2024
DPST
Conference on
Science and Technology

Book of Abstracts

DPST CONFERENCE
ON SCIENCE AND TECHNOLOGY
2024

2nd - 4th August 2024
at Miracle Grand Convention Hotel, Bangkok, Thailand

Joint activities with
the Celebration of 40th Anniversary of DPST Scholarship

2527–2567
40

Welcome Message

**President of The Institute for the Promotion of Teaching Science and Technology
DPST Conference on Science and Technology 2024 (DPSTcon2024) on the celebration of
40th Anniversary of DPST Scholarship**

The DPST Conference on Science and Technology 2024 is held on an auspicious occasion to celebrate the 40th Anniversary of DPST Scholarship. DPSTcon is considered an extracurricular activity for students under the Development and Promotion of Science and Technology Talents Project (DPST). The conference aims to provide an academic forum for DPST scholarship students in the 3rd and 4th year undergraduate levels to present their research findings in science, mathematics and technology, as well as to exchange knowledge with experts, researchers and academics in order to create a network of research cooperation and disseminate science, mathematics and technology outputs. This conference is a combination of academic work and supplementary activities to enhance the qualifications of scientists and innovators by encouraging DPST scholarship students to demonstrate their creativity and innovation in the various fields categorized as mathematics, physics, chemistry, biology, geology and computer science. The Institute for the Promotion of Teaching Science and Technology (IPST) hopes that DPST scholarship students will be inspired by many DPST alumni and experts. The students will not only receive an excellent academic experience, but also be able to apply the knowledge and experience gained from the academic presentations in order to continue their education at a higher level to develop themselves, society, economy and the country. IPST would like to express our sincere appreciation to the Association of the Scholars of the Development and Promotion for Science and Technology talents project (ASDPST) for hosting the DPSTcon2024. Special thanks to the committee members, professors and staff for their contribution to the success of all activities in the conference and to all the students and DPST alumni for their participation. IPST believes that this conference will serve as a platform for DPST scholarship students to showcase academic achievement, exchange knowledge, and build a strong DPST network, which will eventually benefit all participants in the future for sustainability.

Associate Professor Dr. Thiradet Jiarasuksakun

President of The Institute for the Promotion of Teaching Science and Technology (IPST)

Welcome Message

President of the Association of the Scholars of the Development and Promotion for Science and Technology talents project (ASDPST)

On behalf of the organizing committee, I am delighted to welcome all participants to the DPST Conference on Science and Technology 2024 (DPSTcon 2024), taking place from 2nd to 4th August 2024 at Miracle Grand Convention Hotel in Bangkok. This year's conference holds special significance as it forms part of the celebrations marking the 40th anniversary of the DPST Scholarship.

DPSTcon 2024 continues its tradition of providing a valuable platform for 4th-year undergraduate students in the DPST program to showcase their research and explore diverse scientific topics. This annual gathering brings together young scientists with their peers and renowned experts from across Thailand, fostering an environment of learning and innovation. The conference enhances students' presentation skills, both oral and poster, while facilitating engaging discussions. As the conference includes various scientific disciplines, it fosters interdisciplinary learning and encourages students to widen their perspectives beyond their primary fields. In addition, students have an opportunity to participate in special seminars, talks, and exhibitions highlighting the achievements of the past four decades of the DPST scholarship and learn from the success stories of DPST alumni. Through dedicated exhibitions and presentations, participants will gain valuable insights into the diverse career paths and practical guidance for their own future endeavors.

The Association of the Scholars of the Development and Promotion for Science and Technology talents project (ASDPST) would like to extend our gratitude to The Institute for the Promotion of Teaching Science and Technology (IPST) for their unwavering support. Our sincere thanks also go to the committees, speakers, session chairs, and the dedicated organizing team for their hard work in making this conference possible. We wish all participants a productive, inspiring, and memorable experience at the DPST Conference on Science and Technology 2024.

Associate Professor Dr. Parinya Sa Ngiamsunthorn

President of the Association of the Scholars of the Development and Promotion for Science and Technology talents project (ASDPST)

Academic Committee

MATH: Mathematics and Statistics

Assoc. Prof. Dr. Pawaton Kaemawichanurat	King Mongkut's University of Technology Thonburi
Assoc. Prof. Dr. Parinya Sa Ngiamsunthorn	King Mongkut's University of Technology Thonburi
Asst. Prof. Dr.Witsarut Pho-On	Srinakharinwirot University
Assoc. Prof. Dr. Athassawat Kammanee	Prince of Songkla University
Dr. Korkeat Korkeathikhun	Chulalongkorn University
Dr. Monchai Kooakachai	Chulalongkorn University
Dr. Rawee Suwandechochai	Mahidol University
Asst. Prof. Dr. Thidaporn Supapakorn	Kasetsart University
Asst. Prof. Dr. Udomsak Rakwongwan	Kasetsart University
Asst. Prof. Dr. Supanut Chaidee	Chiang Mai University

BIOL: Biological Sciences

Assoc. Prof. Dr. Anchalee Sirikhachornkit	Kasetsart University
Asst. Prof. Dr. Sittiporn Pattaradilokrat	Chulalongkorn University
Asst. Prof. Dr. Pornsri Charoenpanich	Silpakorn University
Asst. Prof. Dr. Wittaya Kaonongbua	King Mongkut's University of Technology Thonburi
Dr. Yaowaluck Maprang Roshorm	King Mongkut's University of Technology Thonburi
Dr. Vachirapong Charoennitiwat	Mahidol University
Dr. Napat Ratnarathorn	Mahidol University

CHEM: Chemistry

Dr. Aurapat Ngamnithiporn	Chulabhorn Research Institute
Dr. Jutatip Boonsombat	Chulabhorn Research Institute
Dr. Piyachat Chuysinuan	Chulabhorn Research Institute
Dr. Kornkanya Pratumyot	King Mongkut's University of Technology Thonburi
Asst. Prof. Dr. Pakawan Puangsombat	Chiang Mai University

CHEM: Chemistry (Cont.)

Asst. Prof. Dr. Panupun Limpachayaporn	Silpakorn University
Dr. Tatchamapan Yoskamtorn	Chulalongkorn University
Dr. Rongrong Cheacharoen	Chulalongkorn University
Assoc. Dr. Thanthapatra Bunchuay	Mahidol University
Dr. Watcharaphol Paritmongkol	VISTEC

PHYS: Physics

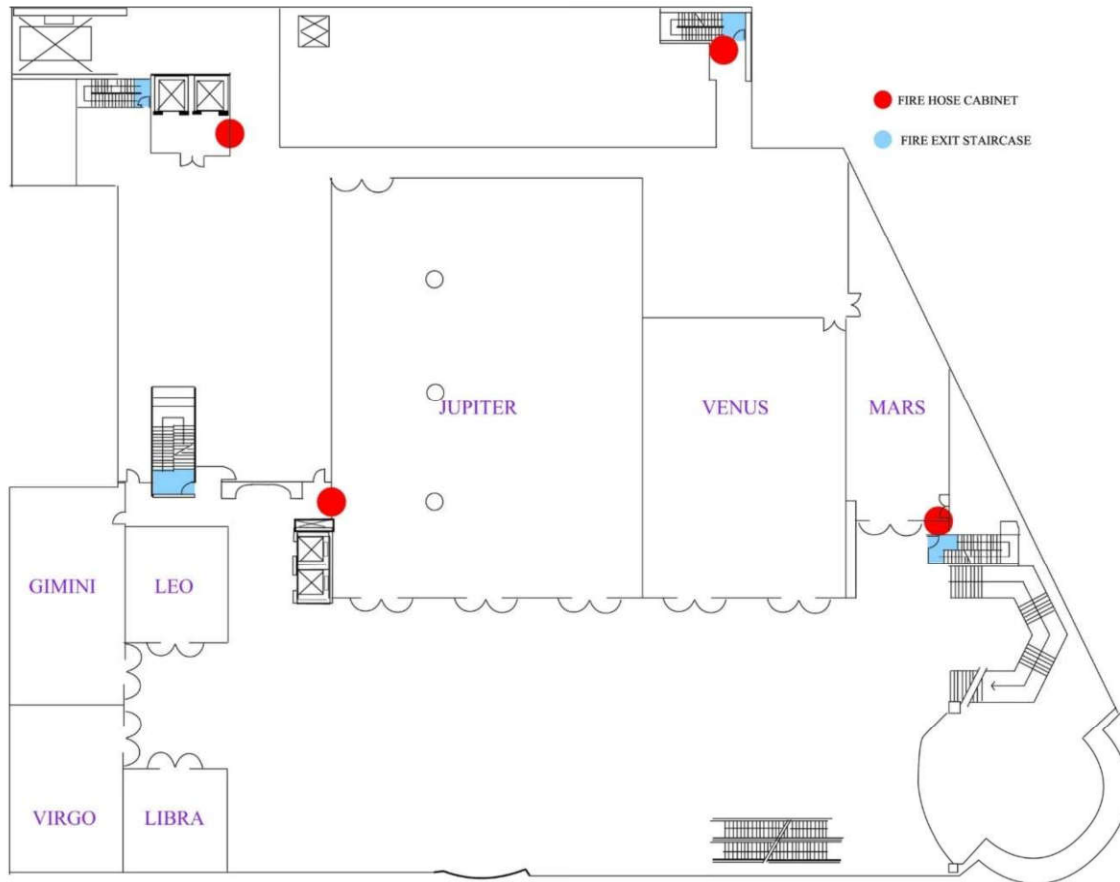|	
Dr. Apimook Watcharangkool	NARIT
Asst. Prof. Dr. Busara Pattanasiri	Kasetsart University
Asst. Prof. Dr. Witchukorn Phuthong	Kasetsart University
Dr. Grit Pichayawaytin	NECTEC
Asst. Prof. Dr. Pawin Ittisamai	Chulalongkorn University
Dr. Petchara Pattarakijwanich	Mahidol University
Dr. Preecha Kiatkirakajorn	The Office of National Higher Education Science Research and Innovation Policy Council (NXPO)
Asst. Prof. Dr. Sitti Buathong	Burapha University
Dr. Panupon Samaimongkol	Burapha University, Chanthaburi Campus
Dr. Somrudee Deepaisarn	Sirindhorn International Institute of Technology

GEOL: Geology

Asst. Prof. Dr. Pichawut Manopkawee	Chiang Mai University
Assoc. Prof. Dr. Sakonvan Chawchai	Chulalongkorn University
Asst. Prof. Dr. Sitti Buathong	Burapha University

COMP: Computer Science
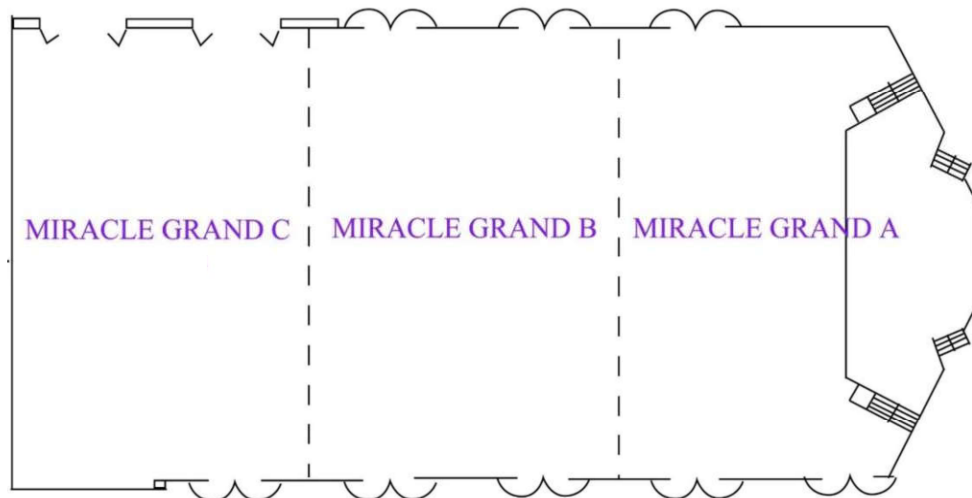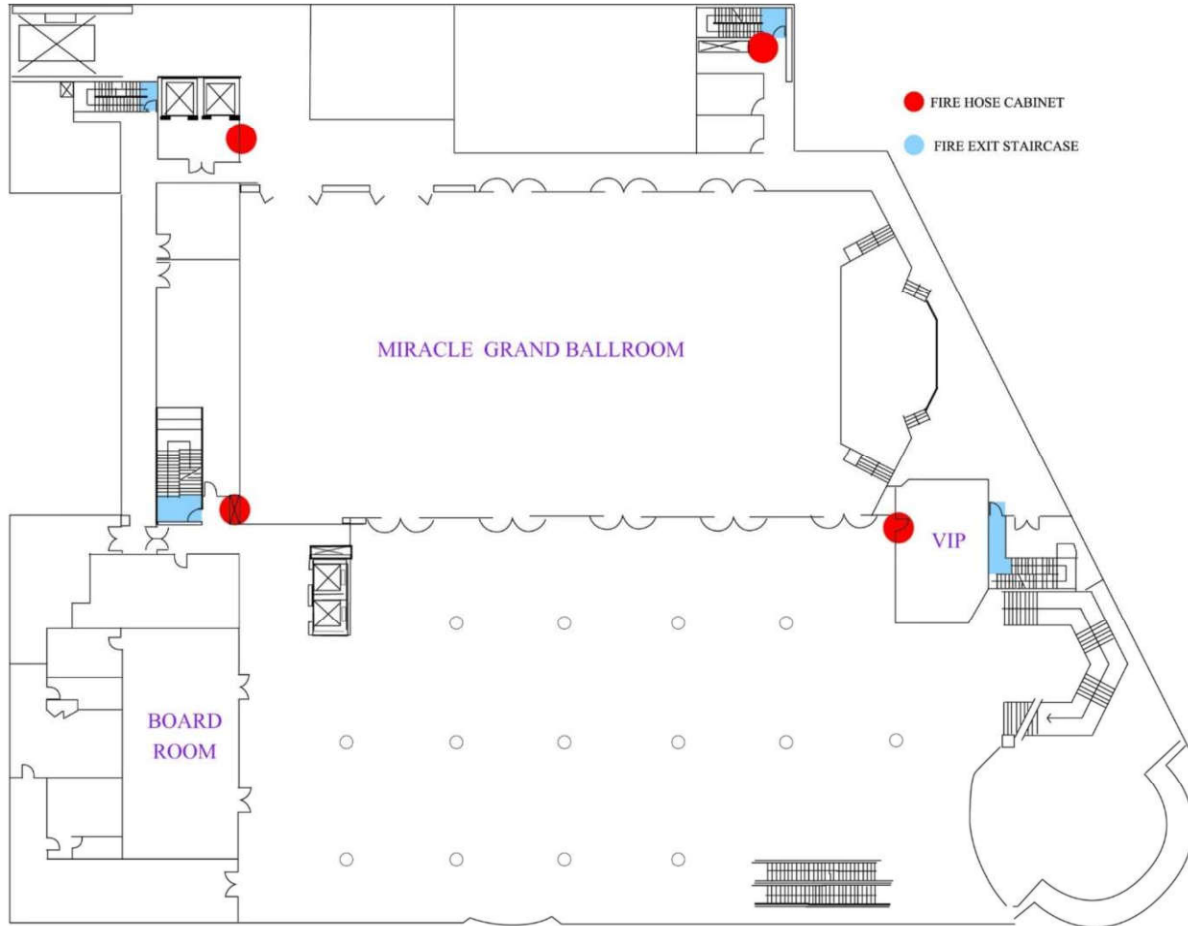
Asst. Prof. Dr. Busara Pattanasiri	Kasetsart University
Dr. Pisut Wisessing	CMKL University
Dr. Somrudee Deepaisarn	Sirindhorn International Institute of Technology

Floor Plans

3rd Floor: Presentation Rooms & Lunch

FIRE HOSE CABINET

FIRE EXIT STAIRCASE

JUPITER

VENUS

MARS

GIMINI

LEO

VIRGO

LIBRA

4ᵗʰ Floor: Main Event Rooms & Presentation Rooms

● FIRE HOSE CABINET

● FIRE EXIT STAIRCASE

MIRACLE GRAND BALLROOM

VIP

BOARD
ROOM

MIRACLE GRAND C | MIRACLE GRAND B | MIRACLE GRAND A

Program Overview

Time	Programs	Places
1st August 2024		
15.00 - 20.00	Registration	Grand Ballroom Foyer
15.00 - 20.00	Poster registration	Miracle Grand C
15.00 - 20.00	Submission of oral presentation file	Online
2nd August 2024		
8.00 - 8.30	Registration	Grand Ballroom Foyer
8.30 - 10.00	Opening ceremony	Miracle Grand A - B
10.00 - 10.30	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
10.30 - 10.40	Coffee break	
10.40 - 12.00	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
12.00 - 13.00	Lunch	Jupiter Room
13.00 - 15.00	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
15.00 - 15.30	Coffee break and job fair I	Miracle Grand A - B
15.30 - 16.30	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
16.30 - 18.30	Poster session I	Miracle Grand C
18.30 - 22.00	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
3rd August 2024		
8.00 - 9.00	Registration	Grand Ballroom Foyer
9.00 - 10.15	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
10.15 - 10.45	Coffee break and job fair II	Miracle Grand A - B
10.45 - 12.00	Activity of the 40th Anniversary Celebration	Miracle Grand A - B
12.00 - 13.00	Lunch	Jupiter Room
13.00 - 14.00	Oral presentation session I	Parallel sessions
14.00 - 14.30	Coffee break and job fair III	Miracle Grand A - B
14.30 - 17.00	Oral presentation session II	Parallel sessions
17.00 - 19.00	Poster session II	Miracle Grand C
19.00 - 22.00	Activity of the 40th Anniversary Celebration	Jupiter Room

Time	Programs	Places
4th August 2024		
8.00 - 8.45	Registration	Grand Ballroom Foyer
8.45 - 9.45	Oral presentation session III	Parallel sessions
9.45 - 10.30	Coffee break	
12.00 - 13.00	Lunch	Jupiter Room
13.00 - 14.30	Closing ceremony and awards	Miracle Grand A - B
14.30	Coffee break	
14.30	Poster removal	Miracle Grand C

Poster Presentation Program

Poster presentation session I 2nd August 2024 16.30 – 18.30			
MATH01	BIOL01	CHEM01	PHYS10
MATH03	BIOL03	CHEM03	PHYS11
MATH05	BIOL05	CHEM05	PHYS12
MATH07	BIOL07	CHEM07	PHYS17
MATH09	BIOL09	CHEM09	PHYS18
MATH11	BIOL11	CHEM11	PHYS19
MATH13	BIOL13	CHEM13	PHYS20
MATH15	BIOL15	CHEM15	PHYS24
MATH17	BIOL17	CHEM17	
MATH19	BIOL19	CHEM19	
MATH21	BIOL21	CHEM21	
MATH23	BIOL23	CHEM23	
MATH25	BIOL25	CHEM25	
MATH27	BIOL27	CHEM27	
MATH29	BIOL29		
MATH31	BIOL31		
MATH33	BIOL33		
MATH35	BIOL35		
MATH37	BIOL37		

Poster presentation session II 3rd August 2024 17.00 – 19.00					
MATH02	BIOL02	CHEM02	PHYS01	COMP01	GEOL01
MATH04	BIOL04	CHEM04	PHYS02	COMP02	GEOL02
MATH06	BIOL06	CHEM06	PHYS03	COMP03	GEOL03
MATH08	BIOL08	CHEM08	PHYS04		
MATH10	BIOL10	CHEM10	PHYS05		
MATH12	BIOL12	CHEM12	PHYS06		
MATH14	BIOL14	CHEM14	PHYS07		
MATH16	BIOL16	CHEM16	PHYS08		
MATH18	BIOL18	CHEM18	PHYS09		
MATH20	BIOL20	CHEM20	PHYS13		
MATH22	BIOL22	CHEM22	PHYS14		
MATH24	BIOL24	CHEM24	PHYS15		
MATH26	BIOL26	CHEM26	PHYS16		
MATH28	BIOL28	CHEM28	PHYS21		
MATH30	BIOL30		PHYS22		
MATH32	BIOL32		PHYS23		
MATH34	BIOL34		PHYS25		
MATH36	BIOL36		PHYS26		
			PHYS27		

Oral Presentation Program

Time\Room	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
3rd Aug 2024	**Miracle Grand A**	**Miracle Grand B**	**Leo**	**Gemini**	**Virgo**	**Libra**	**Venus**	**Mars**
13.00 - 13.15			MATH01	MATH19	COMP01	GEO01	BIOL01	BIOL18
13.15 - 13.30	CHEM01	CHEM13	MATH02	MATH20	COMP02	GEO02	BIOL02	BIOL19
13.30 - 13.45	CHEM02	CHEM14	MATH03	MATH21	COMP03	GEO03	BIOL03	BIOL20
13.45 - 14.00	CHEM03	CHEM15	MATH04	MATH22	MATH37		BIOL04	BIOL21
14.00 - 14.30	Break							
14.30 - 14.45	CHEM04	CHEM16	MATH05	MATH23	PHYS01	PHYS15	BIOL05	BIOL22
14.45 - 15.00	CHEM05	CHEM17	MATH06	MATH24	PHYS02	PHYS16	BIOL06	BIOL23
15.00 - 15.15	CHEM06	CHEM18	MATH07	MATH25	PHYS03	PHYS17	BIOL07	BIOL24
15.15 - 15.30	CHEM07	CHEM19	MATH08	MATH26	PHYS04	PHYS18	BIOL08	BIOL25
15.30 - 15.45	CHEM08	CHEM20	MATH09	MATH27	PHYS05	PHYS19	BIOL09	BIOL26
15.45 - 16.00	CHEM09	CHEM21	MATH10	MATH28	PHYS06	PHYS20	BIOL10	BIOL27
16.00 - 16.15	CHEM10	CHEM22	MATH11	MATH29	PHYS07	PHYS21	BIOL11	BIOL28
16.15 - 16.30	CHEM11	CHEM23	MATH12	MATH30	PHYS08	PHYS22	BIOL12	BIOL29
16.30 - 16.45	CHEM12	CHEM24	MATH13	MATH31	PHYS09	PHYS23	BIOL13	
16.45 - 17.00			MATH14	MATH32	PHYS10			
4th Aug 2024	**Miracle Grand A**	**Board Room**	**Leo**	**Gemini**	**Virgo**	**Libra**	**Venus**	**Mars**
8.45 - 9.00	BIOL34	CHEM25	MATH15	MATH33	PHYS11	PHYS24	BIOL14	BIOL30
9.00 - 9.15	BIOL35	CHEM26	MATH16	MATH34	PHYS12	PHYS25	BIOL15	BIOL31
9.15 - 9.30	BIOL36	CHEM27	MATH17	MATH35	PHYS13	PHYS26	BIOL16	BIOL32
9.30 - 9.45	BIOL37	CHEM28	MATH18	MATH36	PHYS14	PHYS27	BIOL17	BIOL33

Detailed Oral Presentation Program
3rd August 2024

3rd August 2024

Room 1: Miracle Grand A

Time	Code	Title	Presenter	Affiliation
13.15 - 13.30	CHEM01	Monolithic Sorbents for Micro-solid Phase Extraction of Cancer Marker, 8-Hydroxy-2'-deoxyguanosine in Human Urine	Manaphon Traswiman	Suranaree University of Technology
13.30 - 13.45	CHEM02	Expression and Purification of Ferritin for Light-Activated Carbon Monoxide Release Using a Nanocarrier Approach	Tanunya Kamthong	Suranaree University of Technology
13.45 - 14.00	CHEM03	Activated Charcoal Composite Monolith for Micro-solid Phase Extraction of 5-Hydroxyindoleacetic Acid in Human Urine	Rawisara Woensanthia	Suranaree University of Technology

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	CHEM04	Development of Zwitterionic Polymer Hydrogel for Glucose Detection	Tasanaipimol Sivaranon	Chulalongkorn University
14.45 - 15.00	CHEM05	Development of Cellulose Hydrogels Derived from Paper Wastes for Drug Release Applications	Phatthanan Laddawan	Silpakorn University
15.00 - 15.15	CHEM06	The Study of Natural Products from the Culture of *Pseudolagarobasidium* sp. PP17-33 Fungus	Issara Wongsahassawat	Khon Kaen University
15.15 - 15.30	CHEM07	Synthesis of Hexaphenylacepleiadylene	Kittithuch Photong	Mahidol University
15.30 - 15.45	CHEM08	Synthesis of Alkyne Probes of Lovastatin Derivatives	Sasikan Boonsanong	Prince of Songkla University
15.45 - 16.00	CHEM09	Synthesis of Quinuclidinium-containing Methacrylamide-based Monomers for Dental Resin Adhesive	Veerapat Suksai	Prince of Songkla University
16.00 - 16.15	CHEM10	Development of Surface-coated SO3H Carbon Based Catalysts via Condensation of SO3H Containing Monomer	Niratchada Klayphet	Prince of Songkla University
16.15 - 16.30	CHEM11	A Fluorescence Sensor Employs Alizarin-boronic Acid Adduct for Fructose Detection on a Miniature Fluorescence Device-based Smartphone	Aphsit Roschan	Khon Kaen University
16.30 - 16.45	CHEM12	Performance of Lignin and Lignin/AgNPs as Eco-friendly Reinforcing Fillers in Dental Resin Adhesives.	Suphannikar Matphang	Kasetsart University

3rd August 2024

Room 2: Miracle Grand B

Time	Code	Title	Presenter	Affiliation
13.15 - 13.30	CHEM13	Structural Studies of Substituent Effects in [Fe(qsal-X)2]OTf Complexes	Pannawich Jaratape	Walailak University
13.30 - 13.45	CHEM14	Development of WO3/Cs3Sb2Br9 Composite Photocatalyst for Oxidation of Benzyl Alcohol under Green Light Irradiation	Sutsiri Wongngam	Chiang Mai University
13.45 - 14.00	CHEM15	Decoration of Single Gold Atoms and Gold Nanoclusters Supported on MoS2 Nanosheets for Enhanced Hydrogen Evolution Reaction	Nichakarn Sornnoei	Kasetsart University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	CHEM16	Coupled High- and Low-temperature Hydrides for Thermochemical Heat Storage	Chonticha Hansongkram	Suranaree University of Technology
14.45 - 15.00	CHEM17	Boron-doped Diamond Electrode for Electrochemical Detection of Melatonin	Witchayatip Satianram	Suranaree University of Technology
15.00 - 15.15	CHEM18	Low-cost Gold Leaf Electrochemical Sensor and Performance in Detection of Formaldehyde	Supakorn Kittikomoldej	Mahidol University
15.15 - 15.30	CHEM19	A Study of Appropriate Conditions in P-doped Synthesis of Molybdenum Nickel Sulfide Alloys for Application as a Catalyst in the Hydrogen Evolution Reaction	Parinthorn Rattanapan	Walailak University
15.30 - 15.45	CHEM20	Investigation of Carbon Dots (CDs)-Based Fluorescence Turn-off and Turn-on Sensing for Detection of Aspartame	Rewat Nakwisai	Mahidol University
15.45 - 16.00	CHEM21	Development of Portable Retinoic Acid Sensor in Acne Treatment Medicine Using MoS_2-modified Screen-printed Carbon Electrode	Pimphavee Jandahong	Silpakorn University (Sanam Chandra Palace Campus)
16.00 - 16.15	CHEM22	Multivariate Optimization for Vortex-assisted Dispersive Liquid-liquid Microextraction Using Solidified Floating Organic Drop for Nickel Determination in Food Samples by FAAS	Kwanjira Rattakham	Naresuan University
16.15 - 16.30	CHEM23	Fabrication of a Compact Screen-printed Carbon Electrode for Hydrogen Peroxide Detection Based on Bipolar Electrochemiluminescence	Saharat Srisawan	Chiang Mai University
16.30 - 16.45	CHEM24	A Smartphone-based Portable Fluorescence Device for the Detection of Sulfide Ions	Samuch Phetduang	Khon Kaen University

3rd August 2024

Room 3: Leo

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	MATH01	Some Acyclically 5-Choosable Graphs	Sajjaporn Srinet	Khon Kaen University
13.15 - 13.30	MATH02	Edge Coloring and List Edge Coloring of Uma's Graphs and Ryu's Graphs	Chayanon Boonsri	Khon Kaen University
13.30 - 13.45	MATH03	The Roman Domination Number of GCD-Graph	Wachirawut Talwong	Khon Kaen University
13.45 - 14.00	MATH04	Hamiltonian Cycles in Cayley Graphs of Gyrogroups	Charawi Detphumi	Walailak University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	MATH05	Some Generalization of Integral Inequalities Similar to Hardy's Inequalities via (p,q)-Calculus	Yuttagarn Nanjamrat	Khon Kaen University
14.45 - 15.00	MATH06	Fixed Point Theorem for Mappings of Generalized Edelstein-Suzuki's Type	Chaichol Hengsuwan	Khon Kaen University
15.00 - 15.15	MATH07	Novel Closed-form Formula for Conditional Moments of Ornstein–Uhlenbeck Process: A PDE Approach	Phanumas Saengpak	Kasetsart University
15.15 - 15.30	MATH08	Iterative Laplace Transform Method for the Time-Fractional Equations	Chayanon Wannarat	Prince of Songkla University

Time	Code	Title	Presenter	Affiliation
15.30 - 15.45	MATH09	General Solution of the Maxwell Equations to the Stagnation Point Problem with Cylindrical Symmetry	Chittawan Chittam	Suranaree University of Technology
15.45 - 16.00	MATH10	Complete Solutions for Second-order Ordinary Differential Equations	Praeploy Poonprapan	Khon Kaen University
16.00 - 16.15	MATH11	Convergences of Weighted Averaged Operators in p-Uniformly Convex Metric Spaces	Anawat Rodchan	Khon Kaen University
16.15 - 16.30	MATH12	Optiming Neural Ordinary Differential Equations with Lookahead Optimizer	Niyata Sanngai	Chiang Mai University
16.30 - 16.45	MATH13	Extension of Cover's Probability Puzzle	Taratep Rodchomngam	Chulalongkorn University
16.45 - 17.00	MATH14	Global Stability and Optimal Control of Within-host Model of Dengue Virus Infection with Vaccination and Immune Response	Pornthera Aimrod	Naresuan University

3rd August 2024
Room 4: Gemini

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	MATH19	Efficiency of Minimizing Risk Model in Investment in Stock Markets and Its Application in the Stock Exchange of Thailand	Maikwan Pungsrinon	Walailak University
13.15 - 13.30	MATH20	Markowitz Portfolio Theory on Set 50	Rattikarn Pankadae	Walailak University
13.30 - 13.45	MATH21	Application of Real Option to Solve the Venture Problem of Polyplex (Thailand) Public Company Limited	Monthicha Anunak	Silpakorn University
13.45 - 14.00	MATH22	Forecasting Technology Sector Stock Prices Using Machine Learning LSTM and Seasonal Autoregressive Integrated Moving Average	Phontagorn Boonjen	Walailak University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	MATH23	Analysis of Road Traffic Accidents in Thailand Using Machine Learning Techniques	Totsaprach Phanwichit	Suranaree University of Technology
14.45 - 15.00	MATH24	Delivery Zones Partitioning Considering Workload Balance Using Clustering Algorithm	Jaruwan Wangwattanakool	Mahidol University
15.00 - 15.15	MATH25	Data Analysis of Coffee Consumption and Cardiovascular Disease and Development of an Integrated Data Mining Framework for Disease Classification	Nattanicha Reanroo	Mahidol University
15.15 - 15.30	MATH26	Classification of Rice Grains Using a Feedforward Neural Network: An Analysis of Optimization Techniques and Activation Functions	Peerawit Yongyinghan	Suranaree University of Technology
15.30 - 15.45	MATH27	A Comparison of the Efficiency of the DEWMA DMEWMA and MEC Control Chart for Normal Distribution	Chawanagorn Sujintwong	Silpakorn University
15.45 - 16.00	MATH28	Negative Binomial-Size Biased Three-Parameter Lindley Distribution with Properties and Applications	Chorchaba Huneim	Silpakorn University

Time	Code	Title	Presenter	Affiliation
16.00 - 16.15	MATH29	Prediction Model of PM 2.5 Concentration in Northern Region of Thailand Using Atmospheric Parameters	Sila Chalee	Chiang Mai University
16.15 - 16.30	MATH30	Using Convex Hull for Analyzing the State of Fall Detection	Kanchanok Udomjetjamnong	Suranaree University of Technology
16.30 - 16.45	MATH31	The Prediction of Silpakorn Pradit Acrylic Colors Combinations Using the Kubelka-Munk Model	Autcha Sudjai	Silpakorn University
16.45 - 17.00	MATH32	Optimization Methods for Solving the Capacitated Vehicle Routing Problems with Discrete Uniform Distribution Demand	Phuttharak Khadchaphuthad	Khon Kaen University

3rd August 2024
Room 5: Virgo

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	COMP01	Comparison of Neural Network Models for Digital Image Colorization	Sunisa Duangtham	Naresuan University
13.15 - 13.30	COMP02	Innovative VR Solutions for Chest X-ray Training: Improving Skills and Student Satisfaction	Vachirapon Tosawat	Naresuan University
13.30 - 13.45	COMP03	Improving Underwater Object Detection Through Data Augmentation.	Sarawut Buakanok	Naresuan University
13.45 - 14.00	MATH37	DeepToothDuo: Multi-task Age-Sex Estimation and Understanding via Panoramic Radiograph	Natthanich Hirunchavarod	Khon Kaen University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	PHYS01	Particle Energization in Collisionless Shocks through Particle-in-Cell Simulations	Kittiya Plianaek	Kasetsart University
14.45 - 15.00	PHYS02	Simulation of Electron-Nuclear Spin Dynamics Using Liouville Superoperator	Teerapath Sitawan	Suranaree University of Technology
15.00 - 15.15	PHYS03	The Convergence of Ollivier-Ricci Curvature Scalar in the Grid Geometric Graphs	Chattong Yubonpan	Khon Kaen University
15.15 - 15.30	PHYS04	Traversable Wormholes in Minimally Geometrical Deformed Trace-Free Gravity Using Gravitational Decoupling	Piyachat Panyasiripan	Walailak University
15.30 - 15.45	PHYS05	Confronting Interstellar Extinction in the Line of Sight of Galactic Bulge with the VVV Survey	Tanagodchaporn Inyanya	Chiang Mai University
15.45 - 16.00	PHYS06	Long-term Study of PSR J2129-0429 with the Thai National Telescope	Sittipong Konkaew	Chiang Mai University
16.00 - 16.15	PHYS07	Evolution of Axial Ratio Distribution of Galaxies across 13 Billion Years of the Universe	Nattaporn Thongphaijit	Mahidol University
16.15 - 16.30	PHYS08	Powering the Extended Corona near Accreting Black Holes	Sirichok Khumwiriyakun	Suranaree University of Technology
16.30 - 16.45	PHYS09	Using a Neural Network to Determine the Atmospheric Parameters of Exoplanets	Phloiphailin Wiangsanthia	Suranaree University of Technology
16.45 - 17.00	PHYS10	Demonstration of 3D Dipole Light Scattering	Nicharee Janjuang	Naresuan University

3rd August 2024

Room 6: Libra

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	GEOL01	A Preliminary Study of Traveltime Anomaly of Seismic Waves: An Implication for Deep Geological Structure Beneath Thailand	Thanakan Anchana	Mahidol University Kanchanaburi Campus
13.15 - 13.30	GEOL02	Characterization of Impact-generated High-pressure (HP) Glass Using Atomic Force Microscopy	Muanfan Wantong	Kasetsart University
13.30 - 13.45	GEOL03	Influence of Seasonal Factors on Heavy Metals Concentration in Estuaries of the Inner Gulf of Thailand	Phannathon Samaiklang	Kasetsart University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	PHYS15	Daily Solar Radiation and PM2.5 Concentration Forecasting in Thailand Using Long Short-term Memory Neural Network	Pasin Kiratipongwut	Silpakorn University
14.45 - 15.00	PHYS16	Optimizing Acoustic Diffuser Surfaces with Neural Network Predictions	Kadbodee Pliphon	Walailak University
15.00 - 15.15	PHYS17	Machine Learning-Designed Phononic Crystals for Acoustic Cloaking	Soravit Aiammee	Walailak University
15.15 - 15.30	PHYS18	Effects of Indium Chloride Additive in Tin Oxide Electron Transport Layer on Photovoltaic Properties of Perovskite Solar Cells	Teerapong Watthana	Chiang Mai University
15.30 - 15.45	PHYS19	Designing a 2-dimensional Heater for Uniform Heating of Freely Suspended Liquid Crystal Films Inside the Payload for Liquid Crystal Space Experiment	Jurarat Artsri	Kasetsart University
15.45 - 16.00	PHYS20	Calculation of the Critical Temperature of Molybdenum Sulfide Hydride (MoSH) through Density Functional Theory (DFT) Simulations	Attawat Duangnil	Chulalongkorn University
16.00 - 16.15	PHYS21	Design of Faraday Cup for Compact Accelerator Mass Spectrometer	Jetsada Phomuen	Suranaree University of Technology
16.15 - 16.30	PHYS22	Design of Tandem Accelerator for Accelerator Mass Spectrometer for Radiocarbon Dating	Nontaphat Promsena	Suranaree University of Technology
16.30 - 16.45	PHYS23	Magnetic Field Simulation and Measurement of Electromagnetic Undulator for Terahertz Radiation Production	Waralak Jaipang	Chiang Mai University

3rd August 2024

Room 7: Venus

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	BIOL01	Microsatellite Distribution Analysis and Comparison in Genome Sequences of Acheta Domesticus and Gryllus Bimaculatus (Orthoptera: Gryllidae)	Niramai Arkhom	Naresuan University
13.15 - 13.30	BIOL02	Detecting Foreign DNA in Crickets Using Polymerase Chain Reaction (PCR) Technique	Chutiwan Pankram	Naresuan University
13.30 - 13.45	BIOL03	Mitogenomes of the Sea Nomads from Southern Thailand	Apisit Cheukaw	Naresuan University
13.45 - 14.00	BIOL04	Rapid Visual Detection of *Aeromonas hydrophila* Using Recombinase Polymerase Amplification Combined CRISPR/Cas12a	Donlaya Pinmuang	Naresuan University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	BIOL05	Development of the Estradiol Detection System Based on Aptasensor Coupled with Asymmetric Stem-loop-mediated Isothermal DNA Amplification	Sunisa Rothom	Suranaree University of Technology
14.45 - 15.00	BIOL06	Application of the Methyltransferase Enzyme Assay for Discovery of the Dengue Virus Inhibitor	Vipanee Vibulakhaophan	Chulalongkorn University
15.00 - 15.15	BIOL07	Characterization of Lysin Motif Depolymerase Enzyme from *Clostridioides difficile* Phage	Chan Chanduaywit	Mahidol University
15.15 - 15.30	BIOL08	Comparison of the LPS Extraction Methods of *Brucella melitensis* (*B. melitensis*) Using n-butanol-water and Hot Phenol-water to Produce Antigen for iELISA Test Kit	Thongchai Dichayanant	Kasetsart University
15.30 - 15.45	BIOL09	Effects of Hypergravity on Anoikis Resistance in Human Pancreatic Cancer Cells	Natchanon Wasusantakul	Mahidol University
15.45 - 16.00	BIOL10	Antioxidant and Anti-cancer Properties of *Moringa oleifera* Extracts	Wannapat Masangwunthong	Khon Kaen University
16.00 - 16.15	BIOL11	Biological Activities of *Calotropis* sp. Crude Latex in the HaCaT Cell Line	Waralee Choowong	Silpakorn University
16.15 - 16.30	BIOL12	Antiproliferative Activity of Curcumin Derivative CU18 on Lung Cancer Cells	Napongsadis Khrueangphathee	Khon Kaen University
16.30 - 16.45	BIOL13	The Effects of Crude Extracts from *Senna siamea* Lamk. and *Senna tora* Linn. on Lipid Accumulation in THP-1	Kanpitcha Yongrattana	Silpakorn University

3rd August 2024
Room 8: Mars

Time	Code	Title	Presenter	Affiliation
13.00 - 13.15	BIOL18	Diagnosis of *Strongyloides stercoralis* Infection in Rubber Plantation in the Phitsanulok Province with Basic Techniques and Confirm by PCR	Sarinthip Khamthiang	Naresuan University
13.15 - 13.30	BIOL19	Species Delimitation of *Impatiens semounensis* Hook.f. Based on ITS and atpB-rbcL Spacer Sequences	Silakan Khunnok	Khon Kaen University
13.30 - 13.45	BIOL20	Taxonomy and Phylogeny of *Gibellula* (Cordycipitaceae, Hypocreales) in Thailand	Korawitch Keereerak	Walailak University
13.45 - 14.00	BIOL21	Microplastic Bioadsorption Efficiency in Three Freshwater Filamentous Algae	Kanticha Jutharee	Silpakorn University

Time	Code	Title	Presenter	Affiliation
14.30 - 14.45	BIOL22	Investigation of Growth and Metabolite Production of *Limosilactobacillus fermentum* KUB–D18	Suttavadee Junyakul	Kasetsart University
14.45 - 15.00	BIOL23	Investigation of Herbicide Resistance in Barnyard Grass (*Echinochloa crus-galli* (L.) P. Beauv) in Thailand	Sakawwarin Prommana	Chiang Mai University
15.00 - 15.15	BIOL24	Isolation of Lactic Acid Bacteria from Local Fermented Foods and Characterization of Their Anti-Bacterial Activities	Pornpubed Aisarasak Na Ayutaya	Kasetsart University
15.15 - 15.30	BIOL25	Isolation of Endophytic Actinomycetes from *Andrographis paniculata*, *Aloe vera*, *Cymbopogon citratus* and *Azadirachta indica* and Their Antibacterial Activity	Chayada Sarnthong	Silpakorn University

Time	Code	Title	Presenter	Affiliation
15.30 - 15.45	BIOL26	Isolation and Screening of Yeasts from Fermented Foods for Effective Antimicrobial Activities	Rungnapa Pichaikarn	Walailak University
15.45 - 16.00	BIOL27	Molecular Mechanism of Antifungal Activity of Asiatic Acid Against *Cryptococcus neoformans*	Chayakorn Supatthathum	Mahidol University
16.00 - 16.15	BIOL28	Exploring Algal Leaf Spot: Successful Isolation and Growth of *Cephaleuros* from *Epipremnum aureum*	Jor. Pongsapatchanok Chanok	Silpakorn University
16.15 - 16.30	BIOL29	Metabolomics Profiles of Solid State and Submerge Fermentation of Corn Silk Using Mixed Microbes	Watchaphon Wutthiyan	Naresuan University

4th August 2024

4th August 2024

Room 1: Miracle Grand A

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	BIOL34	Carbon Dots as a Deliver Vehicle of CpG Oligodeoxynucleotides into Fish Cells	Wasu Thongsri	Suranaree University of Technology
09.00 - 09.15	BIOL35	Production of Carbon Dots for DNA Delivery into Bacterial Cells	Anutida Tamputsa	Suranaree University of Technology
09.15 - 09.30	BIOL36	Effects of Adjuvants on Physical and Chemical Properties of Kaolin as a Coating Substance for Reducing Leaf and Fruit Surface Temperature of *Citrus*	Nichagarn Greetatorn	Kasetsart University
09.30 - 09.45	BIOL37	Effect of Fraction from Riceberry (*Oryza sativa*) on Breast Cancer Cell Progression	Panadda Meesakul	Kasetsart University

4th August 2024

Room 2: Board Room

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	CHEM25	Apatite Growth on Bioactive Glass Modified with Biopolymer	Phimmada Nithipongwarodom	Silpakorn University
09.00 - 09.15	CHEM26	Design and Fabrication of Scaffold for Bone Regeneration in Dentistry	Nattapong Wongpraphan	Naresuan University
09.15 - 09.30	CHEM27	3D Porous Socket Preservation in Dentistry: The Fabrication and Characterization	Sarawut Jaimook	Naresuan University
09.30 - 09.45	CHEM28	Instant Prediction of Texture Properties of Waxy Corn Using near Infrared Spectroscopy	Chevaporn Chudoung	Chiang Mai University

4th August 2024

Room 3: Leo

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	MATH15	Enumeration of Symmetric Tridiagonal Matrices with Prescribed Determinant over $\mathbb{Z}_p$ and $\mathbb{Z}_{p2}$	Neennara Rodnit	Silpakorn University
09.00 - 09.15	MATH16	Some Results on the Bipolar Set via the Abstract Algebra	Thawit Hanvattanakul	Walailak University
09.15 - 09.30	MATH17	On the Diophantine Equation x+y=xy over the Ring of Integers of a Quadratic Number Field	Piyawan Aryapitak	Prince of Songkla University
09.30 - 09.45	MATH18	On Generalized Fibonacci and Lucas Sequences	Piyaphat Lormprakhon	Khon Kaen University

4th August 2024

Room 4: Gemini

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	MATH33	Submodularity Property for Facility Locations of Dynamic Flow Networks	Peerawit Suriya	Chiang Mai University
09.00 - 09.15	MATH34	An Optimization Model for a Hospital Operating Room Scheduling Problem	Warisara Boontieaw	Mahidol University
09.15 - 09.30	MATH35	Origami Construction of a Regular Tridecagon	Amonthep Boonrit	Chulalongkorn University
09.30 - 09.45	MATH36	Reversible Properties of Polyhedral	Ponpailin Homsombut	Chiang Mai University

4th August 2024

Room 5: Virgo

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	PHYS11	Application of CMOS Image Sensors in Luminescence Measurements	Pornpansa Jarana	Naresuan University
09.00 - 09.15	PHYS12	Design and Construction of Multi-Plane Light Converter (MPLC)	Kesini Chumphuthong	Prince of Songkla University
09.15 - 09.30	PHYS13	The Simulation of the Three-dimensional Optical Tweezers Pattern	Supawit Sungthong	Chiang Mai University
09.30 - 09.45	PHYS14	Non-relativistic Charmonium Mass Spectra with Cornell Potential by Using Nikiforov-Uvarov Method	Taksaporn Promjak	Suranaree University of Technology

4th August 2024

Room 6: Libra

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	PHYS24	The 2D Measurement Processing Software for the Profile Projector	Makornkunthon Paidech	Kasetsart University
09.00 - 09.15	PHYS25	Shimming Coil Design and Fabrication for NMR/MRI's Halbach Array Magnet	Sorrakrit Wannawong	Khon Kaen University
09.15 - 09.30	PHYS26	Design and Program Gradient Device Using STM32F767ZI Board	Witsavawit Boonying	Khon Kaen University
09.30 - 09.45	PHYS27	Designing and Construction of H-shape Permanent Magnet for Measuring the Nuclear Magnetic Resonance Signal	Pongsapol Khumma	Khon Kaen University

4th August 2024

Room 7: Venus

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	BIOL14	Effects of *Lactiplantibacillus pentosus* SF66 on Anxiety-related Behavior and Gene Expression in Stress-induced Zebrafish	Kritsada Sertjantuk	Khon Kaen university
09.00 - 09.15	BIOL15	Investigation of the effect of Kratom Leaf Extract on Colonic Function in Water Avoidance Stress-induced Mouse Model	Panida Chumpong	Prince of Songkla University
09.15 - 09.30	BIOL16	Short-term High-fat and High-sugar Diets Affect Zebrafish (*Danio rerio*) Behavior and Body Changes	Bhornsawan Jannu	Prince of Songkla university
09.30 - 09.45	BIOL17	The Examination of Food and Microplastics in the Digestive Tract of *Cerberus rynchops*	Chompoonut Pengchui	Walailak University

4th August 2024

Room 8: Mars

Time	Code	Title	Presenter	Affiliation
08.45 - 09.00	BIOL30	Taxonomic Status of an Unknown *Derris* Species from Kaeng Krachan National Park, Phetchaburi Province	Kanyarat Rakpong	Silpakorn University
09.00 - 09.15	BIOL31	Soil Seed Banks and Floristic Diversity of Coastal Sand Dune Vegetation in Tha Kham, Hat Yai District, Songkhla Province	Pruchayakorn Pawatung	Prince of Songkla University
09.15 - 09.30	BIOL32	Leaf Epidermis of Some Species of Fabaceae in Limestone Area of Thung Song District, Nakhon Si Thammarat Province	Wichuda Manorin	Walailak University
09.30 - 09.45	BIOL33	Effects of Seed Treatments on Germination of Four Evergreen Tree Species for Forest Restoration	Jirawan Khamkong	Chiang Mai University

Content

[BIOL01]

Microsatellite Distribution Analysis and Comparison in Genome Sequences of Acheta Domesticus and Gryllus Bimaculatus (Orthoptera: Gryllidae)

Niramai Arkhom[a] and Yash Munnalal Gupta [a,*]

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Crickets are among of the most popular economic insects, widely consumed throughout the country for their delicious, crispy, and oily taste, as well as high nutritional value. Two species of crickets studied, *Acheta domesticus* and *Gryllus bimaculatus*, are well-known, extensively cultivated, and consumed in Thailand. Studying the structure of the cricket genome is crucial for the food industry because microsatellites (SSRs) play an important role in genetic diversity. Microsatellites, which have a high repeat rate of change caused by slippage, are a popular genetic marker for identification. In this study, microsatellites were analysed between two cricket species using MISA Perl script to study SSR distribution and frequency. The results showed that trinucleotides were the most frequent in the genome sequences of both species, followed by Di-, Tetra-, Penta- and Hexa- units. Among all types of SSRs, A/T-rich repeats were the most abundant in the genome sequences, indicating the dominance of this motif during the genome evolution of the two species of crickets.

Keywords: Crickets, Microsatellites, MISA Perl Script

[BIOL02]

Detecting Foreign DNA in Crickets Using Polymerase Chain Reaction (PCR) Technique

Chutiwan Pankram[a], Somjit Homchan[a] and Yash Munnalal Gupta[a,*]

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Global population growth and environmental challenges worsen food shortages, increasing interest in crickets for their nutritional value and cultivation ease. However, expanding cricket farming poses disease risks. This research streamlines PCR primer development for pathogen detection in *Acheta domesticus* and *Gryllus bimaculatus*. Specific PCR primers (RCH, SMCH, CCH) detected *Rickettsiella grylli*, *Serratia marcescens*, and *Campylobacter* spp. in *A. domesticus* and *G. bimaculatus* samples. Notably, *Acheta domesticus* densovirus and *Acheta domesticus* volvovirus were not found. High infection rates in farmed crickets are attributed to overcrowding. In conclusion, this research improves food security by providing insights into cricket pathogens and specific PCR primers for pathogen detection in *A. domesticus* and *G. bimaculatus*, while recognizing the need for further comprehensive research.

Keywords: Bacteria, Cricket, Pathogen, Virus

Mitogenomes of the Sea Nomads from Southern Thailand

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Southern Thailand is located on the Malay Peninsula, bordering the Andaman Sea to the west, the Gulf of Thailand to the east, and Malaysia to the south. The majority of people are Southern Thais (99%), while minorities, such as sea nomad and Negrito groups, constitute about 0.33%. In the past, the subsistence pattern of Sea Nomads was maritime foraging for most of the year, although nowadays most of them have settled in coastal areas of Thailand and Myanmar. There are three groups of Thailand Sea Nomads: Moklen, Moken, and Urak Lawoi, with census sizes of around 4,000, 2,000, and 3,000, respectively. There is a paucity of genetic studies of these enigmatic groups. Here, we present a total of 64 complete mitochondrial genomes from Moklen and Moken from southern Thailand. Among the 64 samples, there are 12 haplotypes, with 3 haplotypes shared between them. In general, there is low genetic diversity within groups of all sea nomads compared to the major Southern Thai population. The sea nomads are genetically different from each other and from other Southern Thai groups. South Asian genetic influences were detected in both sea nomad populations, in agreement with previous studies on Southern Thai populations. Among the total of 8 haplogroups found in Sea Nomads, prevalent and specific haplogroups include D4e1a, M21b2, and M50a1. In summary, our results on the mitogenomes of Thailand Sea nomads provide new information from an anthropological perspective and can be utilized in forensic investigations.

Keywords: Mitochondrial Genome, Sea Nomads, Southern Thailand

[BIOL04]

Rapid Visual Detection of *Aeromonas hydrophila* Using Recombinase Polymerase Amplification Combined CRISPR/Cas12a

Donlaya Pinmuang[a], Phanupong Changtor[a] and Nonglak Yimtragool[a,*]

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Aeromonas hydrophila is a gram-negative opportunistic pathogen known to cause red mouth disease in aquatic animals, resulting in substantial economic losses. Additionally, this pathogen induces acute gastroenteritis in humans. In this study, we developed a novel detection method for *A. hydrophila* using the *cytolytic enterotoxin* gene through Recombinase Polymerase Amplification (RPA) combined with CRISPR/Cas12a. Primers for RPA and guide RNA were sequenced designed by the primers sequence to *cytolytic enterotoxin* gene. The optimal temperature for RPA, RPA was conducted at 37 ºC for 30 minutes for DNA amplification. Both pure and mixed DNA samples of *A. hydrophila* were examined for specificity testing. The results showed that RPA exhibited high specificity, even in the presence of contaminated DNA from different bacterial sources. For the sensitivity test, DNA amplification was achieved with DNA concentration ranging from 10^3 to 10^{-4} ng/μl. RPA combined with CRISPR/Cas12a showed sensitivity at the lowest DNA concentration of 10^{-4} ng/μl within 30 minutes. The results demonstrated that the RPA-CRISPR/Cas12a assay is an effective technique for identifying *A. hydrophila*, with the potential for on-site testing.

Keywords: *Aeromonas hydrophila*, CRISPR/Cas12a, *Cytolytic Enterotoxin* Gene, Opportunistic Pathogen, Recombinase Polymerase Amplification

[BIOL06]

Application of the Methyltransferase Enzyme Assay for Discovery of the Dengue Virus Inhibitor

Vipanee Vibulakhaophan[a], Siwaporn Boonyasuppayakorn[b,*] and Sittiporn Pattaradilokrat[a]

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Dengue fever is a global health issue since there is no specific medication to directly cure the disease. To address this need, the research aimed to establish a methyltransferase enzyme assay that enables the rapid discovery of dengue virus inhibitors. The non-structural protein 5 (NS5) of the dengue virus was chosen as a target as it contains methyltransferase (MTase) domain playing an essential role in the viral replication. First, a recombinant plasmid pET-32a(+) containing the gene encoding the MTase domain of *NS5* of dengue virus-2 with a His-Tag was produced and cloned into *Escherichia coli* strain BL21. Second, MTase enzyme was harvested and purified. To optimize the assay, $0 - 100$ μg/ml of the purified MTase were mixed with substrates, virus RNAs and S-adenosylmethionine in the presence of MTase-Glo reagent. The results showed that 100 μg/ml MTase produced 8,451 relative light units (RLU), which reached the minimum amount needed for reliable bioluminescent detection of the MTase activity. Thirdly, the assay was validated using sinefungin, the reference inhibitor of MTase, at concentrations of 1 nM – 10 μM, and found that the MTase activities could be inhibited by sinefungin, with IC_{50} of 0.0157 ± 0.0020 μM. Finally, the MTase assay was applied to test diffractaic acid at concentrations of 100 nM – 75 μM. The study showed IC_{50} of diffractaic acid was at 49.30 ± 1.86 μM, suggesting that it was less potent than sinefungin. Thus, the MTase assay was successfully established, and could be readily employed for screening of dengue virus inhibitors.

Keywords: Dengue Drug Discovery, Dengue Virus, Diffractaic Acid, Methyltransferase, Non-structural Protein 5

[BIOL07]

Characterization of Lysin Motif Depolymerase Enzyme from *Clostridioides difficile* Phage

Chan Chanduaywit[a], Pattanai Konpetch[b], Sitapun Jethanajun[b], Phurt Harnvoravongchai[a] and Surang Chankhamhaengdecha[a,*]

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Clostridioides difficile, a major causative agent of antibiotic-associated diarrhea, poses a significant challenge to the healthcare system. The resilience of its biofilm to antibiotics promotes the exploration of alternative strategies. Phage-encoded depolymerases, including cell wall hydrolases, emerge as promising candidates for disrupting biofilms. Previous study has identified a putative lysin motif (LysM) containing protein in the genome of *C. difficile* specific phage. LysM is a widespread protein module involved in binding peptidoglycan in bacteria and presents in many phages depolymerase enzymes. In this study, we characterize the putative LysM depolymerase enzyme predicted from the previous study, with a focus on its potential for biofilm degradation. Here we optimize the condition for protein expression and purification to yield a higher concentration of purified protein. The LysM-containing protein was recovered from inclusion body using urea solubilization, then purified and refolded on a column using NI-IMAC resin. We determined the function of the LysM domain by protein's binding affinity with bacterial cell walls. Enzymatic assays were performed to assess the protein's ability degrade biofilms. Our results indicated that the LysM-containing protein has an ability to bind with the peptidoglycan-polysaccharide complex (PG-PS), confirming the function of the LysM domain as a substrate binding domain. However, further investigation is required to determine its ability to hydrolyze cell walls and degrading biofilms. A successful characterization of the LysM-containing protein will pave the way for the development of alternative treatments targeting *C. difficile* infections, potentially offering new strategies to combat antibiotic resistance.

Keywords: Bacteriophage, Biofilm, *Clostridioides difficile*, Lysin Motif (LysM), Phage Depolymerase

[BIOL08]

Comparison of the LPS Extraction Methods of *Brucella melitensis* (*B. melitensis*) Using n-butanol-water and Hot Phenol-water to Produce Antigen for iELISA Test Kit

<u>Thongchai Dichayanant</u>[a], Luksika Khumboonthitisakul[b], SulalitaVicheankorn[b], Prissana Wiriyajitsomboon[a,*] and Kreeson Packthongsuk[b,*]

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Lipopolysaccharide (LPS) of *Brucella melitensis* (*B. melitensis*) is a highly immunogenic molecule used for brucellosis serological testing in sheep and goats. The hot phenol-water extraction (HPE) method is generally used to extract LPS from *Brucella* spp. However, it is disadvantageous due to the phenol toxicity. The present study aims to compare the efficient outcomes of a safer n-butanol-water extraction (NBE) method to HPWE. Multiplex-PCR-confirmed *B. melitensis* was cultured, and LPS was extracted using HPE and NBE. The crude LPS was purified by size exclusion chromatography (SEC) and then, the purified LPS (pLPS) was characterized using SDS-PAGE, silver stain, HPLC, Bradford's assay, and the Limulus amebocyte lysate (LAL) test. The positive and negative serum samples were titrated with the diluted pLPS to optimize conditions for an indirect ELISA (iELISA) reaction. Dry weights of pLPS obtained from HPE and NBE were 0.68% and 0.05% (w/w), respectively. SDS-PAGE with silver stain analysis showed two bands sizing as 10–20 kDa and >50 kDa in both methods. Protein and nucleic acid contamination in pLPS from NBE were found to be higher than HPE. HPLC chromatogram showed retention times at about 0.796 minutes. Both pLPS specifically react with LAL test, with concentrations of 65.52 and 63.87 EU/ml, respectively. Optimal concentrations of reactive pLPS and positive serum were 1:10 and 1:20, respectively. In conclusion, pLPS of *B. melitensis* derived HPE contained a higher yield and purity than NBE. Thus, HPE is a suitable extraction method for obtaining pLPS used as an antigen to develop brucellosis-serological diagnosis test.

Keywords: *Brucella melitensis*, Hot Phenol-water Extraction, iELISA, LPS, n-butanol-water extraction

[BIOL09]

Effects of Hypergravity on Anoikis Resistance in Human Pancreatic Cancer Cells

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One of the challenges associated with space exploration is alteration in gravitational force, which is crucial for the biological processes in various cell types. This has sparked interest in cancer therapy and space medicine in altered gravitational conditions. Previous studies have shown that the acquisition of metastatic phenotypes in pancreatic cancer cells was stimulated by simulated microgravity. Anoikis, a programmed cell death triggered upon the detachment from the extracellular matrix and neighboring cells, is required for cancer progression and metastatic colonization. Despite several studies on the impacts of microgravity on cancer cells, research on hypergravity remains limited. Particularly, the molecular mechanism of hypergravity-induced changes in anoikis in pancreatic cancer cells have not been thoroughly examined. Here, we evaluate the levels of anoikis resistance in human pancreatic ductal adenocarcinoma (PDAC) cell lines PANC-1 and MIA PaCa-2. After inducing anoikis for 72 hours, the levels of anoikis resistance in PANC-1 cells is significantly higher compared to MIA PaCa-2 cells. We aim to determine the interactions between hypergravity and anoikis resistance in PDAC cells using the MTT cell viability assay, followed by immunoblotting analyses to investigate how hypergravity remodels anoikis-associated signaling pathway in PDAC cells. These experiments may provide insights into the behavior of cancer cells under modified gravitational conditions, especially hypergravity, thereby enhancing our understanding of space biology and cancer research.

Keywords: Anoikis Resistance, Hypergravity, Pancreatic Cancer Cells

[BIOL10]

Antioxidant and Anti-cancer Properties of *Moringa oleifera* Extracts

Wannapat Masangwunthong[a], Watcharin Loilome[b], Nisana Namwat[b], Arporn Wangwiwatsin[b] and Poramate Klanrit[b,*]

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Moringa oleifera is an herbal plant in Moringaceae family and use in medical medicine in many countries such as India, Africa, and Thailand. Ethnomedicinal used in different countries are from various parts of *M. oleifera,* for example, roots, leaves, seed, and pods. In Thailand, they also use dried leaf powder to make tea or smoothie for drink to promote health. Previous studies have reported that *M. oleifera* has the activity of antimicrobial, antibacterial, antifungal, anti-inflammatory, antioxidant, and anti-cancer. Therefore, we are interested in the antioxidant and anti-cancer properties to find the bioactivities in *in vitro* model and compare the antioxidant activity of different temperature of water used in leaf powder dilution. In addition, the anti-cancer property will be investigated through cytotoxicity assay (Cell TiterGlo™). The cytotoxicity will be evaluated on cholangiocarcinoma cell lines including KKU-213A, KKU-213C, and hepatocellular cell line, HEP G2. This research will use this data to develop potential use of *M. oleifera* extract for antioxidative agent and anti-cancer supplement.

Keywords: Anti-cancer, Antioxidant, Cholangiocarcinoma, Hepatocarcinoma, *Moringa oleifera*

[BIOL11]

Biological Activities of *Calotropis* sp. Crude Latex in the HaCaT Cell Line

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The latex of *Calotropis* sp. (Apocynaceae) has been employed in traditional medicine systems, such as for treating skin diseases and healing wounds. Therefore, this research aimed to investigate the cytotoxicity of dried *Calotropis* latex using the MTT assay and cell migration using the wound healing assay on HaCaT (human keratinocyte) cells. The toxicity evaluation at 24 hours demonstrated that dried *Calotropis* latex solutions were cytotoxic on HaCaT cells with IC_{50} values of 76 µg/ml. HaCaT cell death was noticed starting at a concentration of 50 µg/ml. At higher concentrations, a disruption of the HaCaT cell membrane integrity was observed, which manifested as visible cellular debris. Additionally, it was found that dried latex solutions at concentrations of 1, 5, and 10 µg/ml did not stimulate HaCaT cell migration; conversely, concentrations of 5 and 10 µg/ml significantly inhibited HaCaT cell migration at 24 and 48 hours compared to the control group. In conclusion, the dried latex solution exhibits high toxicity levels towards HaCaT cells.

Keywords: *Calotropis*, Cell Cytotoxicity, MTT Assay, Plant Latex, Wound Healing Assay

[BIOL12]

Antiproliferative Activity of Curcumin Derivative CU18 on Lung Cancer Cells

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Curcumin (CU) is a substance extracted from turmeric known for its antiproliferative activity against several cancers. However, CU has toxicity to non-cancer cells. To address this, CU was modified to a curcumin derivative, CU18. The objective of this project is to study the anti-proliferative effects of CU18 against lung cancer A549 cells using the MTT assay. The results showed that the IC50 values of CU18 against A549 cells at 24, 48, and 72 hours were 32.70 μM, 18.01 μM, and 11.21 μM, respectively. CU18 had potency in inhibiting the proliferation of A549 cells and was less toxic to non-cancer cells compared to CU. Moreover, the combination of the main drug 5-fluorouracil (5-FU) with CU18 exhibited a synergistic effect on A549 cells, with a combination index (CI) below 1 at 48 and 72 hours of treatment. This combination reduced the required dose of the main drug by 35-fold. It can be concluded that CU18 effectively inhibited the proliferation of A549 cells and enhanced the chemotherapeutic effect of 5-FU in A549 cells when used in combination.

Keywords: 5-fluorouracil, Combination Index, Curcumin, Curcumin Derivative CU18, Lung Cancer

[BIOL13]

The Effects of Crude Extracts from *Senna siamea* Lamk. and *Senna tora* Linn. on Lipid Accumulation in THP-1

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Atherosclerosis is caused by the accumulation of plaque. This process involves the oxidation of low-density lipoproteins (LDL) in the bloodstream, leading to macrophages consuming oxidized LDL and accumulating on the artery walls. Previous research has found that Thai herbs such as *Senna siamea* Lamk. and *Senna tora* Linn. are reported to reduce lipid accumulation in preadipocyte cells. This research is interested in studying the effect of extracts from *Senna siamea* Lamk. and *Senna tora* Linn. on toxicity and lipid accumulation in THP-1 macrophages. *Senna siamea* Lamk. extract at concentrations of 25, 50, 100, 250, and 500 µg/ml and *Senna tora* Linn. extracts at concentrations of 25, 50, 100, 250, 500, and 1000 µg/ml were used for 3 days. It was found that THP-1 cell viability with *Senna siamea* Lamk. extracts were 97.48%, 97.40%, 93.55%, 92.65%, and 86.53%, respectively, while *Senna tora* Linn. extracts were 97.81%, 99.10%, 95.04%, 92.96%, 88.21%, and 72.12%, respectively. The assessment of lipid accumulation, conducted using Oil Red O staining and ImageJ analysis, is currently underway.

Keywords: Macrophages, *Senna siamea* Lamk.*, Senna tora* Linn., THP-1

[BIOL14]

Effects of *Lactiplantibacillus pentosus* SF66 on Anxiety-related Behavior and Gene Expression in Stress-induced Zebrafish

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Anxiety is a response to stress in animals and humans, characterised by a mood state and behavioral responses associated with preparing for anticipated events. Prolonged and untreated stress and anxiety may lead to mental illnesses such as depression. Several previous studies have shown the potential anxiolytic effect of probiotics. In the present study, the effects of *Lactiplantibacillus pentosus* SF66 on anxiety-related behavior were assessed by the light dark test and genes expression in stress-induced zebrafish. The results showed that *L. pentosus* SF66 treated group had a lower mean speed compared to the control group ($p = 0.010$). However, there were no statistically significant differences ($p \geq 0.05$) between the two groups in the levels of anxiety-related gene expression, including *gabra1*, *crhb*, *htr1aa*, *tph1a*, *npy*, *slc6a11, drd2a* and *nr3c1*. Based on the results of anxiety-related behavioral study, *L. pentosus* SF66 has the potential for anxiolytic effects. However, further studies are needed to confirm these findings.

Keywords: Anxiolytic Effect, Gut-brain Axis, *L. pentosus* SF66, Probiotic

Short-term High-fat and High-sugar Diets Affect Zebrafish (*Danio rerio*) Behavior and Body Changes

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An unhealthy diet high in fat and sugar has been linked to obesity and negative impacts on emotions and behavior. Zebrafish (*Danio rerio*) are a commonly used animal model for studying behavior and the nervous system, but the effects of unhealthy diets on zebrafish are not fully understood. In this study, we investigated the effects of a high-fat diet, a high-sugar diet, and a diet high in both fat and sugar on morphology and behavior, including anxiety-like behavior, aggressive behavior, social behavior, and learning and memory abilities. The study found that a high-fat diet led to increased body size and weight in zebrafish, indicating significant morphological changes. However, there were no significant behavioral changes or effects on learning and memory abilities in any of the diet groups. This lack of clear effects may be attributed to the feeding methods and the short duration of the experiments, which may not have been sufficient to induce observable behavioral changes. Additionally, the potential stress caused by the anesthesia procedure used during the experiments might have influenced the results. Despite these limitations, this study supports the potential of zebrafish as a model for examining the effects of diet on the body and behavior. Future research should consider longer feeding durations and refined feeding methods to better understand the relationship between diet and behavior. Overall, this study highlights the importance of considering both the duration and methodology when investigating the neurobehavioral effects of diet in animal models.

Keywords: Neurobehavior, Nutritional Neuroscience, Obesity Model, Unhealthy Diets, Zebrafish

[BIOL18]

Diagnosis of *Strongyloides stercoralis* Infection in Rubber Plantation in the Phitsanulok Province with Basic Techniques and Confirm by PCR

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Helminths cause parasitic worms in the digestive tract, with an estimated 3.5 million people worldwide infected with helminths. *Strongyloides stercoralis*, a type of helminths, causes reinfection and can lead to severe infections, transmitted through contaminated soil. This research aimed to the prevalence of *S. stercoralis* using a simple smear method and confirm the infection results using PCR techniques in areas with rubber cultivation, specifically in Wang Thong District, Phitsulok Province. A total of 135 stool samples were examined using the simple smear method. Infection results obtained from this method were subsequently confirmed using PCR techniques with specific primers for *S. stercoralis* strains: SSF/SSR, MSP4F/StrongR and StrCoxAfrF/StrCoxAfrR. The results indicated a 3.70% prevalence of *S. stercoralis* infection (5 out of 135) as detected by the simple smear fecal test. PCR using the MSP4F/StrongR primers demonstrated 100% accuracy in confirming infection. Consequently, for the confirming *S. stercoralis* infection using PCR techniques, the use of MSP4F/StrongR primers is highly recommended. These primers target the 18S rRNA region, characterized by minimal sequence variation, and their DNA size is conducive to sequencing. This database can be a valuable resource for future genetic-level investigations.

Keywords: Diagnosis, PCR, Simple Smear, *Strongyloides stercoralis*

[BIOL19]

Species Delimitation of *Impatiens semounensis* Hook.f. Based on ITS and *atpB-rbcL* Spacer Sequences

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Impatiens semounensis Hook.f. (Family Balsaminaceae) is one of the taxonomically problematic plant species because of confusion in identification based on morphology. Previously, it has been misidentified with the morphologically similar species, *I. noei* Craib. Moreover, the variation of leaves and floral morphology was found among the populations distributed in Thailand. This causes some difficulties for species determination and identification. This study analyzed phylogenetic relationship of seven populations of *I. semounensis* from different provinces and other species in *Impatiens* using the nucleotide sequence data from the ITS and *atpB-rbcL* spacer. The phylogenetic relationships were analyzed using Maximum parsimony and Bayesian inference. The results revealed that all seven populations of *I. semounensis* formed one clade within section *Uniflorae*. This position separated it from the previously confusing species of *I. noei*. Therefore, the results confirm the taxonomic status of the *I. semounensis* and the differentiation of leaves and floral morphology among populations are the variation within species.

Keywords: Balsaminaceae, Phylogeny, Section *Uniflorae*, Species Complex, Taxonomy

[BIOL20]

Taxonomy and Phylogeny of *Gibellula* (Cordycipitaceae, Hypocreales) in Thailand

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The genus *Gibellula* (Cordycipitaceae, Hypocreales) stands out as a well-known genus of spider fungal parasites. The genus *Gibellula* was established by Cavara in 1894 to accommodate *G. pulchra*. The classification of the *Gibellula* genus is still ambiguous and requires in-depth morphological and biomolecular analysis due to limited access to certain information on the holotypes (a lack of holotype sequences as well as a living culture). Around the world, 55 *Gibellula* species were described, and 16 species were reported to associate with spiders in Thailand. Specimens of the genus *Gibellula* stored in the BIOTEC Bangkok Herbarium (BBH), and the cultures deposited at BIOTEC Culture Collection (BCC) were chosen for the present study. *Gibellula* specimens were investigated for morphological characteristics including shape and size of vesicles, metulae, phialides, conidial heads, conidia, conidiophores, arrangement of conidiophores on the surface of synnemata, shapes and sizes of perithecia, asci, and ascospores. Of these, 26 isolates were selected for molecular phylogenetic study using DNA sequence data through the internal transcribed spacers (ITS), large subunit ribosomal DNA (LSU rDNA), translation elongation factor 1 (TEF1), and the largest and second-largest subunits of RNA polymerase II (RPB1 and RPB2). Maximum likelihood-based phylogenetic analysis and Bayesian inference were performed through CIPRES Science Gateway v. 3.3. Among the 26 samples, at least 5 novel groups and 1 lineage of *Gibellula* fungi were found to potentially be new species. The groupings were erected based on the strong support of monophyletic clades. *Gibellula* group 4 was placed closely with a reference species *G. solita*. Moreover, the novel lineage formed a relationship to *G. leiopus* and *G. pilosa*, and *G. brevistipitata*. These new species were placed within the Cordycipitaceae, Hypocreales. The results of this study can be used to fulfil the knowledge gap about the diversity and evolution of spider-associated fungi in Thailand.

Keywords: Entomopathogenic Fungi, *Gibellula* Fungi, Phylogenetic Analyses, Spider

[BIOL21]

Microplastic Bioadsorption Efficiency in Three Freshwater Filamentous Algae

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The contamination of microplastics in aquatic ecosystems is an emerging environmental issue with significant adverse effects on various organisms throughout the food web. This study investigates the potential of filamentous algae in adsorbing microplastics from water bodies, considering the structural properties of algal crystalline cellulose cell walls and the secretion of extracellular polymeric substances (EPS) that are reported to enhance microplastic adsorption. Three common filamentous freshwater algae; *Microspora* sp., *Pithophora* sp., and *Spirogyra* sp. were employed to assess their abilities in microplastic removal. These algae were soaked in a 100 mg/ml polystyrene suspension to assess the microplastic adsorption efficiency. Results indicated that *Microspora* sp. had the highest microplastic adsorption capacity at 70.88 ± 23.89 particles/mm², followed by *Pithophora* sp. and *Spirogyra* sp. at 43.99 ± 11.71 and 7.17 ± 4.40 particles/mm², respectively. The observed floating-sinking behaviors of algae and microplastics were thought to have influenced adsorption capacity. Subsequently, three microplastics with different buoyancies, including polypropylene (float), polystyrene (mostly float), and polyvinyl chloride (mostly sink) were exposed to *Microspora* sp. (float) and *Spirogyra* sp. (sink) in order to examine their adsorption capacity. The hypothesis was confirmed for *Spirogyra* sp., which was most effective at adsorbing polyvinyl chloride microplastics (49.75 ± 18.80 particles/mm²) while failing to adsorb any of the floating polypropylene microplastics. In contrast, *Microspora* sp. could adsorb all types of microplastics equally well. This study demonstrates the potential of filamentous algae in bioadsorbing microplastics, with adsorption efficiency varying depending on the type of microplastic and the specific algal features, including cell wall properties and floating-sinking behaviors.

Keywords: Bioadsorption, Filamentous Algae, Microplastic

[BIOL22]

Investigation of Growth and Metabolite Production of *Limosilactobacillus fermentum* KUB–D18

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L. fermentum KUB-D18 is a potential probiotic which has good cholesterol-lowering properties in industrial biotechnology. However, growth and metabolite data are largely unknown. This study aimed to explore growth profile, biomass and metabolite production e.g. short-chain fatty acids as well as enzyme activity of bile salt hydrolase (BSH) activity of this strain. Accordingly, the results revealed a rapid growth during 6 to 12 hrs as illustrated at log phase. Besides, a maximum specific growth rate (μ_{max}) and biomass yield ($Y_{x/s}$) were determined at 0.2099 ± 0.0124 h^{-1} and 0.0975 ± 0.0065 g/g, respectively. Moreover, *L. fermentum* KUB-D18 showed to have capability on lactic acid production and BSH activity in relation on growth. The basic data throughout this study is useful for future culture optimization of *L. fermentum* KUB-D18.

Keywords: Bile Salt Hydrolase Activity, Biomass, Cell Growth, *Limosilactobacillus fermentum* KUB-D18

[BIOL23]

Investigation of Herbicide Resistance in Barnyard Grass (*Echinochloa crus-galli* (L.) P. Beauv) in Thailand

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Barnyard grass (*Echinochloa crus-galli* (L.) P. Beauv) is one of the most troublesome weeds in paddy fields in Thailand. Its resistance to herbicides has become a major problem for farmers, causing a huge yield loss of rice across the country. Therefore, the solution to this issue is urgently required. This research aims to investigate the herbicide resistance of barnyard grass populations collected from ten areas in Thailand that were heavily infested with uncontrollable weeds. Dose responses of two herbicides, bispyribac-sodium and quinclorac, were examined. The seedlings were cultured in MS solid media containing each herbicide at six concentrations: 0Rec, 0.0001Rec, 0.001Rec, 0.01Rec, 0.1Rec, and 1Rec for nine days (Rec is recommended label rate). Subsequently, plant growth and survival rates were measured to create dose-response curves, calculate resistance ratios, and classify resistant populations. The results showed that three populations exhibited resistance, four were developing resistance, and three were susceptible to bispyribac-sodium. Among them, the SP-4A population from Suphan Buri province demonstrated the highest resistance rate. Regarding quinclorac treatment, seven populations showed resistance, one was developing resistance, and two were susceptible, with the AY1 population from Ayutthaya province showing the highest resistance rate. These findings can guide the selection of appropriate alternative herbicides for farmers in each area. In addition, knowledge from this research benefits further study on the molecular mechanisms of herbicide resistance to develop more effective weed control agents in the future.

Keywords: Bispyribac-sodium, Dose-response, Quinclorac, Resistance Ratio

[BIOL24]

Isolation of Lactic Acid Bacteria from Local Fermented Foods and Characterization of Their Anti-bacterial Activities

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Lactic acid bacteria (LAB), commonly found in fermented foods, are known for their probiotic properties and bacteriocin production. In this study, 175 LAB isolates were obtained from 15 Thai fermented food samples and primarily screened for anti-bacterial activity against 11 Gram-positive and Gram-negative pathogens using the agar spot-on-lawn method. Most isolates showed antibacterial activity. In the secondary screening, the supernatant of isolates with anti-bacterial activity were pH-neutralized and were then boiled or not boiled. Both heated and unheated supernatants were applied against 5 pathogen strains in agar-well diffusion assays. Results showed that supernatants from 8 isolates (AYO05, AYK04, AYK06, PAT01, KB08, SS07, SS14 and SS16) have antibiotic activities against *S. aureus*, *S.* Typhimurium and *P. aeruginosa* after pH-neutralization. Notably, the pH-neutralized and boiled supernatants of both the PAT01 and KB08 isolates retained their activities against *S. aureus* and *S.* Typhimurium. Additionally, PAT01 also showed activity against *P. aeruginosa*. Thus, these two isolates might produce bacteriocins. The isolates screened were then evaluated for fundamental probiotic properties, including survivability under acidic and bile salt conditions. Results suggested that at pH 3.0, the survival at 4 hours after pH 3.0 treatment of the 8 isolates mentioned above were 66.41%, 114.17%, 114.65%, 107.41%, 93.95%, 125.48%, 125.19%, 115.03%, respectively. After being exposed to 0.3% bile salts, the survival at 4 hours were 66.41%, 114.17%, 114.65%, 107.41%, 93.95%, 125.48%, 125.19%, 115.03% for each of the 8 isolates, respectively. In summary, the antagonistic properties and fundamental probiotic properties suggested that these 8 isolates are promising probiotic candidates to be further elucidated.

Keywords: Anti-bacterial, Bacteriocin, Fermented Food, Lactic Acid Bacteria, Probiotic

[BIOL25]

Isolation of Endophytic Actinomycetes from *Andrographis paniculata*, *Aloe vera*, *Cymbopogon citratus* and *Azadirachta indica* and Their Antibacterial Activity

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The isolation of endophytic actinomycetes from surface-sterilized tissues of 4 medicinal plants was carried out using Humic acid-vitamin agar as a selective medium. A total of thirteen isolates were recovered, with the highest prevalence observed in *Aloe vera* (7 isolates, 53.8%) followed by *Andrographis paniculata* (3 isolates, 23.1%), *Azadirachta indica* (2 isolates, 15.4%), and *Cymbopogon citratus* (1 isolate, 7.7%) Their antibacterial activity with microorganisms including *Bacillus cereus* TISTR687, *Bacillus subtilis* TISTR1287, *Escherichia coli* TISTR887, *Pseudomonas aeruginosa* TISTR292, *Staphylococcus epidermidis* TISTR1287 and Methicillin Resistant *Staphylococcus aureus* (MRSA) sp.3 were evaluated using the soft-agar overlay technique. Twelve isolates exhibited antibacterial activity. The two most effective isolates, APR02 and AVL08, were chosen for further investigation through secondary metabolite extraction. The crude extracts of APR02 and AVL08 displayed antibacterial activity with the Minimum Inhibitory Concentration (MIC) of 512 µg/mL. The Bioautography results of crude extracts from APR02 and AVL08 revealed several bands able to inhibit microorganisms. Therefore, the major active bands were selected and purified by thin layer chromatography (TLC). The chemical structures of active compounds were analyzed by studying protons Nuclear Magnetic Resonance (^{1}H-NMR) spectroscopy. The identification of endophytic actinomycetes was based on colony morphological features, scanning electron microscope analysis, chemotaxonomy by whole cell hydrolysates and 16S rDNA analysis. They were classified into the family *Streptomycetaceae*.

Keywords: Antibacterial Activity, Antibiotics, Endophytic Actinomycetes, Medicinal Plants, *Streptomyces*

[BIOL28]

Exploring Algal Leaf Spot:
Successful Isolation and Growth of *Cephaleuros* from *Epipremnum aureum*

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Algal leaf spot disease, caused by the plant-pathogenic algae *Cephaleuros*, mostly appears as round, velvety, orange-red rust-like colonies on the surface of infected leaves. There is a significant challenge in studying this pathogen due to the absence of reliable isolation techniques. This limitation has impeded effective research and management of the disease. To address this issue, our study aimed to establish an isolation method for the responsible algae from the climber plant *Epipremnum* sp. using three autotrophic culture media, HSM, BG-11, and BBM, without the addition of antibiotics or fungicides in 96-well microplates. The effectiveness of these media in isolating pure *Cephaleuros* strains was evaluated across 16 colonies/lesions from the plant leaf. Within 28 days, a 35.42% algal filament growth was observed among these pure *Cephaleuros* strains, with 5.21% free from fungal contamination. HSM medium yielded the highest number of isolates (54.69%), followed by BG-11 (31.25%) and BBM (20.31%), respectively. Morphological characteristics and 18S rRNA gene sequencing confirmed that the alga belonged to the genus *Cephaleuros*. This study also documented *E. aureum* as a host for *Cephaleuros* for the first time and demonstrated the feasibility of isolating pathogenic *Cephaleuros* alga using autotrophic culture media in 96-well microplates while significantly reducing cost, labor, media volume, and working space. This budget-friendly method, which takes only four weeks, impressively offers algal isolates without antibiotics or fungicides, presenting a sustainable and efficient approach to algal isolation.

Keywords: Algal Isolation, Algal Leaf Spot Disease, *Cephaleuros*, *Epipremnum aureum*

[BIOL29]

Metabolomics Profiles of Solid-State and Submerged Fermentation of Corn Silk Using Mixed Microbes

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Corn silk is a waste product when harvesting corn, but it contains many valuable compounds. This research characterized and assessed the antioxidant bioactivity of compounds isolated from fermented corn silk. Two different biological fermentation processes were compared: solid-state fermentation (SSF) and submerged fermentation (SmF). Fresh corn silks (*Zea mays* L.) from both sweet corn and feed corn were fermented separately with various microorganisms (*Bacillus subtilis*, *Lactobacillus* sp., and *Saccharomyces cerevisiae*). Biological compounds were identified using LC-MS/MS. The extracts were then tested for total phenolic content (TPC) and total flavonoid content (TFC). Furthermore, the extracts were tested for xanthine oxidase inhibition and antioxidant inhibition using the ABTS method. Potential contamination with the heavy metals As, Pb, and Hg was also checked. The results showed that fermented corn silk extracts contain numerous bioactive compounds and amino acids. Among the different extract process variations, the highest TPC (6.1 ± 0.7 µg GAE/g dry wt.), the highest TFC (68.3 ± 1.1 µg QE/g dry wt.), and the highest xanthine oxidase inhibition (76.5 ± 6.4%) were obtained using SmF of sweet corn silk for 60 days. In contrast, the highest antioxidant activity of 66.9% was found using SSF of sweet corn silk for 20 days. Neither sweet corn silk nor feed corn silk were found to contain heavy metal ions. In summary, fermented corn silk extract samples contain numerous bioactive compounds, including both flavonoid and phenolic compounds, with antioxidant activity. Fermented corn silk extracts thus have the potential for utilization in health products.

Keywords: Antioxidant, Corn Silk, Heterofermentative Microbe, LC-MS/MS, Xanthine Oxidase Inhibition

[BIOL30]

Taxonomic Status of an Unknown *Derris* Species from Kaeng Krachan National Park, Phetchaburi Province

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Recent survey of Kaeng Krachan National Park, the most diverse hotspot and one of significant centers of biological resources in Asia, has led to discovery of many potentially new plant species such as the unknown *Derris* species in this study. Therefore, the aim of this research is to identified the taxonomic status of this unknown taxon by anatomical, morphological and molecular phylogenetic data based on two chloroplasts regions (*trnL-F* intergenic specer (IGS) and *trnK-matK*) and one nuclear ribosomal internal transcribed spacer (ITS/5.8s). The overall morphology of unknown *Derris* species is similar to that of *D. tonkinensis* Gagnep., especially its highly curved wing petals. However, according to macro-morphological and leaf anatomical data, this taxon has several differences from *D. tonkinensis*; for example, fewer flowers per brachyblast, distinctly larger epidermal cells, and significantly higher stomatal density (up to 1.5 times greater). Furthermore, the distribution and ecology are different. Additionally, results from molecular phylogenetic analyses supported and confirmed its status as a new species to science. We initially named it as *Derris kaengkrachannensis* Rakpong & Sirich., with the Thai name Chompoophanapetch. The specific epithet "*kaengkrachannensis*" refers to its first discovery in Kaeng Krachan National Park, Phetchaburi Province.

Keywords: *Derris*, Leaf Anatomy, Molecular Phylogeny, Morphology, New Species

[BIOL31]

Soil Seed Banks and Floristic Diversity of Coastal Sand Dune Vegetation in Tha Kham, Hat Yai District, Songkhla Province

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The soil seed bank, a reservoir of seeds located on or beneath the soil surface, supports future plant community replacement by germinating under favorable conditions. This study investigates the diversity and composition of plant species in the soil seed bank and aboveground vegetation in the coastal sand dune of Tha Kham, Hat Yai, Songkhla Province. Aboveground vegetation was recorded in April and October 2023 on twenty 20 × 20-meter plots, which were also sampled for the soil seed bank. Soil samples were collected from vegetation-free areas using a 25 × 25-centimeter quadrat. The study analyzed species diversity and abundance at different depths during rainy and dry seasons. Soil samples were divided into four depth levels: 0-5, 5-15, 15-25, and 25-35 centimeters. These samples were placed in a greenhouse and watered weekly for five months, with all emerging species identified and counted. The study identified 41 species in the aboveground vegetation and 15 species in the soil seed bank. Non-colonial species had an average density of 942 individuals per square meter, and colonial species (*Utricularia* spp.) had an average coverage of 24.1%. The highest species diversity and abundance were found in the topsoil layer (0-5 centimeters) and decreasing with depth. The composition and abundance of the soil seed bank overlapped with the aboveground plant community but excluded species without seed dormancy. This study highlights those open areas without vegetation harbor significant soil seed bank species, emphasizing that every plant community location has a soil seed bank essential for community regeneration after disturbances.

Keywords: Coastal Sand Dune Vegetation, Restoration Potential, Season, Soil Depth, Soil Seed Banks

[BIOL32]

Leaf Epidermis of Some Species of Fabaceae in Limestone Area of Thung Song District, Nakhon Si Thammarat Province

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Leaf epidermis of 23 species of the family Fabaceae found in the limestone area of Thung Song district, Nakhon Si Thammarat province was studied. The leaf epidermis was prepared by peeling method and observed under light microscope. The results showed that there are four types of epidermal cell shapes: polygonal with straight arched walls, irregular with undulate walls, irregular sinuolate walls, and irregular with sinuate walls. Four types of stomata were found: anisocytic, anomocytic, laterocyclic, and paracytic stomata. The sizes of the stomata were between 114.63 ± 17.57 μm^2 and 608.88 ± 16.42 μm^2. The stomatal index (SI) was measured from 0.00 to 29.03 ± 1.85. Four trichome types were revealed: capitate glandular, hooked, unicellular, and multicellular uniseriate trichomes. Many anatomical characteristics showed the difference among the genera, leading to the Fabaceae being classified into three groups based on trichome characters.

Keywords: Leaf Anatomy, Legumes, Leguminosae, Micromorphology

[BIOL33]

Effects of Seed Treatments on Germination of Four Evergreen Tree Species for Forest Restoration

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Seed germination is a barrier of natural regeneration mechanisms. It plays a significant role in seedling production for forest restoration. Various seed treatments have been employed to enhance germination and reduce seed dormancy. The objective of this research was to investigate the impacts of different seed treatments on the germination of four evergreen tree species: *Acronychia pedunculata*, *Dillenia indica*, *Tetradium glabrifolium*, and *Macaranga denticulata*. Seeds of each species were divided into four treatments: 1) soaking seeds in room temperature water for 24 hours 2) soaking seeds in concentrated sulfuric acid for 2 minutes 3) soaking seeds in gibberellic acid at a concentration of 400 ppm for 10 hours and 4) control treatment with three replicates per treatment and a total of 1,200 seeds per species were sown. Germination was recorded weekly. In addition, seeds were cut to examine their fullness before and at the end of the experiment. Seed characteristics (size, shape, seed coat thickness, and moisture content) were measured. Only *M. denticulata* seeds germinated. There was no significant difference among germination percentages and median length of dormancy of tested seed treatments.

Keywords: Biodiversity, Climate Change, Doi Suthep, Ecosystem Restoration, Tropical Forests

[BIOL36]

Effects of Adjuvants on Physical and Chemical Properties of Kaolin as a Coating Substance for Reducing Leaf and Fruit Surface Temperature of *Citrus*

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Kaolin is one of plant coating substances that is utilized to reduce the adverse effects caused by high light intensity and temperature. However, its sedimentation causes low efficiency for using in agriculture. Therefore, the objective of this work is to study the effects of adjuvants on physical and chemical properties of kaolin to be as a coating substance for reducing leaf and fruit surface temperature of *Citrus*. The sedimentation, pH value, and efficiency in light intensity reduction were measured after adding adjuvants in kaolin suspension. The results showed that using a combined additives of 0.5 g/L of neutral polymer and 0.1 g/L of anionic polymer is the most effective to reduce the sedimentation of kaolin that probably resulted from repulsive forces between polymer functional groups and kaolin surfaces. In addition, it can bring the light intensity into the light saturation range of *Citrus* and contribute to nearly neutral pH value of the solution. Moreover, it can decrease leaf and fruit surface temperature together with maintaining well-dispersed coating on plant surfaces. Furthermore, kaolin-coated fruits have a larger size during fruit development when compared to the control group. This study provides information for further kaolin development for agricultural utilization.

Keywords: *Citrus*, Kaolinite Clay, Light Response Curve, Plant Surface Temperature, Sedimentation

[BIOL37]

Effect of Fraction from Riceberry (*Oryza sativa*) on Breast Cancer Cell Progression

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Breast cancer is the most common cancer and a leading cause of death among women worldwide. Current medical treatments have been significantly reduced the mortality rate. However, side effect from these therapies greatly affected to patient well being. The previous study demonstrated the anti-proliferation and anti-migration effect of crude extracts from riceberry (*Oryza saliva*) on breast cancer cell line. In this study, we aim to examine the effects of riceberry extract on the proliferation and migration of MDA-MB 231 and MCF-7 breast cancer cells. The riceberry extract was obtained through water extraction, followed by freeze-drying, and analyzed using High Performance Liquid Chromatography (HPLC). The results have shown that the crude extract contains variety of phenolic compounds, and p-hydroxybenzoic acid being the most abundant. Then, wound healing assay was employed to investigate cell migration, breast cancer cells treated with different concentrations (0, 1.0, 5.0, 10.0 mM) of p-hydroxybenzoic acid in cell culture media. The concentration of 5.0 and 10.0 mM p-hydroxybenzoic acid significantly inhibited cell migration of MCF-7 and MDA-MB-231 breast cancer cell lines. Additionally, the cell proliferation assay was significantly different between the control and treated group. Therefore, the decreased migration rate may result from the decreased cell proliferation rate, cells are unable to divide and migrate to cover the wound. In conclusion, the results suggested that p-hydroxybenzoic acid may be a key compound in reducing the migration of breast cancer cells. This is important for the development of extraction techniques of riceberry for future medical applications.

Keywords: MCF-7, MDA-MB 231, Oryza *saliva*, p-Hydroxybenzoic Acid, Ricebery

[CHEM01]

Monolithic Sorbents for Micro-solid Phase Extraction of Cancer Marker, 8-Hydroxy-2'-deoxyguanosine in Human Urine

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The global incidence of new cancer cases and associated mortality rates is steadily rising. However, current screening methodologies depend on advanced and costly equipment, primarily available in hospital settings staffed by specialized personnel. Consequently, the general populace has limited access to screening opportunities. Delayed detection or diagnosis may lead to uncontrolled cancer proliferation, making early detection crucial for successful treatment outcomes. A biomarker, 8-hydroxy-2'-deoxyguanosine (8-OHdG), excreted in human urine, is analyzed for monitoring DNA damage and cancer progression. Various methodologies, including liquid chromatography-mass spectrometry/mass spectrometry and high-performance liquid chromatography with UV detection, are commonly employed for the precise quantification of 8-OHdG. In this study, we synthesized a monolithic sorbent for micro-solid phase extraction (μ-SPE) of 8-OHdG. To obtain an effective extraction method for sample matrix removal with a satisfactory pre-concentration factor, three distinct monoliths, comprising a hydrophilic interaction liquid chromatography (HILIC) monolith and composite monoliths with zeolite and activated charcoal (AC), were in situ synthesized in polypropylene pipette tips. Among these, the AC composite monolith exhibited the best performance, achieving the highest % trapping efficiency, thus representing the optimal choice for 8-OHdG adsorption. Loading 8-OHdG in water yielded a % trapping of 100% with a 3 mL sample volume and a high % extraction efficiency (96.8%), allowing for a 2.5-fold pre-concentration. However, further optimization is required to establish suitable μ-SPE conditions for extracting 8-OHdG from urine samples.

Keywords: 8-OHdG, AC Composite Monolith, HILIC Monolith, Micro-solid Phase Extraction, Zeolite Composite Monolith

[CHEM02]

Expression and Purification of Ferritin for Light-Activated Carbon Monoxide Release Using a Nanocarrier Approach

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Carbon monoxide (CO) has emerged as a promising therapeutic agent due to its cellular signaling properties at low concentrations. The development of CO-releasing molecules (CORMs) offers a controlled delivery method for CO, potentially impacting various diseases. However, current CORM production methods often rely on complex synthetic processes or expensive precursors, hindering accessibility for research. This study addressed this challenge by focusing on the expression and purification of ferritin, a naturally occurring protein explored for its potential as a nanocarrier for CO delivery. Ferritin was expressed in *Escherichia coli* BL21(DE3) cells using the pET-HFn plasmid and purified via anion exchange chromatography. Additionally, the study investigated the synergistic roles of tetra(carboxyphenyl)porphyrin (TCPP) as a photosensitizer and quercetin in the photodegradation process under red light irradiation, aiming to elucidate pathways for CO release. Carbon monoxide formation was monitored via UV-Vis spectrophotometry to provide insights into the mechanisms by which quercetin, facilitated by TCPP, releases CO. By advancing understanding in these areas, this research aims to pave the way for the development of a simpler and more cost-effective approach to CORM production utilizing readily available materials and natural protein scaffolds like ferritin.

Keywords: Carbon Monoxide (CO), Carbon Monoxide Releasing Molecules (CORMs), Ferritin, Photosensitizer, Quercetin

[CHEM03]

Activated Charcoal Composite Monolith for Micro-solid Phase Extraction of 5-Hydroxyindoleacetic Acid in Human Urine

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Monoliths are increasingly employed in micro-solid phase extraction (μ-SPE) due to their high surface area and porosity. In this work, we introduced an in situ synthesized composite monolith within a polypropylene pipette tip for μ-SPE. The material consists of activated charcoal (AC) particles with methacrylic acid monomer co-polymerized with the crosslinker ethylene glycol dimethacrylate. A simple and rapid synthesis method was carried out using photo- and thermal-polymerization, allowing for the preparation of fifteen in-tip monoliths within 90 minutes, with 6 minutes required for each tip. The synthesized in-tip AC composite monolith was used for the μ-SPE of 5-Hydroxyindoleacetic acid (5-HIAA). The effects of sample pH, washing solvent concentration of acetonitrile, and eluting solvent concentration of acetonitrile, pH and volume of eluting solvent were investigated to optimize μ-SPE conditions. A pre-concentration factor of 2.5, with a loading volume of 500 μL and eluting volume of 200 μL, and 86% extraction efficiency was achieved by desorbing 5-HIAA using 200 μL of a mixture of 50% acetonitrile and 20 mM phosphate buffer at pH 7. The optimized μ-SPE conditions were evaluated for determining 5-HIAA in human urine. The method exhibited excellent linearity ($R^2 = 0.9962$) in the concentration range of 250 – 1000 μg L^{-1}. The method could be an attractive choice for determining 5-HIAA in urine samples; however, further work on method optimization and evaluation is required.

Keywords: 5-Hydroxyindoleacetic Acid, Activated Charcoal, In-tip Micro-solid Phase Extraction, Monoliths

[CHEM04]

Development of Zwitterionic Polymer Hydrogel for Glucose Detection

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Enzymes are widely used in sensors for disease diagnosis. However, enzymes are easily denatured in inappropriate conditions such as high temperature. In this research, two zwitterionic polymers, namely poly[2-methacryloyloxyethyl phosphorylcholine (MPC)-*co*-n-butyl methacrylate (BMA)-*co*-*N*-methacryloyloxyethyl tyrosine methylester (MAT)] (PMBM) and poly(MPC-*co*-MAT) (PMM) were synthesized and characterized using ^{1}H NMR and ATR-FTIR spectroscopy. They were used to preserve catalytic activity of two enzymes, glucose oxidase (GOx) and horseradish peroxidase (HRP) for glucose detection. PMBM was first coated on a silicon wafer substrate. Subsequently, a mixture of PMM, ruthenium complex, ammonium persulfate, GOx, and HRP was coated and irradiated with visible light through a grid mask for 45 s to make an enzyme-immobilized polymer hydrogel pattern. Each coating step was confirmed by water contact angle measurements. The enzymatic reaction of GOx and HRP facilitated crosslinking between cyanine 3 tyramide, a fluorescent dye, and MAT moieties in the polymers. The fluorescence pattern was observed under a fluorescence microscope and the intensity was analyzed using ImageJ software. The pattern appeared specifically in irradiated areas and the intensity was directly proportional to glucose concentration in a range of 0 - 8 mM with linear relationship and limit of detection (LOD) of $R^2 = 0.91$, 3.34 mM for the red channel and $R^2 = 0.96$, LOD = 2.33 mM for the green channel. The variation of intensity may be improved by optimizing various factors such as PMM concentration. This demonstrates that PMBM and PMM hydrogels are interesting materials for enzyme preservation which can be easily prepared.

Keywords: Glucose Detection, Visible Light Crosslinking, Zwitterionic Polymer Hydrogel

[CHEM05]

Development of Cellulose Hydrogels Derived from Paper Wastes for Drug Release Applications

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Globally, paper waste generation reaches hundreds of millions of tons annually. Although paper produced from the most abundant biopolymer on earth, cellulose, can be naturally degradable, its decomposition takes several years. Improper disposal of paper waste may harm living communities and disrupt terrestrial and aquatic ecosystems. Therefore, this research investigates the feasibility of repurposing office paper waste into carboxymethyl cellulose (CMC) hydrogels for the controlled release of diclofenac. Epichlorohydrin was used as a cross-linking agent to create hydrogels with suitable properties. Diclofenac is a non-steroidal anti-inflammatory drug (NSAID). High-dose usage of diclofenac can cause gastrointestinal irritation. Therefore, using hydrogels as drug absorbers to control the slow release of diclofenac is necessary to reduce these side effects and increase long-term drug action. In this research, the structure and morphology of the CMC hydrogels were investigated using Fourier transform infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). Other properties of the CMC hydrogels i.e. water swelling ratio, water retention, drug uptake, and drug release were also conducted. In this study, we have successfully produced CMC hydrogel derived from paper wastes. It could effectively encapsulate diclofenac 11.20 mg/g of the hydrogel and help control diclofenac release. The CMC hydrogel showed a swelling ratio of 29 times its original size. It could retain water up to 3.63% after 48 hours. Moreover, the hydrogel was able to provide controlled drug release for up to 74 hours, with only 43.74 and 41.38% drug release in water and pH 7.4 buffer, respectively.

Keywords: Carboxymethyl Cellulose, Cellulose, Cellulose Hydrogels, Controlled Drug Release, Diclofenac

[CHEM06]

The Study of Natural Products from the Culture of *Pseudolagarobasidium* sp. PP17-33 Fungus

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Natural Products are chemicals which are extracted from natural resources including plants, fungi and animals. Most of which exhibit potent bioactivities and have been utilized by human such as drugs, supplements, and pesticides. Fungi are an interesting source of natural products because of their ability to grow both in natural and laboratory environments. The differences of growth factors, such as C/N sources, PH, salinity and temperature, influenced the variety of produced natural products. Thus, this project focused on the study of natural products from *Pseudolagarobasidium* sp. PP17-33 fungus which was cultivated in potato dextrose broth medium (PDB). This fungus was collected from the dry evergreen forest in Sakon Nakhon Province, Thailand. The chromatographic separations of ethyl acetate crude extract from broth yielded five compounds. The structure identification using infrared spectroscopy, and nuclear magnetic spectroscopy, together with comparisons of physical properties with literature revealed that all isolated compounds were nor-sesquiterpenoids, including Merulin A or Steperoxide B, Acaciicolide B and three Acaciicolide C derivatives.

Keywords: Extraction, Fungi, Natural Products, Terpenoids

[CHEM07]

Synthesis of Hexaphenylacepleiadylene

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Acepleiadylene, a non-benzenoid non-alternant isomer of pyrene containing 5/6/7-membered rings, has been employed as a unique building block for nanographenes (NGs). Herein, we focus on developing a novel synthesis for substituted acepleiadylene from 1,4,5,8-naphthalene-tetracarboxylic dianhydride and diphenylacetylene via double decarboxylative annulation process in only a single step. We optimized the reaction conditions by screening various parameters, including reaction atmosphere, solvent, base, oxidant, catalyst, time and temperature to obtain the desired product in moderate yield. The molecular structure was confirmed by ^{1}H NMR, ^{13}C NMR spectroscopy, and mass spectrometry. The substrate scope of diarylacetylenes will be examined to study the functional group compatibility of the reaction. Finally, control experiments will be carried out to propose reaction mechanism. This work will pave the way for the efficient synthesis of other non-alternant polyaromatic compounds.

Keywords: 5/6/7-membered Rings, Acepleiadylene, Decarboxylative Annulation, Nanographenes

[CHEM08]

Synthesis of Alkyne Probes of Lovasatatin Derivatives

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Lovastatin is a statin medication that lowers blood cholesterol level by inhibiting HMG-CoA reductase enzyme. Recently, two active statin derivatives were reported. Alpha, beta-dehydromonacolin S decreases blood lipid level, relating to cardiovascular disease. Alpha, beta-dehydromonacolin K inhibits cAMP-induced chloride secretion of colon cell lines, associating with diarrhea. This research investigated synthesis of alkyne probes derived from these statins to elucidate mechanisms at their molecular targets in inhibiting fatty liver and intestinal absorption as well as inhibiting chloride secretion, respectively. Alpha, beta-dehydromonacolin K, the starting material for synthesis of various alkyne probes, was synthesized from lovastatin via a dehydration reaction. Reduction of this statin, followed by reaction with acid chloride formed alkyne probe of alpha, beta-dehydromonacolin K. 1,4-Dihydroxylation of this probe generated alkyne probe of alpha, beta-dehydromonacolin S in a closed lactone form, which was then hydrolyzed to generate alkyne probe of alpha, beta-dehydromonacolin S in an opened lactone form. Statin alkyne probe of alpha, beta-dehydromonacolin K exhibited similar inhibition as its original compound. However, statin alkyne probes in closed and opened forms expressed much less activity than alpha, beta-dehydromonacolin S. Hence, statin alkyne probe of alpha, beta-dehydromonacolin K and alpha, beta-dehydromonacolin S containing no alkyne probe will be utilized in proteomic approach.

Keywords: Alkyne Probe, Blood Cholesterol, Diarrhea, Lovastatin Derivatives, Statin Probe

[CHEM09]

Synthesis of Quinuclidinium-containing Methacrylamide-based Monomers for Dental Resin Adhesive

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Currently, resin dental materials, which are tooth-colored filling materials, are becoming increasingly popular. These resin materials are used in conjunction with dental adhesive that comprises various types of monomers, predominantly methacrylates, which can be degraded. This research investigated synthesis of methacrylamide monomers to extend their lifespan. Moreover, quinuclidinium salt was included in the final structure of the monomers for antibacterial effects in the oral cavity. Methacrylamide monomers containing twelve- (n=12) and fourteen-carbon (n=14) chain length were synthesized using 12-bromododecanol and 14-bromotetradecanol as starting materials, respectively, through a five-step reaction process including key substitution and reduction reactions. The synthesis of methacrylamide-based monomer, n=12, was successfully scaled up without reduction of product yields. Condition for the substitution reaction with quinuclidine was optimized by varying solvent and temperature. The most suitable solvents and temperatures for monomer with twelve-carbon chain length (n=12) was isopropanol at reflux, and monomer with fourteen-carbon chain length (n=14) was acetonitrile at 85 °C. Overall yields of monomers containing twelve- and fourteen-carbon chain length were 30.5% and 16.3%, respectively. Antibacterial activity and hydrolysis resistance of synthesized monomers will be conducted.

Keywords: Antibacterial Monomer, Dental Resin Adhesive, Methacrylamide, Quinuclidinium Salt, Resin Composite

[CHEM10]

Development of Surface-coated SO$_3$H Carbon Based Catalysts via Condensation of SO$_3$H Containing Monomer

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Dihydropyrimidinone compounds are one of the most important N-containing heterocycles possessing a variety of biological activities. They are synthesized through the Biginelli reaction, which has been catalyzed by acids. This study investigated sulfonated-carbon derived catalysts from surface modifications using 4-hydroxybenzaldehyde-derived monomers with varying alkyl carbon chain lengths. It was found that the product yield of dihydropyrimidinone compounds from Biginelli reaction was high (91-99% yield). Additionally, the catalyst synthesized from the monomers with a 2-carbon alkyl chain length, exhibited high catalytic efficiency (99% yield) and reusability (at least 4 cycles).

Keywords: Acid Catalyst, Biginelli Reaction, Sulfonated Carbon

[CHEM13]

Structural Studies of Substituent Effects in [Fe(qsal-X)$_2$]OTf Complexes

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Crystal packing has been shown to have a considerable impact on spin crossover behavior (SCO). In this study, we explored the effect of the halogen substituent on the crystal structure and magnetic behavior of the series [Fe(qsal-X)$_2$]OTf (qsal-X = 4-X-2-[(8-quinolylimino)methyl]phenolate; X = F **1**, Cl **2**, Br **3**, and I **4**; OTf = CF$_3$SO$_3$). Two novel compounds in the series, **2** and **3•MeOH**, were successfully synthesized and characterized. All compounds crystallized in the triclinic $P\bar{1}$ space group with **1** and **2** have two independent iron(III) centers in the asymmetric unit, whereas **3•MeOH** and **4•MeOH** contain just one iron(III) center and one molecule of methanol. Gradual SCO was identified in **1**, but the SCXRD structures show that **2** is stabilized in the low spin state (LS). 3D networks in **1** are created by stacking corrugated planes. Alternatively, **2** depicts a stacking of 2D planes with alternating Fe1 and Fe2 planes (Fe1-Fe2-Fe1). Meanwhile, abruptly SCO has been observed in **4•MeOH**, and the SCXRD structures indicate that **3•MeOH** also exhibits SCO. Additionally, **3•MeOH** and **4•MeOH** are isostructural packing with highly cooperative 2D networks.

Keywords: Iron(III) Complexes, Single Crystal X-ray Diffraction, Spin Crossover(SCO)

[CHEM14]

Development of WO_3/$Cs_3Sb_2Br_9$ Composite Photocatalyst for Oxidation of Benzyl Alcohol under Green Light Irradiation

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A new tungsten trioxide/cesium antimony bromide (WO_3/CSB) heterostructure photocatalyst was developed herein for the selective oxidation of benzyl alcohol under green light irradiation. The WO_3 from hydrothermal method was composited with a certain amount of $Cs_3Sb_2Br_9$ (CSB) from antisolvent precipitation through simple heat treatment. Crystal structure and purity were investigated by powder X-ray diffraction (XRD) technique. Long needle-like coating with irregular particles of hexagonal CSB and small rod-like particles of monoclinic WO_3 were revealed by scanning electron microscopy (SEM). The morphology of WO_3/CSB exhibits characteristic features from both WO_3 and CSB components. The highest benzaldehyde production rate of 3,422 $\mu molg^{-1} h^{-1}$ was obtained from 70WO_3/CSB heterostructure, while only 52 and 2,776 $\mu molg^{-1} h^{-1}$ were observed for pristine WO_3 and bulk CSB, respectively. UV-Vis diffuse reflection spectroscopy results showed a decrease of band gap energy of the WO_3/CSB as increasing CSB content. Steady-state photoluminescence study indicated that forming the WO_3/CSB heterostructure significantly reduced electron-hole recombination probability, which is beneficial for photocatalytic activity enhancement. Present results suggest that CSB acts as an active site for the oxidation of benzyl alcohol under green LED, while WO_3 may function only as a reducible support for the active CSB catalyst. However, further characterizations are still needed to clarify the role of WO_3 and CSB and to understand the mechanism thereof.

Keywords: Benzyl Alcohol, $Cs_3Sb_2Br_9$, Heterostructure Photocatalyst, WO_3

[CHEM16]

Coupled High- and Low-temperature Hydrides for Thermochemical Heat Storage

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Thermal Energy Storage (TES) is a technology that stores thermal energy by heating or cooling a storage medium for later use. TES system based on coupled metal hydrides is receiving attention for its clean energy and high energy storage density. In this study, we selected a pair of low temperature metal hydrides due to their practical use as hydrogen storage at ambient conditions. The coupled system employs $LaNi_5$ as a high-temperature metal hydride (HTMH) because it does not require very high temperatures for heat charging. $La_{1-x}M_xNi_5$ is utilized as a low-temperature metal hydride (LTMH) due to its higher equilibrium pressure than HTMH, making it suitable for both recharging and discharging in the thermal storage system. The heat charging and discharging performances are investigated using a laboratory test station. HTMH emits hot air at around 50 °C for 100 min, while LTMH releases cool air at about 22 °C for 400 min. However, the design of the heat exchanger is in progress. Consequently, these results show the feasibility of the thermal battery utilizing a pair of $LaNi_5$-$La_{1-x}M_xNi_5$.

Keywords: Hydrides, Hydrogen Reservoir, Thermal Battery, Thermochemical Storage

[CHEM18]

Low-cost Gold Leaf Electrochemical Sensor and Performance in Detection of Formaldehyde

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Formaldehyde, also known as formalin, is commonly used as an industrial disinfectant and as a preservative in medical laboratories. However, formaldehyde is sometimes illegally used in to preserve food. The Food and Drug Administration of Thailand announces that addition of formaldehyde into food is prohibited. Despite its illegal use in food, formaldehyde is also produced naturally in some foods, such as beef, fish, and coffee beans, through metabolic processes. Therefore, determining the formaldehyde levels in food is essential for ensuring food safety. Our objective is to develop an electrochemical sensor for measuring formaldehyde contents in food. The in-house gold leaf electrochemical sensor consists of a gold leaf working electrode, a mask-printed carbon counter electrode, and a mask-printed silver-silver chloride reference electrode. The sensor costs only 0.2 USD, and its performance in formaldehyde determination is comparable to standard electrodes. Formaldehyde analysis is performed in a 0.1 M NaOH solution using square wave voltammetry, which allows for sample analysis within 2 minutes. The sensor can detect formaldehyde concentrations ranging from 0.2 to 2 mM, with a calibration curve of y = (26.02±0.58)x - (1.76±0.72), R^2 = 0.9961. The limit of detection (2.31 × SD of regression/slope) was found to be 0.093 mM. Additionally, the low-cost gold leaf electrochemical sensor provides good accuracy in measuring formaldehyde concentration in food samples (5 different samples), with a recovery range of 96% to 112%. Moreover, successful testing in detecting formaldehyde gas demonstrates its potential for further development in future applications.

Keywords: Electrochemical Sensor, Formaldehyde, Gold-leaf Sensor, Voltammetry

[CHEM19]

A Study of Appropriate Conditions in P-doped Synthesis of Molybdenum Nickel Sulfide Alloys for Application as a Catalyst in the Hydrogen Evolution Reaction

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Hydrogen fuel is a renewable energy source widely used today. Hydrogen synthesis via electrolysis is becoming very popular due to the high purity of hydrogen it produces. However, water electrolysis requires a catalyst, typically platinum (Pt), which is a rare and expensive mineral. This research focuses on developing and synthesizing a phosphorus-doped molybdenum nickel sulfide alloy to be used as a catalyst in the hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). From the experiments, the optimal condition for synthesizing the supporting material was determined to be 15.0 mg of graphene oxide and 3% glutaraldehyde. The efficiency of the HER and OER reactions was tested in solutions of 0.5 M sulfuric acid and 1.0 M potassium hydroxide, respectively. Under these optimal conditions, the catalyst achieved an overpotential of 238.1 mV and a Tafel slope of 99.3 mV/dec for the HER reaction, demonstrating good stability. For the OER reaction, the catalyst showed an overpotential of 135.5 mV and a Tafel slope of 254.7 mV/dec, though it exhibited poor stability.

Keywords: Electrocatalyst, Electrolysis, Hydrogen Evolution Reaction, Molybdenum Nickel Sulfide Alloy, Oxygen Evolution Reaction

[CHEM20]

Investigation of Carbon Dots (CDs)-Based Fluorescence
Turn-off and Turn-on Sensing for Detection of Aspartame

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Aspartame is widely used as artificial sweetener in various beverages. There have been some reports concerning its potentially carcinogenic effects on humans. This work aims to develop a simple fluorescence-based method using carbon dots (CDs) for the detection of aspartame. CDs are synthesized from citric acid and urea (1:1 mass ratio) via a rapid one-step microwave-assisted pyrolysis method (700 watt for 4 min). When exposed to UV light, the CDs emit intense blue fluorescence (λ_{ex} = 357 nm, λ_{em} = 444 nm), whereas the CDs solution shows a yellow color under visible light (λ_{max} = 338 nm). The concept of fluorescence turn-off and turn-on of CDs was applied for detection of aspartame. When silver(I) ions are added to the as-prepared CDs solution, fluorescence quenching (turn-off) increases with the concentration of silver(I) ions. A possible quenching mechanism is the interaction of silver(I) ions with the functional groups present on the surface of CDs in carbonate-buffered solution. The addition of aspartame solution to the quenched CDs solution results in recovery of the CDs' fluorescence (turn-on), due to the silver-aspartame complex formation. According to the preliminary results, increasing concentrations of aspartame in the range of 0 – 48 µmol L^{-1} lead to gradually enhanced fluorescence of the CDs solutions with a linear calibration function of y = (0.0106±0.0005) x + (0.988±0.016), r^2 = 0.995 with the limit of detection of 13.6 µmol L^{-1}. Investigation of physical and chemical parameters to obtain the required sensitivity and possible application to beverage samples will be discussed.

Keywords: Aspartame, Carbon Dots, Fluorescence, Microwave-assisted Pyrolysis Method, Turn-off/Turn-on

[CHEM21]

Development of Portable Retinoic Acid Sensor in Acne Treatment Medicine Using MoS$_2$-modified Screen-printed Carbon Electrode

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Retinoic acid (RA), a derivative of Vitamin A, is crucial in acne therapy due to its significant impact on reducing inflammation and regulating skin cell turnover. However, improper use can lead to skin irritation and side effects, necessitating controlled application. Food and Drug Administration (FDA) has defined the maximum dosage approval of RA in tropical medication at 0.1%. This work aims to develop a portable RA sensor based on the screen-printed carbon electrode (SPCE). To enhance the sensitivity, molybdenum disulfide (MoS$_2$) was used as a modifier on the surface of SPCE. Cyclic voltammetry (CV) was operated to study electrochemical behavior. For the determination of RA, the oxidation current of RA was collected using differential pulse voltammetry (DPV). Under optimized conditions, MoS$_2$-modified SPCE was effectively determined with a sensitivity of 1.268 µA/mM and a linear range of 0.0625 to 1.25 mM. The limit of detection (LOD) was 17.9 µM, which is less than the FDA maximum dosage. Finally, the capability for analyzing RA in pharmaceutical samples using the proposed sensor was studied. The results found that the detected concentration of RA with the developed sensor was consistent with the defined concentration of RA on the prescription label. Additionally, the proposed sensor is user-friendly, cost-effective, disposable, and requires minimal chemicals and samples, making it suitable for external laboratory applications.

Keywords: Molybdenum Disulfide, Portable Sensor, Retinoic Acid, Screen-printed Carbon Electrode

[CHEM22]

Multivariate Optimization for Vortex-assisted Dispersive Liquid-liquid Microextraction Using Solidified Floating Organic Drop for Nickel Determination in Food Samples by FAAS

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This study presents the development of vortex-assisted dispersive liquid-liquid microextraction using solidified floating organic drop (VA-DLLME-SFOD) for the determination of nickel in water and canned food samples by flame atomic absorption spectrometry (FAAS). Multivariate optimization was employed to investigate and optimize microextraction efficiency parameters including pH, sample volume, extractant volume, ligand concentration, type and volume of dispersive solvents, and extraction time. Under the optimized conditions, an enrichment factor of 9.082 was achieved with the extraction efficiency of 75.68% using a 12.0 mL sample volume. The calibration curve was linear within the concentration range of 0.05 to 0.125 mg/L, with a limit of detection (LOD) and limit of quantification (LOQ) of 0.025 mg/L and 0.085 mg/L, respectively. The relative standard deviation (RSD) for five replicate measurements of 0.125 mg/L Ni(II) was 3.5%. The method was successfully applied to analyze surface water, tap water, drinking water, and canned food samples, demonstrating spiked recoveries ranging from 93% to 106%. The accuracy of the method, assessed by percentage recovery, gave satisfactory results.

Keywords: Dispersive Liquid-liquid Microextraction (DLLME), Flame Atomic Absorption Spectrometry (FAAS), Nickel, Solidified Floating Organic Drop (SFOD), Vortex

[CHEM23]

Fabrication of a Compact Screen-printed Carbon Electrode for Hydrogen Peroxide Detection Based on Bipolar Electrochemiluminescence

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This work aims to design and fabricate a compacted screen-printed carbon electrode (SPCEs) for the bipolar electrochemiluminescence (ECL) platform. Three different designs of the bipolar screen-printed carbon electrode were fabricated with a focus on compactness, affordability, and comparable performance compared with a commercial screen-printed carbon electrode. The ECL system, using luminol as a luminophore and hydrogen peroxide as a co-reactant, was used to investigate the compacted screen-printed carbon electrodes by using a smartphone as a light detector. Comparative analyses with commercial SPCEs were conducted to evaluate the detection performance. The compacted homemade SPCEs were used for hydrogen peroxide detection, offering a portable setup for various applications in biomedical diagnostics and environmental monitoring.

Keywords: Bipolar Electrochemiluminescence, Hydrogen Peroxide, Luminol, Screen-printed Carbon Electrode

[CHEM25]

Apatite Growth on Bioactive Glass Modified with Biopolymer

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Bioactive glass (BG) strengthening by biopolymers is an effective scaffold for the growth of hydroxyapatite when being in contacts with simulated body fluid (SBF). The objectives of this research are to prepare BG-gelatin composite, study on biomineralization and mechanism of apatite growth. BG solution (sol) was prepared by mixing tetraethyl orthosilicate (TEOS) with deionized water, HNO_3, ethanol, triethyl phosphate and $CaCl_2$. Then it was mixed with gelatin and glutaraldehyde (Glu) solution in N,N-dimethylacetamide (DMAc) and kept for gelation to obtain BG-G(DMAc)+Glu sample. BG_Fil and BG-G(DMAc)+Glu_Fil were prepared by dropping BG sol or BG-gelatin sol respectively onto filter paper (Fil) and kept still for 7 days. The biomineralization was performed in SBF for 8, 16 and 24 days at 37°C. The SBF solution was collected and replaced with the freshly-prepared solution every 2 day. Biomineralized samples were characterized by various spectroscopic techniques. The collected solutions were analyzed for Ca^{2+} concentrations using Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES). The Infrared (IR), Scanning Electron Microscopy-Energy Dispersive X-ray (SEM-EDX) and X-ray Diffraction (XRD) results evidenced the growth of hydroxyapatite in which the enhancement was caused by gelatin. From ICP-OES, Ca^{2+} was released and the maxima were reached within 2 days. While the speed for equilibrium reach is in the descending order: BG-G(DMAc)+Glu_Fil>BG-G(DMAc)+Glu>BG_Fil. The higher surface area of BG-G(DMAc)+Glu_Fil as compared with BG-G(DMAc)+Glu helps accelerate the growth of apatite resulting in the faster equilibrium reach. It was also found that gelatin helps increase the attachment of BG to the filter paper surface.

Keywords: Bioactive Glass, Cellulose, Gelatin, Hydroxyapatite

[CHEM26]

Design and Fabrication of Scaffold for Bone Regeneration in Dentistry

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Scaffolds are essential medical materials used to promote the growth and repair of damaged cells, finding extensive applications in bone and dental tissue engineering. These scaffolds are designed to possess favorable properties such as high surface area, excellent water absorption, and high porosity, which are critical for facilitating cell adhesion, proliferation, and differentiation. In this study, scaffolds were fabricated using a combination of chitosan (CS), gelatin (Gel), and silk fibroin (SF), with dimethylolurea (DMU) serving as a cross-linking agent. The freeze-drying technique was employed to produce these scaffolds, ensuring the creation of a porous structure suitable for biomedical applications. The structural and functional properties of the polymers were analyzed using Fourier transform infrared (FTIR) spectroscopy. The FTIR analysis revealed distinct absorption peaks corresponding to the functional groups present in the materials. The absorption peaks for N-H and O-H stretching vibrations were observed in the range of 3272-3278 cm^{-1}, while C-H stretching appeared at 2934-2936 cm^{-1}. The C=O stretching vibrations were detected at 1632-1636 cm^{-1}, indicating the presence of amide bonds. Additionally, C=N stretching was observed at 1238 cm^{-1}, C=C aromatic stretching at 1515-1531 cm^{-1}, and C-O/C-N stretching vibrations at 1058-1067 cm^{-1}. The water swelling ability of the scaffolds was assessed, and the results showed that the scaffolds could reach a maximum swelling ratio of approximately 2500%. This high swelling capacity is indicative of the scaffolds' ability to retain water, which is essential for maintaining a moist environment conducive to cell growth and tissue regeneration. Surface morphology of the scaffolds was examined using scanning electron microscopy (SEM). The SEM images revealed a highly porous structure with interconnected pores, which is crucial for nutrient and waste exchange, as well as for providing mechanical support to the growing tissue. The porosity and structural integrity of the scaffolds were found to be suitable potential for study in dental tissue engineering in future.

Keywords: Chitosan, Dimethylolurea, Gelatin, Scaffold, Silk Fibroin, Tissue Engineering

[CHEM27]

3D Porous Socket Preservation in Dentistry: The Fabrication and Characterization

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The use of 3D porous scaffolds based on biocompatible and biodegradable polymers has been extensively studied for socket preservation applications. These porous scaffolds mimic the extracellular matrix (ECM) and effectively establish a microenvironment conducive to cell adhesion, viability, proliferation, and differentiation. In this study, porous scaffolds were fabricated using poly(vinyl alcohol) (PVA), chitosan, gelatin, silk proteins, and dimethylolurea (DMU) as a crosslinker, employing the freeze-drying technique. All materials usedare biocompatible, biodegradable, and non-toxic. The porous structures were characterized using a field emission scanning electron microscope (FE-SEM), revealing that the addition of gelatin increased porosity, pore size, swelling ratio, and equilibrium water content. A Fourier transform infrared spectrometer (FT-IR) was used to characterize the functional groups present in the scaffolds. The analysis identified five functional groups: O-H stretching, C-H stretching, amide I, amide II, and amide III. Furthermore, the FT-IR results confirmed that the porous scaffold structure contains the molecular interaction by hydrogen bonding between the functional groups of the materials used.

Keywords: Chitosan, Poly(vinyl alcohol) (PVA), Porous Scaffolds, Silk FIBROIN (SF), Silk Sericin (SS)

[CHEM28]

Instant Prediction of Texture Properties of Waxy Corn Using near Infrared Spectroscopy

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Near Infrared Spectroscopy (NIR) has been proven as a versatile tool for rapid and non-invasive analysis of agricultural products. This study aimed to assess the potential of NIR spectroscopy in detecting the texture properties of waxy corn samples in different condition states, including fresh corn, cooked corn, and corn which were cooked and remained in a refrigerator overnight. Principal Component Analysis (PCA) and Self-Organizing Map (SOM) were used to investigate the characteristic difference among the samples. Currently, the quantitative predictions were based on Partial Least Squares (PLS). The results from the PCA and SOM analysis showed that the processing conditions could affect the chemical components in the corn samples. Using PLS, the relationship between NIR spectra and physical properties including hardness, and chewiness, could be investigated. Additionally, hardness could be predicted giving the best predictive performance with R^2 and Q^2 values of 0.63 – 0.78, 0.54 – 0.76. The Root Mean Square Error (RMSEs) of 1.32 – 1.85 were also obtained. The future work, the performance of the PLS models will be improved for the prediction of the waxy corn samples kept in different storage conditions.

Keywords: Chemometrics, Near Infrared Spectroscopy, Texture Properties, Waxy Corn

[COMP01]

Comparison of Neural Network Models for Digital Image Colorization

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Colorization is the process of adding colors to grayscale or unclear images using an algorithm that can automatically convert grayscale images to colored images. Deep learning models are used to process and predict appropriate colors for each pixel of the image. The researchers aim to compare three neural network models for colorization to determine which model is suitable for use with different types of images. The comparison is conducted using 1,200 images, each of size 256x256 pixels. The dataset consists of three different types of pictures: pets (dogs and cats), landscapes, and human portraits, with 100 images for each type. Each image is then processed using the three colorization methods: 1) U-Net with conditional Generative Adversarial Networks (GAN), 2) neural networks with 8 convolutional layers, and 3) neural networks with 10 convolutional layers. The results were then evaluated using these three methods: 1) finding the average sum of red, green and blue (RGB) color differences between the original image and the colorized image, 2) scoring comparisons, and 3) asking human opinion. The results of methods 1 and 2 show that neural network with 10 convolutional layers model is the best for colorization of images of dogs, cats and humans, while U-Net and conditional GAN model is the best for landscape images. The experimental results indicate that the neural network with 10 convolutional layers is the most suitable for colorization of all image types.

Keywords: Colorization, Image Enhancement, Neural Network Models, RGB

[COMP02]

Innovative VR Solutions for Chest X-ray Training: Improving Skills and Student Satisfaction

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Chest X-ray is a common medical examination that uses ionizing radiation, posing potential health risks if accumulated in large amounts. Proficiency in radiographic positioning is essential for operators. Virtual Reality (VR) technology offers a solution by creating immersive, virtual environments where users can learn and practice skills without being in a real setting. This research aimed to develop a VR application for training in chest X-ray positioning, particularly for radiology technology students. The VR application allows continuous practice without the limitations of physical X-ray machines, which are often insufficient for the increasing number of students. The study found high satisfaction levels among 1st to 4th year radiology students, particularly regarding the model's interest, scene aesthetics, content appropriateness, ease of use, and realism. The VR application effectively trains students in the PA (Posterior-Anterior) Upright position for chest radiographs, though some limitations remain in mimicking real patient positioning. The research suggests VR as a valuable tool for training in radiographic positioning and highlights its potential application in other radiographic areas.

Keywords: Chest X-ray, PA Upright Position, Training Simulation, Virtual Reality (VR)

[COMP03]

Improving Underwater Object Detection Through Data Augmentation

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Detecting objects underwater is difficult because of the unique optical properties of water, particularly when visibility is poor. The lack of sufficient data hampers the effectiveness of deep learning models, which need large datasets to function well. Data augmentation can help mitigate this issue. Nonetheless, the ideal dataset size and augmentation techniques for this project are still uncertain. Our study examined the effects of data size and augmentation on model efficiency. We experimented with different dataset sizes and augmentation methods (such as mosaic, crop, rotation, bounding box rotation, and background mix-up) to evaluate their impact and identify the most effective ones for object detection. While simply increasing the dataset size doesn't necessarily improve efficiency, data augmentation consistently enhances performance, particularly with mosaic, crop, and bounding box techniques, which provide higher mean Average Precision at 50% Intersection over Union (mAP50) compared to the model without augmentation on the test set. However, excessive augmentation with a small dataset, or using augmentation with too few data points, can be counterproductive, leading to decreased model performance and increased overfitting. Overall, data augmentation shows promise for underwater object detection, but dataset size must also be taken into account. We believe this research will benefit organizations working with underwater computer vision by demonstrating how to optimize models even with limited data.

Keywords: Data Augmentation, Deep Learning, Object Detection, Overfitting, Underwater

[GEOL01]

A Preliminary Study of Traveltime Anomaly of Seismic Waves:
An Implication for Deep Geological Structure Beneath Thailand

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From the Thai Seismic Array (TSAR), there are 39 seismic stations distributed in the upper part of Thailand. Data from 83 teleseismic earthquake events, with magnitudes (Mw) greater than 5 and occurring at distances between 30° and 90° from 2016 to 2017, were collected. These records were filtered using a low-pass filter at 0.1 Hz and selected visually event by event. The selected data were processed for seismic travel-time residuals and arrival times using the Adaptive Stacking technique. The results can be interpreted in terms of deep structures in the mantle beneath Thailand. The travel-time residual map for the upper part of Thailand indicates that the northeast and central parts of Thailand exhibit slower travel time residuals compared to the west of Thailand. Low-velocity anomalies are possibly associated with a mantle upwelling plume in the upper mantle beneath central and northeast Thailand. High-velocity anomalies are possibly associated with the Indian plate slabs beneath the western part of Thailand and remnants of the Tethys beneath northeast Thailand. The presence of mantle upwelling is probably related to the source zone of Cenozoic volcanism distributed across the country. It is possibly connected to the same sources, such as the basalt body in Buriram, the Bo-Phloi basalt in Kanchanaburi, and others. We suggest that recent tectonic processes enhance the understanding of tectonic evolution and indicate that the velocity anomalies are related to the dynamics of the mantle beneath Thailand. This is only a preliminary result. Seismic tomography will be required for more accurate results.

Keywords: Deep Structure, Tectonics Evolution of Thailand, The Mantle, Travel-time Anomaly, Upper Part of Thailand

[GEOL02]

Characterization of Impact-generated High-pressure (HP) Glass Using Atomic Force Microscopy

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Natural glass found on Earth, in addition to glass generated from volcanic processes, is 'impact glass' generated from meteoritic impact events found in various localities. There is lacking tool to classify impact glass and identify its origin. Hence, this research studies physical and chemical characteristics of impact glass using Atomic Force Microscope (AFM) and Raman spectroscopy in order to provide data for future determination of source crater. The chemical composition shows that silica content and network-modifying cation oxide of impact glass from various origins are different. It is associated with a different degree of polymerization reflected in different Raman shifts. The amount of network-modifying cation oxide also relates to the cooling rate of the glass. FeO and TiO_2 contents increase when the cooling rates of the sample increase. Surface textures collected from AFM of moldavite are different from those of Australasian tektites, which is related to the degree of polymerization. The group of impact glass with high degree of polymerization has more roughness than the group with lower degree of polymerization. The impact glass with high degree of polymerization is highly resistant to polishing. Thus, hill size and height remain greater than the impact glass with low degree of polymerization. In conclusion, the chemical composition and polymerization of impact glass can be used as a tool to distinguish between various impact glasses. This would lead to an identification of impact glass and may help identify source crater of the impact glass strewnfield.

Keywords: Impact Crater, Impact Glass, Raman Spectroscopy, Surface Textures, Tektite

[GEOL03]

Influence of Seasonal Factors on Heavy Metals Concentration in Estuaries of the Inner Gulf of Thailand

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Heavy metal pollution is an environmental problem in many regions, including the Inner Gulf of Thailand. Studies about the factors that affect the concentration of heavy metals are essential for understanding the trends in their accumulation, which impacts the ecosystem and human health. Thus, this study aimed to analyze the relationship between seasonal hydrodynamic factors (discharge) that affect the heavy metals concentration in estuaries of the Inner Gulf of Thailand, including Mae Klong, Tha Chin, Chao Phraya and Bang Pakong estuaries, by comparing the types and concentrations of heavy metals in seawater and sediment of each estuary between the dry and wet seasons. As a result of the analysis of 8 heavy metals in seawater (As, Cd, Pb, Cu, Cr, Zn, Fe and Mn) and 9 heavy metals in sediment (Hg, As, Cd, Pb, Cu, Cr, Zn, Fe and Mn), the concentration of Pb, Cu, Fe and Mn found in seawater samples during the dry season was higher than those in the wet season in all estuaries. The reason is that there is more discharge during the wet season that flows from the river into the sea than during the dry season. Therefore, it contributes to dilute the concentration of heavy metals in the water. In comparison, a trend of difference between seasons in the sediment samples could not be concluded. Analyzing the relationship between the concentration of heavy metals and the discharge that used the correlation coefficient found that the correlation could not be concluded statistically. However, comparing heavy metal concentrations in both seasons can determine that the discharge affects the heavy metal concentration in seawater.

Keywords: Discharge, Heavy Metal, Seasonal Variation, Seawater, Sediment

[MATH01]

Some Acyclically 5-Choosable Graphs

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A graph G is acyclically k-choosable if graph G can be properly colored by colors from lists of L that $|L(v)| \geq k$ for any $v \in V(G)$ and each cycle which is a subgraph of graph G is colored with at least 3 colors. In this work, we show that a graph G is acyclically 5-choosable if G is a planar graph such that each vertex in a cycle with degree more than 2 is adjacent only to vertices with degree 1 or 2.

Keywords: Acyclic Coloring, Graph Coloring, List Coloring, Planar Graphs

[MATH02]

Edge Coloring and List Edge Coloring of Uma's Graphs and Ryu's Graphs

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In this project, we study edge coloring and list edge coloring for some case of Uma's graph $(H_{m,n})$ and Ryu's graph $(R_{m,n})$ on a chessboard of size $m \times n$, which is graph with strcture representing the possible moves of an uma piece and a ryu piece on chessboard. The chromatic index of Uma's graph $(H_{m,n})$ and Ryu's graph $(R_{m,n})$ for some cases are as below.

1. $\chi'(H_{1,2}) = 1$ and $\chi'(H_{1,n}) = 2$ for $n \geq 3$.
2. $\chi'(H_{2,2}) = 3$ and $\chi'(H_{2,n}) = 5$ for $n \geq 3$.
3. $\chi'(H_{3,n}) = 8$ for $n \geq 3$.
4. $\chi'(H_{4,4}) = 9$ and $\chi'(H_{4,n}) = 10$ for $n \geq 5$.
5. $\chi'(R_{1,n}) = \begin{cases} \Delta(R_{1,n}) & ; n \in \mathbb{E}, \\ \Delta(R_{1,n}) + 1 & ; n \in \mathbb{O}. \end{cases}$
6. $\chi'(R_{2,n}) = \Delta(R_{2,n})$ for $n \geq 2$.
7. $\chi'(R_{3,n}) = \Delta(R_{3,n})$ for $n \geq 3$.
8. $\chi'(R_{4,n}) = \Delta(R_{4,n})$ for $n \geq 4$.

The list chromatic index has been found for some cases as below.

1. $\chi'_L(H_{1,n}) = 2$ for $n \geq 3$.
2. $\chi'_L(H_{2,n}) = 5$ for $n \geq 3$.
3. $\chi'_L(H_{3,n}) = 8$ for $n \geq 3$.
4. $\chi'_L(R_{1,n}) = \begin{cases} \Delta(R_{1,n}) & ; n \in \mathbb{E}, \\ \Delta(R_{1,n}) + 1 & ; n \in \mathbb{O}. \end{cases}$

Keywords: Chromatic Index, Edge Coloring, List Chromatic Index, List Edge Coloring, Ryu's Graph, Uma's Graph

[MATH03]

The Roman Domination Number of GCD-Graph

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Let $n \in \mathbb{N}$ be such that $n \geq 2$ and $X_n = \{1, 2, \ldots, n\}$. Let $D_n = \{d \in X_n : d \mid n\}$ and $\emptyset \neq A \subseteq D_n$. The greatest common divisor graph $\Gamma_n(A)$ is defined as a graph with vertex set X_n and edge set $\{\{x, y\} : x, y \in X_n, \gcd(x - y, n) \in A\}$. Let $G = \{V, E\}$ be a graph and let $f : V \to \{0, 1, 2\}$ be a roman dominating function if for all $u \in V$ for which $f(u) = 0$ then u is adjacent to v for some $v \in V$ for which $f(v) = 2$, and $f(V) = \sum_{u \in V} f(u)$ is the weight of a roman dominating function f. Moreover The roman domination number of a graph G is the minimum weight of a roman dominating function of the graph G and denoted by $\gamma_R(G)$. In this project, we introduce some basic properties of Γ_n. Moreover, we study the decomposition of Γ_n into regular graphs. Finally, we study the roman domination number of gcd-graphs Γ_n.

Keywords: Gcd-graph, Graph Decomposition, Roman Dominating Function, Roman Domination Number

[MATH04]

Hamiltonian Cycles in Cayley Graphs of Gyrogroups

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The gyrogroup structure is a non-associative algebraic structure discovered by A.A. Ungar during his study of Einstein's relativistic velocity addition law. It can be regarded as a generalization of the structure of groups where the associative property is substituted by the left gyroassociative property and the left loop property. Hamiltonian cycles in right-Cayley graphs of gyrogroups will be covered in this talk. Specifically, we will provide some instances and a gyrogroup version of the factor group lemma. We also intend to demonstrate that some right-Cayley graphs of a certain class of gyrogroups are Hamiltonian.

Keywords: Cayley Graph, Gyrogroup, Hamiltonian Cycle

[MATH05]

Some Generalization of Integral Inequalities Similar to Hardy's Inequalities via *(p,q)*-Calculus

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In this project, we provide some Hardy type integral inequalities via *(p, q)*- calculus. The main results are proven to generalize of some integral inequalities, which introduced by S. A. Bendaoud and A. Senouci in 2022 [Bendaoud, S.A. and Senouci, A. *Some generalizations of integral inequalities similar to Hardy's inequality*. In: Afr. Mat. 33, 20 (2022)].

Keywords : *(p,q)*-calculus, *(p,q)*-differentiable Function, *(p,q)*-integrable Function, Hardy Type Integral Inequalities

[MATH06]

Fixed Point Theorem for Mappings of Generalized Edelstein-Suzuki's Type

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In 2009, Suzuki introduced a new type of mappings in a metric space. He proved that if the space is compact, such a mapping always has a fixed point. Suzuki's result strictly generalizes Edelstein's fixed point theorem in the sense that there exists an example satisfying Suzuki's assumption but lying beyond the scope of Edelstein's. Inspired by Suzuki's result, we introduce various conditions on the mappings guaranteeing the existence of a fixed point in a compact metric space. Our results strictly generalize Suzuki's fixed point theorem and are illustrated by some examples.

Keywords: Compact Metric Space, Fixed Point Theorem

[MATH07]

Novel Closed-form Formula for Conditional Moments of Ornstein–Uhlenbeck Process: A PDE Approach

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Closed-form formula representing conditional moments of Ornstein-Uhlenbeck process is established. The obtained formula is combinatorial in nature, involving the Faà di Bruno's formula, and are derived through the use of an exponential affine transform, which are solutions of partial differential equations arising from Feynman-Kac theorem.

Keywords: Conditional Moments, Ornstein-Unlenbeck Process

[MATH08]

Iterative Laplace Transform Method for the Time-Fractional Equations

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This project studies two methods of solving time-fractional PDE: the New Transform Method and the Laplace Residue Power Series Method. Both methods utilize the Laplace transform to obtain solutions. We apply these methods to solve the time-fractional Navier-Stokes equation in cylindrical coordinates and the time-fractional Newell-Whitehead-Segel equation.

Keywords: Fractional Calculus, Laplace Transform, Time-Fractional Navier-Stokes, Time-Fractional Newell-Whitehead-Segel

[MATH09]

General Solution of the Maxwell Equations to the Stagnation Point Problem with Cylindrical Symmetry

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The two-dimensional flows near a free critical point of an incompressible viscoelastic Maxwell medium with the rheological constitutive law is considered in the presentation. The study of the stagnation point flow problems has been studied frequently. However, general exact analytical solutions of stresses for cylindrical case, which are more practical and suitable for some certain experiments, has not been found. In this study, the general solution of the Maxwell model with Johnson-Segalman convected derivative in cylindrical is found for all values of a parameter of the model.

Keywords: Johnson-Segalman Convected Derivative, Maxwell Model, Stagnation Point, Viscoelastic Flow

[MATH10]

Complete Solutions for Second-order Ordinary Differential Equations

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This project studied the finding of complete solutions of second-order ordinary differential equations of the form

$$\frac{d^2y}{dx^2} + (m + n)\frac{dy}{dx} + mny = e^{-a}\ (A\sin(bx) + B\cos(bx)), \text{ when } x \in \mathbb{R}.$$

The initial conditions are $y(0) = y_0$ and $y'(0) = y_0'$ where m, n, k, a, y_0 and y_0' are real numbers. This will be considered separately into 2 cases: the case where $m, n,$ and a are all different real numbers and the case where $m, n,$ and a are real numbers where $m = n = a$. Moreover, the researchers have presented some examples, which are consistent with the complete solutions obtained as well.

Keywords: Complementary Solution, Complete Solution, Particular Solution

Research Abstract

**DPST Conference on Science and Technology 2024
(DPSTcon2024)**

[MATH11]

Convergences of Weighted Averaged Operators in p-Uniformly Convex Metric Spaces

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In this project, we improve theorems related to the Δ-convergence of an iterative sequences within p-uniformly convex metric spaces. We investigate a sequence generated by weighted average operators on a pair of simultaneously quasi-nonexpansive mappings. Our goal is to establish enhanced conditions that facilitate the convergence of these iterative methods.

Keywords: Δ-convergence, P-uniformly Convex Metric Space, Quasi-nonexpansive

[MATH12]

Optimizing Neural Ordinary Differential Equations with Lookahead Optimizer

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This study delves into the application of Neural Ordinary Differential Equations (Neural ODEs) within the machine learning domain, introducing an innovative optimization strategy using the Lookahead Optimizer. Utilizing Euler's Method for both forward and adjoint sensitivity calculations, we discuss the trade-offs between computational efficiency and numerical accuracy. Our experimental results indicate that the Lookahead Optimizer converges faster at lower learning rates and exhibits greater stability at higher learning rates compared to standard Gradient Descent. This work provides empirical evidence supporting the efficacy of the Lookahead Optimizer in Neural ODE contexts and offers an open-source codebase for future research.

Keywords: Lookahead Optimizer, Neural Ordinary Differential Equations, Sensitivity Analysis

[MATH13]

Extension of Cover's Probability Puzzle

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Cover's probability puzzle said that in a gameshow, a moderator writes down any two different numbers on separated slips of paper and then a player randomly chooses one of these slips of paper. The player must answer that the other number is higher or lower than the number that the player chooses. In this project, we increase the number of separated slips of paper that the moderator writes from two to three and allow the player to randomly choose two of these slips of paper. The player must answer that the unchosen number is higher than, between, or lower than the chosen numbers. In this work, we will show that there are strategies that the player can answer this question correctly with probability strictly greater than 1/3. We will find a formula for the probability that the player answers the question correctly when we have a decision function and know the distributions of the three numbers. We perform Monte Carlo simulation to confirm our formula.

Keywords: Cover's Probability Puzzle, Monte Carlo Method

[MATH15]

Enumeration of Symmetric Tridiagonal Matrices with Prescribed Determinant over $\mathbb{Z}_p$ and $\mathbb{Z}_{p^2}$

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In this research, we investigate the determinants of symmetric tridiagonal matrices over the rings $\mathbb{Z}_p$ and $\mathbb{Z}_{p^2}$. The objective of this study is to find the formula for the number of n × n symmetric tridiagonal matrices for a given determinant over $\mathbb{Z}_p$ and $\mathbb{Z}_{p^2}$. First, the number of non-singular symmetric tridiagonal matrices over such rings is completely determined. Next, for an odd integer n, the number of n × n symmetric tridiagonal matrices with prescribed determinant over $\mathbb{Z}_p$ is presented as well as the number of n×n non-singular symmetric tridiagonal matrices with prescribed determinant over $\mathbb{Z}_{p^2}$. For an even positive integer n, a partial enumeration of n × n symmetric tridiagonal matrices with prescribed determinant over $\mathbb{Z}_p$ is presented.

Keywords: Determinants, Enumeration, Integers Modulo p, Symmetric Tridiagonal Matrices

[MATH16]

Some Results on the Bipolar Set via the Abstract Algebra

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In this article, we provide our results to two parts: theorems and properties of algebraic structure of the subsets of bipolar set and ring theory over the space of bipolar quantum linear algebra (BQLA).

Keywords: Bipolar Quantum Linear Algebra, Group Theory, Ring Theory

[MATH17]

On the Diophantine Equation $x + y = xy$
over the Ring of Integers of a Quadratic Number Field

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In this project, we will show that there are infinitely many solutions to the Diophantine equation $xy = x + y$ over the ring of integers of a quadratic field $\mathbb{Q}(\sqrt{d})$. Furthermore, we also show that the Diophantine equation $xy = x + y$ has a unit solution over the ring of integers of a quadratic field $\mathbb{Q}(\sqrt{d})$ if and only if $d = -3$ or $d = 5$. Moreover, we show the existence of a unit solution to the Diophantine equation:
$$x_1 + x_2 + \cdots + x_n = x_1 x_2 \cdots x_n$$
for any positive integer $n > 1$ over the ring of integers of an imaginary quadratic field.

Keywords: A Quadratic Number Field, A Unit Solution, Diophantine Equation, The Ring of Integers

[MATH18]

On Generalized Fibonacci and Lucas Sequences

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In this project, we study generalized Fibonacci and Lucas sequences $\{f_n\}_{n=0}^{\infty}$ and $\{l_n\}_{n=0}^{\infty}$, which are defined by the recurrence relations

$$f_n = 2af_{n-1} + (b - a^2)f_{n-2} \quad \text{and} \quad l_n = 2al_{n-1} + (b - a^2)l_{n-2}$$

with initial conditions $f_0 = 0, f_1 = 1$ and $l_0 = 2, l_1 = 2a$, respectively, where a and b are any nonzero real numbers. Using generating functions, Binet's formulas for both sequences, and mathematical induction, we verify some identities and explicit sums formulas for both sequences. In addition, we also obtain two families of tridiagonal matrices whose determinants are all the generalized Fibonacci numbers f_n and the generalized Lucas numbers l_n.

Keywords: Binet's Formula, Generalized Fibonacci Sequence, Generalized Lucas Sequence, Generating Function

[MATH19]

Efficiency of Minimizing Risk Model in Investment in Stock Markets and Its Application in the Stock Exchange of Thailand

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In this project, our aim is to propose a new mathematical efficiency model for a strategic investment, providing investors with greater precision to accurately respond to fluctuations in stock prices within stock markets. Our empirical data consist of historical closing prices of stocks from SET50. Additionally, we utilize a developed strategic investment constructed from risk management focused on realized volatility. Finally, we present the efficiency of that strategic investment model for expected returns ranging from 1 - 5.

Keywords: A Mathematical Efficiency Model, Historical Closing Prices, Realized Volatility, SET50, Strategic Investment

[MATH20]

Markowitz Portfolio Theory on Set 50

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Modern portfolio theory introduced by Harry Markowitz is one of the most practical portfolio management theories. The theory is assembled using mean-variance analysis. Under the assumption of risk averse investors, the theory mathematically and practically gives the investors the way to construct a portfolio that has the lowest risk for a given expected return or having the highest expected return for a given risk. In this work, we apply Markowitz portfolio theory on the stock exchange of Thailand, SET 50. Based on the theory, we have found the best portfolio for each case of 2, 3, and 4 stocks that give the lowest risk with short selling and without short selling.

Keywords: Expected Return, Markowitz Portfolio Theory, Risk

[MATH21]

Application of Real Option to Solve the Venture Problem of Polyplex (Thailand) Public Company Limited

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The purpose of this research project is to present the principles of real options for using in analyzing investment projects for project managers. Real options help in making sequential decisions about a project, such as stages of development in a new product line. Each stage is an option to proceed based on the success and information gathered in the previous stage. In this research, the constant values used in calculating cash flow are obtained by calibrating a tree of prices that are based on the price of PET soft films. We will apply this analysis method to Polyplex Thailand Public Company Limited.

Keywords: Calibrating a Tree of Prices, Discussion Tree, Expanding Production Lines, Maximizes Market Value, Real Options

[MATH22]

Forecasting Technology Sector Stock Prices Using Machine Learning LSTM and Seasonal Autoregressive Integrated Moving Average

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This study examines two predictive approaches for forecasting the daily closing prices of leading stocks in the artificial intelligence sector, with a special focus on NVIDIA Corp (NASDAQ: NVDA). The analysis covers daily closing price data from January 2020 through February 2024, comparing the efficacy of seasonal ARIMA models with that of artificial neural networks, particularly long short-term memory (LSTM) networks. Evaluation metrics including root mean square error (RMSE), mean absolute percentage error (MAPE), mean absolute error (MAE), and mean absolute scaled error (MASE) are utilized to assess the accuracy of these forecasting models. The results consistently demonstrate that LSTM networks outperform seasonal ARIMA models in predicting the closing prices of the selected stock, indicated by lower values across all metrics. This finding underscores the superior performance of LSTM networks in providing accurate stock price forecasts, thereby proving their effectiveness in the dynamic AI stock market.

Keywords: ARIMA Model, Artificial Neural Networks, Mean Absolute Percentage Error (MAPE), NVIDIA Corp (NASDAQ: NVDA), Stock Price Forecasting

[MATH23]

Analysis of Road Traffic Accidents in Thailand Using Machine Learning Techniques

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Traffic accidents refer to incidents involving injuries and fatalities that occur on roadways, excluding incidents of vehicle-related suicides. A survey conducted on the Thai population from 2019 to 2022 identified a total of 81,736 traffic accidents. Variables such as accident type, weather conditions, and road characteristics influence the severity of injuries and fatalities. This research project aims to analyze the factors contributing to traffic accidents in Thailand through feature engineering. Subsequently, these factors will be utilized to develop a predictive model employing techniques such as Decision Trees, Random Forest, and Gradient Boosting Trees. Data for this study will be obtained from the Kaggle website, specifically from the dataset titled "Thailand Road Accident [2019 - 2022]."

Keywords: Fatalities, Injuries, Machine Learning, Road Accidents

[MATH25]

Data Analysis of Coffee Consumption and Cardiovascular Disease and Development of an Integrated Data Mining Framework for Disease Classification

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Cardiovascular diseases are the primary cause of death worldwide, including in Thailand. It is, therefore, imperative to investigate the effects from factors including food and beverages, especially those that are widely consumed. Coffee falls into this category with rising popularity in Thailand. The main objective of this study, therefore, is to investigate the relationship between coffee consumption and cardiovascular disease using a logistic regression model. The result shows a negative relationship between caffeinated coffee consumption and cardiovascular diseases.

An additional objective of this study is to develop an integrated framework of data mining techniques that are used in predicting cardiovascular diseases in patients. The techniques involved are classification tree for discretizing quantitative predictors to categorical predictors, association rules analysis for generating interactions among variables, and the logistic regression model for developing the classification model with both the original and the generated variables taken into account. The integrated framework was found to outperform each of the data mining techniques when used individually. The dataset used in this study comprises data collected between 2007 and 2017 and was obtained from the Electricity Generating Authority of Thailand.

Keywords: Association Rule Analysis, Cardiovascular Diseases, Coffee, Logistic Regression

[MATH27]

A Comparison of the Efficiency of the DEWMA DMEWMA and MEC Control Chart for Normal Distribution

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This research aimed to compare the efficiency of Double Exponentially Weighted Moving Average (DEWMA), Double Modified Exponentially Weighted Moving Average DMEWMA, and Mixed Exponentially Weighted Moving Average- Cumulative SUM (MEC) control charts in detecting changes in the location parameter (μ) of a normally distributed production process. Data simulation was conducted using Monte Carlo Simulation in R Studio, iterated 10,000 times. The smoothing parameter (λ) for all three control charts was set to 0.03, 0.05, 0.1 and 0.2, and the magnitude of process shifts (δ) was set to 0.01, 0.05, 0.07, 0.1, 0.5, 0.7, 1, and 2. The performance criterion for comparing the control charts was the Average Run Length (ARL), with the control chart having the lowest out-of-control ARL (ARL1) deemed most effective in detecting changes in the location parameter (μ) for a normal distribution.

Keywords: Average Run Length, DEWMA, DMEWMA, MEC, Monte Carlo Simulation, Normal Distribution, Out of Control ARL

[MATH28]

Negative Binomial-Size Biased Three-Parameter Lindley Distribution with Properties and Applications

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In this work, we introduce the negative binomial size-biased three-parameter Lindley distribution (NBSBTPLD), which is a mixture of the negative binomial distribution (NB) and the size-biased three-parameter Lindley distribution (SBTPLD). Their probability mass function (pmf) and statistical properties are derived. Maximum likelihood estimation is investigated for estimating the parameters of the distribution. Finally, goodness of fit of the proposed distribution is discussed.

Keywords: Count Data, Goodness of Fit, Maximum Likelihood Estimation, Negative Binomial, Overdispersion, Size-biased Three-parameter Lindley Distribution

[MATH29]

Prediction Model of PM 2.5 Concentration in Northern Region of Thailand Using Atmospheric Parameters

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Air quality, especially fine particulate matter (PM 2.5), has emerged as a critical environmental and public health concern globally. This is particularly evident in Northern Thailand, where PM 2.5 frequently exceeds safe levels, posing substantial health risks during dry season. By visualizing data from the Pollution Control Department collected between January 1, 2019, and June 30, 2023, we can identify high-risk months and general periods of elevated risk. This study aims to develop predictive models for PM 2.5 concentration in Northern Thailand using atmospheric parameters. Employing an Autoregressive Distributed Lag (ARDL) model, we integrated six parameters: temperature, humidity, precipitation, wind speed, air pressure, and PM 2.5 itself, to predict PM 2.5 concentration in the next hour and to reflect the complex interplay of factors influencing PM 2.5 levels. The findings have significant implications for public health, particularly for individuals with respiratory conditions, as the model can help identify days when PM 2.5 levels are likely to exceed safe thresholds.

Keywords: Autoregressive Distributed Lag (ARDL) Model, Northern Thailand, PM 2.5, Prediction, Public Health

[MATH30]

Using Convex Hull for Analyzing the State of Fall Detection

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The rapid growth of Thailand's elderly population is transforming the country into a senior society, where falls greatly reduce their quality of life and place significant caregiving burdens on their descendants. This research integrates appropriate technology with mathematical concepts to address these issues by developing Python-based software for real-time fall detection from video footage. The first part of this research involves using the MediaPipe library for keypoint detection and human pose estimation. It then applies the creation of a convex hull of these keypoints along with area calculations, enhancing accuracy and dependability through neural network and area tracking techniques. When the system detects a fall, it promptly notifies caregivers through the LINE application, offering immediate assistance and reducing the negative consequences of falls. The software demonstrates effectiveness in accurately detecting falls and providing timely notifications, supported by preliminary assessments conducted using 100 fall videos. It represents an opportunity to significantly enhance the quality of life for seniors and alleviate caregiving burdens. This research breakthrough includes exploring convex hull assessments within fall detection systems, aiming to improve both physical and mental health outcomes among the senior population.

Keywords: Convex Hull, Fall Detection, Human Pose Estimation, Keypoint Detection

[MATH31]

The Prediction of Silpakorn Pradit Acrylic Colors Combinations Using the Kubelka-Munk Model

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In this project, we construct a prediction model for Silpakorn Pradit acrylic colors based on the Kubelka-Munk theory. Applying non-negative least square (NNLS) regression within the model enhances its practical utility. The proposed model offers a valuable tool for those seeking to refine the merging ratios of Silpakorn Pradit acrylic colors. The results reveal versatility of the Kubelka-Munk model for fine-tuning of acrylic color ratios in repair and preservation contexts.

Keywords: Kubelka-Munk Theory, Multiple Linear Regression, Non-negative Least Square Regression, Prediction Model

[MATH33]

Submodularity Property for Facility Locations of Dynamic Flow Networks

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This project considers facility location problems within dynamic flow networks, shifting the focus from minimizing evacuation time to handling situations with a constrained evacuation timeframe. Our study sets two main goals: 1) Determining a fixed-size set of locations that can maximize the number of evacuees, and 2) Identifying the smallest set of locations capable of accommodating all evacuees within the time constraint. We introduce $flow_t(S)$ to represent the number of evacuees for given locations S within a fixed time limit t. We prove that $flow_t$ function is a monotone submodular function, which allows us to apply an approximation algorithm specifically designed for maximizing such functions with size restrictions. For the second objective, we implement an approximation algorithm tailored to solving the submodular cover problem. We conduct experiments on the real datasets of Chiang Mai and demonstrate that the approximation algorithms give solutions which are close to optimal for all of the experiments we have conducted.

Keywords: Approximation Algorithms, Dynamic Networks, Facility Location, Submodular Function Optimization

[MATH34]

An Optimization Model for a Hospital Operating Room Scheduling Problem

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Operating rooms (ORs) in hospitals face a multitude of challenges. These challenges include uncertainties in surgery start times, lengthy patient wait times, cancellations, and limited resource constraints. Effective OR scheduling directly addresses these issues by optimizing resource allocation. However, creating an OR schedule remains a complex task. Factors such as resource limitations, varying surgery durations, and the reliance on experienced schedulers require careful consideration. To address these challenges, we developed a Mixed-Integer Linear Programming (MILP) model specifically tailored for OR scheduling. The model incorporates scheduling constraints derived from in-depth interviews with OR supervisors and leverages data provided by HLab, our research collaborator. The scheduling approach employed in this study involves pairing surgeons with patients and assigning them to specific time blocks within a closed-block framework (full and half days). Notably, the model is applied one day prior to the operation after gathering OR requests for elective cases only. Therefore, the model is designed to simultaneously minimize idle time and penalties that occur when surgeries are not performed within the surgeon's preferred time block. The model has been shown to outperform manual scheduling by nurses, as it can efficiently generate schedules that maximize OR utilization while accommodating surgeons' preferences.

Keywords: Closed-block, Elective Cases, Mixed-Integer Linear Programming, Operating Rooms Scheduling, OR Utilization

[MATH35]

Origami Construction of a Regular Tridecagon

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We show how a regular tridecagon can be constructed by Origami with the theory of field extensions, group theory and Huzita-Hatori axioms. We provide two possible Origami constructions of a regular tridecagon.

Keywords: Beloch's Fold, Field Extensions, Huzita-Hatori Axioms, Origami

[MATH36]

Reversible Properties of Polyhedral

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In this study, we have a motivation from the study of Professor Akiyama Jin on the topic "On Reversibility among Parallelohedra". This study examines the reversibility of non-space-filling polyhedra by hinge dissection using the double reversal plate method. Using insights from Professor Akiyama Jin's study, we derive a lemma for peer-checking whether space filla can be achieved using this method. Our analysis identifies the truncated cube, rhombicuboctahedron, and cuboctahedron as potential candidates because they are non-space filla with the same Dehn invariant, suggesting potential reversibility between them. Through further investigation, considering volume equality, we found that the pair of rhombicuboctahedron and cuboctahedron and the pair of truncated cube and cuboctahedron cannot be reversed using the double reversal plate method.

Keywords: Non-space Filla, Reversible Polyhedra, Space Filla,

[MATH37]

DeepToothDuo: Multi-task Age-Sex Estimation and Understanding via Panoramic Radiograph

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We proposed DeepToothDuo, a Deep Convolutional Neural Network trained with a multi-task approach to estimate age and sex from a panoramic radiograph. This reduced the number of parameters required when training the model to predict age and sex separately. Moreover, we showed that training model to simultaneously predict age and sex provided better network understanding results from SHAP. Our proposed network could predict sex with 87.38% accuracy and estimate age within 1.96 years error. The model understanding study showed that the network considered anatomical features aligned with existing human dental and anatomical studies.

Keywords: Age Estimation, Model Understanding, Multi-task Learning, Sex Classification, SHAP

[PHYS01]

Particle Energization in Collisionless Shocks through Particle-in-Cell Simulations

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Collisionless shocks are dynamic phenomena occurring in plasmas when an object or flow moves through collisionless plasma at a speed faster than sound speed and Alfvén speed. They are investigated through Particle-In-Cell (PIC) simulations to understand particle energization mechanisms. Analysis of simulated data reveals spatial and temporal dynamics of key quantities, such as magnetic field strength, temperature, flow velocity, and average pressure. The analysis indicates significant changes in these fields, shock compression, and differential heating between ions and electrons. Moreover, the dominance of p thetap theta over pi−Dpi−D suggests that shock compression effects have a more pronounced impact on particle dynamics compared to strain-rate effects. These findings provide more information to better understand collisionless shock physics, emphasizing the intricate interplay between particles and electromagnetic fields.

Keywords: Collisionless Shocks, Particle Energization, Particle-in-Cell Simulations, Plasma Dynamics, Pressure Work

[PHYS02]

Simulation of Electron-Nuclear Spin Dynamics Using Liouville Superoperator

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Quantum computers, unlike regular ones, use qubits that can be in multiple states at once. These qubits are manipulated by special quantum gates to solve complex problems. The Nitrogen-vacancy (NV) center in diamond offers promising potential for quantum computation at room temperature due to its efficient optical spin initialization and readout, and hyperfine coupling enables the detection and regulation of neighboring nuclear spins, enabling electron and nuclear spin qubit operations. The magnetic moment of the nuclear spins endows them with prolonged coherence times and resilience against external environmental disturbances, but also makes them harder to interact with direct AC magnetic fields. Instead, we can create phase gate operations on a nuclear spin qubit by driving electronic spin transitions in an NV center. In this study, we simulate controlling of the nuclear spin with a phase gate by calculating spin dynamics with the Liouville superoperator, which can be easily constructed from the Lindblad master equation. By calculating this operator, we can simulate the phase gate on the nuclear Rabi oscillation transition, and also demonstrate repeated applications of the phase gate to decouple the nuclear spin from the environment.

Keywords: Liouville Superoperator, Quantum Gate, Spin Dynamics

[PHYS03]

The Convergence of Ollivier-Ricci Curvature Scalar in the Grid Geometric Graphs

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Curvature stands as one of the cornerstone concepts in geometry, providing a fundamental description of geometric properties. Historically, geometry was chiefly defined within local coordinate and chart frameworks during the mid-18th century. In the realm of microscopic-scale physics, phenomena like those in quantum mechanics have revealed perplexing behaviors and their associated consequences. The introduction of discrete parameters has emerged as a significant mathematical observability within our physical theories. While investigations into the convergence of discrete curvature to continuous parameters have been undertaken, particularly in the domain of random graphs, challenges related to interpretation and computation have surfaced. In this study, we explore the potential convergence of curvature from a discrete to a continuous context, specifically within the realm of geometric graphs. The process consists of grid geometric graph formulation, probability distribution and measurement, and optimal transportation computation. During the process of optimization computing, we used the different algorithms in this project, assembling the Hopfield neural network model, and correlating it with a well-defined optimal transport algorithm. This exploration holds particular significance in instances of high node density that adhere to systemic constraints. Moreover, we unveil computational methodologies applicable to optimization problems within network science. By bridging the gap between discrete and continuous curvatures in the context of geometric graphs, this research not only sheds light on the convergence phenomenon but also offers practical tools for tackling optimization challenges within discrete graph network computation.

Keywords: Discrete Curvature, Grid Geometric Graphs, Hopfield Neural Networks, Optimal Transportation, Random Graphs

[PHYS04]

Traversable Wormholes in Minimally Geometrical Deformed Trace-free Gravity Using Gravitational Decoupling

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In this work, we investigate wormhole solutions through the utilization of gravitational decoupling, employing the Minimal Geometric Deformation (MGD) procedure within the framework of Trace-Free Gravity. We consider static and spherically symmetric 'Morris – Thorne' traversable wormholes in both cases of constant and varying equation of state parameter. We then compute field equations and derive the shape function for each case. We employ the gravitational decoupling technique and consider various forms of the energy density for smeared and particle-like gravitational sources in the context of statically charged fluid in noncommutative geometry. We find that the Null Energy Condition (NEC) is violated. Finally, we use the Gauss-Bonnet theorem to compute the weak deflection angle for the wormhole solutions.

Keywords: Energy Conditions, Energy-Momentum Tensor, Flaring-Out Condition, Gravitational Decoupling, Traversable Wormhole

[PHYS05]

Confronting Interstellar Extinction in the Line of Sight of Galactic Bulge with the VVV Survey

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The Nancy Grace Roman Space Telescope is dedicated to the search for exoplanets using the microlensing technique in space. During the era of the Roman telescope, to optimize the best area for the survey, we need to predict the rate of these events using microlensing event simulators, such as the Manchester-Besançon Microlensing Simulator (MaBµlS). MaBµlS utilizes the Besançon Galactic model to produce multi-wavelength microlensing optical depth, microlensing event rates, and average timescale maps. However, the model still under-predicts the event rate per source and over-predicts the microlensing timescale. The factor causing this mismatch might be the extinction model of the Besançon. To address this, we map the Milky Way Bulge to create a 3D extinction map along the lines of sight of the bulge region. To determine the extinction, the average J-Ks color and distance of stars are provided from the model to calculate the extinction distribution as a distance function for each line of sight. Then, the difference in the J-Ks color distribution of stars between the model and from VVV is attributed to interstellar extinction. The results provide the first detailed extinction map at distances between 2 - 10 kpc. The extinction is higher in the fields close to the galactic center. The latitude slices of the integrated map also show some features of high extinction density located at distances of approximately 2 kpc and 7 kpc, which may indicate the presence of dust lanes in these areas, consistent with previous studies.

Keywords: Astronomy, Galactic Bulge, Interstellar Extinction

[PHYS06]

Long-term Study of PSR J2129-0429 with the Thai National Telescope

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PSR J2129-0429, discovered in 2011 by the Green Bank Telescope (GBT), is an eclipsing binary consisting of a millisecond pulsar and a non-degenerate star known as a "redback". With an orbital period of 15.2 hours and a companion mass $Mc=0.44\pm0.04 M\odot$, PSR J2129-0429 is the redback with one of the heaviest companion mass and the longest orbital period. This pulsar is accompanied by an optically bright G-type star with a mean magnitude of 16.6 in the R band. Due to its brightness, it has been observed and has an extensive archival record spanning over a decade with many sky surveys. Based on previous long-term studies, the system appears to be fainter and exhibits variations in light curves over time. This may indicate the changes in its size and/or surface temperature and/or additional factors, suggesting that the system is possibly undergoing a bifurcation phase of a pulsar evolution. To further study PSR J2129-0429, we observed it using ULTRASPEC on the 2.4-m Thai National Telescope (TNT) of three filters g′, r′ and i′ in November 2023. In this work, we present updated light curves and the mean magnitude of the system.

Keywords: Millisecond Pulsar, PSR J2129-042, Redback

[PHYS07]

Evolution of Axial Ratio Distribution of Galaxies across 13 Billion Years of the Universe

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The distribution of axial ratios, defined as the division of the minor to major axis of a galaxy's projected shape (b/a), over cosmic time is an important tool for understanding the complex evolution of galaxy shapes. This provides insights into the three-dimensional structure and orientation of galaxies. The calculation of the apparent axial ratios at high redshift requires the use of high-resolution images, particularly in the infrared spectrum ($z > 2.5$). We investigated the distribution of axial ratios across 13 billion years of the universe using data from the Cosmic Evolution Early Release Science Survey (CEERs) taken with the James Webb Space Telescope (JWST). In this work, we investigated the b/a distribution of galaxies at $z < 6.0$ covering 13 billion years of the universe. The data is obtained from the CEERs release 0.5 and 0.6 observed with JWST. Depending on the redshift, the rest-frame optical b/a distribution of galaxies are derived from JWST/NIRCam images with the F115, F200, F277, F356, F410 and F444 filters. The final sample is 2,708 galaxies within the last 13 billion years of the universe. The axial ratio distribution at all epochs follows a skewed normal distribution, with a median value of approximately 0.62-0.64. From the Kolmogorov-Smirnov test, this work indicated the evolution of galaxy morphology at redshifts greater than 2.5 as the axial ratio distribution at higher redshifts differs significantly from that at lower redshifts.

Keywords: Galaxy Evolution, Galaxy Morphology, High Redshift

[PHYS08]

Powering the Extended Corona near Accreting Black Holes

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An Active Galactic Nucleus (AGN) is made up of a supermassive accreting black hole located at the center of the host galaxy, which emits large amounts of light across the electromagnetic spectrum, particularly in the X-ray band. The region where X-rays emerge is known as the corona. Thermal seed photons radiated by the accretion disk reach the corona and are up-scattered by hot electrons, resulting in scattered X-ray photons. This study focuses on the on-axis lamppost corona, where the spherical corona is situated above the black hole's symmetry axis. The study shows that to power X-ray lamppost is to intercept more disk photons. Larger amount of X-rays are produced in case of higher-spinning black hole with a higher accretion rate. Changes in corona configuration also affect a number of seed photons entering the lamppost as well as affect the output X-rays of AGN.

Keywords: Accretion Disk, Active Galactic Nuclei, Astrophysics, Black Hole, X-ray Corona

[PHYS09]

Using a Neural Network to Determine the Atmospheric Parameters of Exoplanets

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In this research, we present an innovative application of Neural Network (NN) techniques for the analysis of exoplanet atmospheres using transmission spectra, effectively addressing the computational challenges associated with traditional retrieval methods such as Markov Chain Monte Carlo (MCMC) and nested sampling. We achieved an exceptional R-squared value of $R^2 = 0.998$ for planetary radius predictions, along with impressive accuracy for planetary mass ($R^2 = 0.895$) and atmospheric temperature ($R^2 = 0.832$). Additionally, the NN model demonstrates a substantial reduction in computational time, underscoring its efficiency in extracting exoplanetary atmospheric parameters from spectral data. Regarding the prediction of the C/O ratio ($R^2 = 0.076$), our model has not performed as well as expected. This is because we used transit depth in visible wavelength for the prediction, and the C/O ratio has relatively little effect on the spectrum in the visible wavelength. In the future, we should improve the training of the neural network by utilizing other wavelength detections, such as the infrared range, which are likely to have a greater impact on predicting the C/O ratio. This will enhance the efficiency of predicting parameters of exoplanets used in studying the atmospheres of exoplanets.

Keywords: Exoplanet Atmosphere, Neural Network, Transmission Spectra, Visible Light Wavelength

[PHYS10]

Demonstration of 3D Dipole Light Scattering

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This research establishes a cost-effective system to demonstrate 3D dipole light scattering using high-quality yet affordable optical equipment. The primary objective is to analyze and compare experimental results with light scattering theory. A red laser with a wavelength of 650 nanometers, emitting polarized light, is used as the light source. The laser beam is perpendicularly incident on a sample consisting of a water and milk mixture. A Light Dependent Resistor (LDR) is used as the light sensor, measuring relative light intensity at angles from 0 to 350 degrees in 5-degree increments, completing one full rotation per round. Measurements are conducted over 36 rounds. The collected data is used to construct a 3D image of dipole light scattering. Experimental results indicate a minimum light intensity of approximately 0.225, which closely aligns with theoretical predictions. The 3D images derived from experimental data resemble theoretical models, demonstrating the system's capability to analyze light scattering in various solutions. This system not only enhances the understanding of dipole light scattering physics but also serves as a basis for advanced practical experiments and studies on light polarization.

Keywords: Dipole, Light Scattering, Polarization

[PHYS11]

Application of CMOS Image Sensors in Luminescence Measurements

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This research has established a system to apply a CMOS image sensor to measure light emissions for recording images. This is because CMOS sensors are inexpensive and have good light response speeds. Therefore, it is convenient to set up the system and move. There will be two experiments: measuring the light intensity of greenish-yellow fluorescent substances under various light sources and measuring the light intensity distribution of greenish-yellow fluorescent substances under various light sources. With a CMOS image sensor system, the recorded images were analyzed to determine the intensity of light emitting from each pixel in the image with the MATLAB program to analyze the amount of light intensity through an RGB (red, green, blue) color filter. Each experiment was different MATLAB codes will be used. From the results of the experiment, it was found that each experiment can use the MATLAB program to analyze, classify, and explain the method for measuring the light intensity of RGB colors to provide a guideline for application in measuring various types of light emissions.

Keywords: CMOS Image Sensors, Fluorescent, Luminescence Measurements

[PHYS12]

Design and Construction of Multi-Plane Light Converter (MPLC)

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Optical apparatus operating on multiple degrees of freedom of light—including polarization, frequency, and transverse spatial mode—has been pivotal in the advancement of sciences and technologies. Among those, the manipulation of transverse spatial modes is typically limited to standard designs involving lenses and mirrors. To address this limitation, a device known as the multi-plane light converter (MPLC) has been developed. The MPLC consists of two main optical elements placed in parallel: a mirror and a spatial light modulator (SLM). Those elements are used to transform the wavefronts of different spatial modes of light while propagating through the apparatus. By using different sets of phase patterns displayed on SLM, the MPLC can be reprogrammed to perform various functions, such as multiplexing optical signals for optical communication and quantum measurements. In this project, we designed and constructed a four-plane MPLC system using the Wavefront Matching technique. The procedure began with the optical design and calibration, during which the optical properties and positions of each optical element were determined and the optical performance of SLM was evaluated by measuring the diffraction efficiency of displayed gratings with different periods. Subsequently, we assembled the MPLC and conducted experiments to characterize and adjust the location and characteristics of the light beams on each phase plane using the Knife-edge technique and computer-generated holograms (CGHs). The implementation of the four-plane MPLC apparatus will enable spatial manipulation of light and pave a vital way for potential applications in telecommunications, quantum information processing, and imaging.

Keywords: Computer-Generated Holograms, Multi-Plane Light Converter, Spatial Light Modulator, Transverse Spatial Modes

The Simulation of the Three-dimensional Optical Tweezers Pattern

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The quantum experiments based on neutral atoms require precision and accuracy in the atomic arrangement to assess the interaction between atoms and their surroundings. Optical tweezers are crucial instruments for manipulating the position of atoms in arbitrary geometries. However, most research often designs the tweezers pattern in two dimensions, limiting the control of atoms in other focal plane layers. In this work, we focus on simulating optical tweezers arrays in three dimensions using a modulated phase mask of a Gaussian beam profile. The phase mask is generated using three methods: the Gerchberg-Saxton algorithm, direct phase combination, and a heuristic weighted Gerchberg-Saxton algorithm. We then analyze the characteristics of light after it passes through the Fourier lens using the angular spectrum method. We have computed the phase mask for a 3x3 optical tweezers array, which relies on different focal planes. These results will soon be applied to manipulate atoms in our ultracold atom experiments.

Keywords: Angular Spectrum Method, Fourier Optics, Optical Tweezers, Quantum Simulation

[PHYS14]

Non-relativistic Charmonium Mass Spectra in Cornell Potential by Using Nikiforov-Uvarov Method

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Quark confinement, a fundamental property of strong interactions within bound states, is investigated in this study using charmonium (charm-anticharm quark pair), a light-heavy quarkonium system. This decision is based on non-relativistic and ignores relativistic effects. Only the radial part of the Schrödinger equation is considered in this framework for the distance between the charm quark and the anti-charm quark. In this work, we chose the Cornell potential due to its specific suitability, empirical success, and computational feasibility, and the Nikiforov-Uvarov (NU) method to solve this Schrödinger equation due to its proficiency in dealing with second-order differential equations. To show the accuracy of our results, we compute the charmonium mass spectra from eigenvalues for various principal quantum numbers (n) and angular momentum quantum numbers (l) by varying two different parameters in the Cornell potential. The results in states 1S, 2S, 3S, 4S, 5S, 1P, and 2P exhibit good consistency with a maximum difference of 4.685% compared to the data from the particle data book 2024, and our results are in consonance with theoretical results from alternative methodologies.

Keywords: Charmonium, Cornell Potential, Nikiforov-Uvarov Method, Time-independent Schrödinger Equation

[PHYS15]

Daily Solar Radiation and PM2.5 Concentration Forecasting in Thailand Using Long Short-term Memory Neural Network

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This research utilizes Long Short-Term Memory (LSTM) deep learning techniques to forecast solar radiation and PM2.5 concentrations in Nakhon Pathom province, drawing on data from 2019 to 2022 including solar radiation, PM2.5 concentrations, meteorological data, and sequential data inputs. A variety of unique datasets and hyperparameters were selected to optimize the model for accurate forecasting. For the one day ahead forecasting of PM2.5 concentrations, the model demonstrated effective performance with statistic values: MPE, RMSD, and PCC were -4.74%, 4.90 $\mu g/m^3$, and 0.9285 respectively. Similarly, the model effectively forecasted solar radiation one day ahead, with corresponding statistic values: MPE, RMSD, and PCC were -7.27%, 2.30 MJ/m^2, and 0.9822 respectively. Due to the reliability of both models, forecasting for PM2.5 concentrations and solar radiation has been extended beyond a single day. Both forecasting models utilized the same dataset inputs and hyperparameters as those used for the one day ahead forecasting.

Keywords: Deep Learning, Forecasting, LSTM, PM2.5, Solar Radiation

[PHYS16]

Optimizing Acoustic Diffuser Surfaces with Neural Network Predictions

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This project aims to enhance diffuser surface performance using advanced acoustic engineering techniques and neural network predictions. By optimizing surface parameters, such as segment length and rotation angle, specific Sound Pressure Levels (SPL) are targeted at predefined points. Two neural network models are developed: one predicts diffuser shape based on SPL data and the other forecasts SPL distribution from varying source configurations. This synergistic approach combines acoustics, computational modeling, and machine learning to revolutionize diffuser optimization, offering innovative solutions for improved acoustic performance in diverse environments.

Keywords: Acoustic Engineering, Diffuser Surfaces, Neural Network

[PHYS17]

Machine Learning-Designed Phononic Crystals for Acoustic Cloaking

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This research investigates the potential of utilizing phononic crystals as cloaking materials for acoustic waves, coupled with machine learning techniques for predicting lattice constants. The study employs a systematic approach to adjust lattice constants in both the x-axis and y-axis, analyzing their impact on autocorrelation values—a measure of acoustic cloaking efficacy. Through simulations, specific lattice constants are identified, demonstrating promising potential for achieving acoustic cloaking. Machine learning models are then implemented to predict lattice constants based on autocorrelation values. While the models exhibit limitations in accuracy, notable successes are observed, particularly in achieving high autocorrelation values for certain lattice constant predictions. However, discrepancies between predicted and actual autocorrelation values highlight challenges in achieving consistent predictions.

Keywords: Acoustic Cloaking, Machine learning, Phononic Crystal

Effects of Indium Chloride Additive in Tin Oxide Electron Transport Layer on Photovoltaic Properties of Perovskite Solar Cells

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Perovskite solar cells show great potential for converting light energy into electricity. However, there is a need to improve their performance and stability. One way to achieve this is by modifying the electron transport layer (ETL). This study looked at the effects of adding indium chloride ($InCl_3$) to tin oxide (SnO_2) ETL. The solar cells had a structure of transparent conductive oxide (TCO)/ SnO_2 ETL/ perovskite layer/hole transport layer/carbon electrode. Different concentrations of $InCl_3$, ranging from 0 to 4.5 mol%, were tested. The results showed that a 2 mol% $InCl_3$ concentration in SnO_2 thin films provided the highest power conversion efficiency (PCE) of 12.34%. This PCE value is higher than that of the pure SnO_2-based ETL, which had an efficiency of 8.75%. It is believed that the improved cell performance was due to $InCl_3$ helping to disperse SnO_2 nanoparticles on the TCO surface and enhance electron transfer, as well as suppressing charge recombination at the ETL-perovskite layer interface. This study demonstrates that incorporating $InCl_3$ can improve the PCE of solar cells by promoting increased charge transfer.

Keywords: Electron Transport Layer, Indium Chloride Concentrations, Perovskite Solar Cells, Power Conversion Efficiency, Tin oxide

Designing a 2-dimensional Heater for Uniform Heating of Freely Suspended Liquid Crystal Films Inside the Payload for Liquid Crystal Space Experiment

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Our research focuses on designing a two-dimensional heater for the uniform heating of freely suspended liquid crystal films inside a space experiment payload. In this study, we utilized a finite element analysis program to predict the result and performed the experiment to test the prediction. We examined a 2D indium in oxide (ITO) heating system and investigated how the temperature is influenced by the thickness of the ITO film. The film thickness evaluated in our design includes 0.1, 0.5, 1, 5, 10, 50, and 100 microns, respectively. The simulation results from the finite element analysis program indicate that thicker ITO films generate higher temperatures compared to thinner ones. Additionally, the temperature is affected by the electrical voltage applied to the heating system. Our experimental findings validated the simulation model, showing that the temperature distribution predicted by the software closely matches the data obtained from laboratory experiment, with the central area being the hottest. The percentage difference between the simulation and the experimental results is 11.78%. This validation supports the accuracy of our simulation model, allowing it to be used for further research in this field.

Keywords: Finite Element Analysis, Indium in Oxide (ITO), Thin Film Heater

Calculation of the Critical Temperature of Molybdenum Sulfide Hydride (MoSH) through Density Functional Theory (DFT) Simulations

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The exploration of two-dimensional (2D) materials has captivated researchers worldwide due to their intriguing properties and potential applications in various fields, including superconductivity. Among the materials of interest are metal hydrides, renowned for their high critical temperatures. In this project, Molybdenum Sulfide Hydride (MoSH) has emerged as a good candidate because of both properties. This study employs Density Functional Theory (DFT) simulations to delve in to the spectral function that relates to the critical temperature. After combining the spectral function and McMillan's equation, we can estimate the critical temperature of MoSH. Our investigations reveal a critical temperature value of 15.88 Kelvin. This result surpasses the Tc value of 28.58 Kelvin reported by [P. Liu et al., Phys. Rev. B 105, 245420] the difference of value is caused by the scale of the simulation system and computational resources.

Keywords: Critical Temperatures, Density Functional Theory, Metal Hydrides, Molybdenum Sulfide Hydride, Superconductor

[PHYS21]

Design of Faraday Cup for Compact Accelerator Mass Spectrometer

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A Faraday cup has long been used in ion accelerators for ion beam current measurements. In this work, a Faraday cup was designed for a compact 200-kV AMS radiocarbon dating system to measure carbon-12 and carbon-13 ion beam currents with 40 keV, 100 μA, and 440 keV, 50 μA. The design of the Faraday cup is compact and simple. As heat dissipation in the ion beam is not high, no liquid cooling is necessary. The primary consideration was secondary electron suppression. Secondary electrons are prevented from escaping the Faraday cup by the electric field generated by a negatively biased metallic plate installed in the Faraday cup at -120 V. This report will present FEA electric field and secondary electron tracking simulation results obtained by using CST Studio Suite software. A detailed design of the Faraday cup will also be reported.

Keywords: Accelerator Mass Spectrometry (AMS), Faraday Cup, Radiocarbon Dating

[PHYS22]

Design of Tandem Accelerator for Accelerator Mass Spectrometer for Radiocarbon Dating

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This work focused on the design of a compact 200-kV tandem accelerator for radiocarbon dating by Accelerator Mass Spectrometry (AMS). Highly efficient charge conversion was the prime goal, which was achieved by high transmission of the ion beam and high stripping gas pressure. Thus, the shape of the accelerating electrodes was carefully designed to deliver the ion beam passing through the charge-stripping section with low-conductance tubes. The gas conductance of the tubes is designed to maintain a large pressure difference between the charge stripping and acceleration zones. From the calculation, the length and diameter of pressure reduction tubes are 12 cm and 1 cm, respectively. The CST Studio Suite was used for finite element analysis of electric fields in the accelerator. This software allows particle tracking simulations with the possibility of optimizing electrode shape and dimensions to allow the ion beam to pass through the charge conversion section with a goal of nearly 100% transmission. The accelerator dimensions will be approximately 100 cm and 56 cm in length and diameter, respectively.

Keywords: Accelerator Mass Spectrometry (AMS), Gas Stripping, Pressure Reduction Tubes, Radiocarbon Dating, Tandem Accelerator

[PHYS23]

Magnetic Field Simulation and Measurement of Electromagnetic Undulator for Terahertz Radiation Production

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Development of an electromagnetic undulator for generation of terahertz (THz) radiation is ongoing at the PBP-CMU Electron Linac Laboratory (PCELL), Chiang Mai University. It has 19.5 periods, each with a length of 100 mm. The maximum K parameter of 1 is expected to be achieved with a peak magnetic field of 0.107066 T. This study aims to investigate the properties of magnetic field produced from the constructed undulator by employing a computer simulation using the CST EM Studio software. The comparison between simulation results and preliminary magnetic field measurements was conducted to confirm the reliability of the simulation outcomes. In simulations, the gap of undulator was adjusted from 15 to 40 mm and the applied current for the main poles was varied in a range of 0.5 to 10 A. For result analysis, the B2E software was used to generate an ideal magnetic field and compute an undulator radiation spectrum. Then, the electron trajectories in ideal magnetic field and simulated magnetic field obtained from CST EM Studio program were compared. This was accomplished by adjusting end poles' current of the undulator to achieve the radiation spectrum as close to the ideal case as possible. The magnetic field measurements using a movable Hall probe with precise position control via automatic computer interface are underway. Preliminary measurements of magnetic field for the gap of 15 mm were performed. It was found that at the main pole current of 2 A, the optimal end pole current was 1.1 A. At these currents the undulator has the transverse good field region of 19 mm. The comparison between the measured and simulated magnetic fields reveals that the magnetic field deviation obtained from the experiment is 9% higher than that of the simulation at the same current. This difference is due to the power supplies, which provide current to the coil at the main poles with a coarse adjustment range, leading to uneven magnetic field amplitudes in certain sections. Despite this discrepancy, the undulator is able to emit radiation in the THz regime, with a frequency of 4.64 and 4.44 THz for simulated and measured magnetic fields, respectively.

Keywords: Hall Probe, Terahertz Radiation, Undulator, Undulator radiation

[PHYS24]

The 2D Measurement Processing Software for the Profile Projector

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From my internship at the National Institute of Metrology, in the Coordinate Measurement Laboratory, we utilized a Profile Projector (Nikon Profile Projector V-20A) to measure 2D workpiece dimensions. The Profile Projector works by projecting the shadow of the workpiece onto a viewing screen to observe its edges, which can be measured as coordinates x, y. The coordinates obtained are processed using a 2D data processing unit (Nikon DATA PROCESSOR DP-301). Currently, the profile projector can still be used to measure workpieces, but the 2D data processing unit is damaged from long-term use, with no repair parts available. In this work, we designed 2D measurement processing software for the Profile Projector to replace the functionality of the 2D Data Processing Unit and to process and present measurement coordinates as graphs and text files. We developed a Graphical User Interface (GUI) to facilitate current operations. We developed a Graphical User Interface (GUI) to facilitate current operations. The measurement processing software includes functions for calculation. These functions include Least Square Line, Least Square Circle, Intersection, Distance, Angle, and Coordinate Transform. The software is developed using Python for a 2D measurement system on Raspberry Pi 5, which interfaces with a Profile Projector via RS232 connection to receive measured coordinates. The results demonstrate that the 2D measurement processing software with the Profile Projector can compute workpiece dimensions and output the results as text files and graphical representations the actual shape of the workpiece. The 2D measurement processing software effectively replaces the functionality of the aging 2D data processing unit, offering enhanced measurement processing and display capabilities through its user-friendly GUI, in a more compact and convenient form factor

Keywords: 2D Data Processing Unit, Least Squares Fitting, Profile Projector

[PHYS25]

Shimming Coil Design and Fabrication for NMR/MRI's Halbach Array Magnet

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In this research project, shimming coils were designed and built to improve the uniformity of the main magnetic field of a prefabricated 300 mT Halbach array magnet with a 75 mm internal space diameter. With this space, only 2 shimming coils can be installed. Thus, before designing the coils, the actual main magnetic field was measured to provide information in selecting the best two shimming coil patterns. The coils were designed by using the stream function optimization method, an open-source MATLAB program. The resulting stream functions were used to construct wire paths using iso-potential method. The wire paths have been milled onto four 1 mm thick nylon sheets using a CNC machine. The four sheets were glued together to support two layers of 2 mm diameter copper wire and then rolled them into cylinder coils. The magnetic field of the constructed shimming coils with applied currents of 5 and 10 A are in the order of 1 mT and 2 mT, respectively. The shimming coils with 10 A applying current yielded a better magnetic field homogeneity improvement in a 40 mm diameter spherical working volume. It can improve the field homogeneity in xy xz and yz planes from 8402.25 ppm, 17180.50 ppm, and 20232.00 ppm to 7662.14 ppm, 9812.61 ppm and 15928.10 ppm respectively. Since the main magnetic field varying inside the working volume is approximately 6mT, 30 A current is needed to drive the shimming coil to generate the magnetic field at this level and the cooper wire diameter need to change to 4 mm. Furthermore, the spatial distribution of the shimming field seems narrower than that of the magnetic field. That means, the shimming coil should be a bigger size and the gap inside the Halbach magnet must be larger.

Keywords: Halbach Array, MRI, NMR, Shimming Coil

[PHYS26]

Design and Program Gradient Device Using STM32F767ZI Board

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Gradient Coils are a key component of Magnetic Resonance Imaging (MRI) machines. The gradient coils create gradient magnetic fields for MRI imaging. The magnetic gradient fields are turned on/off, changed amplitude and reversed direction by the MRI pulse sequences. Therefore, a microcontroller is required to control the on/off, magnitude, and direction changes of the applied electric current of the coils regarding to the requirement of the pulse sequence. In this project, a basic circuit for driving electric current to the gradient coil was built and a program to control the STM32F767ZI microcontroller for controlling the supplied current to the gradient coil was developed. A gradient coil was also built.

A microcontroller program was successfully developed to generate electrical signals for controlling the supply of current to the gradient coil as desired. Evidentially, the main current amplifier was damaged during the experiment, the current control circuit could not be connected to the gradient coil.

Keywords: Gradient Device, STM32F767ZI Microcontroller

[PHYS27]

Designing and Construction of H-shape Permanent Magnet for Measuring the Nuclear Magnetic Resonance Signal

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The main magnet of a nuclear magnetic resonance (NMR) instrument requires a strong, stable, and extremely homogeneous magnetic field across the volume of interest (VOI). In this project, an H-shape magnet for NMR with a spherical VOI of a diameter of 6 mm was designed using COMSOL Multiphysics. Two cylindrical N52 permanent magnets of radius 50 mm and height 50 mm were used as the magnetic source. Iron yoke size, side gap, and iron bar thickness were optimized to obtain the highest magnetic field strength inside the VOI. Furthermore, two magnetic pole pieces and the magnet gap were optimized to achieve the best magnetic field homogeneity. The radiofrequency (RF) coil was also designed using Autodesk Fusion and fabricated using a CNC machine. The simulation result indicated that an iron bar thickness of 40 mm and a side gap of 40 mm yielded the strongest magnetic field inside the VOI at 0.55 T while a magnet gap of 10 mm and a pole piece thickness of 10 mm gave the best magnet field homogeneity at 96.10 ppm. The RF coil was built with a resonance frequency of 23.12 MHz (corresponding to the main magnet field 0.55 T) and its measured q-factor was 3.69. The fabricated H-shape magnet yielded an average magnetic field of 0.533 T, slightly lower than the simulated value. However, the measured magnetic field homogeneity was 829 ppm significantly poorer than the simulation result. Observing the magnetic field in each plane (xy, xz, and yz planes), the magnetic field varies with position as a gradient field. The unparallel alignment of the permanent magnets and pole pieces could be responsible for this issue. To solve this problem, the structure of the magnet should be able to adjust the parallelism of the magnetic cylinders and the pole pieces.

Keywords: H-shape Magnet, Nuclear Magnetic Resonance, Radiofrequency Coil