peels contain polysaccharides such as cellulose, lignin, and pectin, which contain carboxyl and hydroxyl groups known to bind with metal ions. Using these properties, the ability of banana peels to act as a biosorbent was assessed. Varying amounts of dried banana peel were immersed in copper (II) chloride solutions for a fixed period, and changes in copper ion concentration, precipitation, and color were observed and recorded. The results showed that banana peels effectively absorbed Cu^{2+} ions, reducing the copper concentration in the solution. These findings suggest that banana peels have potential as a low-cost and environmentally friendly, natural material for water purification.

Testing The Effect Of Different Ratios Of Sodium Thiosulfate And Urea On The Melting Rate Of Ice

Nene Nobe

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

The addition of salts such as sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}$) and urea ($\text{CO}(\text{NH}_2)_2$) lowers the melting point of water. I did this experiment because I wanted to find a way to keep the inside of a styrofoam box cold longer for deliveries during Summer.

I mixed sodium thiosulfate and urea (total 20g) with 60mL of water. Keeping the total mass of salts at 20g, I tested different ratios of sodium thiosulfate and urea. For example, I used 15g of sodium thiosulfate and 5g of urea in one of the trials. I poured the solution in a ziploc bag and placed it in a freezer to freeze for one week. After one week, I placed the cold pack in a styrofoam box. The styrofoam box was put in an incubator and left at 30°C . After 30 minutes, I checked how much the ice had melted. I used the ratio of ice to water to measure how long it took to melt.

I found that a 1:1 ratio of the two chemicals resulted in the longest-lasting cooling effect. Keeping the chemical ratio at 1:1, I tested different ratios of solvent to solute and found that the ice pack with no added chemicals performed the best, due to water's high specific heat capacity. Convection was found to occur inside the ice packs with the chemicals inside, which caused them to lose their cooling effects faster. In the future, I would like to prevent convection by making the ice pack thicker or increasing the viscosity of the solution.

Making And Comparing The Cleaning Efficacy Of Eco-Friendly Soaps Using Milk, Ash And Vegetable Oil (Marseille Soap)

Rei Sasaoka

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In recent years, surfactants contained in synthetic detergents used in the home have become a problem because they runoff into rivers and oceans, adversely affecting the environment. In this study, we conducted an experiment to compare the cleaning power against eight types of stains; sebum, oil-based markers, water-based markers, oil paints, water-based paints, soil, soy sauce and ketchup using natural soaps made from: milk, ash, and vegetable oil (Marseille soap).

The results showed that ash and Marseille soap, in particular, showed high cleaning effectiveness and were able to handle stains from oil-based pens. They also have low environmental impact, indicating their potential as alternative detergents that can contribute to a sustainable society. In the future, we expect to focus on the cleaning components of other natural materials and apply them to the development of detergents with higher performance and safety.

Finding The Best Method To Protect Hair From Heat Damage

Rinka Yagi

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study aimed to identify the most effective hair care method for minimizing heat-induced damage. To achieve this, five different treatment combinations using commercially available products, such as shampoo, conditioner, hair mask, and hair oil, were applied to bundles of human hair. Each treatment was performed 21 times to simulate a 21-day hair care routine. After the treatments, changes in hair elasticity were evaluated using a weight-based breakage test to assess the protective effects of each method. The results showed that hair not exposed to heat (Treatment 1) experienced the least amount of damage. Among the heat-treated groups, the combination of conditioner and hair oil (Treatment 5) was the most effective in maintaining hair elasticity and preventing heat-related damage.

References

1. Kanako Suzuki, Analysis of Hair Surface Structural Changes and Heat Damage.
2. Heat Induced Hair Damage and Its Indicators

Making A Cream-Type Insect Repellent Using Spearmint

Saya Suzuki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This experiment was conducted in response to the expected increase in insect-borne infections due to global warming. The objective of the experiment was to create a cream-type insect repellent that could be used in any location and under any weather conditions compared to conventional spray-type insect repellents.

In this experiment, L-menthol, a naturally occurring organic compound found in spearmint was used as the active ingredient to create this insect repellent. To create a cream-type insect repellent, a moisturizing cream was made from a mixture of shea butter, argan oil, and an L-menthol solution (L-menthol crystals + 95% ethanol concentration + pure water). The cream was then applied to the skin and the results showed that the scent of L-menthol could be detected. In the future, this cream-type insect repellent will be tested using mosquitoes.

References

1. Ministry of Health, Labour and Welfare, Quarantine Station. Dengue Fever–Global Situation. 2024.
https://www.forth.go.jp/topics/2024/20240610_00001.html
2. L Chibanian and Agricultural School. The Secret of Mosquito-Repelling Scents. 2024.
<https://chibanian.info/20240429-155/>

The Relationship Between Paper Deterioration and UV Rays

KITAZAWA Chihiro¹, TAKEISHI Yushun², KINAMI Koki³

¹²³ Niigata Prefectural Shibata High School, Niigata Prefecture, Japan

Abstract

Paper deteriorates when exposed to sunlight, which contains various types of light. Among these, ultraviolet (UV) light is particularly energetic. UV rays are known to damage human DNA and cause sunburn. Furthermore, they have the effect of altering cellulose, the main component of paper. In this study, we investigate changes in paper strength by varying the UV irradiation time, wavelength, and paper components. Additionally, we aim to explore ways to mitigate the effects of UV rays, ultimately leading to the development of paper that is less susceptible to deterioration in the future.

Investigating Extracted Pigments From Weeds And Their Potential As Natural Dyes And Ph Indicators

Shinsui Fujioka¹ and Leon Yamada²

¹²Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Weeds are a hindrance in daily life and are usually discarded or removed because they are a breeding ground for pests, hinder the growth of crops, and interfere with harvesting operations. There are also other economic costs involved in the treatment and removal of weeds. However, there are many species of weeds that contain natural pigment components such as chlorophyll, carotenoids, flavonoids, and betalains. The purpose of this study is to focus on weeds, which have not received much attention as pigments, and to explore ways to utilize them as sustainable resources with little environmental impact such as in dyeing processes and as pH indicators.

The weeds, *Solidago Altissima* and *Artemisia Princeps* were crushed and their pigments were extracted. A pigment solution that changed color depending on acidity and alkalinity was produced. Therefore, this showed the potential for pigments extracted from weeds to be as a simple pH indicator. The pigments also showed potential for use as a natural dye. This suggested that weeds, usually considered as waste, may have hidden value as useful resources.

Examination Of Balloon Fuels Based On Differences In Flight

Shohei Inuzuka

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study investigated the efficiency and environmental implications of various fuels used in small-scale hot air balloons. Hot air balloons offer cost advantages and reusability compared to rockets in meteorological observations; however, their long-term use may result in higher CO₂ emissions, raising environmental concerns. The primary objective was to evaluate fuel performance in terms of combustion duration, lift-off capability, and overall flight efficiency, while also considering environmental impact. A balloon was constructed from a 45L polyethylene bag serving as the envelope, enamel wire as the frame, and an aluminum foil basket. Ethanol was used in preliminary trials to determine optimal fuel volume, which was found to be 7 mL. For the main experiment, five fuels were selected from Class IV hazardous materials: ethanol, ethyl acetate, isopropyl alcohol, acetic acid, and propionic acid. A specially designed launch platform minimized external interference during testing. Experimental measurements included ignition-to-lift-off time, total combustion duration, and effective flight time, defined as combustion time minus the delay before lift-off. Ethanol was successful, with a 12.81-second lift-off delay, 130.00 seconds of combustion, and a net flight duration of 107.19 seconds. However, other fuels, when standardized to 7 mL, failed to achieve lift due to either insufficient or excessive combustion intensity. The findings highlighted a major limitation: applying ethanol's optimal fuel volume to other substances disregards differences in combustion characteristics, leading to inconsistent results. Additional factors influencing variability included ambient temperature, humidity, uncontrolled volatilization time, and slight alterations introduced during flame extinction procedures. Future investigations should establish fuel-specific optimal volumes, systematically measure environmental conditions, and standardize volatilization processes. Such refinements will enable more reliable comparisons and may facilitate the identification of fuels that provide both effective balloon performance and reduced environmental impact.

Extraction of CNF from Inedible Parts of Vegetables

TAKAHASHI Sora

Yamagata Prefectural Touhigakkan Senior High School, Yamagata Prefecture, Japan

Abstract

This study aims to extract cellulose nanofibers (CNF) from inedible parts of vegetables, specifically edamame pods and daikon radish peels. The raw materials were subjected to chemical treatment with hydrochloric acid and sodium hypochlorite. The resulting samples were successfully obtained and characterized using scanning electron microscopy. We will further advance this research by incorporating alkali treatment as described in the literature. In addition, we are actively conducting research on the potential of utilizing the inedible parts of vegetables as a sustainable and environmentally friendly source of cellulose nanofibers (CNF).

Making Soap Using Lemons

Yuko Kawaguchi

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In this experiment, soap was made by extracting fatty acids from lemon juice, esterifying the fatty acids with glycerin, and performing saponification with sodium hydroxide. The results were then tested for precipitation, emulsification and pH. The purpose of this project was to use fruit that would have been thrown away, therefore reducing food waste. Fruits go bad quickly and easily and are often thrown away before being eaten. Using these otherwise discarded fruits to make soap would reduce food wastage.

The results of this experiment after saponification produced a small sized soap with a basic pH of 10. Precipitation in hard water was observed due to metal ions combining with fatty acids which formed insoluble calcium, magnesium and other salts. However, emulsification was not observed possibly due to the small amount of soap produced. Future research would include re-examining and optimising the reaction conditions and the amount of raw materials used to produce a reliable soap.

Development of a low-cost autonomous prosthetic arm prototype for assisting the disabled

Nutnicha Wissawapaisa¹, Rinlapat Sriwichai^{1*}, Sarit Promthep^{1,2} and Waipot Ngamsaad^{1,3}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Information and Communication Technology University of Phayao, Phayao 56000, Thailand

³ School of Science University of Phayao, Phayao 56000, Thailand

* Corresponding author email: rinlapat7324@gmail.com

Abstract

Currently, Thailand has approximately 2.3 million people with disabilities, accounting for 3.43 percent of the total population. Among them, 52.19 percent are individuals with mobility impairments, and the number continues to increase steadily. Economically, more than 70 percent of people with disabilities have an average monthly income of less than 703.02 USD, while their average monthly expenses are as high as 579.10 USD. This study aimed to develop a practical, low-cost prosthetic arm for individuals with mobility impairments. The research process consisted of two main parts: (1) design and (2) development of the prosthetic arm mechanism. In the design phase, servo motors were used to replace finger joints in a four-finger configuration to increase flexibility. For the mechanism, a control system was developed using an angle detection sensor (MPU6050) installed along the humeral plane to control movement. The results showed that a four-finger design can perform as effectively as a five-finger design. Positioning the thumb at a 45-degree oblique angle on the wrist plane proved to be the most efficient method for lifting variously shaped objects, while also reducing the complexity of the mechanism without affecting functionality. Consequently, the prototype prosthetic arm was able to lift objects with robustness and stability. These findings confirm that the developed prosthetic arm provides a practical and cost-effective solution for individuals with mobility impairments. The study highlights the potential of low-cost assistive technologies to increase independence, reduce financial barriers, and enhance the quality of life for people with disabilities.

Keywords: Low-cost prosthetic arm; Mobility impairments; Bionic arm

Effect of Magnetic Field on the Heat Transfer Performance of Ferrofluid

Ananya Kooviboonsin¹, Sirinda Suknaphasawat¹ and Piyachon Ketsuwan^{1,2*}

¹ 1 Demonstration School University of Phayao, Phayao 56000, Thailand

² 2 School of Science University of Phayao, Phayao 56000, Thailand

* Corresponding author email: piyachon.ke@up.ac.th

Abstract

This research aimed to investigate the behavior of ferrofluid under a magnetic field, as well as its thermal conductivity and heat transfer properties compared to water. The study was divided into three experiments. The first experiment examined the control of ferrofluid motion using an Arduino-based system. The results showed that ferrofluid responded effectively to the magnetic field, enabling precise control of its movement and distribution. The second experiment focused on the heat transfer characteristics of ferrofluid in comparison with water. It was found that ferrofluid exhibited superior thermal conductivity and heat dissipation, suggesting its potential as a material for thermal management applications. The third experiment combined the two previous approaches, demonstrating that magnetically controlled ferrofluid achieved the highest level of heat conduction. However, the ferrofluid could not reduce the temperature to ambient level, likely due to heat accumulation within the solenoid, which affected cooling efficiency.

Overall, the findings highlight the feasibility of applying ferrofluid in systems that require both controllability and efficient thermal management. This study provides a foundation for future research and technological applications where ferrofluids may serve as innovative materials for heat control and transfer.

Keywords: Ferrofluid, Solenoid, Arduino-based system

Determining physical conditions in NGC 40 with safe-written emission line tools

Chanut Peamee¹, Phonlapat Sririoam¹, Achiraya Chanlen¹, Manus Poothawee¹
and Samaporn Tinyanont^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² National Astronomical Research Institute of Thailand 260 Moo 4, Donkaew, Maerim, Chiang Mai 50180, Thailand

* Corresponding author email: samaporn@narit.or.th

Abstract

An emission nebula is an interstellar gas that emits light when excited, and spectroscopic studies provide direct insight into its chemical composition, temperature, density, and the underlying physical processes. Emission line analysis plays a crucial role not only in understanding stellar evolution but also in tracing the chemical processes that drive the transformation of the universe. This project focuses on the planetary nebula NGC 40, aiming to determine its physical conditions through diagnostic line ratios. Archival spectra covering the 3600–9600 Å wavelength range were obtained from Williams College Planetary Nebula Spectra Database. The analysis was performed with Python code developed entirely by the researcher, who set the initial parameters, fitting ranges, and methodology without reliance on pre-built software. Both Gaussian and Lorentzian profiles were tested for emission line fitting, with residuals examined to assess model accuracy.

The results show that Gaussian profiles provide the most reliable fits, allowing accurate flux determination for key emission lines. Using these fluxes, diagnostic ratios were calculated, yielding an electron density of 1800.27 cm^{-3} from [S II] line intensity ratios and an electron temperature of 8135.66 K from [N II] line ratios.

Overall, this work highlights the integration of astronomical knowledge, programming, and quantitative analysis. By combining archival data with self-developed computational methods, the project demonstrates a detailed and precise reanalysis of NGC 40, offering new insights into the physical state of its ionized gas.

Keywords: emission nebula; NGC 40; spectroscopy; diagnostic line ratios; line fitting

Development of a novel deep learning algorithm for predicting Fishman's skeletal maturity indicators

Kittiphat Yodphet¹, Natthakit Wongchaiya¹, Pongpol Phromcharoen¹, Nattawut Pholasa^{1,2*},
 , Watcharaporn Cholanjiak² and Pornpat Theerasopon³

¹ Demonstration School, University of Phayao 56000, Thailand

² School of Science, University of Phayao, Phayao 56000, Thailand

³ Department of Orthodontics, School of Dentistry, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: nattawut.ph@up.ac.th

Abstract

Skeletal maturity assessment using Fishman's Skeletal Maturity Indicators (SMI) is an essential tool in medical field. However, the manual evaluation of SMI from hand-wrist radiographs is time-consuming and prone to human error, requiring expert interpretation. While there have been attempts to develop deep learning models for automating SMI prediction, existing models have yet to achieve the level of accuracy required for reliable use in clinical settings. This project aims to develop a deep learning model that offers the accuracy and efficiency necessary for practical medical applications. The model is trained using hand-wrist radiographs from 285 patients at Songklanagarind Hospital and 2439 datasets from roboflow, utilizing Roboflow for bounding box detection to identify key bone parts essential for SMI evaluation. The model's performance is evaluated on metrics such as accuracy, sensitivity, and consistency, with comparisons made to expert assessments. By automating the prediction of SMI, this project seeks to reduce the workload of physicians, minimize human error, and improve the consistency and speed of skeletal maturity assessments. Ultimately, the goal is to create a model that can be integrated into clinical practice, providing healthcare professionals with a reliable decision-support tool for more efficient and accurate patient care. Future development will focus on refining the model, incorporating additional datasets, and ensuring compliance with ethical standards for patient data privacy.

Keywords: 3-5 words: skeleton maturity; Indicator; Fishman; skeleton

Investigation of Blood Bilirubin Levels In Neonatal Jaundice for the Development of a Non-Invasive Light-Based Monitoring Device

Kodchapnan Nanan¹, Pedparethong Kiddee¹, Siripatchaya Tawai¹, Piyakron Numim^{1,2*},
and Dendanai Luerach²

¹ Demonstration School, University of Phayao, Phayao 56000, Thailand

² School of Science, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: Amaom339@gmail.com

Abstract

Jaundice is a medical condition caused by excessive bilirubin in the bloodstream, commonly observed in newborns, particularly those who are premature or delivered via cesarean section. Bilirubin, a yellow pigment derived from the breakdown of red blood cells, is normally eliminated through the liver. In neonates, however, liver immaturity during the first few days of life often leads to temporary jaundice. If bilirubin levels rise excessively, the condition may progress to neurotoxicity, resulting in irreversible brain damage, delayed development, and reduced cognitive function. Current diagnostic methods require invasive blood sampling, which causes pain and increases the risk of infection in infants. To address these limitations, a non-invasive light-based bilirubin measurement approach was investigated. Curcumin, a yellow compound with optical properties comparable to bilirubin, was extracted and tested using a spectrometer across five wavelength ranges. The results indicated that the strongest absorption occurred within 480–580 nm. Further analysis demonstrated that bilirubin-equivalent samples at concentrations of 100, 200, and 300 mg exhibited maximum absorption at 550–570 nm, with standard deviations of 0.0056, 0.017, and 0.028, respectively. These findings suggest that the optimal wavelength range for neonatal bilirubin detection is 550–570 nm. This study provides the foundation for the development of innovative non-invasive bilirubin monitoring devices, offering a safer and more effective diagnostic method for neonatal jaundice—because every life matters.

Keywords: Bilirubin, Curcumin, Jaundice, Light absorption

SKY LAB

Nakorn Suyajai¹, Promphiriya Tapom², Phipatphan Punyang³

¹Demonstration School University of Phayao, Phayao 56000, Thailand

²School of International and Communication Technology University of Phayao, 56000, Thailand School of
Science University of Phayao, Phayao

*Correspondence author email: baconou@gmail.com

Abstract

Due to the rapid and severe changes in weather conditions, air pollution, and health issues within the Demonstration School of the University of Phayao, daily life and the well-being of both staff and students have been significantly affected. Recognizing the importance of systematic and detailed monitoring of air quality, this project aims to raise awareness and provide guidelines for students to protect their health and adapt their daily routines accordingly. In this project, an innovation has been developed by designing and utilizing drones to collect environmental data within the school area. The data is systematically stored and processed to ensure comprehensive and accurate information. The collected parameters include airborne particulate matter (PM 2.5, PM 10, and PM 1), temperature, humidity, and UV radiation—all of which are key factors influencing human health. These data will serve as valuable resources for assessing air quality and supporting long-term health management within the school community.

Keyword : Air quality monitoring; Drone technology; Particulate matter (PM2.5, PM10, PM1); Health impacts; School environment

Brainwave-Based Communication aid using EEG sensor

Nayada Nuankhum¹, Rinrada Kongarin¹, Sakdapong Chanaphai¹ and Waipot Ngamsaad^{2*}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Science University of Phayao, Phayao 56000, Thailand

* Corresponding author email: Waipot.ng@up.ac.th

Abstract

Brain–Computer Interface (BCI) is a research field that aims to enable direct communication between the human brain and computers without relying on physical movements. This study proposes the development of a prototype BCI system for speech-based communication (Speech BCI) by utilizing electroencephalogram (EEG) signals as the medium for transmitting user intentions.

Electroencephalography (EEG) signals were recorded from three volunteers using a Sichiray TGAM device in a controlled, noise-free environment. The data underwent preprocessing with Python, utilizing the MNE library for signal filtering and Keras for the development of deep learning models. These models were employed to decode and classify brain signals in relation to speech patterns or textual outputs. The findings indicate a tendency for gamma wave power to increase, while alpha wave power tended to decrease. Notably, over 90% of the recorded data demonstrated this directional change. This system highlights a promising approach and potential for further development as an assistive communication tool in medical applications and future implementations.

Keywords: Electroencephalography (EEG), Preprocessing, Deep Learning, Brain Signal Covertion, Speech Pattern Classification

The Effects of Plyometric Training on Two-Leg Vertical Jump Performance in Basketball Players

Papangkorn Paramesthanakorn¹, Siwapat Taokeun¹, Krittithee Srijai¹
and Suriyon Luangtrongkit^{1,2}

¹Demonstration School University of Phayao, Phayao 56000, Thailand

²Health and related Physical Education. Demonstration School University of Phayao, Phayao 56000, Thailand

Corresponding author email: suriyon.koe@gmail.com

Abstract

This study aimed to investigate and compare the effects of plyometric training on two-legged vertical jump performance among basketball players. The participants consisted of 24 secondary school students from the Demonstration School of the University of Phayao in the 2025 academic year, selected using purposive sampling. They were randomly assigned into two groups of 12 participants each. The control group received regular basketball training, while the experimental group received a combined program of basketball and plyometric training for six weeks, three sessions per week (Monday, Wednesday, and Friday). The two-leg vertical jump test was used to assess lower limb muscular strength. Performance assessments were conducted at two time points: prior to the training (Week 1) and after the training program (Week 6). Descriptive statistics, including means and standard deviations, were used to summarize the data. Inferential statistics, specifically paired sample t-tests for within-group comparisons and independent sample t-tests for between-group comparisons, were employed. The significance level was set at .05. The results indicated that (1) the experimental group showed a statistically significant improvement in two-legged vertical jump performance after six weeks of training ($p < .05$), and (2) a statistically significant difference was found between the experimental and control groups following the intervention, with the experimental group demonstrating superior performance ($p < .05$).

Keywords: Plyometric, Basketball, Two-leg jump, Vertical Jump

Machine Learning Modeling to Predict the Specific Heat Capacity Function of Concrete from its Constituent's Thermal Properties

Prawitchaya Lakhan¹, Tawanrat Jaimun¹, Klaokaew Jaikla¹
and Asst. Prof. Phacharatouch Chaimongkon^{1,2}

¹Demonstration School University of Phayao, Phayao 56000, Thailand

²Health and related Physical Education. Demonstration School University of Phayao, Phayao 56000, Thailand

Corresponding author email: phacharatouch.ch@up.ac.th

Abstract

This project aims to develop a machine learning (ML) model to predict the specific heat capacity function of concrete ($cp(T)$) based on the thermal properties of its constituents. The study begins with experimental measurements of $cp(T)$ for fundamental materials—river sand, crushed granite, and crushed clay brick—within the temperature range of 30–600 °C using Differential Scanning Calorimetry (DSC). A synthetic dataset was then generated using the Rule of Mixtures to represent diverse concrete mixtures. This dataset was employed to train regression-based ML models, such as Random Forest Regressors, enabling the prediction of cp values across the entire temperature function rather than at single points. The results demonstrate that the developed ML models can accurately predict the $cp(T)$ curves of new, unseen mixtures, highlighting the potential of ML as a powerful tool for designing concrete materials tailored for thermal energy storage (TES). Furthermore, this work underscores the feasibility of leveraging data-driven approaches to accelerate the development of sustainable energy materials in the future.

Keywords: Machine Learning, Specific Heat, Capacity (cp), Concrete, Thermal Energy Storage (TES), Differential Scanning Calorimetry (DSC)

Development of a Low-Cost Prototype Aircraft for Medicine Delivery in Remote Regions

Surasit Klongdee¹ and Sarit Promthep^{1,2}

¹ Demonstration School University of Phayao, Phayao 56000, Thailand

² School of Information and Communication Technology University of Phayao, Phayao 56000, Thailand

³ School of Science University of Phayao, Phayao 56000, Thailand

Corresponding author email: buyc88857@gmail.com

Abstract

Many mountainous rural areas face difficulties in receiving medical supplies due to geography and limited resources compared to city hospitals (Greater Mekong Sub-region Medical Journal, 2022). Natural disasters such as flash floods and landslides also disrupt transportation (Thai Enquirer, 2025). This project designs a low-cost, lightweight fixed-wing RC aircraft with a detachable payload system to address these challenges. The airframe, modeled after a Cessna 172, is constructed from polyfoam and plywood. The aircraft weighs about 800 grams without payload and 1300 grams at maximum load. A 3D-printed payload box, equipped with an Arduino Nano and NRF24L01 wireless receiver, enables remote-controlled release via servo motor and can carry up to 500 grams. Research included reviewing RC applications in medical logistics, designing the payload mechanism, constructing the prototype, and conducting test flights in simulated rural settings. Ground tests confirmed wireless release at 30–50 meters, while flight tests demonstrated stable operation under low altitude. However, carrying heavier payloads resulted in higher stall speed, reduced low-speed controllability, and shorter endurance, with average flight time decreasing from 16.5 minutes without payload to around 10 minutes at 500 grams. Findings indicate payload mass directly affects thrust, stability, and endurance. To ensure safe and efficient operation, the optimal payload should not exceed 200–300 grams. This study demonstrates the feasibility of using RC aircraft as a supplementary tool for medical logistics in remote areas, offering a practical and low-cost alternative to traditional delivery methods.

Keywords: RC aircraft; medical delivery; air transport; wireless control; rural health

Design and Development of a High-Intensity Ultraviolet Radiation and Fluctuating Magnetic Field System towards Advanced Experimental Applications

Kanokorn Sungkasing¹, Kamonchanok Saenkompa¹, Jirawat Sannok¹

Asst. Prof. Supakorn Harnsoongnoen, Ph.D.^{2*}

¹Maharakham University Demonstration School (Secondary), Maharakham, 44150, Thailand,

²Maharakham University, Department of physics, Faculty of science, Maharakham, 44150, Thailand

*Corresponding author email: supakorn.h@msu.ac.th

Abstract

This study aims to develop a sophisticated artificial environmental system capable of generating high-intensity ultraviolet (UV) radiation under fluctuating magnetic fields, serving as a foundational platform for investigating the effects on aquatic plants and animals. The system was meticulously designed by installing Helmholtz coils connected to a direct current power supply, positioned on both sides of a glass chamber, with a 15-watt high-intensity UV lamp mounted on top to deliver controlled radiation exposure. Magnetic field intensity was rigorously measured using a smartphone with the phyphox application, with measurements conducted across three vertical levels: Level 1 (chamber bottom), Level 2 (midpoint between the bottom and the center of the Helmholtz coils), and Level 3 (center of the Helmholtz coils). Each level was further divided into nine positions within the effective radius to comprehensively capture spatial variations. The results revealed maximum magnetic field intensities of $1.48 \times 10^2 \mu\text{T}$ at Level 1, $3.79 \times 10^2 \mu\text{T}$ at Level 2, and $6.47 \times 10^2 \mu\text{T}$ at Level 3, with Level 3 exhibiting the highest intensity. These outcomes confirm that the developed system can precisely generate both high-intensity UV radiation and dynamically fluctuating magnetic fields. Consequently, this platform holds significant potential as a versatile research tool for space biology, as well as for studying aquatic plants under extreme and variable environmental conditions, offering a robust foundation for future investigations into the effects of extraterrestrial-like environments on living organisms.

Keywords: Artificial environment system, Ultraviolet (UV) radiation, Fluctuating magnetic fields, Helmholtz coils, Aquatic plants

The Relationship Between String Sound And Accuracy In Japanese Archery (Kyudo)

Ami Yara

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In Kyudo, it is said that skilled archers produce a clear and high-pitched string sound. I wondered if we could use the sound waveform of a skilled archer as a model, and by helping others adjust their sound to match it, they could improve their technique. As a member of the Kyudo club at my high school, I noticed during practice that a lot of instructions are based on physical feelings or intuition. Even the official coaching guides often describe techniques in a vague, sensory way. I thought that if we could use more scientific or physical methods, it might be possible to create a teaching style that works for everyone. I did the experiment with two people, one person pulled the bow and shot the arrow, and the other recorded the 'tsurune,' which refers to the sound made by the bowstring after the arrow is released. The sound of the waveform was changed into data. Then we put the data into Excel and did a Fourier analysis, which produces sine and cosine waves, allowing for the study of their frequencies. I did the same experiment with several people and compared the results.

The experiment found that players with higher skill levels tend to have greater amplitude distributions in both the lower and higher frequency ranges, while the mid-frequency range is less prominent compared to players with lower skill levels. The experiment confirmed that higher skill levels are associated with clearer, higher-pitched bowstring sounds. It was also observed that archers of similar Dan ranks tend to produce similar waveforms.

Investigating The Effects Of A Building's Foundation Columns' Depths And Water-To-Soil Ratio During An Earthquake

Daichi Masuda

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study consisted of two experiments. The first experiment investigated whether the length of piles (foundation columns) driven into the ground correlated with the magnitude of shaking on the above ground floors. A simplified building model with four floors was constructed. Wireless accelerometers were placed on each floor and the pile lengths investigated were 3cm, 6cm, 9cm, 12cm, and 15cm. The accelerometer measurements were taken for each pile length at each floor and the results were compared.

The second experiment investigated whether the amount of water contained in the soil affected the magnitude of shaking experienced on the above ground floors. 3 containers with 4kg of soil each were used and water amounts of 500ml, 1000ml, and 1500ml respectively were added. A simplified building model with four floors was constructed. Wireless accelerometers were placed on each floor and the building piles were set to 3cm, 6cm, 9cm, and 12cm respectively.

References

1. Takayama, M.; Tamura, K.; Ikeda, Y.; et al. The Clearest Explanation of Earthquake Resistance, Vibration Control and Seismic Isolation (Illustrated Diagrams). n.p., n.d.
2. Takayama, M.; Tamura, K.; Ikeda, Y.; et al. Seismic Resistance, Vibration Control and Seismic Isolation Explained (Illustrated Diagrams). n.p., n.d.

Optimal Blade Angle for Wind Power Generation

Kazuya Seki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Clean energy generation is becoming more important as climate change increases global temperatures. In this study, I examined the optimal blade angle and size to improve the efficiency of wind power generation. Blades made of toothpicks and thick paper were attached to a rotating axis, and the amount of electricity generated was measured while varying both the angle and size of the blades. As a result, the most efficient blade angle was found to be 70° , and no power was generated when the wind came from the side. The reason 70° was optimal is that it provided a good balance between lift and drag, maximizing the force acting on the blades. Furthermore, in experiments where the blade size was varied, the highest power output was observed when the vertical length was 8 cm and the horizontal width was 4 cm. This is likely because increasing the width also increased the blade's mass, making it more difficult to rotate. This study may contribute to improving the efficiency of wind power generation and addressing the depletion of fossil fuels.

Investigation Of Rainbow Generation Conditions Using Rainbow Beads

Masamichi Shirataki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In the experiment I conducted, I used small spheres called rainbow beads to simulate the generation of a rainbow.

When investigating the conditions for generating a rainbow, we first looked into how to make it occur under the same conditions as a real rainbow. Our initial plan was to move straight to measuring the angle and examine the refractive index, but there was a significant discrepancy between the angle at which the rainbow occurs and the actual angle at which it occurs, so in this experiment we focused on how to simulate a rainbow under the same conditions as a real rainbow, focusing on the angle.

There are several types of rainbows, and various changes occur not only in the appearance of the rainbow but also in the surrounding area due to the reflection and refraction of light. Investigating how to generate a rainbow under the same conditions as a real rainbow is an essential step in investigating these phenomena.

The main method of the experiment was to attach rainbow beads to paper and shine light on them to create a rainbow. However, when we first tried to create a rainbow using an incandescent light bulb, the location of the rainbow was reversed, so we scaled it up and created a rainbow using sunlight. For example, Alexander's dark bands, which were not visible when using incandescent light bulbs because the scale of the experiment was too small, became clearly observable when experiments were conducted using sunlight.

In experiments using incandescent light bulbs, the angle of the rainbow was much sharper than in real rainbows. However, when experiments were performed using sunlight, a rainbow was generated under conditions close to those of a real rainbow. This was probably due to the relative positions of the light source and the observer.

Exploring The Seismic Resistance Of Traditional Japanese Construction Methods

Sayaka Kaijima

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In 2024, a major earthquake struck the Noto Peninsula, where my grandparents reside. This caused extensive damage to traditional buildings. Consequently, as part of the landscape restoration efforts in Noto, this experiment was conducted to investigate the seismic safety of these structures.

Last year, an experiment investigated the seismic characteristics of traditional buildings. Based on those results, this experiment examined the seismic effects of different beam configurations and compared them with traditional buildings. Two simplified models, each comprising three walls, were constructed. Beams could be inserted into the spaces between the walls. An earthquake simulator was used to apply shaking. The acceleration acting on the wall surfaces was measured and compiled as data.

Overall, the structures demonstrated a lower resistance to horizontal shaking compared to vertical shaking. Based on the data, one of the conventional construction methods was found to have the highest horizontal rigidity, effective distribution of the seismic force across the entire structure, and excellent seismic performance. The findings were generally consistent with existing knowledge that conventional construction methods possess high seismic performance.

Impact Of Breakwater Angles On Tsunami Damage Minimisation

Shotaro Harada

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

In recent years, the probability of earthquakes occurring in the Nankai Trough has increased. Consequently, the probability of tsunami generation has also risen. Furthermore, the way breakwaters are damaged differs, leading us to consider whether this is due to the various slope angles of the breakwaters.

Therefore, in this experiment, a homemade tsunami generator was installed in a water tank. A breakwater was placed at tilted angles (45 degrees, 135 degrees, 90 degrees) to conduct the following measurements: A: Flooded area, B: Spray height, C: Tsunami velocity (before and after the breakwater), D: Tsunami impact (distance blocks moved).

The results showed that the 45-degree breakwater most effectively prevented tsunami inundation and exhibited high wave reflection and attenuation effects. Conversely, the 90-degree breakwater reflected wave energy but resulted in the largest inundation area, failing to disperse the tsunami's momentum. Furthermore, the 135-degree breakwater appears to disperse the wave's force by causing it to climb the slope, thereby reducing its impact on land.

Therefore, the impact of a tsunami varies significantly depending on the breakwater angle. This study suggests that the 45-degree wave-reflecting type is likely the most effective. Moving forward, better results are expected by conducting larger-scale experiments and varying the breakwater material and installation conditions.

Flow Velocity Resistance In Gabions Of Different Shapes

Shunya Watanabe

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

Global warming is currently progressing. Rising sea surface temperatures are expected to bring about increasingly powerful typhoons. I wondered if there was something I could do to prevent the resulting flooding. One thing that caught my eye was a gabion installed on a seawall in Ukishima-cho, Kawasaki Ward, Kawasaki City.

The gabion was installed to protect against scouring caused by typhoon overflows, and weighs eight tons. Seeing this gabion, I wondered if it could withstand the water currents of a massive typhoon. I wanted to investigate a new use for gabions, one designed to disperse water currents.

In a water sink, bricks were used to represent a levee, with a model gabion placed behind it, and which allowed them to connect well with other gabions, making them difficult to move.

The area of water flowing through gabions made of stones held together by a mesh was approximately three times larger than that of cubic wire mesh gabions. The cubic wire mesh gabions are more effective in preventing overflow than gabions made of stones held together by a mesh.

The Relationship Between The Temperature Difference And The Rotational Speed Of A Stirling Engine

Tsukasa Fujisaki

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

The Stirling engine is an external combustion engine that is highly efficient, low in emissions, and expected to contribute to solving environmental problems. The Stirling engine operates based on a temperature difference. By investigating the relationship between rotational speed and temperature difference, it would be possible to determine the efficiency of the power output. In this study, hot water at approximately 70°C was applied to the hot side of an experimental Stirling engine. The temperatures of the hot and cold sides, as well as the number of revolutions within 30 seconds were measured to examine changes in rotational speed. Although there were some variations immediately after startup, once the data stabilized, I found that a larger temperature difference tended to result in higher rotational speed. Additional measurements were taken under conditions in which ice was used to lower the temperature of the cold side. The influence of the cold-side temperature was found to be small, but excessive cooling caused solidification of grease, which led to the engine stopping. These results suggest that the Stirling engine can achieve stable output within an appropriate range of temperature differences. Further verification using improved engines that can adapt to different cooling conditions will be necessary in the future.

Using Model Rocket and Taking Pictures from the Sky

INOUE Sara¹, KANEDA Sara², NAKAMURA Rentaro³, NISHIGAITO Masaaki⁴

¹²³⁴ Fukui Prefectural Wakasa High School, Fukui Prefecture, Japan

Abstract

A model rocket is a small rocket used for education purposes. Today, the world is focusing on space development. A model rocket will be a good opportunity to interest other people. But model rockets are not widely known. This announcement's task is not only flying rockets but also taking pictures. To achieve these goals, we will explain the process of getting a license, making rockets, and flying test rocket's state of pictures and movies.

Verification Of The Flight Path Of Japanese Archery Arrows Using High-Speed Cameras

Yuki Motojima

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

I conducted an experiment about the Flight of the Japanese Archery Arrow. This experiment had two objectives: to deepen the scientific understanding of Kyudo, and to apply this understanding of data to individual instruction.

For the experiment it was assumed that the archer's skill affects how the arrow's speed changes and its maximum value. Additionally, this experiment revealed aspects like the arrow's flight path and acceleration that one wouldn't notice during regular Kyudo practice.

Multiple people drawing bows were filmed to observe whether differences in archery skill resulted in variations in acceleration patterns and maximum values. The main findings of this experiment revealed that while the maximum values varied depending on the archer's skill level, no differences were observed in the manner of acceleration. I considered that the reason no variation in acceleration was observed regardless of the archer's skill was that once the arrow leaves the string, the archer cannot touch it, so the archer's skill may not be reflected after the arrow leaves the string.

In this experiment, the narrow field of view may have prevented us from observing significant differences in acceleration patterns. Therefore, in future experiments, I would like to investigate whether expanding the field of view would reveal such differences.

A Preliminary Study on Developing a Furniture-Inspired Communication Robot for Natural Human–Robot Interaction

ABDULLAH ATTARIQ ALHADI

Tokyo Metropolitan High school of Science and Technology, Tokyo, Japan

Abstract

*An abstract is not required for poster-only presentations.

Development of a Machine Learning Algorithm for Age Group Classification Using Dental Panoramic Radiographs

Rawitsara Takum¹, Intira Cholumjick¹, Supakorn Srion¹, Nattawut Pholasa^{1,2*},
Watcharaporn cholamjiak² and Pornpat Theerasopon³

¹ Demonstration School, University of Phayao 56000, Thailand

² School of Science, University of Phayao, Phayao 56000, Thailand

³ Department of Orthodontics, School of Dentistry, University of Phayao, Phayao 56000, Thailand

* Corresponding author email: Nattawut.ph@up.ac.th

Abstract

Dental panoramic radiographs (DPRs) are widely used in dentistry and forensic science because they provide a comprehensive view of teeth and jaw structures in a single image. Age estimation using DPRs is clinically important for orthodontic planning, dental surgery, and forensic identification. However, conventional methods for age estimation rely heavily on expert evaluation of dental anatomy, which is time-consuming, subjective, and prone to variability. To address these limitations, this study develops a machine learning algorithm for automated age group classification based on DPRs. A dataset of 285 radiographs collected from Songklanagarind Hospital and 1,220 datasets from Roboflow was preprocessed through auto-orientation, cropping, normalization, and augmentation techniques to enhance image quality and model robustness. Four convolutional neural network architectures SqueezeNet, VGG19, ResNet152, and EfficientNet were implemented and trained under consistent conditions. A novel optimization algorithm was integrated into the training framework to improve efficiency and predictive performance beyond standard gradient-based optimizers. Model performance was evaluated using standard classification metrics, including accuracy, precision, recall, and F1-score. The proposed approach is expected to achieve clinically reliable age group classification, supporting non-invasive, scalable, and objective dental age estimation. Potential applications extend to orthodontic treatment planning, assessment of tooth development, dental implant preparation, and forensic identification in cases where other methods are inconclusive. Despite challenges such as image quality variability and class imbalance, the findings suggest that deep learning applied to DPRs offers a promising tool for both clinical and forensic applications. This work demonstrates the feasibility of integrating artificial intelligence into dental diagnostics for improved accuracy and efficiency.

Keywords: 3-5 words, Dental radiographs; Age estimation; Machine learning; Deep learning

Ai-Powered Thalassemia Risk Assessment: Leveraging Red Blood Cell Features For Precision Diagnosis

Jarupoom Keawkham¹, Patcharaphon Surinlert¹, Wanpisut Nonrungrueng¹
and Thitiya Theparod^{2*}

¹Mahasarakham University Demonstration School (Secondary), Maha Sarakham, 44150, Thailand,

²Mahasarakham University, Department of Mathematics, Faculty of science, Mahasarakham, 44150, Thailand

*Corresponding author email: thitiya.t@msu.ac.th

Abstract

Thalassemia is a genetic blood disorder caused by mutations that impair hemoglobin production in red blood cells, leading to reduced cellular function despite a normal or sufficient cell count. In Thailand, approximately 600,000 individuals are affected, and an additional 30–40% of the population are carriers, increasing contributing to a high risk of disease transmission across generations. Although current screening methods such as complete blood count (CBC), hemoglobin analysis, and DNA testing are highly accurate, they remain resource-intensive. To address this limitation, this study aims to develop an artificial intelligence (AI) model for predicting thalassemia risk based on red blood cell features from both patients and healthy individuals. Five classification models were compared Random Forest, Decision Tree, Logistic Regression, Support Vector Machine, and Stochastic Gradient. Among these, the Random Forest model demonstrated the highest accuracy and proved most suitable for practical application. These findings highlight the potential of AI-based approaches to improve screening accuracy, reduce diagnostic burden, save time in clinical services, and support healthcare systems in resource-limited settings, ultimately improving quality of life and reducing the economic and social burden of thalassemia.

Keywords : Thalassemia, complete blood count (CBC), artificial intelligence (AI), Machine learning models

Variations in Urinal Design and Spacing Across Academic Buildings: Evidence from Mahasarakham University.

Chakkarin Khao-on¹, Kasidat Bualad², Wachirawit Nampairoj³

Asst. Prof. Akeapot Srifa^{*1}

^{1,2,3}Mahasarakham University Demonstration School (Secondary)

^{**1}Department of Biology, Faculty of Science, Mahasarakham University

^{*1}Email: akeapot.s@msu.ac.th

Abstract

Designs of restrooms usually consider functionality and aesthetics. Urinals are one of the components in men's restrooms that needs to be arranged for spacing among them within the restroom. Users tend to like urinal with high spacing to keep their personal space while installing more urinals can serve more users. This tradeoff highlights the balance between functionality and aesthetics. This research aimed to survey the characteristics and patterns of urinal installment in men's restrooms across 4 buildings in Kham Riang campus of Mahasarakham University. Urinal morphology, characteristics of installments, and spacing were measured by using a measuring tape. This study surveyed 58 restrooms across 4 buildings: Biological Sciences building (SC2), Faculty of Science (SC1), Faculty of Nursing (NU), and Faculty of Engineering (EN). Overall, it was found that 3 out of 58 restrooms (5%) lacked urinal barriers. The average distance between urinals was 23.0 cm $\pm$ 12.6 cm, with a significant difference among buildings ($H=86.8$, $p=4.536e-8$). The Faculty of Science (SC1) had the lowest average distance at 9.9 cm $\pm$ 3.0 cm. The average height from the floor to the bottom of the urinal was 57.5 cm $\pm$ 5.8 cm, showing a significant difference among buildings ($H=159.2$, $p=0.01177$), where the Faculty of Engineering recorded the lowest average height at 51.8 cm $\pm$ 0.6 cm. Urinal width averaged 45.1 cm $\pm$ 5.0 cm, with significant variation among buildings ($H=12.7$, $p=0.00542$), where the Faculty of Engineering had the lowest average width at 40.0 cm $\pm$ 7.5 cm. Average usable space was at 6.9 m² $\pm$ 4.5 m², also showing a significant difference among buildings ($H=37.5$, $p=3.596e-8$), where the Faculty of Nursing had the lowest average usable space at 3.8 m² $\pm$ 1.3 m². This research highlights the significant inconsistencies in urinal placement and design across these academic buildings, suggesting a clear lack of standardized practices. The findings provide a foundational dataset for future ergonomic studies and restroom design improvements.

Keywords : Urinals, restroom, space, Distance, Barrier

Analysis of Factors Contributing to Population Change in Japan Using ‘Random Forest’

Shona Tanaka

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

With Japan facing a rapid population decline and aging, understanding the drivers of population change has become increasingly important. This study aimed to identify the key factors influencing population growth or decline in Japan by analyzing various social and economic indicators using a random forest model. Furthermore, SHAP values (a method used to explain the output of machine learning models) were used to visualize the direction and magnitude of each factor's influence. The results showed that life event-related indicators such as birth rates and marriage rates had a positive impact on population growth, whereas economic indicators did not necessarily correlate positively with population increase. Birth rate is the most critical determinant of population growth. Macroeconomic indicators like GDP and exchange rate have limited direct influence. Rising prices (CPI) reduce the positive effects of income growth, increasing financial strain and contributing to population decline. A comprehensive understanding of population dynamics must consider both economic indicators and real living costs. These findings suggest that understanding population dynamics requires a multifaceted perspective - not only considering raw economic figures, but also incorporating factors such as cost of living and subjective quality of life.

Convergence and Divergence: A Decade of "New Engel's Coefficient" in Beijing and Tokyo

Shinhao Ō

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

I have lived in both Beijing and Tokyo, and I have felt a significant difference in daily living costs. This inspired me to investigate how much people can actually live on in each city, especially under minimum wage conditions. I used the economic indicator Engel's coefficient to measure the level of financial pressure. This coefficient is widely used as an indicator of living standards and economic well-being. As household income increases, the proportion of income spent on food typically decreases, even though the absolute amount spent on food may rise. I compared the cost of living for minimum wage earners in Beijing and Tokyo. I calculated and analyzed the data using Engel's coefficient in both cities using a standardized model of food and living expenses. I explored whether the minimum wage can actually support basic living expenses in both societies. First, I set a monthly food consumption standard based on nutrition guidelines and real consumption data. I collected the current minimum wage data (15 Chinese yuan renminbi per hour in Beijing and 1,113 Japanese yen per hour in Tokyo). I estimated the monthly income and monthly food expenses, and calculated it using Engel's coefficient:

$$\text{Engel's Coefficient} = \frac{\text{Food Expenditure}}{\text{Total Expenditure}} \times 100\%$$

Beijing's (China) Engel's Coefficient was 53.6%, and Tokyo's (Japan) was Engel's Coefficient was 22.7%. Overall, I found that in Beijing, minimum wage earners face high food cost burden; more than 50% of income goes on food. In Tokyo, despite higher food prices, higher income makes life more sustainable. The Engel's coefficient clearly shows that the minimum wage in Japan supports a more stable lifestyle. In the future, I would like to compare changes in Engel's coefficient over the past 10 to 20 years. In addition, I would like to include other costs (rent, transport, education) for a more complete view. Finally, I would like to develop a visual tool or app that shows the real-time Engel's coefficient based on region and income.

Solving Hit-And-Blow With Mathematics: The Quest For The Shortest Move Count

Mika Son

Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

I experimented with the fastest way to solve the Hit-and-Blow game. This game involves guessing the position and color of four hidden pegs chosen from a set of six colors. Clearing the game requires perfectly matching both the color and position of each peg. I researched this experiment to find a way to solve it faster, hoping to make the game feel a little easier and more enjoyable. I investigated this mathematically, using “entropy” this time. When I incremented the numbers on the PC from 1111 to 1112 and beyond, the value distribution gradually increased. The values became significantly larger for combinations like 1123 and 1234. By creating a table, I found that the closer the Hit-and-Blow values are to 1, the faster the game can be cleared. The reason I chose this theme is that I am not very good at or particularly fond of the game Hit-and-Blow itself, so I thought that if I could find the fastest way to solve it, I might enjoy it a little more. I experimented using a PC and a mathematical formula to determine the total number of moves required to clear the game by varying the number of digits and using a formula involving hits, blows, and entropy. I found that 1234 and all numbers with completely different digits had high entropy, but 1123, which has a repeated digit, had a slightly higher entropy. This time I conducted the experiment using only entropy, but I think that using other formulas or methods would likely yield faster and clearer solutions.

Effective Positioning For Successful 3-Point Basketball Shots

Ayata Okamoto¹ and Tembu Nishikawa²

¹²Tokai University Takanawadai Senior High School, Tokyo, Japan

Abstract

This study explored the effectiveness of three-point (3P) basketball shots taken from different court positions. The motivation came from the idea that basketball is often viewed as a cool and attractive sport, and that mastering the 3P shot may contribute to a player's confidence and appeal.

To test this, participants attempted 3P shots from several angles: the center, the right 45°, and the left 45° positions. Results were recorded and averaged for each location. Analysis of the data revealed that the left 45° position consistently produced the highest success rate and showed the greatest stability across players. In contrast, other angles displayed more variability and lower averages. These findings suggest that certain shooting angles may provide a natural advantage, possibly due to shooting mechanics, body orientation, or visual alignment with the basket.

Understanding these differences could be valuable both for beginners seeking to improve their performance and for coaches designing practice drills. While the context of this study was playful, the results highlight how experimental approaches can yield practical insights into sports performance.



- Tokai University Takanawadai Senior High School
- Niigata Prefectural Shibata High School
- Fukui Prefectural Wakasa High School
- Yamagata Prefectural Touhokukan Senior High School
- Tokyo Metropolitan High school of Science and Technology
- Mahasarakham University Demonstration School (Secondary)
- Demonstration School, University of Phayao