DPST CONFERENCE ON SCIENCE AND TECHNOLOGY 2021: DPSTCON 2021

July 8th - 9th 2021

FACULTY OF SCIENCE, KASETSART UNIVERSITY &
THE INSTITUTE FOR THE PROMOTION OF TEACHING SCIENCE AND TECHNOLOGY (IPST)

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คำกล่าวรายงาน

“งานประชุมวิชาการวิทยาศาสตร์และเทคโนโลยี นักเรียนทุน พสวท. ประจำปี 2564 การประชุมวิชาการระดับนานาชาติด้านวิทยาศาสตร์และนวัตกรรมสำหรับนักเรียน ครั้งที่ 2

และ งานประชุมวิชาการวิทยาศาสตร์ คณิตศาสตร์ และเทคโนโลยี สำหรับนักเรียนทุน พสวท. ระดับมัธยมศึกษา ครั้งที่ 36”

วันที่ 8-9 กรกฎาคม 2564

คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

ของคณบดีคณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

เรียน ดร.กฤษณพงษ์ กีรติกร นายกสภามหาวิทยาลัยเกษตรศาสตร์ และประธานอนุกรรมการพัฒนาและส่งเสริมผู้มีความสามารถพิเศษทางวิทยาศาสตร์และเทคโนโลยี ศึกษาในประเทศ และศาสตราจารย์ ดร.ชูกิจ ลิมปิจำนงค์ ผู้อำนวยการสถาบันส่งเสริมการสอนวิทยาศาสตร์และเทคโนโลยี

ศูนย์ พสวท. มหาวิทยาลัยเกษตรศาสตร์ รู้สึกเป็นเกียรติอย่างยิ่งที่ได้มีโอกาสเป็นเจ้าภาพร่วมงาน ประชุมวิชาการวิทยาศาสตร์และเทคโนโลยี นักเรียนทุน พสวท. ประจำปี 2564 การประชุมวิชาการระดับ นานาชาติด้านวิทยาศาสตร์และนวัตกรรมสำหรับนักเรียน ครั้งที่ 2 และ งานประชุมวิชาการวิทยาศาสตร์ คณิตศาสตร์ และเทคโนโลยี สำหรับนักเรียนทุน พสวท. ระดับมัธยมศึกษา ครั้งที่ 36

โครงการพัฒนาและส่งเสริมผู้มีความสามารถพิเศษทางด้านวิทยาศาสตร์และเทคโนโลยี (พสวท.) และศูนย์มหาวิทยาลัยเกษตรศาสตร์ มีความสัมพันธ์กันอย่างแน่นแฟ้น โดยคณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ เริ่มรับนักเรียนเข้าศึกษาต่อในระดับอุดมศึกษาด้วยทุน พสวท. มา ตั้งแต่ปี พ.ศ. 2529 จนถึงบัดนี้ นิสิต พสวท. ชั้นปีที่ 1 ประจำปีการศึกษา 2564 นับเป็นนิสิตรุ่นที่ 36 ที่ทาง คณะได้มีโอกาสดูแล ซึ่งนิสิตรุ่นแรก ๆ หลายท่านก็ยังอยู่กับเรา เมื่อนับจนถึงสิ้นสุดปีการศึกษา 2563 โครงการ พสวท. และศูนย์มหาวิทยาลัยเกษตรศาสตร์ ได้ร่วมกันผลิตบัณฑิตคุณภาพมากมาย โดยเป็นบัณฑิตที่สำเร็จ การศึกษา ระดับปริญญาตรี 331 คน ระดับปริญญาโท 156 คน และระดับปริญญาเอก 40 คน รวมถึงขณะนี้มหาวิทยาลัยเกษตรศาสตร์ รวมทุกวิทยาเขต มีบัณฑิตพสวท. ปฏิบัติงานอยู่ถึง 117 คน นับว่าโครงการ พสวท. มีบทบาทอย่างมากในการผลิตบุคลากรคุณภาพสูงที่มีองค์ความรู้วิทยาศาสตร์ที่เข้มแข็ง ให้เป็นนักวิทยาศาสตร์ นักวิจัย และนวัตกรรมที่มีความสามารถในการศึกษาวิจัย ประดิษฐ์ และคิดค้นผลงานทางวิทยาศาสตร์ เทคโนโลยี และนวัตกรรม เพื่อช่วยขับเคลื่อนและเสริมสร้างศักยภาพในด้านต่าง ๆ ของประเทศอย่างต่อเนื่อง ซึ่งต่อจากนี้ไป โครงการ พสวท. จะมีบทบาทในการผลิตบัณฑิตคุณภาพสูงในหลากหลายสาขาวิชามากยิ่งขึ้น การอนุญาตให้ นักเรียนสามารถเลือกศึกษาต่อระดับอุดมศึกษา ในคณะวิทยาศาสตร์ สาขาวิชาวิทยาศาสตร์ประยุกต์ นับเป็นก้าว ที่ยิ่งใหญ่ของโครงการ พสวท. คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ มั่นใจว่าจะมีส่วนช่วยสนับสนุน ก้าวที่สำคัญก้าวนี้ของโครงการ พสวท. ให้เกิดผลสัมฤทธิ์ตามวัตถุประสงค์ของโครงการ

การจัดงานในครั้งนี้มีความท้าทายซึ่งเป็นผลจากสถานการณ์การระบาดของโรคโควิด-19 ทำให้ต้องจัดงาน ประชุมวิชาการออนไลน์อย่างเต็มรูปแบบ ซึ่งต้องสามารถรองรับผู้เข้าร่วมงานจำนวนมากได้อย่างมีประสิทธิภาพ โดยมีกลุ่มเป้าหมายหลักคือ นักเรียนทุน พสวท. ระดับมัธยมศึกษา ระดับปริญญาตรี ชั้นปีที่ 3 และชั้นปีที่ 4 รวมถึงนักเรียนระดับมัธยมศึกษาทั่วประเทศที่ทำโครงงานวิทยาศาสตร์ อีกทั้งได้รับเกียรติจากบัณฑิต พสวท. และผู้ทรงคุณวุฒิในแต่ละสาขา

มาบรรยายพิเศษเพื่อสร้างแรงบันดาลใจแก่ผู้เข้าร่วมงาน ในส่วนของการนำเสนอผลงาน ของนักเรียน นักศึกษานั้น ประกอบด้วยการนำเสนอแบบบรรยายผ่าน Cisco Webex และแบบโปสเตอร์ผ่าน Google Meet โดยการนำเสนอภาคบรรยายถูกแบ่งออกเป็นวันละ 27 ห้อง เป็นการนำเสนอผลงานในระดับปริญญาตรี 15 ห้อง และระดับมัธยมศึกษา 12 ห้อง โดยมีการนำเสนอผลงานระดับปริญญาตรีรวม 164 ผลงาน แบ่งเป็น 5 สาขาวิชา ดังนี้

สาขาชีววิทยา	37	ผลงาน
สาขาเคมี	49	ผลงาน
สาขาคณิตศาสตร์	34	ผลงาน
สาขาฟิสิกส์	35	ผลงาน และ
สาขาธรณีวิทยา	9	ผลงาน

การนำเสนอผลงานระดับมัธยมศึกษาประกอบด้วยการนำเสนอผลงานระดับมัธยมศึกษาตอนต้นและตอนปลาย ทั้งสิ้น 235 ผลงาน โดยเป็นผลงานระดับมัธยมศึกษาตอนต้น ในสาขาวิทยาศาสตร์กายภาพและคณิตศาสตร์ 9 ผลงาน และสาขาวิทยาศาสตร์ชีวภาพ 21 ผลงาน ส่วนการนำเสนอผลงานในระดับมัธยมศึกษาตอนปลาย แบ่งเป็น 6 สาขาวิชา ดังนี้

สาขาเคมีและเศรษฐกิจชีวภาพ	39	ผลงาน
สาขาวิทยาศาสตร์สิ่งแวดล้อม	35	ผลงาน
สาขาฟิสิกส์ ดาราศาสตร์ และวิทยาศาสตร์กายภาพ	25	ผลงาน
สาขาคณิตศาสตร์	14	ผลงาน
สาขาคอมพิวเตอร์และสิ่งประดิษฐ์	42	ผลงาน และ
สาขาวิทยาศาสตร์ชีวภาพ	50	ผลงาน

ทั้งนี้ ทางคณะผู้จัดงานได้เตรียมรางวัลสำหรับผู้ที่นำเสนอผลงานได้อย่างยอดเยี่ยม เพื่อเป็นการตอบแทน ความตั้งใจ ความพากเพียร และเป็นกำลังใจให้นักเรียน นักศึกษา ที่เข้าร่วมนำเสนอผลงาน ดังนี้

1. รางวัลการนำเสนอภาคบรรยายระดับปริญญาตรี แบ่งตามห้องบรรยาย รวม 15 รางวัล
2. รางวัลการนำเสนอโปสเตอร์ระดับปริญญาตรี แบ่งตามสาขาวิชา รวม 13 รางวัล
3. รางวัลการนำเสนอภาคบรรยายระดับมัธยมศึกษา และ
4. รางวัลการนำเสนอโปสเตอร์ระดับมัธยมศึกษา

โดยการนำเสนอในระดับมัธยมศึกษาจะได้รับรางวัลเป็นเกียรติบัตรเหรียญทอง เหรียญเงิน และเหรียญทองแดง ตามเกณฑ์ที่กำหนดไว้

ในการจัดงานครั้งนี้ สสวท. และศูนย์มหาวิทยาลัยเกษตรศาสตร์ ได้รับการตอบรับอย่างดียิ่งจากผู้ทรงคุณวุฒิ โดยเฉพาะอย่างยิ่งบัณฑิต พสวท. จากหน่วยงานต่าง ๆ ทั้งภาครัฐ สถาบันการศึกษา และสถาบันวิจัย ระดับแนวหน้าของประเทศไทย ในการร่วมเป็นผู้บรรยายพิเศษ ผู้ประเมินรายงานวิจัยฉบับย่อ และกรรมการ ประเมินการนำเสนอผลงาน อีกทั้งยังให้ความช่วยเหลืออื่น ๆ อีกมากมาย ศูนย์มหาวิทยาลัยเกษตรศาสตร์ ในฐานะเจ้าภาพร่วมต้องขอขอบคุณทุกท่านเป็นอย่างสูง สุดท้ายนี้ กระผมหวังเป็นอย่างยิ่งว่างานประชุมวิชาการ ครั้งนี้จะสำเร็จลุล่วงตามวัตถุประสงค์ทุกประการ ขอบคุณครับ

คำกล่าวรายงาน
“งานประชุมวิชาการวิทยาศาสตร์และเทคโนโลยี นักเรียนทุน พสวท. ประจำปี 2564 การประชุมวิชาการ ระดับนานาชาติด้านวิทยาศาสตร์และนวัตกรรมสำหรับนักเรียน ครั้งที่ 2 และ งานประชุมวิชาการวิทยาศาสตร์ คณิตศาสตร์ และเทคโนโลยี สำหรับนักเรียนทุน พสวท. ระดับมัธยมศึกษา ครั้งที่ 36”
วันที่ 8-9 กรกฎาคม 2564 คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์
ของศาสตราจารย์ ดร.ชูกิจ ลิมปิจำนงค์ ผู้อำนวยการสถาบันส่งเสริมการสอนวิทยาศาสตร์และเทคโนโลยี

เรียน ดร.กฤษณพงษ์ กีรติกร นายกสภามหาวิทยาลัยเกษตรศาสตร์ และประธานอนุกรรมการพัฒนาและส่งเสริมผู้มีความสามารถพิเศษทางวิทยาศาสตร์และเทคโนโลยี ศึกษาในประเทศ และรองศาสตราจารย์ ดร. อภิสิฏฐ์ ศงสะเสน คณบดีคณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

กระผมรู้สึกดีใจและภูมิใจอย่างยิ่งที่ได้รับเกียรติ ต้อนรับท่านผู้มีเกียรติทุกท่านในวันนี้ สู่งานประชุมวิชาการวิทยาศาสตร์และเทคโนโลยี นักเรียนทุน พสวท. ประจำปี 2564 การประชุมวิชาการระดับนานาชาติ ด้านวิทยาศาสตร์และนวัตกรรมสำหรับนักเรียน ครั้งที่ 2 และ งานประชุมวิชาการวิทยาศาสตร์ คณิตศาสตร์ และเทคโนโลยี สำหรับนักเรียนทุน พสวท. ระดับมัธยมศึกษา ครั้งที่ 36 และถือโอกาสนี้ขอบพระคุณมหาวิทยาลัยเกษตรศาสตร์ที่เป็นเจ้าภาพจัดงานในปีนี้ การประชุมวิชาการนี้ จัดขึ้นทุกปี เพื่อเปิดโอกาสให้นักเรียน นิสิต นักศึกษาในโครงการ พสวท. ทั้งในระดับอุดมศึกษาและระดับมัธยมศึกษา ได้เผยแพร่และแลกเปลี่ยนความรู้ทางด้านวิทยาศาสตร์และเทคโนโลยี ผ่านการนำเสนอผลงานวิจัยทั้งในรูปแบบบรรยายและโปสเตอร์ ซึ่งจะนำไปสู่ความร่วมมือทางวิชาการ ของนิสิต นักศึกษา คณาจารย์ นักวิชาการ และนักวิจัยในสถาบันอุดมศึกษาต่อไป

ในปี พ.ศ. 2527 สสวท เริ่มดำเนินโครงการ พสวท. โดย ค้นหาเด็กนักเรียนที่มีความสามารถพิเศษทางวิทยาศาสตร์และเทคโนโลยีจากทั่วประเทศ มาเข้าโครงการบ่มเพาะและให้ทุนการศึกษาจนถึงระดับปริญญาเอก โดยนักเรียนสามารถเลือกเรียนในสาขาวิทยาศาสตร์และเทคโนโลยีที่ตนเองถนัด จนถึงวันนี้ บัณฑิต พสวท. ได้กลับมาเป็นอาจารย์ที่มีชื่อเสียงในมหาวิทยาลัยต่างๆ ทั่วประเทศ เป็นนักวิจัยชั้นแนวหน้า และเป็นนักเทคโนโลยีชั้นนำในโลกปัจจุบัน ไม่ว่าจะเป็นด้าน Block chain, AI, Quantum, Space, Robotic หรือแม้แต่ Vaccine ที่ไม่เคยคาดคิดว่าจะมีการให้ทุนจากภาครัฐไปเรียน ทั้งหมดนี้เป็นเพราะทุน พสวท. เปิดให้นักเรียนเลือกเรียนตามความสนใจ และเดินในหนทางที่ตัวเองชอบ เมื่อมีด้านที่มีความนิยมสูง ก็มีด้านที่อาจจะหางานยากในประเทศ ซึ่งหวังว่าการมาร่วมกันนำเสนอผลงานในการประชุมนี้จะทำให้บัณฑิตได้พบผู้ประกอบการหรือหน่วยงานที่ตรงสายวิชาที่เรียนมาไม่มากก็น้อย

ในปีนี้ ประเทศไทยเผชิญกับการระบาดระลอกใหม่ของโควิด-19 ที่เริ่มมาตั้งแต่เดือนกุมภาพันธ์ ซึ่งการระบาดระลอกใหม่มีความต่างในหลายด้านจากการระบาดในปีที่ผ่านมา เริ่มจากจำนวนผู้ติดเชื้อมีจำนวนมากกว่า กระจายไปหลายจังหวัดกว่า ส่งผลกระทบต่อการจัดการเรียนการสอน นักเรียนมาโรงเรียนไม่ได้ในหลายพื้นที่ เพื่อให้นักเรียนมีโอกาสที่จะเรียนรู้ เสริมทักษะทางความคิด เพื่อพัฒนาศักยภาพของตนเองอย่างต่อเนื่อง ทาง สสวท. เองก็ได้ผลิตสื่อ Project-14 เป็นคลิปการเรียนการสอน ที่ส่งเสริมวิถีการเรียนรู้ใหม่ ไม่จำกัดแค่อยู่ในห้องเรียนอีกต่อไป โดยผู้เรียนสามารถกำหนดการเรียนรู้ของตัวเอง ครอบคลุมการศึกษาขั้นพื้นฐานทั้ง 12 ชั้นปี ที่ สสวท. รับผิดชอบ เป็น New Normal ทางการศึกษา การประชุมต่างๆ ไม่ว่าเล็กใหญ่ก็เช่นเดียวกัน ต่างต้องใช้การประชุมทางไกล ไม่เว้นแม้แต่ การประชุมวิชาการ

วิทยาศาสตร์และเทคโนโลยี ของเราในปีนี้ ซึ่งจากปกติเป็นแบบ Onsite ได้ต้องปรับเปลี่ยนมาเป็นแบบ Online แม้ว่าผู้เข้าร่วมอาจจะไม่ได้อรรถรสในการพบปะกันเหมือนเดิม ก็ต้องขออภัย แต่ขอให้นึกว่าเป็น New Normal ที่เชื่อว่าทุกคนได้ปรับตัวมาระดับหนึ่งแล้ว และ เราจะช่วยกันใช้การประชุมให้เกิดประโยชน์ที่สุดเท่าที่จะทำได้ภายใต้สภาวการณ์ขณะนี้

ขอขอบพระคุณ ท่านประธาน ท่านคณบดี ท่านวิทยากร อาจารย์ นักเรียน นิสิต นักศึกษา ได้สละเวลาอันมีค่ามาร่วมประชุม เพื่อส่งเสริมเครือข่ายของกลุ่มบัณฑิต พสวท. เสริมพัฒนาการของนักเรียนทุน พสวท. และ หวังว่าจะเป็นประโยชน์ต่อการพัฒนาวิทยาศาสตร์ในประเทศไทย ในนาม สสวท ผมยินดีต้อนรับทุกท่าน สู่การประชุมวิชาการครั้งนี้ ขอขอบคุณครับ

คำกล่าวนายกสภามหาวิทยาลัยเกษตรศาสตร์

คณะทำงานจัดงานประชุมวิชาการนักเรียนทุน พสวท. ประจำปี 2564

นาย	อภิสิฏฐ์ ศงสะเสน	ที่ปรึกษา
นางสาว	อรินทิพย์ ธรรมชัยพิเนต	ที่ปรึกษา
นางสาว	สุธารัตน์ โชติกประคัลภ์	ที่ปรึกษา
นาย	ชูกิจ ลิมปิจำนงค์	ที่ปรึกษา
นาย	พิทักษ์ เชื้อวงศ์	ประธานคณะทำงาน
นางสาว	ราตรี วงศ์ปัญญา	รองประธานคณะทำงาน
นาย	พรชัย อินทร์ฉาย	รองประธานคณะทำงาน
นางสาว	กชกร อิ่มเจริญ	คณะทำงาน
นางสาว	กมลรัตน์ ฉิมพาลี	คณะทำงาน
นาย	กฤษณะ อ่วมทอง	คณะทำงาน
นาย	ขุนทอง คล้ายทอง	คณะทำงาน
นาย	คณิณ รุ่งวัฒนา	คณะทำงาน
นางสาว	จันฒิมา มากมูล	คณะทำงาน
นางสาว	จันทร์ธา วงษ์อู่ทอง	คณะทำงาน
นาย	จารุพัฒน์ วงษ์พานิช	คณะทำงาน
นางสาว	จิตราภรณ์ บุญถนอม	คณะทำงาน
นาย	จิรโรจน์ ต.เทียนประเสริฐ	คณะทำงาน
นางสาว	จิระประภา ขันสุข	คณะทำงาน
นางสาว	จีรพรรณ บุญฤทธิ์	คณะทำงาน
นางสาว	จุติภรณ์ ทัสสกุลพนิช	คณะทำงาน
นางสาว	จุรีภรณ์ เชื้อดวงผุย	คณะทำงาน
นาย	เจษฎา โพธิรัตน์	คณะทำงาน
นาย	ฉัตรเฉลิม เกษเวชสุริยา	คณะทำงาน
นางสาว	ชนากานต์ ปลั่งสมบัติ	คณะทำงาน
นาย	ชนินทร โสรถาวร	คณะทำงาน

นาย	ชัยชลิต ศรีสวัสดิ์	คณะทำงาน
นาย	ชิตพงษ์ เหนือเกาะหวาย	คณะทำงาน
นาย	ชุมพล จันทะลา	คณะทำงาน
นาย	โชคชัย ยืนยง	คณะทำงาน
นางสาว	ณัฏฐณิชา สุขพอดี	คณะทำงาน
นาย	ณัฐพล บัวอุไร	คณะทำงาน
นาง	ณัฐิดา ถิรัตประดับกุล	คณะทำงาน
นาย	ไตรรงค์ เสมแย้ม	คณะทำงาน
นางสาว	ทองจินดา แก้วอาษา	คณะทำงาน
นาย	ธนพันธุ์ พูนหมี	คณะทำงาน
นางสาว	ธัญญลักษณ์ คุณโฑ	คณะทำงาน
นางสาว	ธิดาพร ศุภภากร	คณะทำงาน
นาย	ธีทัต ถิรัตประดับกุล	คณะทำงาน
นางสาว	นงพร บุญสวัสดิ์	คณะทำงาน
นางสาว	นพรัตน์ ศรีเจริญ	คณะทำงาน
นาย	นพรัตน์ สระแก้ว	คณะทำงาน
นาง	นภาพรรณ ไพรพยอม	คณะทำงาน
นาย	นรินทร์ ชมภูพวง	คณะทำงาน
นางสาว	นริศรา ปิยะแสงทอง	คณะทำงาน
นางสาว	นวรัตน์ สามารถ	คณะทำงาน
นาง	นางปานทิพย์ ชัยจักร์	คณะทำงาน
นางสาว	น้ำเพชร นาสารีย์	คณะทำงาน
นาย	นิชพล ชินบัวทอง	คณะทำงาน
นางสาว	นิตยา สมทรัพย์	คณะทำงาน
นาง	นิภาศิริ ทัพไชย	คณะทำงาน
นาง	บงกช วัดเมือง	คณะทำงาน
นาย	ปกรณ์ วรรธนะอมร	คณะทำงาน
นางสาว	ปนัสยา เดชประมวลพล	คณะทำงาน
นาย	ปพิชญา ชัยสกุล	คณะทำงาน

นาย	ปิยังกูล เหลืองเจริญกิจ	คณะทำงาน
นางสาว	พนัฐศิกาญจน์ เชาวลิต	คณะทำงาน
นางสาว	พรภัทรา สองรักษ์	คณะทำงาน
นางสาว	พรรณนรี ศรีน้อย	คณะทำงาน
นางสาว	พรสวรรค์ สุทธินนท์	คณะทำงาน
นางสาว	พัณณิดา ขุนนามวงษ์	คณะทำงาน
นางสาว	พันทิพย์ โตแก้ว	คณะทำงาน
นาย	พีรภัฏ รุ่งสัทธรรม	คณะทำงาน
นาย	พีระ พงษ์กิติวณิชกุล	คณะทำงาน
นางสาว	เพ็ญพิชชา ผินสูงเนิน	คณะทำงาน
นาย	ไพศาล แมลงทับทอง	คณะทำงาน
นางสาว	ภวิกา ลิ้มอุดมพร	คณะทำงาน
นาย	ภาคภูมิ เรือนจันทร์	คณะทำงาน
นาย	ภานุ พิมพ์วิริยะกุล	คณะทำงาน
นาย	มิตรชัย คำงอก	คณะทำงาน
นาย	รณภณ เนตรสว่างวิชา	คณะทำงาน
นางสาว	รัชธิดา เดชอุดม	คณะทำงาน
นาย	รัฐพันธ์ ตรงวิวัฒน์	คณะทำงาน
นางสาว	เรืองลักษณ์ จงโชตินนท์	คณะทำงาน
นางสาว	วนิดา สนสุวรรณ	คณะทำงาน
นาย	วรเศรษฐ สุวรรณิก	คณะทำงาน
นางสาว	วริศษา นรินทร	คณะทำงาน
นางสาว	วศินี อัศวเสรีเลิศ	คณะทำงาน
นาย	วัชรพล พิมพ์เสริฐ	คณะทำงาน
นาย	วิทชุกร ภู่ทอง	คณะทำงาน
นางสาว	วิวาภร สุดแสวง	คณะทำงาน
นาย	วิศิษฏ์ หิรัณย์ภิญโญภาศ	คณะทำงาน
นาย	วีกิตติ์ ศิริศักดิ์สุนทร	คณะทำงาน
นางสาว	ศริญญา ไพศาลสมบัติ	คณะทำงาน

นางสาว	ศิริวรรณ ฉัตรมณีรุ่งเจริญ	คณะทำงาน
นาย	สันติรักษ์ โยธาธิติกุล	คณะทำงาน
นาย	สิทธิโชค แซ่ห่าน	คณะทำงาน
นางสาว	สิริวรรณ เนิดน้อย	คณะทำงาน
นางสาว	สุกัญญา สุตะพันธ์	คณะทำงาน
นางสาว	สุชาวดี เพ็ชร์อำไพ	คณะทำงาน
นางสาว	สุชิรา โรจนกุศล	คณะทำงาน
นางสาว	สุพัตรา เฉลิมเผ่า	คณะทำงาน
นาย	สุรศักดิ์ ผลชะอุ่ม	คณะทำงาน
นาย	สุริยา ณ หนองคาย	คณะทำงาน
นางสาว	สุวินัย มงคลธารณ์	คณะทำงาน
นาย	อดิศักดิ์ บุญชื่น	คณะทำงาน
นาย	อทิตวัฒน์ ทัดเสือ	คณะทำงาน
นางสาว	อนงค์ภัทร สุทธางคกูล	คณะทำงาน
นางสาว	อนันญา แสงทนต์	คณะทำงาน
นาง	อรอุษา คำสุข	คณะทำงาน
นาย	อัครวัฒน์ ศรีสวัสดิ์	คณะทำงาน
นางสาว	อัมริสา จันทนะศิริ	คณะทำงาน
นางสาว	อำไพวรรณ ทวีธัญลักษณ์	คณะทำงาน
นาย	อุดมศักดิ์ รักวงษ์วาน	คณะทำงาน
นางสาว	อุษาวดี แซ่หลี	คณะทำงาน
นาย	เอกพันธ์ ไกรจักร์	คณะทำงาน

July 8th, 2021	
Time	**Room**
08.00 a.m. – 08.30 a.m.	**ลงทะเบียนเข้าร่วมงาน ณ ห้องบรรยายออนไลน์**
08.30 a.m. – 08.40 a.m.	**กล่าวรายงาน** *โดย รองศาสตราจารย์ ดร.อภิสิฏฐ์ ศงสะเสน* *คณบดีคณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์*
08.40 a.m. – 08.50 a.m.	**กล่าวต้อนรับ** *โดย ศาสตราจารย์ ดร.ชูกิจ ลิมปิจำนงค์* *ผู้อำนวยการสถาบันส่งเสริมการสอนวิทยาศาสตร์ และเทคโนโลยี*
08.50 a.m. – 09.30 a.m.	**ประธานในพิธีกล่าวเปิดงานและปาฐกถาพิเศษ** ***"การปลูกจิตสำนึก สาธารณะให้ผู้มีความสามารถพิเศษทางวิทยาศาสตร์และเทคโนโลยีในยุคที่มีการเปลี่ยน แปลงฉับพลัน"*** *โดย ดร.กฤษณพงษ์ กีรติกร* *นายกสภามหาวิทยาลัยเกษตรศาสตร์ และประธานอนุกรรมการ พัฒนาและส่งเสริมผู้มีความสามารถพิเศษทางวิทยาศาสตร์และเทคโนโลยี ศึกษาในประเทศ*
09.35 a.m. – 10.15 a.m.	**Plenary Lecture I** OASIS Mission for the Study of Liquid Crystals in Space Investigated on International Space Station *โดย ผู้ช่วยศาสตราจารย์ ดร.ณัฐพร ฉัตรแถม* *คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์*
10.20 a.m. – 11.00 a.m.	**Plenary Lecture II** Collaboration: The key secret of the liverwort genera *Thysananthus* and *Frullania* studies *โดย รองศาสตราจารย์ ดร.เพียงพักตร์ สุขรักษ์* *คณะวิทยาศาสตร์ มหาวิทยาลัยบูรพา*
12.00 a.m. – 12.00 a.m.	**Poster Session : Group A**
12.00 a.m. – 01.00 p.m.	**Lunch**
01.00 p.m. – 05.00 p.m.	**Oral Session**

July 9th, 2021	
Time	**Room**
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09.30 a.m. – 12.30 p.m.	**Oral Session**
12.30 p.m. – 01.00 p.m.	**Lunch**
01.00 p.m. – 02.00 p.m.	**Poster Session : Group B**
02.00 p.m. – 02.40 p.m.	**Plenary Lecture III** Computer vision research in a nutshell *โดย ดร.ศุภศรณ์ สุวจนกรณ์ สถาบันวิทยสิริเมธี*
02.50 p.m. – 03.40 p.m.	**บรรยายพิเศษ จากสถาบันสารสนเทศทรัพยากรน้ำ (สสน.)** *หัวข้อ "New Choices to Changes and Challenges"* *โดย ดร.ปรารถนา ดีประเสริฐกุล และดร.ไอศวรรย์ ชั้นกาญจน์*
03.40 p.m. – 04.10 p.m.	**พิธีปิด** *โดย รศ. ดร.อภิสิฏฐ์ ศงสะเสน* *คณบดีคณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์*

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MAT1: Algebra and Number Theory (July 8th, 2021)

Session Mathematics

MAT2: Mathematical Modeling and Computational Mathematics (July 8th, 2021)

Session Mathematics

MAT3: Probability, Statistics and Computer Science (July 8th, 2021)

Session Mathematics

MAT1: Algebra and Number Theory (July 9th, 2021)

Session Mathematics

MAT2: Mathematical Modeling and Computational Mathematics (July 9th, 2021)

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Session Chemistry

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Session Chemistry

CHEM3: Physical and Inorganic Chemistry (July 8th, 2021)

Session Chemistry

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Session Chemistry

CHEM1: Analytical and Materials Chemistry (July 9th, 2021)

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Session Chemistry

CHEM2: Organic and Biological Chemistry (July 9th, 2021)

Session Chemistry

CHEM3: Physical and Inorganic Chemistry (July 9th, 2021)

Session Chemistry

CHEM4: Inorganic Chemistry (July 9th, 2021)

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BIO2: Plant Biochemistry /Physiology and Microbiology (July 8th, 2021)

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BIO4: Ecology, Evolution, Systematics and Population Genetics (July 8th, 2021)

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Session Biology

BIO2: Plant Biochemistry /Physiology and Microbiology (July 9th, 2021)

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Session Biology

BIO3: Gene and Cell Function and Molecular Biology (July 9th, 2021)

Session Biology

BIO4: Ecology, Evolution, Systematics and Population Genetics (July 9th, 2021)

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Session Geology

GEO: Earth Sciences and Geology (July 9th, 2021)

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Session Physical

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Session Physical

PHY3: Gravitation, Astrophysics and Cosmology (July 8th, 2021)

Session Physical

PHY1: General Physics, Atomic, Molecular and Optical Physics, Particle Physics, Particle Accelerator, Plasma and Beam Physics and Biological Physics (July 9th, 2021)

Session Physical

PHY2: Condensed Matter and Materials Physics and Nuclear Physics (July 9th, 2021)

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PHY3: Gravitation, Astrophysics and Cosmology (July 9th, 2021)

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PLENARY SESSION

Research Abstract
DPST student conference on Science and Technology 2021
(DPSTcon2021)

OASIS Mission for the Study of Liquid Crystals in Space Investigated on International Space Station

Apichart Pattanaporkratana[1], Natthawat Hongkarnjanakul[2], Nattaporn Chattham[1,*]
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OASIS (Observation and Analysis of Smectic Islands in Space) project is to better understand the unique behavior of liquid crystals in microgravity. Liquid crystals have been used extensively for several technologies on earth nowadays, e.g., display technology, optical components for communication and optical components in many other industries. Thus, bringing the liquid crystal technology up in space requires intensive studies of its behavior in microgravity, especially, since its state is complex fluid which could behave quite differently in space. OASIS was started in 2000 by Prof. Noel Clark from University of Colorado, Boulder, USA as the principal investigator of the project and the operation and engineering team were supported by NASA. Full ranges of optical experiments were done for the study of liquid crystal bubbles from ground-based study to parabolic flight (zero-G flight) testing and the completed experiment was finally launched in 2015 on the International Space Station (ISS) for over 9 month long in space. Following its success of OASIS I, OASIS II has been proposed and started its operation in 2018 for ground-based study and the launching plan on ISS is scheduled to be in 2023 with our mission for Thailand as international collaborator on the project to explore the study of freely suspended liquid crystal films (Figure 1) in space under heat flux and in optical trap. We will share with you our 20 year experience of employing optical experiments to investigate behaviors of liquid crystals in space on this OASIS mission.

This work was supported by Kasetsart University, GISTDA and NASA.

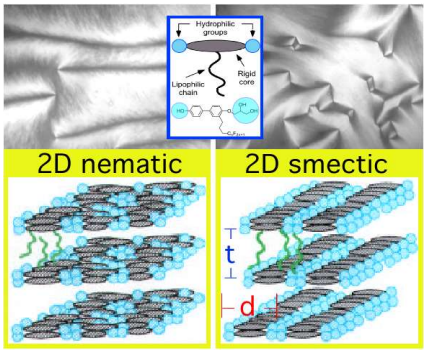

Figure 1: (**top**) 2D nematic and smectic textures in few-layer thick freely suspended films of the bola-amphiphilic liquid crystals. (**bottom**) Schematic representation of the molecular organization of the phases. [1]

Collaboration: The Key Secret of The Liverwort Genera *Thysananthus* and *Frullania* Studies

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Liverwort is a non-vascular, flowerless, and spore-producing plant which is either thalloid form or leafy form. *Thysananthus* and *Frullania* are the genera of leafy liverwort and distributed worldwide. For the studies of *Thysananthus* on a global scale and *Frullania* in Thailand, collaboration is the key secret of the success as it brings distinct results and incredible achievements. By collaborating with researchers from Japan and the Netherlands as well as the curators of the herbaria worldwide, a comprehensive taxonomic study of the genus *Thysananthus* leads to the recognition of 15 species**.** *Thysananthus* is morphologically close to *Mastigolejeunea* and the morphologically intermediate species exist. Therefore, the separation of these two genera has long been controversial. With the support from the French and German organizations, the relationship between *Thysananthus* and *Mastigolejeunea* is assessed. Molecular analysis reveals that *Mastigolejeunea* is resolved as sister to *Thysananthus* with moderate support but the diagnostic morphological features separating *Mastigolejeunea* from *Thysananthus* are lacking. *Mastigolejeunea* is, therefore, treated as a subgenus of *Thysananthus.* Attending the 18th International Botanical Congress in Australia provides an opportunity not only to present the results of *Thysananthus* study but also to meet the world expert of the liverwort genus *Frullania* and to be invited to attend the workshop of the latter genus at the Field Museum, U.S.A. These lead to the revision of *Frullania* in Thailand project, in which 39 species of the genus reported from the country. Of these, three species including *F. hypoleuca* Nees, *F. ramuligera* (Nees) Mont., and *F. sinuata* Sande Lac. are newly recorded for Thailand.

Keywords: Bryophyte, monograph, revision, Taxonomy, Thailand

Computer Vision Research in a Nutshell

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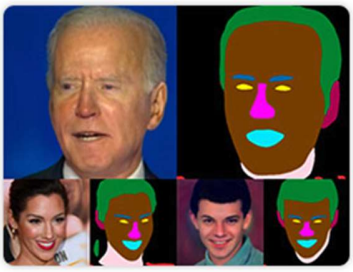
How intelligent really is Artificial Intelligence? We've seen many breakthroughs where AI beat humans in a variety of tasks, but how close are we in building a system that can "see" and "understand" things just like humans do? In this talk, I will talk about exciting progress and research at the frontier of computer vision and AI as well as some of our research done at VISTEC in ones of the hottest areas: unsupervised / few-shot learning and novel view synthesis.

Nex: Real-time View Synthesis with Neural Basis Expansion
S. Wizadwongsa, P. Phongthawee, J. Yenphraphai, S. Suwajanakorn
CVPR 2021 (Oral)

We present NeX, a new approach to novel view synthesis based on enhancements of multiplane image (MPI) that can reproduce NeXt-level view-dependent effects---in real time. A 1000x speed up from SOTA.
Paper Web



Repurposing GANs for One-shot Semantic Part Segmentation
N. Tritrong, P. Rewatbowornwong, S. Suwajanakorn
CVPR 2021 (Oral)

We present a simple and powerful method that repurposes GANs for few-shot semantic part segmentation. Our approach achieves surprising and unprecedented performance and is competitive with fully-supervised baselines that require 10-50x more label examples.
Paper Web

Keywords: Computer Vision, Deep Learning, AI, 3D Reconstruction

Research Abstract
DPST student conference on Science and Technology 2021
(DPSTcon2021)

NUMBERS

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This is an anecdote about different kinds of numbers. The talk is mostly non-technical and is aimed at a general audience. Starting from the integers, through personal reminiscences, creations of several other well-known numbers are described and discussed.

Keywords: Rational number, algebraic number, transcendental number, field, p-adic number

Closed-Form Formula for some Self-Replicating Sequences

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We study a family of self-replicating sequences which has the property that, if one forms a second sequence that records the number of $m's$ between successive $k's$, the result is identical to the given sequence. To illustrate, we start with an initial k. This is followed by a block of $k's$ m, $k, \underbrace{m, m, m, \ldots, m}_{k \text{ times}}, k$. Since the second entry is m, we have a block of $m's$ m, and the process continues, i.e., the resulting sequence is $k, \underbrace{m, m, m, \ldots, m}_{k \text{ times}}, k, \underbrace{m, m, m, \ldots, m}_{m \text{ times}}, k, \ldots$. In this talk, we find the closed-form formula of the self-replicating sequence in the case when $m - k = 1$ by using the Beatty sequence. Moreover, the generalized self-replicating sequence is found to be related to the numbers that cannot be written as a sum of distinct Lucas numbers.

Keywords: Beatty sequence, Lucas number, self-repeating sequence, Fibonacci sequence

The number of k-symmetric numerical semigroups $\{0\} \cup [a, b] \cup [c, \infty)$

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Let $a, b, c \in \mathbb{N}$ be such that $2 < a < b < c - 1$. Denote the set of all integer a x such that $a \leq x \leq b$ by $[a, b]$ and the set of all integer a y such that $y \geq c$ by $[c, \infty)$. Then $\{0\} \cup [a, b] \cup [c, \infty)$ is a numerical semigroup if and only if $c \leq 2a$. Let $\mathcal{U} = \{S : S = \{0\} \cup [a, b] \cup [c, \infty)$ is a numerical semigroup$\}$. In this research, we count the number of all k-symmetric numerical semigroups in $\mathcal{U}$ which having the same Frobenius number. Moreover, we determine the number of all 3-symmetric numerical semigroups in $\mathcal{U}$ which having the same genus number.

Keywords: Frobenius number, Genus number, k-symmetric, Numerical Semigroup.

p-Adic Numbers

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In this work, we give the definition of the p-adic number system which is another extension of the real system. Moreover, we establish some of its important properties analogous to the real number system. Finally, we showed how to construct p-adic numbers by using Hensel's theorem.

Keywords: p-Adic, absolute value function, Hensel's theorem

A Correspondence between Finite Topological Spaces and Directed Graphs through MATLAB

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A directed graph and a finite topological space are correspondent in some sense. In this research, we want to find a finite topology determined from a directed graph and investigate some property on it such as Kolmogorov ($T_0 - axiom$). We write algorithms to find such topology and write the codes by MATLAB. Moreover, we compute the time complexity of the algorithm, which is $O(n^4)$.

Keywords: Finite topology, Directed graph, Kolmogorov space, T0 space, MATLAB

In P-Minimal Structures with Definable Skolem Functions

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Let $\mathfrak{L}$ be a countable language and let $\mathfrak{M}$ be a P-minimal $\mathfrak{L}$-structure. We show that if $\mathfrak{M}$ admits definable Skolem function, has the Exchange Property and is $\aleph_1$-saturated and $(G, \cdot)$ is a group such that $G \subseteq M^n$is definable and n-dimensional, then there is a topology that makes $(G, \cdot)$ a topological group.

Keywords: definable group, definable Skolem function, P-minimal

Some certain involution rings and their interaction

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We study some certain classes of rings as follows: reduced rings, symmetric rings, reversible rings, semicommutative rings and abelian rings. In this project, such certain rings generalized via an involution ring are called $*$- reduced, $*$- symmetric, right(left) $*$- reversible, $*$- semicommutative and $*$- abelian rings, respectively. Then, we provide some results concerning to generalized rings.

Keywords: reduced rings, symmetric rings, reversible rings, semicommutative rings, abelian rings

Challenges in the use of mathematical modeling

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Mathematical modeling is the process in which the real world phenomena are described by mathematical language. Making a good model is very challenging. For every model, the familiar question that the modeler faces is "Is this model correct?". In this talk, we first introduce two famous quotes wrote by two statisticians. One quote by George Box is "All models are wrong, some are useful". The other one by Thad Tarpey is "All models are right, most are useless". Then their points of view are compared and contrasted. Of course, it may be easier to understand their opinions about "wrong", "right", "useful", and "useless" through examples. Finally, lesson learned from mathematical models are illustrated. Hopefully, next time when building a model, we keep these quotes in mind.

Keywords: (Approximation, Assumption, Mathematical modeling, Prediction)

Review of Ovsyannikov's work in group classification of equations of the form $y'' = f(x, y)$

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This project is conducted to study the work of L. V. Ovsyannikov, a famous mathematician in the field of group analysis, that published in the Journal of Applied Mechanics and Technical Physics, Vol. 45, No. 2, pp. 153–157 in 2004 with the title "Group Classification of Equations of the Form $y'' = f(x, y)$" . The topic includes equivalence groups, admissible operators and group classification. For the differential equations in the form $y'' = f(x, y)$, group classification can be used to find all types of f possible and to reduce order of the equation. We apply the method to several examples.

Keywords: Differential Equation, Group Classification, Equivalence Transformation

Linearization of System of Two Second-Order Ordinary Differential Equations by Fiber Preserving Transformations

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We present the linearization problem of system of two second-order ordinary differential equations under the fiber preserving transformation$t = \varphi(x),\ u_1 = \psi_1(x, y_1, y_2), u_2 = \psi_2(x, y_1, y_2)$. We found the necessary form which allow the system of two second-order ordinary differential equations $y_1'' = F_1(x, y_1, y_2, y_1', y_2'),\ y_2'' = F_2(x, y_1, y_2, y_1', y_2')$ to be transformed to the linear system $u_1'' + k_1 u_1' + k_2 u_1 = 0,\ u_2'' + k_3 u_2' + k_4 u_2 = 0$. We also found the sufficient conditions which allow the obtained form to be linearizable. Moreover, the procedure for obtaining the linearizing transformation and coefficients of linear system are provided in explicit forms. Examples demonstrating the procedure of using the linearization theorems are presented.

Keywords: Linearization problem, point transformation, fiber preserving transformation, system of two second-order ordinary differential equations

Entire Solutions of a Pexider-Type of Log-Quadratic Functional Equation

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This research investigates solutions of a *Pexider-type of log-quadratic functional equation*: $f(x+y)g(x-y)=h(x)k(y)$, where $f,g,h,k:\mathbb{C}\to\mathbb{C}$ are entire functions and x,y are complex variables. Moreover, we solve other functional equations, as its applications.

Keywords: Pexider-type of functional equation, log-quadratic functional equation, entire function, exponential function

Finding the collision-free path for moving multiple objects to the predetermined destination

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Motivated by the atom trapping problem, we restate the problem as considering a matrix with elements 1 or 0. The goal is finding an instruction for simultaneously pushing 1 to the position of 0 forming a square matrix without collision. The Genetic algorithm is used to find such a solution with the minimum sum of the total distance from the moving of all 1.

Keywords: Genetic Algorithm, Optimization

Convergence of a distributed method for minimizing sum of convex functions with fixed-point constraints.

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We consider a networked system with m users which can have a different weight and deals with the problem of minimizing the sum of all the users' convex objective functions over the intersection of all the users' fixed-point set of firmly nonexpansive mapping with a closed convex and bounded set as a common constraint on a Euclidean space. This enables us to consider the case in which the projection onto the constraint set cannot be calculated efficiently. We propose a distributed method for solving the problem and the sequence generated by this method has a subsequence which converges to the solution of the problem under certain assumption. We also show that, if one of the objective function is strictly convex, then the whole sequence converges to the unique solution. Some numerical experiments are given to show the effectiveness of the obtained theoretical result.

Keywords: convex function, distributed method, firmly nonexpansive mapping, proximal method

Boundaries of Overlapping Isosceles Right Triangle

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The paper studies the study two congruent isosceles right triangles T_1 and T_2 whose interiors intersect. The main objective of the paper is to find the bound of the ratio of length of the part of the boundary of T_1 that lies inside T_2 and the length of part of the boundary of T_2 that lies inside T_1. It is found that the ratio is between $\frac{1}{\sqrt{4+2\sqrt{2}}}$ and $\sqrt{4+2\sqrt{2}}$.

Keywords: inequality isosceles right triangles, intersecting isosceles right triangles, overlapping congruent isosceles right triangles, overlapping isosceles right triangles

Digital Character Design and Human Perception

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This talk will introduce the audience to the brief history of digital character development and basic concept of visual perception. It will also cover some of the recent perceptual research on designing appealing virtual avatars. As the content of this presentation is not highly technical, it is suitable for viewers with any level of expertise.

Keywords: Character Design, Virtual Avatar, Digital Human, Visual Perception

Forecasting development indicators in Thailand using a hybrid method based on vector autoregression and Kalman filtering

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Development indicators are the measurements used to justify how the country develop. By using development indicators, the government can impose a national economic planning. In this work, we purpose a hybrid approach consisting of the vector autoregression model and Kalman filter in order to estimate and predict the development indicators. The data exploited in this study are population, gross domestic product (GDP) and human development index (HDI) during 1990-2018. They are divided to two groups: the data from 1990-2017 are considered as the training data while those of 2018 as the testing data. To assess the accuracy of the models, the absolute percentage error (APE) and the mean absolute percentage error (MAPE) are employed. For the performance comparison, the hybrid VAR-KF method provides superior estimation and prediction accuracy when compared with VAR(1) model.

Keywords: Development indicators, Kalman filter, VAR model

SEIR model for COVID-19 situation in Thailand

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In this study, we constructed the new mathematical model to describe COVID-19 situation in Thai-land. In this model, population were divided into five classes including Susceptible(S), Exposed(E), Infected(I), Detected infectious(I_d) and Recovered(R). This model has vaccination parame-ters consisting of efficiency of vaccine and vaccination rate to predict COVID-19 cases. The analysis of model concerned about the existence and uniqueness of solution, disease free equilibrium (DFE), the basic reproductive number (R_0) by using next generation matrix approach and model stability. The result showed that the solution of model was unique. The estimatedR0from the model without vaccination parameters was 4.0301 which implies instability of the system. Including the vaccina-tion parameters reduced the value of R_0 to be under 0.3947. Stability of disease free equilibrium was investigated in this study, it is locally stable. Global stability of the equilibrium depends on the value of R_0, it is globally asymptotic stable if R_0<1 and it unstable when R_0>1. Our simulationresults showed that COVID-19 cases will be under control (almost 0% infected) in Thailand by June, 2022 predicted by the model without vaccination. On the other hand, the model with vaccination showed that COVID-19 cases will almost disappear by January or March, 2022 depending on the vaccine efficiency and vaccine distribution rate parameters. Moreover, using vaccine was able to reduce COVID-19 cases. The fining in this study indicated that this model might be alternative to predict the pandemic outbreak in Thailand.

Keywords: Basic reproductive number (R_0), COVID-19, Disease free equilibrium (DFE) and SEIR model.

Nash Equlibria for Auction

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In this work, we study the concept of Nash equilibria for auctions focusing on first-price sealed-bid auctions. More precisely, we study an exact formula for the Nash equilibrium in two cases: two-player two-item auctions and N-player M-item auctions. In addition, players usually place bids in whole numbers, the auction is then considered as a finite game. We then study the Lemke-Howson algorithm, which can be used to compute a Nash equilibrium of a 2-player finite game.

Keywords: auctions, first-price sealed-bid auctions, Lemke-Howson algorithm, nash equilibrium.

Three-Parameter Poisson-Lindley Linear Model for Count Data

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Analysis of correlation network of stocks in SET50 during COVID-19 outbreak

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In this project we create network graphs of SET50 stocks using correlation coefficient derived from closing price and trading volume changes. After that, we analyze the graphs using visualization, graph communities and betweenness centrality.

The results show that stocks with high betweenness centrality have a significant impact on the SET50 network graph. In terms of market direction, they are very similar to the SET50 index. The data of the stocks used was collected from 2 January 2019 to 30 December 2020 during the first Covid-19 outbreak in Thailand.

Keywords: Betweenness Centrality, Correlation Coefficient, Graph Communities, Visualization

Brainwave values effect on decision making for left and right arm lifting

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In this independent study, we studied brainwave values effect on decision making for left and right arm lifting. We indicated the model of brainwave values by studying Principal Component Analysis: PCA and classification with k-nearest neighbour: kNN and Support Vector Machines: SVM. We conducted this study on the MATLAB program and Classification Learner Application. We divided this independent study into 2 parts. First, reduction of data dimensions (the brainwave values are big data) with PCA is large and difficult to manage. In this independent study, it was necessary to reduce the dimensions of the data to make the data smaller and more manageable. We represented the data set by choosing the data of 5 trials from 100 trials. We considered the component of each trial that covers the highest of 3 variances. After that, we used 5 matrices that are the coefficient of components (size $2{,}560\times 3$). Then, we selected the maximum 5 values of the amplitude with their position and kept them in coordinate (wavelength, coefficient values, z) where $z\in\{-1,+1\}$. Therefore, we have the amplitude 5 points × 3components × 5 trials × 2 arms are 150 data points. Second, we designed the mathematical model. Defined 80% of the data set is the training set (120 points), 25% of the training set is the validation set (30 points) and 20% of the data set is the test set (30 points). By kNN algorithm, we let $k=7,9,15$ and use the Euclidian distance. By SVM algorithm, we let kernel functions be quadratic function, cubic function, and Gaussian function. The results of this independent study, we found that the study was able to manipulate large data for easier study by using PCA and designed the mathematical models to classify the data as the effect on decision making for left or right arm lifting by using classification by kNN and SVM. The models gave correct arm results in the range of 80-100% of the test set, not more than 20% of the amount of data set. Therefore, all 6 models are not suitable for daily use. This is because the accuracy of the model results is too low.

Invited Speaker MAT1-2

Some Number-Theoretic Products

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For positive integers n and k, let $P_k(n)$ and $P'_k(n)$ be the products of all elements in the finite sets $\{x^k : 1 \leq x \leq n, (x,n) = 1\}$ and $\left\{x^k : 1 \leq x \leq \frac{n}{2}, (x,n) = 1\right\}$, respectively. The formulae for both $P_k(n)$ and $P'_k(n)$ are established. The explicit formulae for $P_k(p^a)$ and $P'_k(p^a)$, where p^a is a prime power, are also verified.

Keywords: Arithmetic functions, Euler-phi function, Möbius function, Möbius inversion formula

The complex pulsating $(a_1, a_2, \ldots, a_m, c)$-Fibonacci sequence

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We introduce complex pulsating Fibonacci sequence of mth order and investigate the closed form of this sequence by the matrix method.

Keywords: Fibonacci sequences, complex pulsating sequences, matrix decomposition

The Frobenius problem with embedding dimension three on the partial order relation

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We denote $\mathbb{N}$ as a set of nonnegative integers and $\langle a,b,c\rangle = \{ax_1 + bx_2 + cx_3 : x_1,x_2,x_2 \in \mathbb{N}\}$ where $a,b,c \in \mathbb{N}$ and $a < b < c$ such that $gcd(a,b,c) = 1$. The genus number of $\langle a,b,c\rangle$ is the cardinality of $\mathbb{N}\backslash\langle a,b,c\rangle$ which is denoted by $g(\langle a,b,c\rangle)$ and denote the largest element of $\mathbb{N}\backslash\langle a,b,c\rangle$ by $F(\langle a,b,c\rangle)$ which is called the Frobenius number of $\langle a,b,c\rangle$. The Frobenius problem is a problem concern with the Frobenius number. In this research we give an upper bound for $F(\langle a,b,c\rangle)$ and $g(\langle a,b,c\rangle)$. Moreover, we give the exact results in some particular cases.

Keywords: Embedding dimension 3, Frobenius number, Genus number, Numerical semigroup

On perfect codes with a pomset metric

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We discovered the perfect code, called r-perfect, on $\mathbb{Z}_m$ under a new metric "Pomset" that was recently published in 2018 by Sudha and Selvaraj and the other work I-perfect, which is a perfect code that was created using another concept. The purpose of this work is to discuss and illustrate the perfect code r-perfect and compare the similarities and differences between I-perfect and r-perfect.

Keywords: Pomset, perfect code, r-perfect, I-perfect

Study on rings whose prime right ideals are totally fully invariant

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Apply learning to time series analysis from human expert to automation using data

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Forecasting the future value from data series is one of the challenging tasks for experts from many decades. Statisticians deals with this problem using the statistical analysis called time series analysis that aims to predict future values using the past information. It involves building a forecasting model based on the statistical method, regression analysis, to capture changes in the data series. The model composes of (1) the autoregressive part and (2) the moving average part which require different coefficients and orders called ARMA(p, q) model (Autoregressive moving average model). An order of this model refers to the number of past terms that include in the model which are currently identified by statisticians visually by the graph of the autocorrelation function (ACF) and the graph of the partial autocorrelation function (PACF) from the data series. This challenging tasks have been attacked by various researches to identify this order reliably using a computer algorithm.

At present, the concept to automate this process is asking a user to select a single criterion and the algorithm will vary each order to find the best fitted coefficient to the particular time series data. This is implmented in R as auto.arima() based on minimizing AIC (Akaike Information Criterion) or AICc (Akaike Information Criterion correction for a small sample size). However, the best model from this library may not be able to capture the essence of stationary of the residual. The new learning method should be used to identify the order with the stationary of the residual.

This talk will cover the forecast motivation and forecasting tasks in the real world environment. It will cover the statistical model, ARIMA (Autoregressive integrated moving average) model and how to construct such as model. The current deep learning model and concept will be covered. Then they will be integrated to automate the process of building time series model. The performance of this methodology will be demonstrated and the future work will be covered at the end of the talk.

Keywords: Time series forecast; Autoregressive moving average model; deep learning model; auto.arima; deep learning ARIMA

Options portfolio selection under mean-variance utility with finite liquidity

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An approach to optimizing a portfolio is proposed to reduce risk. We will focus on the selection of options portfolios that minimize various disutilities and investigate asset allocation problems which can be seen as optimization problems of an investor's risk. In this work, the mean-variance utility is used as a risk measure.

Keywords: financial mathematics, mean-variance utility, portfolio optimization, variance gamma model

Mathematical Models of Cancer Progression and Metastasis including Eliminating Cancer Stem Cell Treatment

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Throughout the last decades, cancer proliferation based on the cancer stem cell hypothesis has been taken into account that cancer stem cells relate to cancer treatment problems, both metastasis and cancer relapse in many cases. In this work, the study focuses on initial and metastatic cancer progression before and after treatment using several drugs by formulating the problems as a mathematical model. We also perform the stability analysis to determine the tumor-free equilibriums and stable conditions for tumor eradication. Moreover, the treatment simulations indicate that the treatment with a high dose of chemotherapy is ineffective since it negatively affects the immune system. However, using a combination of 5-Fluorouracil and small-molecule ferroptotic agents is more effective against cancer cells and cancer relapse.

Keywords: cancer stem cells, cancer treatment, mathematical model, metastasis

Asymptotic Properties of Discrete Minimal $s, \log^t$-Energy Constants and Configurations

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Combining the ideas of Riesz s-energy and log-energy, we introduce the so-called $s, \log^t$-energy. In this research project, we investigate the asymptotic behaviors of minimal N-point $s, \log^t$-energy constants and configurations of an infinite compact metric space of diameter less than 1 when the variables N, t are fixed but the variable s is varied. In particular, we study certain continuity and differentiability properties of minimal N-point $s, \log^t$-energy constants with respect variable s and we show that in the limits as $s \to \infty$ and as $s \to s_0 > 0$, minimal N-point $s, \log^t$-energy configurations tend to an N-point best-packing configuration and a minimal N-point $s_0, \log^t$-energy configuration, respectively. Furthermore, the optimality of N distinct equally spaced points on circles in $\mathbb{R}^2$ for some certain $s, \log^t$-energy problems was proved.

Keywords: best-packing, discrete minimal energy, logarithmic energy, Riesz energy

Upper bounds of the modulus of the derivative of polynomials

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In this research, we investigate upper bounds modulus for the derivative of polynomials of degree n ($p(z)$) in three classes as follows:
1. $p(z)$ has no zero in $D(0,k), k>0$;
2. $p(z)=a_0+\sum_{i=\mu}^{n}a_iz^i, 1\leq\mu\leq n, a_\mu\neq 0$, has no zero in $D(0,k), k\geq 1$;
3. $p(z)=(z-z_0)^s\left(a_0+\sum_{i=\mu}^{n-s}a_iz^i\right), 0\leq s\leq n-1, 1\leq\mu\leq n-s,\ a_\mu\neq 0$, where a polynomial $a_0+\sum_{i=\mu}^{n-s}a_iz^i$ has no zero in $D(0,k), k>0$.

Keywords: derivative, polynomial, inequality, upper bound

Value-Distribution of Zeta-Functions

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We prove a formula for the sum of the values of the periodic zeta-function at the nontrivial zeros of the Riemann zeta-function. This extends previous results due to Garunkštis, Kalpokas, and recently, Sowa. Whereas Sowa's approach was assuming the Riemann hypothesis, our result holds unconditionally.

Keywords: nontrivial zeros, Riemann hypothesis, Riemann-von Mangold formula, zeta-functions

Mathematical Modelling of E. coli in Humans: A Case Study on the Effect of Antibiotics and Immune Response

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In this paper, the mathematical model of E. coli with considering antibiotics and the immune response is proposed. Then, the steady-state of the model is evaluated. The stability analysis and numerical results are presented. The obtained results indicate that the immune response can control the growth of E. coli and the administration of antibiotics can eliminate bacteria in the body.

Keywords: mathematical model, antibiotics, immune response, equilibrium point, stability, Routh–Hurwitz Criteria

Invited Speaker MAT3-2

The Operator Splitting Method for Approximating the Advection-Diffusion Equation: On Applications with PM2.5 Data

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Hierarchical Visual Cryptography for Multi Secret Color Images

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Visual cryptography is a process that changes visual data, aka secret image, to secret data. The secret data can be decoded visually without any cryptographic computation.

In this study, we extend Naor and Shamir's secret sharing schemes from single secret image to multi secret images, and from black and white schemes to color schemes. In the original (n,k)-secret sharing schemes, n shares of secret data are distributed to n secret bearers. To recover the secret image, at least k shares from k secret bearers are required. In our multi secret scheme, three secret images are transformed into three shares. Each pair of shares can recover different secret images. In our color schemes, we repeat black and white schemes on CMY color space. Moreover, we add hierarchy to subsets of secret bearers. Certain qualified subsets of secret bearers can visually recover the secret, but other forbidden sets of secret bearers can retrieve no information on the secret.

Keywords: visual cryptography, multi secret, secret sharing, secret images, color schemes

A study on insertion of parentheses into series

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In this research, we study the insertion of parentheses into a conditionally convergent series to get an absolutely convergent series by considering a monotone subsequence of the sequence of the partial sums of $\sum_0^\infty a_n$. Additionally this result extends to any convergent series and a power series with an interval of convergence of the form $[a,b)$ or $(a,b]$.

Keywords: Insertion of parentheses, real series, power series

Algorithm for Examination Proctor Assignment

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Proctor Assignment for Examination Scheduling is a difficult and complex problem to solve. Manual assignment by human often mistakes and requires a lot of time and effort, due to a large number of constraints. This project aims to study and solve this problem by developing an algorithm using genetic algorithm approach. Our constraints and data are based on the mid-term examination of the 2nd semester, academic year 2019 of Faculty Science, Silpakorn University. The hard constraints require that each proctor is not assigned two overlapping supervisions. The soft constraints concern with proctors' satisfaction and quality of the scheduling. The testing results indicate our algorithm can increase proctors' satisfaction and requires little time when compare with manual assignment by human. Moreover, the algorithm can completely get rid of the double assignment mistake and reduce human errors.

Keywords: Examination Scheduling; Timetabling, Genetic Algorithms; Meta-heuristics

Snakes and Ladders with Large Spinners under an Alternative Winning Rule

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Snakes and Ladders is a game that players have to move their game pieces from square to square to reach the last one. On each turn, they have to spin a spinner that moves them between 1 and r squares with equal probability, where r is the range of the spinner. If the number gotten by the spinner is more than the number of the remaining squares, that player cannot walk in that turn. Besides, under an alternative winning rule in Thailand, a player goes forward until reaching the last square and then moves backward with the remaining number. We focus on the expected number of turns until a game piece starting at the beginning (square 0) lands exactly on square n when using the large-range spinners on n-square board. This study considers the boards in 3 cases: a board with no snakes or ladders, a board with snakes and ladders but none of the ladders leads to the last square, and a board with a single ladder to the last square. In the first two cases, we found that both using a spinner of range n and $n-1$ give the same expected number. However, it is not the case for a spinner of range $n-2$ whose expected number is less than n, whenever there are no snakes sending a player back to square 1. For the last case, we provide an approach to calculate the expected numbers of using a spinner of range n and $n-1$ using theorems in linear algebra and Markov process.

Keywords: board game, expected number, probability, snakes and ladders

Research in Chemistry: Research Inspiration toward High Citation with Reputed Journals

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The internet has changed the world, and it has changed the way of daily life style of human. For example, nowadays people read news from the internet using mobile phone and notebook, not from a printed newspaper. Scientists read articles and books by accessing these academic resources through a "Virtual Library" *via* the internet. Statistics have been used for the measurement of metrics of individual research article, for example, number of article access and read, download, and citation, which leads to "journal metrics" or journal ranking (by journal impact factor and quartile) and measurement for achievement of individual scientists (by *h*-index and number of citation). This lecture covers journal metrics and research inspiration toward high citation, as well as a research strategy for publication in good journals.

Keywords: Research in chemistry; Journal impact factor; Database; Journal metrics

The influence of tannic acid on properties of bagasse ash filled acrylonitrile butadiene rubber composites

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Biodegradable rubbish bags from Biocomposite film based on Polybutylene succinate with Basil Powder

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The use of petroleum-based plastic causes damage to the environment and the plastic takes a long time to degrade. Thus, the existence of biodegradable plastic may serve as a promising solution to this problem. This research was aimed to study the feasibility to improve the properties of Polybutylene succinate (PBS) by mixing with basil leaves powder (BSP; 5 10 and 15 %wt); BSP was used to be the filler. This biocomposite film was prepared by using the twin-screw extruder and blow film extruder. The physical, thermal, chemical, mechanical properties and aging test were characterized. From the results, the greater BSP increased the ability to protect the UV transmission and give the lower value of L* (lightness) color parameter and higher value of a* (redness), b* (yellowness) color parameter, and also for ΔE. In terms of tensile properties of PBS/BSP film, the tensile strength, elongation and modulus at yield decreased when %BSP increased, it causes the difficulty of PBS chain rearrangement. Additionally, the BSP promotes the modulus at yield of transverse direction (TD) orientation of PBS/BSP film. For the aging test for 3 months, it illustrates that the tensile property was slightly reduced. From the preparation of the PBS/BSP film, it concludes that BSP could be introduced to PBS and this film is biodegradable and capable of using for rubbish bag application.

Keywords: Basil Powder, Biocomposite film, Biodegradable, Polybutylene succinate

Synthesis of magnetic carbon materials from water hyacinth (*Eichhornia crassipes*) and their adsorption study of methylene blue

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Conversion of para rubber wood ash and iron rust into value-added heterogeneous Fenton catalyst with magnetic properties and their use for removal of organic pollutants in water

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Facile Synthesis of Magnetic Porous Carbon Catalysts *via* Soft-Template Self-Assembly for Application in Conversion of Xylose into Furfural

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Furfural is the famous value-added chemical derived from biomass. It has replaced crude-oil base-organics for production of furan-based chemicals and solvents to be used in plastics, pharmaceutical and agrochemical industries. Various acidic catalysts have been employed for the conversion of xylose into furfural. However, the preparation of these types of catalysts is complicated by multi-step to prepare porous material. Furthermore, the fine powder catalysts are usually lost during the catalytic-recycle process. In this work, magnetic porous carbon materials (Fe/MC) were successfully prepared *via* facile self-assembly in a single step, followed by hydrothermal sulfonation of Fe/MC with H_2SO_4 to obtain sulphonated porous carbon catalyst (SO_3H@Fe/MC) with magnetic properties. The SO_3H@Fe/MC was characterized by various techniques to confirm the catalytic performance in conversion of xylose into furfural. The catalyst gave a high conversion and an acceptable furfural yield and selectivity when performed at 170 °C for 1 h with γ-valerolactone (GVL) as a solvent. Also, the catalyst was easily separated using a magnet after 5th run, confirming sufficient magnetic stability.

Keywords: Furfural, Magnetic, Porous carbon catalyst, Xylose

Development of polymeric hydrogels as bio-glue

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Surgical sutures and staples are usually used to close wounds and improve wound healing process in our body. Nevertheless, they are still invasive and may cause additional damage to the tissues. Especially, they cannot prevent body fluid or air leakage and are not suitable for procedures in a limited surgical site. Tissue adhesive or so-called "bio-glue" becomes an interesting alternative as it enables wound healing via the adhesion among tissues as well as between tissues to non-tissue surfaces. Here in this research, two polymeric hydrogel systems were developed to be used as bio-glue. The first system was based on a synthetic polyphosphoester, which was synthesized from two monomers, namely 2-isopropoxy-1,3,2-dioxaphospholane-2-oxide (IPP) and protected *N*-tyrosine-m-ester phospholane amidate (P-TMP) followed by deprotection. It was anticipated that the resulting random copolymer of poly(TMP-*r*-IPP) would undergo tyrosine crosslinking upon visible light irradiation in the presence of $[RuII(bpy)_3]^{2+}$ and sodium persulfate (SPS) to form soft gel that can be applied as bio-glue. The second system was based on naturally derived polysaccharides. Tyrosine-modified alginate (OAT) and quaternized chitosan (QC) were first prepared by chemical modification of alginate and chitosan, respectively. OAT and QC were expected to form a double network hydrogel. Primary crosslinking of imine bonds took place between aldehyde groups in OAT and amino groups in QC while the secondary crosslinking was formed via visible light-induced gelation of tyrosine units in the OAT. Preliminary investigation suggested that OAT with 16.8% substituted tyrosine can dissolve at physiological pH with up to 2%w/v and can form gel within 30 s.

Keywords: Polyphosphoesters, Polysaccharides, Tissue adhesives, Visible light, Gelation.

Invited Speaker CHEM2-1

Molecular docking study of newly designed drug binding to cancer-causing Hsp90 protein

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Cancer is currently a major public health concern and increasingly likely worldwide. Previous studies have shown that heat shock protein (Hsp90) is the most common cause of cancer, making Hsp90 as a molecular target for the development of Hsp90 cancer drugs. Geldanamycin (GDM), a benzoquinone ansamycin compound, is a prototype for the development of an anticancer drug that inhibits the activity of the Hsp90. Herein, novel geldanamycin derivatives, **N1-N6** were designed as potential Hsp90 cancer drug by targeting signal transduction pathway, especially against oncogenic client protein. The binding of **N1-N6** in the cavity of Hsp90 were investigated by molecular docking using the iGEMDOCK v2.1 software. The results illustrated that **N1-N6** bound in the binding site of Hsp90 with similar manner to geldanamycin. The binding energies of **N1-N6** in Hsp90 (-137.49 to -131.22 kcal/mol) were comparable to that of geldanamycin (-133.06 kcal/mol). **N1-N6** interacted well by hydrogen bonding with key amino acids including Lys112 and Phe138 in the binding site of Hsp90. Additionally, **N1-N6** formed hydrogen bonding with other amino acids including Asp54 and Asp93, which could inhibit the cancer cell growth. Therefore, **N1-N6** could be promising molecules for anti-cancer drug against Hsp90 in the future.

Keywords: Heat shock protein (Hsp90), geldanamycin analogue, molecular docking, cancer, drug target

Effect of anti-human CD63 monoclonal antibody COS3A on costimulatory molecules expression and monocyte-T cell interaction during CD3-mediated T cell activation

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CD63, is a member of the tetraspanin family proteins which is ubiquitously expressed by all leukocytes and is exerted in several cellular processes. It is weakly expressed on T lymphocytes, but up regulated during T cell activation, indicating the involvement in T cell response. Previous study reported that an anti-human CD63 monoclonal antibody (mAb) COS3A suppresses CD3-mediated T cell activation by alteration of the cytokines production, while using peripheral blood mononuclear (PBMCs) as a study model. However, depletion of monocyte improved cell proliferation to 50% and the inhibitory effect was vanished while purified T cells were used as model, suggesting that monocytes play a critical role in T cell suppression by the mAb COS3A. This study aims to investigate effects of the mAb COS3A on T cell activation by focusing on the expression of costimulatory molecules on monocytes during T cell activation. Moreover, its effect on cell-cell interaction between monocytes and T cell during T cell activation will be analyzed. The initial results confirmed that mAb COS3A could inhibit CD3-mediated T cell proliferation in PBMCs as previous report. Analysis of costimulatory molecules and monocytes-T cells interaction is under investigation.

Keywords: CD63 molecule, CD3-mediated T cell activation, Cell proliferation, Monoclonal antibody

Bioactive glass/cellulose composite as a potential scaffold for bone engineering

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Bioactive glass (BG) is one of biomaterials that is used as a scaffold for the regeneration of defective bone due to its high porosity and ability to promote hydroxyapatite layer on its surface when contacting with simulated body fluid (SBF). In this research, BG prepared via sol-gel method was combined with cellulose hydrogel (CH) to yield a bioactive glass/cellulose composite (BG_CH). The CH is a highly porous polymer which is suitable for improving mechanical properties and promoting cell proliferation of the bioactive glass. The wet gel (BG sol) was prepared by mixing deionized water, HCl, EtOH, TEOS, TEP and $CaCl_2$. Then it was slowly added to the CH (prepared by dissolving cellulose in DMA/LiCl) and stirred to obtain homogenous BG_CH sol. 4 g of the sol was poured into a cylindrical container and keep at room temperature for 14 days to get bioactive glass/cellulose hydrogel in shape of cylindrical (BG_CH_cy). These samples were characterized by FTIR, SEM-EDS and TGA. For bioactivity test, these samples were kept in simulated body fluid (SBF) at 37.5 ± 0.5 °C for various periods: 8, 16 and 24 days. The Ca^{2+} concentrations in collected SBF solutions were analyzed by Atomic Absorption Spectroscopy. Apart from Ca^{2+} concentrations, PO_4^{3-} concentrations were determined using UV-VIS spectroscopy. The FTIR and SEM-EDS results evidenced the appearance of hydroxyapatite layer on the surface of BG_CH_cy. All samples showed the maximum Ca^{2+} released concentration after being kept for 2 day in SBF solution. In addition, the maximum PO_4^{3-} adsorption onto the BG surface was found at the same period of time.

Keywords: Bioactive glass, Cellulose hydrogel, Bone engineering, Hydroxyapatite

Research Abstract
DPST student conference on Science and Technology 2021
(DPSTcon2021)

Synthesis of Profluorescent Nitroxides for Detection of Glucose and Vitamins A and E

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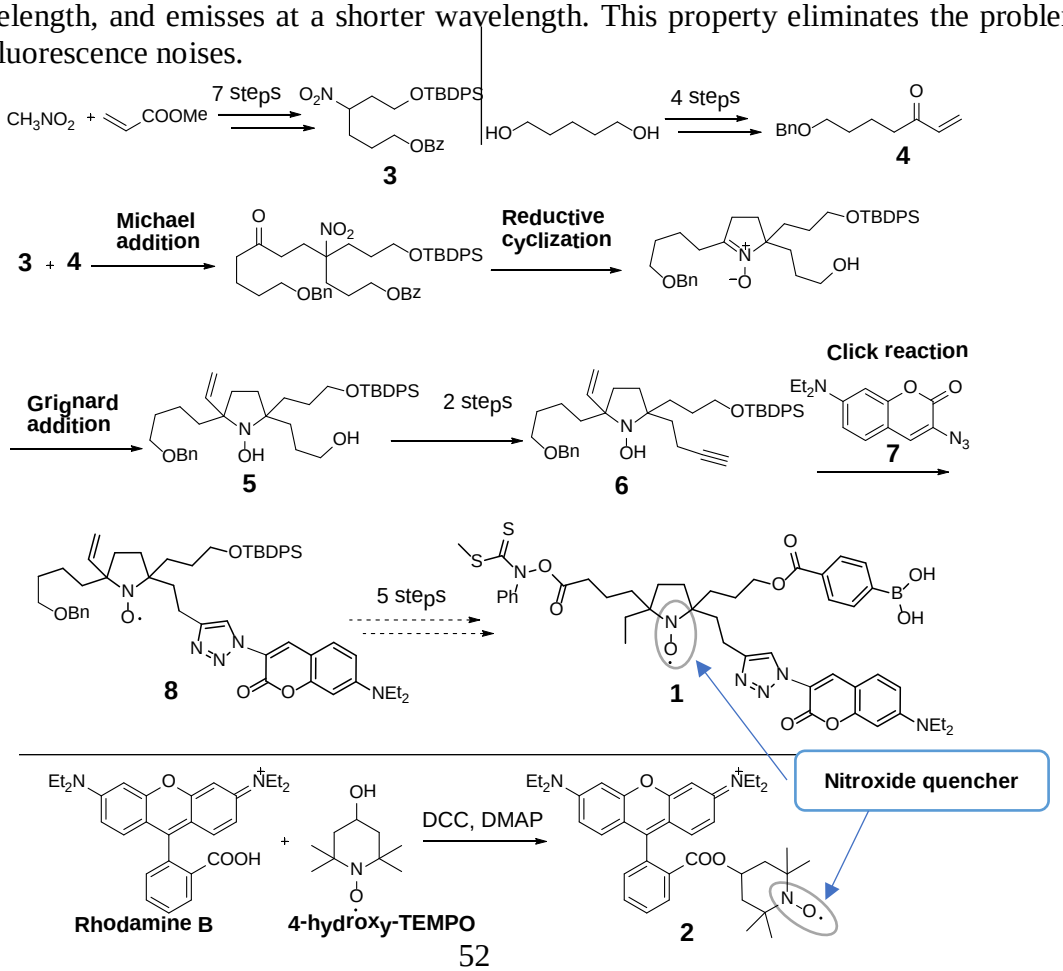
Profluorescent nitroxides can be applied for detection of various analytes. Detection mechanism is that nitroxide, a free radical, is a quencher inhibiting fluorescence emission through spin exchange. After being reduced or trapped with carbon radical to form hydroxylamine or alkoxylamine, quenching is not allowed, and the fluorescence emission is consequently restored. Two profluorescent nitroxides were being synthesized in this research. Profluorescent nitroxide **1** will be utilized for detection of glucose. Synthesis of **1** would be accomplished from key intermediates **3** and **4**. Intermediate **3** was synthesized by using nitromethane and methyl acrylate as starting materials through 7 steps, and intermediate **4** was synthesized from 1,5-pentadiol in 4 steps. Combination of nitro compound **3** and α,β-unsaturated ketone **4** through Michael addition, reductive cyclization and Grignard addition as main reactions yielded hydroxylamine **5**. After that, alcohol group of compound **5** was converted to terminal alkyne, followed by coupling with compound **7** *via* Click reaction to afford compound **8**. Compound **8** would be further reacted in 5 more steps to complete the synthesis of **1**. Next, profluorescent nitroxide **2** will be utilized for detection of vitamins A and E in palm oil. It was formed by Steglich esterification reaction between Rhodamine B and 4-hydroxy-TEMPO. Rhodamine B is anti-stoke dye that absorbs photons at a longer wavelength, and emisses at a shorter wavelength. This property eliminates the problems from auto-fluorescence noises.



The Effect of Metal-Organic Framework HKUST-1 in the Synthesis of Diarylacetylenes via Sonogashira Coupling Reaction with Calcium Carbide as an Acetylene Source

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Sonogashira coupling reaction allows carbon-carbon bond formation between a terminal alkyne and an aryl or vinyl halide using a palladium catalyst and copper co-catalyst. Besides, acetylene gas resulting from a reaction between calcium carbide and water can also be used, along with an aryl iodide, to generate symmetrical diarylacetylenes, which are prevalent intermediates in the pharmaceutical industry. In this study, five para-substituted iodobenzenes were utilized as reactants in the Sonogashira reaction with calcium carbide as an acetylene source to yield symmetrical diarylacetylenes in 19-87% yields. In addition, the effect of the metal-organic framework HKUST-1 on the Sonogashira coupling reaction was investigated. HKUST-1 was selected as an additive for this reaction due to its ability to adsorb acetylene gas. However, the Sonogashira coupling reaction between methyl 4-iodobenzoate and calcium carbide in the presence of HKUST-1 did not result in yield improvement. Therefore, further optimization is needed to apply HKUST-1 as an additive in synthesizing diarylacetylenes via the Sonogashira coupling reaction.

Keywords: Sonogashira coupling reaction, calcium carbide, diarylacetylene, MOF, HKUST-1

Synthesis and biological activities of tetrahydro-β-carboline-2,5-diketopiperazine derivative

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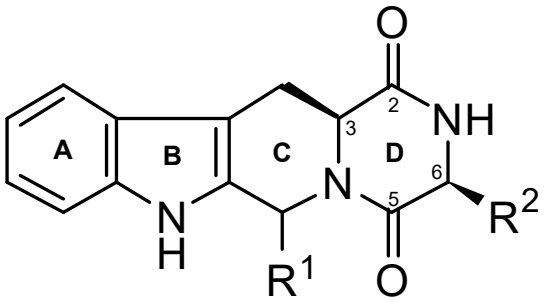
Cancer is the leading cause of death worldwide, with over 19 million people suffering from cancer and 10 million deaths from cancer in 2020. Currently, a wide variety of anticancer drugs was used in the treatment. From previous studies, 2,5-diketopiperazine moieties from natural sources or synthesized compounds were reported to inhibit the growth of the cancer cell lines. 2,5-Diketopiperazine is a cyclic dipeptide that consists of a six-membered ring containing two amide linkages where the two nitrogen atoms and the two carbonyls are at opposite positions in the ring. In this research, the tetrahydro-*β*-carboline-2,5-diketopiperazine derivatives were synthesized starting from synthesis of tetrahydro-*β*-carboline via Pictet-spengler with various types of aldehydes in acidic condition, then the 2,5-diketopiperazine moiety was synthesized via peptide coupling and intramolecular ester amidation with leucine to obtain the 2,5-diketopiperazine ring fused with tetrahydro-*β*-carboline as required.



General structure of tetrahydro-*β*-carboline-2,5-diketopiperazine

Design and Synthesis of 1,2,3-Triazole-Containing Letrozole Analogues as Aromatase Inhibitors for Breast Cancer Treatment

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The development of nanoparticles for medical diagnosis

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Accurate and early diagnosis using a simple and less time-consuming method is a key factor to improve treatment efficiency and reduce patient mortality. Nowadays, nanotechnology plays an important role in the development of biosensors for medical diagnosis. Specifically, the use of nanoparticles for signal production or amplification provides highly sensitive and specific target detection resulting in effective early diagnosis and accurate follow-up process. The focus of this research is to design, synthesize, and modify nanoparticle surfaces with biomolecules such as DNA probes, aptamers, or antibodies. The resulting particles is subsequently used in the development of biosensors for biomarkers analysis using two techniques: surface-enhanced Raman scattering (SERS) and fluorescence. These techniques are very sensitive and applicable for multiple target analysis which can be applied for diagnosis and screening of cancer– a disease with high fatality rates. In addition, the knowledge from this research has been expanded to develop a test kit for infectious disease screening, specifically influenza – a widespread disease that causes of death in Thailand every year.

Keywords: nanoparticle, biosensor, cancer, influenza, surface enhanced Raman scattering (SERS)

Multiwalled Carbon Nanotube@N-doped Reduced Graphene Oxide Nanoribbon toward Catalysis of Oxygen Reduction for Proton Exchange Membrane Fuel Cells

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Multiwalled carbon nanotube@N-doped reduced graphene nanoribbon (N-doped MWCNT@rGNR) has been facilely prepared via high temperature pyrolysis of multiwalled carbon nanotube@graphene oxide nanoribbon (MWCNT@GONR)/dicyandiamide (DCDA) composite. Here, the MWCNT@GONR with excellent surface integration was prepared by longitudinally unzipping the multi-walled carbon nanotubes. With a high length-to-width ratio (~17), the MWCNT@rGNR sheets are prone to form a conductive network by connecting end-to-end to facilitate the transfer of electrons. DCDA acting as a N resource was deposited on the surface of MWCNT@GONRs via grinding by ball milling, resulting in the formation of N-doped MWCNT@rGNR after being pyrolyzed. Electrochemical characterizations reveal that the obtained N-doped MWCNT@rGNR has excellent catalytic activity toward an oxygen reduction reaction (ORR) in an alkaline electrolyte. This superior property makes the N-doped MWCNT@rGNR a promising kind of cathode catalyst for alkaline fuel cell applications.

Keywords: *Multiwalled carbon nanotube; N-doped reduced graphene nanoribbon; Dicyandiamide; Oxygen reduction*

Theoretical Study of Fluorescence Quenching of unsaturated *meso*-BODIPY Dyes with Nitrogen-containing Substituents

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Meso-vinyl-1,3,5,7-tetramethyl BODIPY (VB) was previously found to rearrange its ring conformation leading to quenching of the fused BODIPY core at excited state, resulting in non-radiative deactivation. Nitrogen-containing substituents including nitro-, amino-, and azido- were introduced to *meso*-vinyl position and were represented by NiVB, AmVB, and AzVB, respectively. The substituents on *meso*-vinyl position of VB greatly changed its photophysical properties. In this works, the photochemical changes of VB derivatives affected by Nitrogen-containing substituents and the possibility of potential energy surfaces (PESs) crossing between ground (S_0) and excited states (S_1) to rationalize fluorescence quenching will be investigated using a hybrid density functional theory (DFT) and time-dependent DFT at B3LYP with TZVP basis set. The results showed that the energy gaps of PESs were well-correlated to planarity. The crossing probability of NiVB, AmVB, and AzVB were 0, 88, 100 percent, respectively. The geometries of AmVB, and AzVB exhibited the bending of fused BODIPY core along the closer gaps of S_0 and S_1 states. Thus, amino- and azido-substituents implied likeliness of quenching of BODIPY core. On the contrary, the NiVB, PESs exhibited high stability upon photoexcitation over 500 fs. The geometry of NiVB remained planar. This led to a prospect that VB should remain fluorescent when nitro-substituents were introduced. This suggested that adding electron withdrawing group at *meso*-vinyl position is an alternative way to prevent non-fluorescent decay of VB. The findings from this work could be useful in the design of hydrogen sulfide sensing probes.

Keywords: Computational Study, Dynamic and Static calculation, Fluorescence Quenching, *meso*-vinyl BODIPY

Nitrate Removal from Aqueous Solutions Using Laminar Graphene-Based Membranes

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Membrane technology can be applied in wide range filtration applications, especially removing contaminants from water. Two-dimensional materials such as graphene oxide (GO) and reduced graphene oxide (rGO) have been widely used to produce laminar membranes for applications in water purifications. This is due to the formation of tortuous nanocapillaries between laminar stacking, exhibiting ion sieving with high water flux. Here, we demonstrate the graphene membranes with an extremely low oxygen content for increasing stability of membrane (i.e., swelling effect) in aqueous solutions, unlike a case of GO/rGO. The membranes can be produced from graphene prepared by liquid-phase exfoliation with laminar stacking formed by pressure assisted self-assembly technique. The thickness of stacked graphene can be prepared from 0.5 µm to 3 µm, depending on the graphene mass loading. The channel height (interplanar spacing) is ~0.34 nm, as determined by X-ray diffraction (XRD) technique. This can reject undesired ionic species and allow water molecules to pass through. The membrane exhibits excellent ion rejection (~95%) and water permeance of 15.4×10^{-3} L m^{-2} h^{-1} bar^{-1}. The mechanism is based on the size exclusion between the charged ions and nanochannel and lower friction between water molecules and graphene channel's wall. Therefore, the laminar stacked graphene membrane could be potential for future applications in water purification processes.

Keywords: graphene, filtration, membrane, nanomaterials

Manipulation and control of fluorescence by metal nanoparticles

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Currently, fluorescent sensing is gaining many interests as a method to detect heavy metal contamination in biological samples. One option to increase the sensitivity of the fluorescent sensing is using plasmonic enhancement of metal nanoparticles (MNPs), upon electromagnetic wave excitation, MNPs undergo a phenomenon known as surface plasmon resonance (SPR), which can non-radiatively transmits their energy to the fluorescent molecules and leads to stronger fluorescent emission. In this work, 3 types of nanoparticles with different SPRs were synthesized to study their effect on the fluorescent emission of rhodamine B. It was found that the nanoparticles with surface plasmon resonance that overlapped with the excitation wavelength of rhodamine B could increase the intensity of the fluorescence. However, quenching of the fluorescence was observed when the concentration of MNPs was too high.

Keywords: Surface plasmon resonance (SPR), Nanoparticles, Fluorescence molecules.

Multiscale molecular simulation for structures and properties of amorphous poly(ethylene imine) and poly(ethylene oxide)

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Recent development of multiscale simulation of amorphous polymeric materials at the bulk density was applied to poly(ethylene oxide), PEO, and poly(ethylene imine), PEI, for comparison in their structures and properties. Both polymers can be represented as (CH_3–[CH_2–CH_2–X]$_n$$CH_3$) where X = O and NH for PEO and PEI, respectively. The multiscale simulation starts from two different approaches. The first approach was based on the refinement of the Rotational Isomeric State (RIS) model derived from *ab initio* quantum chemistry calculation (MP2/D95** for PEO and HF/6-31G(d), MP2/6-311++G(3df,3pd) for PEI) by neglect the third-order interaction and the reduction of the original 9 x 9 to 3x3 statistical weight matrices. The other approach was to construct the numeric form of 3x3 statistical weight matrices directly from the conformational energy map based on molecular mechanic calculation of representative segments of polymer. Both polymers were then coarse-grained by grouping two backbone units (CH_2-CH_2, CH_2-X and X-CH_2) to one bead and mapped onto the second nearest neighbor diamond (*2nnd*) lattice. The average nonbonded interactions were treated by the discretized Lennard-Jones (LJ) potential. Large amorphous PEO and PEI bulks was generated and equilibrated using Monte Carlo algorithm. The on-lattice properties agree well with the analytical theory. Fully atomistic amorphous PEO and PEI models can be obtained by the reverse mapping procedure to recover the missing atoms. After energy minimization and molecular dynamic simulation, structures and properties including torsional angle distribution, solubility parameter and atomic pair correlation function and scattering structure factor were compared with experiment.

Keywords: molecular dynamic, multiscale, poly(ethylene imine), poly(ethylene oxide)

Development of a multiscale molecular simulation to study molecular and material properties of amorphous poly(propylene oxide)

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A method to generate the amorphous structures of polymer electrolytes was developed for amorphous poly(propylene oxide), PPO, with structure of $CH_3O–[CH_2–CH(CH_3)–O]nCH_3$ at the bulk density. The method starts from the refinement of the rotational isomeric state (RIS) model of PPO determined from both *ab initio* quantum chemical calculation results from literature and molecular mechanical calculations of the representative segments. Multiple PPO chains were then mapped onto the coarse-grained model on the second nearest neighbor diamond (2nnd) lattice. The average non-bonded interactions were treated by the discretized Lennard-Jones (LJ) potential with the parameters (σ and ε) averaged from the $CH_2=CH(CH_3)$ and CH_3OCH_3 units. Bulk amorphous PPO structure was generated and equilibrated using Monte Carlo algorithm in the lattice space. Fully atomistic amorphous PPO structures was then obtained by the reverse mapping procedure, followed by energy minimization and a short run (< 1 ns) of molecular dynamics simulation. Some molecular and material properties, including torsional angle distribution, solubility parameter, atomic pair correlation function, and scattering structure factor, were determined and compared with experimental data.

Keywords: Multiscale Simulation, Monte Carlo simulation, Rotational Isomeric State (RIS) model, Poly(propylene oxide)

Electrochemistry of Graphene: from Fundamental to Applications

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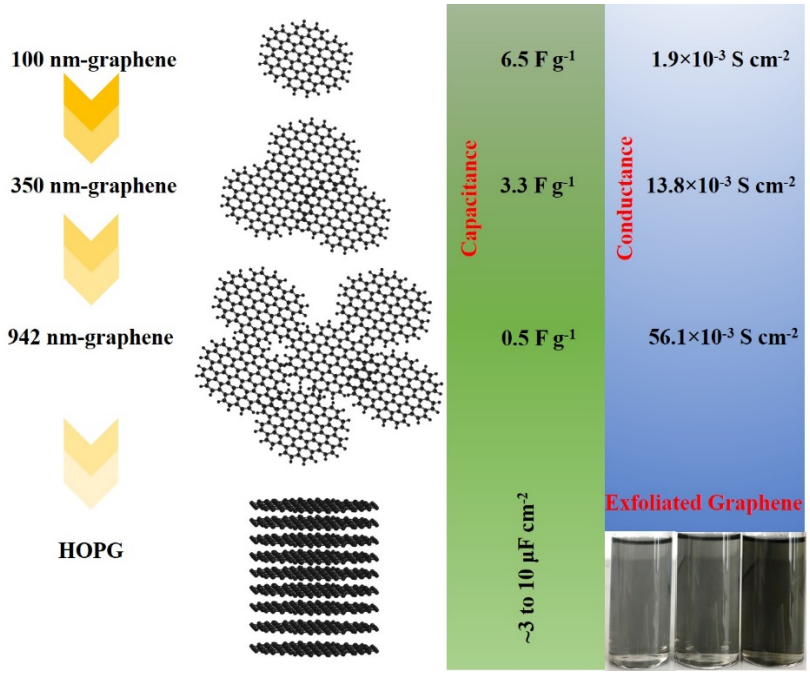
Recently, graphene-based materials have become ubiquitous in electrochemical devices including electrochemical sensors, electrocatalysts, capacitive and membrane desalination and energy storage devices. However, many of the electrochemical properties of graphene (particularly the capacitance and ionic transport) are not yet fully understood. This work explores the capacitance and ionic transport properties of size dependent graphene (from 100 nm to 1 μm) prepared through the liquid phase exfoliation of graphite in which the size of graphene was finely selected using a multi-step centrifugation technique. Our experiment was then expanded to include basal plane graphene using highly ordered pyrolytic graphite as a model electrode, describing the assumed theoretical graphene capacitance (quoted as 550 F g^{-1} or 21 μF cm^{-2}) and the electrochemical surface area of the carbon-based materials. This work improves our understanding of graphene electrochemistry (capacitance and ion transport), which should lead to the continuing development of many high-performance electrochemical devices, especially supercapacitors, capacitive desalination and ion-based selective membranes.



Keywords: Graphene, Capacitance, Electrochemistry, Ion transport

The Immobilisation of Iridium Complexes for Photoredox Catalysis

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The functionalized tris-cyclometalated iridium(III) complexes [Ir(ppy)2(C^N)] (C^N = N-(4-(pyridin-2-yl)benzyl)butane-1-amine, (Ir N) and [Ir(ppy)2(C^N)] (C^N = 5-(butyl(4-(pyridin-2-yl)benzyl)amino)-5-oxopentanoic acid have been synthesized and characterized by NMR, absorption and emission spectroscopy and mass spectrometric methods. These complexes were studied in terms of their photophysical properties. The complexes exhibit emission peak with a maximum at 520 nm. Furthermore, photoredox catalysis was performed with these complexes. Two different photoredox catalyzed reactions were chosen for this study. One of these was arylation of α-amino C-H bonds while another one was the difluoromethylation of phenol with difluorobromoacetic acid. Having successfully synthesized the catalyst complexes Ir M- IrO, we have shown that these synthesized complexes have photophysical properties that are very similar to those of fac-[Ir(ppy)3]. Immobilisation of Ir O to be photoredox catalyst was successful and we proceeded to performing the selected photoredox catalyzed reactions with it. The complexes have shown catalytic activity in the two chosen photoredox reactions. Given the time limitation of this project, the Cat 2. was not further investigated and optimized and will have to be investigated in the future.

Keywords: Aminoalkyl, Iridium, Immobilisation, Photoredox reaction

Structural and magnetic studies of Manganese(III) Schiff base complexes

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Single-ion magnets (SIMs) are molecular nanomagnets that exhibit slow relaxation of their magnetization permitting molecular switching. These can be applied in high-density information storage, molecular spintronics, and quantum computation devices. The magnetic properties of SIMs depend on their structures. The Jahn-Teller effect involves geometric distortion of the metal centre to lower its energy and thereby impacting the electronic structure. To explore the impact of the R group on Schiff base ligand (salRen-Br) and anions on the electronic structures and the magnetic properties a series of Mn(III) complexes, $[Mn(salBzen\text{-}Br)_2]Y$ (salBzen-Br = 2-{[2-(benzylamino)ethylimino]methyl}-4-Br-phenol; Y = BF_4^- **1** and ClO_4^- **2**) and $[Mn(salEen\text{-}Br)_2]Y$ (salEen-Br = 2-{[2-(ethylamino)ethylimino]methyl}-4-Br-phenol; Y = BF_4^- **3** and ClO_4^- **4**), have been studies. X-ray structures of **1-4** show an octahedral geometry with two N_2O Schiff base ligands (salRen-Br). The complexes mostly crystallize in monoclinic $P2_1/c$. Uniquely, **3** is found in monoclinic $P2_1/n$ at 100 K with the unit cell trebling in size. Remarkably, at room temperature the Jahn-Teller axis is poorly defined but becomes clear at low temperature, indicative of dynamic Jahn-Teller distortion and thus a flexible electronic structure. The magnetic results reveal that **1** and **2** show SIM properties. To the best of our knowledge this is the first such example of dynamic Jahn-Teller distortion in the solid state.

Keywords: Jahn-Teller distortion, manganese(III) Schiff base complexes, single-ion magnets (SIM)

Anion effects on Spin Crossover in Iron(III)-Quinolylsalicylaldiminate complexes

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Fine-tuning Dye Adsorption Capacity of UiO-66 Via Mixed-Ligand Approach

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Synthesis and Characterization of Titanium Complexes Bearing Phenoxy-azo and Phenoxy-imine Ligands and Their Application for the Ring-Opening Polymerization of *rac*–Lactide

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A series of titanium complexes (**1**–**9**) based on bis(phenoxy-azo) (**L_1H**–**L_7H**) and bis(phenoxy-imine) (**L_8H**–**L_9H**) ligands derived from azo coupling and Schiff base reactions were synthesized and characterized using ^{1}H NMR spectroscopy. These complexes were evaluated as initiators in the ring-opening polymerization of *rac*-lactide at 70, 100, and 130 °C. The titanium complexes were prepared via the reaction between two equivalents of the appropriate ligand and one equivalent of Ti(O^iPr)$_4$. The desire complexes were obtained in fair to good yields (48-78%). All *rac*-lactide polymerizations initiated by all complexes at 100 °C were well-controlled and living, affording polylactides with predetermined molecular mass and narrow dispersity. The microstructures of polylactides determined by the homonuclear decoupled ^{1}H NMR spectroscopy technique were atactic in all cases. Kinetic studies revealed the first-order dependency on the monomer concentration. The plots of molecular masses versus polymer conversion were linear, illustrating the living polymerization.

Keywords: Titanium complexes, phenoxy-azo ligand, polylactide, ring-opening polymerization

Metal complexes incorporated triazole macrocycle for anion recognition in aqueous media

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Halogen bonding (XB), a highly directional and attractive intermolecular non-covalent interaction formed between an electrophilic halogen atom and Lewis bases, has emerged as a complement interaction to the ubiquitous hydrogen bonding (HB) for anion recognition and sensing especially in aqueous media. To date, examples of XB hosts capable of anion binding incompetitive aqueous media remain extremely rare. Herein, the design of XB ditopic macrocycles was synthesised via strategic stepwised-macrocyclisation reaction. The target macrocycles contain three-main parts including a) a polyether solubilizing group, b) anion binding motif, and c) metal-bipyridyl ($M(bpy)_2^{2+}$) complexes. Incorporations of an inert d^6-transition metal (M= Ru, Os) complex in the macrocycle can enhance anion binding affinities and add special functions such as optical, fluorescent, and electrochemical anion sensing to such host molecule. Moreover, the scope of this study is also extended to prepare neutral XB macrocycles capable of anion recognition in aqueous media.

Keywords: macrocycle, metal complex, anion

Invited Speaker CHEM1-2

Nanooptosensor based on molecularly imprinted polymer composited with quantum dots for the detection of trace cefoperazone

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An optosensor based on the fluorescence quenching of nanocomposite probe was designed and fabricated for the detection of cefoperazone. The developed sensing probe consisted of cadmium telluride quantum dots (CdTe QDs) incorporated in molecularly imprinted polymer (MIP). The composite CdTe QDs/@MIP nanoprobe was synthesized through a co-polymerization using cefoperazone as a template, 3-aminopropyltriethoxylane (APTES) as a monomer, and tetraethyl oxysilane (TEOS) as a cross linker. The synthesized nanocomposite probe was characterized by scanning electron microscope (SEM) and Fourier transform infrared spectrometer (FT-IR). The developed nanocomposite probe exhibited a rough surface and spherical shape. To achieve the highest sensitivity, the detection condition was optimized. Under the optimum condition, the fluorescence emission intensity of nanocomposite probe decreased with increasing concentration of cefoperazone, and the linearity was achieved in the range of 0.10 to 25.0 μg L^{-1}. The limit of detection (LOD) and the limit for quantification (LOQ) were 0.10 μg L^{-1} and 0.32 μg L^{-1}, respectively. The developed optosensor was utilized to detect cefoperazone in milk samples and the results were in good agreement with high performance liquid chromatography (HPLC) method. The developed nanooptosensor provided a good recovery between 80 and 98% with the relative standard deviation less than 6%. The advantages of this optosensor are simple and rapid detection, high sensitivity and good selectivity.

Keywords: Quantum dots, molecularly imprinted polymer, cefoperazone, fluorescence quenching, optosensor

Development of paper-based analytical device for fluorescence detection of formaldehyde

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Flow-based Technique and Portable Device Utilizing Environmentally-Friendly Orchid Reagent for Determination of Copper

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Anthocyanin, pigment in orchid flowers, has been utilized as a natural reagent in flow-based technique in order to potentially determine copper ion. This method has been investigated by the color of anthocyanin-copper complex that could be measured from both general UV-Vis spectrophotometer and a paired emitter detector diode (PEDD), a laboratory-made optical detection unit. After applying with MS-Visual C# - fully automated sequential injection analysis (SIA-PEDD) for on-line measurement, effect of LED color and physical parameters including zone sequence, volume of reagent, and flow rate to detector, were investigated. At the optimum condition, analytical performance of linear range between 100 to 3000 µM with limit of detection 87.0 µM, 1.13 %RSD and sample throughput of 42 sample.h^{-1} were obtained. Additionally, for on-site analysis, the use of portable photometric device called PiCOEXPLORER with orchid reagent was also studied. Color of LED light was selected. Some features were reported such as, linear range between 5 to 25 mM, limit of detection 4.5 mM and 7.3 %RSD. Finally, the amount of copper in dietary supplement and surface water was determined using the developed methods and the results were compared with standard flame atomic absorption spectroscopy (flame-AAS).

Keywords: Green Chemistry, Orchid, Copper, SIA-PEDD

Research Title

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Preparation of Nisin monoliths for enantioseparation by micro-liquid chromatography

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Enantiomer drugs could show differently bioactivity or pharmacokinetic properties in medical treatment. Due to their similar chemical structure and physical properties, separation of the enantiomer drugs require chromatographic column with active chiral centers. In this work, synthesis of a novel chiral monolithic column from nisin was investigated by derivatizing nisin monomer with glycidyl methacrylate before thermal co-polymerization with ethylene dimethacrylate in presence of porogenic solvents (water, ethylene glycol, acetic acid, and methanol). In order to obtain the monolith with good morphology, type of porogens, monomer composition and ratio of monomer to porogens were optimized. Characterization of the prepared monolith from scanning electron microscopy, and Fourier transform Infrared spectroscopy showed that nisin successfully polymerized to form monolith with good porosity. Enantioseparation by the nisin column using micro-liquid chromatography is under investigation.

Keywords: chiral chromatography, enantioseparation, micro-LC, nisin, organic polymer-based monolith

Prussian Blue modified pencil graphite electrode as a hydrogen peroxide sensor

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A low-cost hydrogen peroxide sensor from a Prussian Blue modified pencil graphite electrode provides a good alternative method for hydrogen peroxide determination. Prussian Blue was electrodeposited by cyclic voltammetry for 16 cycles with an applied potential range of 0 - 0.750 V vs Ag/AgCl reference electrode, in a fresh solution containing 2 mM $K_3[Fe(CN)_6]$, 2 mM $FeCl_3$, 0.1 M HCl and, 0.1 M KCl with a constant stirring rate of 750 rpm (16 cycles). Effects of applied potential range and number of scan cycle for working electrode activation were investigated. The modified electrode displayed electrocatalytic activity towards the reduction of hydrogen peroxide in an acid medium. Chronoamperometric detection of hydrogen peroxide in phosphate buffer pH 6.0 is possible at the operation potential of +0.1 V vs Ag/AgCl. The analytical performances of hydrogen peroxide determination in sample will be reported in terms of linear concentration range, sensitivity, and percentage relative standard deviation.

Keywords: Chronoamperometric detection, Hydrogen peroxide sensor, Pencil graphite electrode, Prussian Blue.

Transition-Matal Catalyzed C-O Bond Activation: Nucleophilic Substitution and Deoxygenation Reactions

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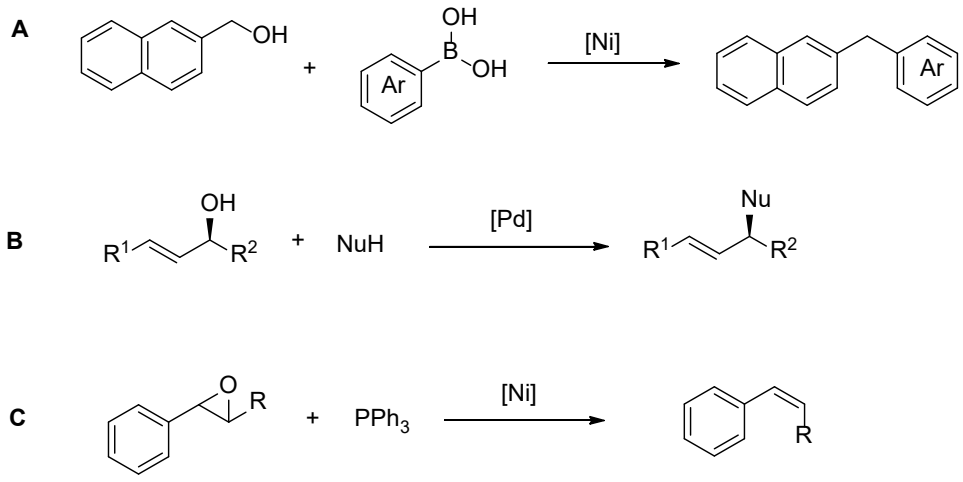
Development of methods for utilizing biomass as renewable energy and chemicals become important research topic due to climate change, deplete of fossil also to valorize agriculture waste. Biomass based carbon are hydroxygenated compounds in which we could use as an oxygenated electrophile in transition-metal catalyzed reactions. In this seminar, we are going to present the C-O bond activation reaction of alcohols and cyclic ethers (epoxides) for nucleophilic substitution reactions and deoxygenation, respectively. The details of our observation and progression in this research area will be presented.



Keywords: green chemistry, catalysis, nucleophilic substitution, deoxygenation

Synthesis of ethyl cinnamate derivatives via Wittig reaction under solvent-free conditions

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Synthesis of ethyl cinnamate and derivatives was performed at room temperature under solvent-free conditions with grinding. Different bases and overall stoichiometries of the starting benzaldehyde and reagents were varied to optimize the reaction conditions. The reaction conditions that lead to high yields of ethyl cinnamate (92%) were benzaldehyde (1 equiv), potassium carbonate (1.5 equiv), and phosphonium chloride salt (1.5 equiv). Subsequently, these conditions were employed as a standard condition to synthesize ethyl cinnamate derivatives and aliphatic aldehydes. It was observed that these conditions led to excellent yields of products containing either electron-withdrawing or electron-donating substituent, indicative of a broad array of functional group tolerance on the aromatic ring. The products were mixtures of *E*- and *Z*-stereoisomers with the *E*-stereoisomers as the major products. However, aliphatic substrates caused a negative effect on the reaction, affording lower product yields compared to those obtained from aldehyde substrates.

Keywords: alkyl cinnamate, green chemistry, grinding technique, Wittig reaction

Synthesis of 2,4-Diiodoquinolines via the Intramolecular Cyclization of *o*-Alkynylisocyanobenzenes

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Quinolines are privileged alkaloids found in a wide range of natural products and biologically active compounds. Given the importance of quinoline-containing molecules in various fields, a number of synthetic strategies were developed to access the quinoline scaffolds. Halogen-containing quinolines are useful synthetic substances for further manipulation through metal-catalyzed cross coupling reactions toward the synthesis of functionalized quinolines. Therefore, in the present work, we investigated a synthetic methodology to access 2,4-diiodoquinolines through an intramolecular cyclization of *o*-alkynylisocyanobenzenes. Primarily, the reaction of *o*-(phenylethynyl)isocyanobenzene to prepare 2,4-diiodo-3-phenylquinoline was chosen as a model reaction for optimization study. At present, the 2,4-diiodo-3-phenylquinoline can be readily prepared in moderate yields.

Keywords: Intramolecular cyclization, Iodine, Isocyanobenzenes, Quinolines

Research Abstract
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Towards the synthesis of a glycoside analogue of 8-*O*-methylfusarubin

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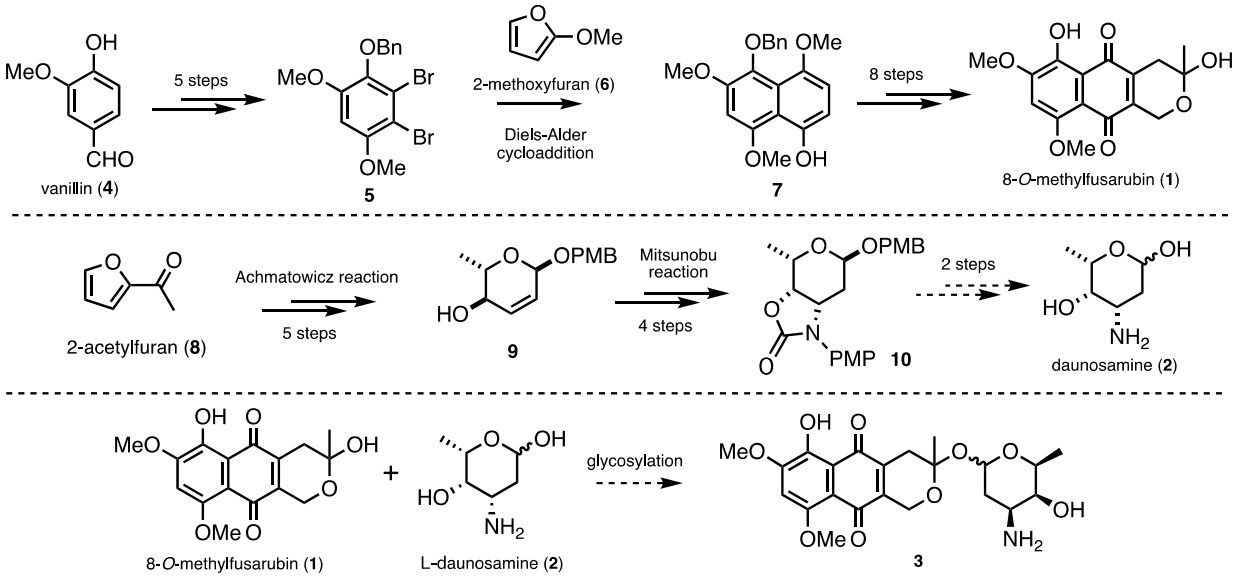
8-*O*-Methylfusarubin (**1**) is a pyranonaphthoguinone natural product which displays excellent cytotoxic activity against MCF-7 breast cancer cells with an IC_{50} value of 1.01 µM with no cytotoxic effect on noncancerous Vero cells. In this work, we are interested in synthesizing the glycoside analogue **3** via glycosylation of **1** and L-daunosamine (**2**) in order to improve the cytotoxic activity against MCF-7 cells. The daunosamine (**2**) is a component of doxorubicin which is a highly effective anticancer drug. The synthesis of **1** was accomplished in 13 steps starting from vanillin (**4**) by Diels–Alder cycloaddition between **5** and 2-methoxyfuran (**6**) as a key step to construct naphthalene core. The synthesis of **2** started with 2-acetylfuran (**8**) by key Achmatowicz reaction to provide the corresponding pyranone, which was subjected to Mitsunobu reaction to obtain oxazolidinone **10** in 9 steps. Oxazolidinone **10** would be used as a precursor for the synthesis of **2**. The glycosylation between **1** and **2** would be performed to provide **3**, which would be evaluated for cytotoxic activity against MCF-7 cells.

Keywords: Achmatowicz reaction, daunosamine, Diels–Alder cycloaddition, 8-*O*-methylfusarubin



The Synthesis of (+)-*cis*-(1*S*,6*S*)-Isopiperitenol from (-)-Isopulegol

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Isopulegol is a type of monoterpene which is contained in cannabis. It has health benefits including: anti-inflammatory effect of gastrointestinal tract and anti-virus. It could indicate that isopulegol may be an important substrate or intermediate for the biosynthesis pathway of tetrahydrocannabinol (THC). This research is interested in using isopulegol as a starting material to synthesize (+)-*cis*-(1*S*,6*S*)-isopiperitenol. The first step is synthesis of Isopulegone which was performed by various oxidizing agents: dess-Martin periodinane (DMP), pyridinium chlorochromate (PCC), 2-iodoxybenzoic acid (IBX), pyridinium chlorochromate (PCC) / silica, 2-iodoxybenzoic acid (IBX) / silica, 2-iodoxybenzoic acid (IBX) / acetic acid, manganese dioxide and oxone. The summary show that dess-Martin periodinane (DMP) can be used as an oxidizing agent in 92.72 %Yield, But the other oxidizing reagents produce mixture products which are (*R*)-(+)-pulegone and *cis*-isopulegone. These mixtures products might be produced by isopulegone rearrangement from electron delocalize in an acid condition. Then synthesis of 2-phenylselenylisopulegone was synthesized by using LDA to substitute phenylselenium at C-2 position. This substitution product was obtained in 18.84 %Yield. Then synthesis of isopiperitenone by using $NaIO_4$ was found that the product could not be examined. The optimal conditions for future synthesis have to be determined.

Keywords: Oxidation of (-)-Isopulegol, Isopulegone, (+)-*cis*-(1*S*,6*S*)-Isopiperitenol

Regioselectivity of the reaction between dimethyl methylmalonate and (alkylidene-pi-allyl)-Pd for synthesis of allenes

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Synthesis and biological activities evaluation of limonene derivatives

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Limonene is classified as a terpenoid belonging to the monoterpene category and can be found on the rind surface in citrus fruits such as oranges and lemons. It is found in the D-limonene form and commonly used as a flavouring agent in the food industries and cosmetic products such as shampoos, lotions, soaps, etc. Limonene has a wide range of biological benefits including antimicrobial, antibacterial and anti-inflammatory activities. In this research, a limonene derivative was prepared. Epoxidation of (+)-limonene was performed to form the limonene oxide followed by epoxide ring opening with various nucleophiles to form the limonene derivatives. These derivatives will be further investigated for their antimicrobial activities.

Keywords: limonene, limonene oxide, limonene derivatives, epoxidation

Plasmonic Nanoparticles for Enhanced Photocatalytic Efficiency

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This presentation focuses on the synthesis and characterizations of noble metal-based nanoparticles for enhanced photocatalytic activity. The first study reports the simple and reproducible synthesis procedure of ultrathin silica-coated hollow gold-silver nanoshells (GS-NS@SiO_2) with controllable silica shell thickness. The LSPR extinction peak of hollow gold-silver nanoshells (GS-NS) are tunable in the range of visible to NIR region (500 – 900 nm). Additionally, gold nanoparticles are also reported to broaden the photo-responsive range of photocatalyst in the specific range of light. Another part of this presentation describes the synthesis of gold-decorated metal alkaline earth titanate (MTO) nanoparticles, barium titanate (BTO) and strontium titanate (STO) nanoparticles with various photo-responsive range. All the as prepared nanoparticles including silica-coated GS-NS, BTO@Au, and STO@Au nanoparticles are considered as promising materials to enhance photocatalytic activity of various photocatalytic reactions.

Keywords: plasmonic nanoparticles, noble metal nanoparticles, photocatalysts

Surface Modification of Silica-coated Magnesium Ferrite Nanoparticles for Adsorption of Congo Red

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Reusable pectin-coated magnetic nanosorbent functionalized with an aptamer for highly selective Hg^{2+} detection

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BODIPY-based boronic Acid: Synthesis, Characterization and Study of Sensing Behaviours

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Pathogenic bacteria can cause infections such as tetanus, typhoid fever, diphtheria, syphilis, and leprosy. They are also the cause of high infant mortality rates in developing countries. Rapid identification of bacterial pathogens would thus inform a more effective, pathogen-directed clinical treatment of the infection. Two key aspects of detections are the ability to correctly detect and identify pathogenic bacteria, which requires consideration of sensitivity, specificity, cost, and detection time, and the ability to identify bacteria directly from clinical samples. State-of-the-art microbiological diagnosis of bacteria relies on phenotyping characterization via cultivation on chromogenic media combined with DNA detection (PCR) or mass spectrometry (MS) approaches. However, all these mentioned approaches require sampling, transport, purification, and/or cultivation. Optical detection with the desired selectivity and sensitivity remains a challenge. In this work, a fluorescent probe BODIPY-based boronic acid was thus designed. The boronic acid functional group is responsible for specific binding to the cell wall of bacteria, and the BODIPY unit should show the change in fluorescence signal upon bacteria recognition. The fluorescent probe was synthesized and characterized. The study of bacteria detection is in progress.

Keywords: Bacteria detection, BODIPY, Fluorescence dye, Fluorescence sensor

Synthesis and Characterization of Silver Nanowires and their Applications in Sprays and the Formation of Thin Films

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Silver nanowires (AgNWs) are one of the well-known nanomaterials because of their outstanding properties of high electrical conductance and can be applied in several applications such as biosensors, optoelectronic devices, and security inks. In this study, we synthesized AgNWs using a polyol method by varying the concentration of sodium bromide (NaBr) to obtain AgNWs with diameters less than 50 nm which can be used as security ink due to their transparent properties. We successfully synthesized AgNWs-0.0Br, AgNWs-0.55Br, AgNWs-1.1Br, AgNWs-2.2Br, and AgNWs-3.3Br. Next, our prepared AgNWs were characterized by UV-VIS spectroscopy revealing the surface plasmon resonance band at 350 and 380 nm. In addition, the morphology of AgNWs was evaluated by Focused Ion Beam-Scanning Electron Microscopy (FIB-SEM) showing average diameters of AgNWs with less than 55 nm. In addition, we selected the sample AgNWs-1.1Br and AgNWs-3.3Br to produce the spray solution and coated on some surfaces. Moreover, AgNWs-1.1Br can be prepared as thin films and were characterized by Attenuated Total Reflection–Fourier Transform Infrared Spectroscopy (ATR-FTIR Spectroscopy). Furthermore, we expect that AgNWs may be used as a potential application in anti-counterfeit technologies and optoelectronic devices.

Keywords: nanomaterials, nanowire, silver, thin film

Clay supported earth-abundant metal phosphide nanoparticles catalyzing sugar conversion to value-added chemicals

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This work aims to transform monosaccharides (i.e., glucose and fructose) to HMF and HMF-reduced products such as BHMF through a one-pot tandem catalysis. Therefore, an acid-catalyzed Cr-exchanged montmorillonite K10 clay (Cr-K10) and a hydrogenate metal phosphide nanoparticles ($Ni_xCo_{2-x}P$) were combined. Metal phosphide nanoparticles were thermally synthesized using Ni(II) and/or Co(II) salt with phosphite salt, in the presence of surfactants. The nanoparticles were later dispersed on to the surface of Cr-K10. The synthesized catalysts were characterized by several spectroscopic techniques to confirm the chemical structure. In addition, effects of different types of ionic liquids including N-methylimidazolium chloride ([HMIM]Cl), 1-butyl-3-methylimidazolium chloride ([BMIM]Cl) and N-methylimidazolium bisulfate ($[HMIM][HSO_4]$) on the catalytic activity were investigated. Due to the time limit, the catalytic performance towards conversion of sugar into HMF was only examined. Results demonstrated that using [HMIM]Cl as medium provided the highest yield of HMF compared to other ionic liquids. Furthermore, over 60% yields of HMF from fructose were obtained in all catalysts (Cr-K10, Ni_2P/Cr-K10 and Ni_2P mixed with Cr-K10) at 120 ºC within 1.5 h, while the HMF yields from glucose were unsatisfyingly achieved. This suggested that the synthesized Ni_2P/Cr-K10, compared with Cr-K10, is found to be a good catalyst and can be potentially applicable for further conversion to other value-added chemicals in the next step.

Keywords: 5-Hydroxymethylfurfural, Ionic liquid, Metal phosphide nanoparticles, Montmorillonite

Effects of pH and Ag cocatalyst on photodegradation property of $BiNbO_4$

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Photocatalysis is an attractive way to solve environmental problems. Bismuth(III) niobate is a stable and good photocatalyst. This study aims to investigate the effects of pH and Ag addition on photodegradation property of BiNbO4. BiNbO4 were prepared with hydrothermal method using different pH of 4, 7, and 10. It was found that the samples contain different phase of BiNbO4. The sample prepared at pH 7 is a mixture of triclinic and rhombohedral phase and it shows the best efficiency of degrading Rhodamine B due to formation of heterostructure. The result show at pH7 can more degrade dye than pH10 and pH4 catalyst, respectively. However, adding Ag cocatalyst in BiNbO4 cannot improve the catalyst.

Keywords: $BiNbO_4$, hydrothermal, photocatalysts, silver

Selective Ionic Sieving through Two-dimensional (2D) Materials Based Laminar Membranes

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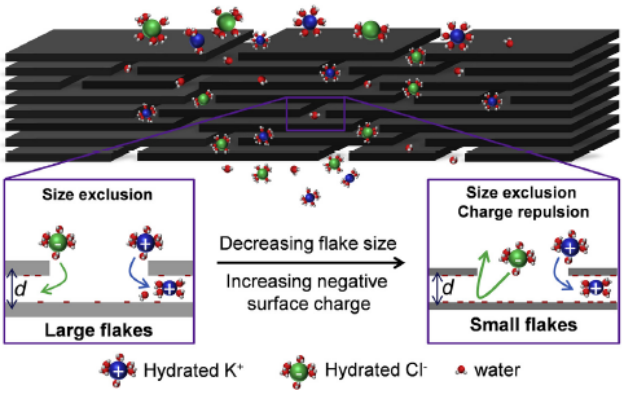
This work develops the use of self-assembled 2D materials as permeable membranes for water purification. Such structures have been formed through the formation of a laminate on a suitable support material, which is one of the anisotropic membranes (i.e., thin-film composite).

The stacking of 2D-materials is transformed as membranes using external supporting materials (PVDF support). This provides laminar stacking membranes, which are shown to be excellent candidate materials for use in water purification. This is due to the network of nanocapillary channels formed between individual 2D nanosheets which exhibit a molecular and ionic sieving effect. Simple chemical functionalization of the MoS_2 membranes with dyes (MoS_2/CV (crystal violet) and MoS_2/SY (sunset yellow)) resulted in the enhancement of ionic rejection and water permeance compared to those reported for graphene oxide (GO) membranes, with long-term stability (no detectable swelling) in aqueous and organic media. Application of an electric field across the membranes was used to investigate ion transport through the nanocapillary channels. It was found that ion transport through MoS_2/SY significantly decreased, by 2 orders of magnitude compared to the bulk ion mobility, and exhibited a 10-fold reduction compared to pristine MoS_2 as well as the transport parameters reported for GO, MXene ($Ti_3C_2T_x$) and polymeric membranes. The effect of solute concentration, pH, and ionic charge/size on the ionic selectivity of the MoS_2 membranes is also studied.

Size-selected graphene membranes have also been demonstrated to be capable of charge- and size-selective ion sieving. It was found that lateral flake length and thickness of the graphene play a crucial role in ion transport through laminar stacked membranes. The membrane with smaller flakes exhibits the most tortuous nanocapillary channels, resulting in the reduction of ion transport with high charge selectivity. The graphene membranes also provided excellent Na^+ rejection, combined with a higher water permeance than reported for GO and MoS_2 membranes. Therefore, the study of the 2D membranes could be scaled up for potential applications in electro-dialysis and ion-exchange for water purification technologies.

Keywords: membrane, ionic sieving, functionalization, MoS_2, graphene



Ion sieving through 2D Materials-based laminar membranes

Photocatalytic Properties of Cadmium Sulfide Quantum Dots (CdS QDs) in Amidation Reaction

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Amides are important compounds in organic chemistry. They are the main components of many polymers. However, the amide synthesis process could need days and obtained low yield. It does not create cost-effectiveness in industrial production. Therefore, researchers' current ways to mitigate this problem is the use of photocatalyst can shorten the time in the process. This research project aims at developing a procedure for the synthesis of CdS quantum dots (CdS QDs) with high photocatalytic activity to be used as heterogeneous photocatalysis in amidation reactions. CdS QDs were synthesized in two procedures. One of those two methods was found to be more effective because Full-Width-at-Half-Maximum is lower than CdS QDs that was synthesized with another procedure. CdS QDs from CdS-Catalyst Procedure2 were effectively stable within 14 days. Elemental distribution analysis was confirmed by SEM-EDS technique. Five different samples of CdS QDs of different sizes were then synthesized using CdS-Catalyst Procedure2 to compare the catalytic efficiency in amidation reaction, and the hydrodynamic size was measured by DLS technique. Subsequently, CdS QDs were applied to compare the effective efficiency in accelerating the amidation reaction. It was found that Blue CdS QDs were the most capable of catalyzing in amidation reaction with the percentage of conversion of 37% and the percentage of yield of 4%. Based on the observed results, if further experiments were obtained, the researcher was expected to be able to use CdS QDs to better accelerate amidation reaction in different conditions with higher percentage of conversion and yield.

Keywords: amidation reaction, quantum dots, photocatalyst, photocatalytic activity

Enhanced photocatalytic performance of Zno/Bi_2WO_6 heterojuctions toward photodegradation of fluoroquinolone-based antibiotics in wastewater

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The development of ZnO/Bi_2WO_6 photocatalyst with a high solar light responsive property and a promising charge carriers separation efficiency has been demonstrated. A novel ZnO/Bi_2WO_6 heterojunction based on well dispersion of flower like Bi_2WO_6 on the surface of rod like ZnO has been synthesized. The prepared photocatalyst exhibited the orthorhombic phase of Bi_2WO_6 (BWO) together with the hexagonal phase of ZnO. The 0.05ZnO/BWO heterojunction photocatalyst with the smallest size (9.24 nm) and lowest photoluminescence (PL) intensity, implying highest electron hole separation efficiency, exhibited the highest photoactivity of 87%, 85%, and 84%, respectively, toward degradation of norfloxacin (NOR), ciprofloxacin (CIP), and ofloxacin (OFL) antibiotics. The photocatalyst also provided a very high solar light driven photodegradation performance of 97% toward degradation of NOR antibiotic for 120 min. The generation of the ZnO/Bi_2WO_6 heterostructures is the key factor for an enhanced photocatalytic performance in the resultant photocatalyst. The photodegradation of the fluoroquinolone antibiotics followed the first order reaction. Photogenerated hole plays an important role in removal of NOR antibiotic. The chemical structure of the 0.05ZnO/BWO heterojunction photocatalyst remained stable after photodegradation according to the catalyst, after fifth run cycles, its photocatalytic efficiency decreased from 87% to 59%, implying its structural stability and reusability. This work demonstrates a very high potential of the prepared heterojunction 0.05ZnO/BWO photocatalyst for detoxification of fluoroquinolone-based antibiotics in wastewater.

Keywords: ZnO/Bi_2WO_6, Photodegradation, Antibiotics, Solar light

Development of advanced copper-based sensors for electrochemical nitrate detection in environmental samples

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Nitrate fertilization is a routine agricultural strategy used to enhance plant growth and crop yield. A problem, however, is the common overuse of the synthetic plant nutrient by farmers because excess amount of nitrate tends to accumulate in the plants, soil and ground water and ultimately end up as unhealthy contamination of food and drinking water. Environmental and food nitrate monitoring is thus an important task and within this DPST-sponsored study a copper electrode-based nitrate electroanalysis was targeted, as an alternative to existing electrochemical or optical options. Tool for the nitrate measurements were glass-insulated copper disk electrodes. It was observed that an *in-situ* pre-treatment of the copper disk detectors with a series of positive (oxidizing) and negative (reducing) potential pulses improved their response toward nitrate in an acidic measurement buffer. Cyclic voltammetry (CV) tests proved the high sensitivity of pre-treated copper-disk electrodes for the reduction of nitrate ion and in square wave voltammetry (SWV) trials their cathodic nitrate reduction peak scaled linearly with the nitrate electrolyte level from 1 to 6000 µM. Under optimal conditions, the detection limit was 1 µM nitrate ion. In future extensions of the work, the sensor will be employed for the determination of nitrate in model and real sample.

Keywords: (Cyclic voltammetry (CV), Environmental nitrate monitoring, glass-insulated copper disk electrodes, Square wave voltammetry (SWV))

Catalyst grafted on Poly(2-Diethylaminoethyl Methacrylate) -Carboxymethyl Chitosan for 4-Nitrophenol Reduction

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Syntheses and Characterizations of Near-infrared Aza-BODIPYs Absorbing Dye Towards Applications in Photothermal Cancer Therapy

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At present, near-infrared absorbing dyes that can absorb and/or emit light in the near-infrared (NIR) region gain much interests in biological and medical applications, since NIR light can penetrate through biological tissue better than visible light. This study focuses on the synthesis of NIR absorbing dyes and encapsulated to form nanoparticles for biological usage. Aza-dipyrromethenes boron difluoride (aza-BODIPY) with benzene substituent at 1, 3, 5 and 7 positions was chosen as a core structure. The modified structure with trifluoromethyl and dimethylamino groups at para-position of the substituted benzene rings was expected to exhibit longer absorption and emission wavelengths due to the push-pull effect. Moreover, the hydrophilicity of the dye can be improved by encapsulation to form nanoparticles. From, preliminary results, photophysical properties of NIR aza-BODIPY (with push-pull effect), the dye with CF_3 and NMe_2- substituent has the absorption wavelength in NIR region peaking at 871 nm in DMSO, however, the dye does not show fluorescent emission due to relaxation by radiative decay. In contrast, this dye displays some photothermal properties, *i.e.*, heat generation after excitation. Therefore, modification of aza-BODIPY with trifluoromethyl and dimethylamino groups at para-position helps aza-BODIPY absorb light above 800 nm that could be used as a photothermal agent. In addition, the polymeric nano form of this dye with a particle size ranging around 70 to 80 nm for DSPE-PEG_{2000} polymer shows better water dispersibility than the free dye. We believe that this nano system will be suitable to apply in photothermal therapy of cancer cells in vitro and in vivo in the future.

Keywords: aza-BODIPY, organic nanoparticles, photothermal therapy, polymeric nanoparticles

Composite of metal organic frameworks for arsenic adsorption

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This research focused on the synthesis of metal organic frameworks (MOFs) and their composites for arsenic(V) adsorption. The MIL-53(Fe) and NH_2-MIL-53(Fe) were successfully synthesized by the solvothermal method and characterized by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). Different composites of MIL-53(Fe), $FeCl_3$, NH_2-MIL-53(Fe) and chitosan were prepared. The effect of MOFs and $FeCl_3$ content in the chitosan composite beads was investigated. The obtained composites were used in arsenic(V) adsorption. The results showed that chitosan composite beads were stable in water and exhibited a good efficiency in arsenic(V) adsorption. The suitable condition for the composites synthesis was to use 40 %w/w MIL-53(Fe) or 10% w/w $FeCl_3.6H_2O$. The beads containing MIL-53(Fe) showed a higher adsorption efficiency than NH_2-MIL-53(Fe)-beads. The effect of pH on arsenic(V) adsorption was also studied at pH 4 and pH 7. The suitable pH for arsenic(V) adsorption by composites containing MOFs and $FeCl_3$ was pH 4.

Keywords: adsorbs, MIL-53(Fe), chitosan, composite, arsenic(V), beads

Invited Speaker BIO1-1

Effect of Peptide Hydrolysate Derived from Riceberry Rice Bran on Colon Cancer Cell Line SW620.

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Colon cancer is one of the most common cancer diagnosed in the human population and remains a serious global health threat. In the previous study, Rice bran peptide hydrolysate has a potent anticancer activity for several cancer cells. Thus, the study aimed to investigate the most active peptide fraction of Riceberry rice bran on anticancer activities of colon cancer cell line. Rice bran peptide hydrolysates were fractionated into 3 peptide fractions (>50 kDa, 50-30 kDa, and 30-10 kDa) by spin column at molecular weight cut-of. Anticancer activities of all fractions (0.625 – 10 mg/mL) against SW620 (metastatic colon cancer cell line) were determined after 24, 48, and 72-hour treatments. The cell viability was evaluated by MTT assay in 96 well plate as triplicate. The fraction >50 kDa showed significant anticancer activities against SW620 cell line at 5 mg/mL for 48 hours and 1.25, 2.5, 5, and 10 mg/mL for 72 hours. These results were further confirmed by acridine orange/propidium iodide (AO/PI) double staining cell morphological assessment and percentage of total apoptosis was measured by flow cytometry through Annexin V-FITC/PI staining. Our results showed that the fraction >50 kDa in 1.25, 2.5, 5, and 10 mg/mL induced cell apoptosis in a dose - dependent manner after 72-hour treatment. However, further mechanistic studies and peptides identification in this fraction are needed.

Keywords: Colon cancer, Riceberry rice bran, Anticancer peptides, SW620, Apoptosis

Effect of *p*-coumaric acid on muscle strength and striatum tyrosine hydroxylase in rotenone-induced Parkinson mice.

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Parkinson's disease (PD) is a neurodegenerative disease associated with dopaminergic neuron damage which leads to motor dysfunction with concurrent loss of the muscle strength and coordination impairment. We investigated on the effect of *p*-coumaric acid on both the muscle strength and striatum tyrosine hydroxylase in the rotenone-induced Parkinson mice. Thirty male ICR mice were randomly divided into 3 groups of Sham-veh, Rot-veh and Rot-*p*CA. Mice in the Rot-veh group were received intraperitoneal injection of rotenone 2.5 mg/kg/48h and *p*-coumaric acid (*p*CA) 100 mg/kg/48h was given alternately with rotenone injection in Rot-*p*CA group. Both rotenone and *p*-coumaric were given continuously for 6 weeks. Muscle strength was evaluated using hanging wire test. Striatum tyrosine hydroxylase evaluation using immunohistochemistry was also determined. Results showed that rotenone significantly induced the weakness of muscle strength at the 2nd weeks following administration (at 2nd week ($p=0.0423$); at 4th week ($p=0.0149$); and at 6th week ($p=0.0236$)). This study also found concurrently with the decline in striatum tyrosine hydroxylase when compared Rot-veh group to Sham-veh group ($p=0.00001$). Treatment with *p*-coumaric acid significantly improved the weakness of muscle strength at the 4th and 6th week following administration ($p=0.0045$ and $p=0.0149$ respectively). It also significantly prevented the reduction of striatum tyrosine hydroxylase when compared Rot-*p*CA group to the Rot-veh group ($p=0.0041$). This study suggested that *p*-coumaric acid alleviated the weakness of muscle strength and prevented the reduction in striatum tyrosine hydroxylase in rotenone-induced Parkinson mice.

Keywords: Muscle strength, Parkinson mice, *p*-coumaric acid, Rotenone, Tyrosine hydroxylase

Initial taxonomic analysis of human gut microbiome: Case study of Thai infants

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Gut microbiome plays importance roles to the human body. The infant gut microbiome consists of a complex and diverse microbial community. Initial taxonomic knowledge about infant gut microbial communities supports medical and biological applications. Therefore, this study aimed to investigate the microbial taxonomic profiles and diversities of Thai infants among aged 9, 19, 24 and 30 months using 16S rRNA sequence data. To explore, 16S rRNA gene sequences of 28 Thai infants were analyzed. The results showed that the dominant families were *Lachnospiracea* (42.2%), *Bifidobacteriaceae* (26.6%), and *Ruminococcaceae* (10.9%). Moreover, we also found that *Lachnospiracea* and *Ruminococcaceae* under the Firmicute phylum significantly showed higher relative abundance in 30-month subjects than 9-month subjects (p-values = 0.008 and 0.007, respectively). In contrast, *Bifidobacteriaceae* under the Actinobacteria phylum showed lower relative abundance at 30 months than 9 months (p-value = 0.006). However, the alpha-diversity within gut microbiome at family level by Shannon and Simpson's reciprocal indices across different ages of infants from 9 to 30 months showed no difference in microbial community between groups (p-value >0.05). This study serves as a useful first step allowing for further investigation of taxonomic-wide metabolic functional infant gut microbiome in relation to disease.

Keywords: bioinformatics, gut microbiome, healthy infants, metagenomics

A cytotoxicity evaluation of plasma-activated phosphate buffer saline on oral squamous cell carcinoma based on three-dimensional of tumor spheroid

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Determining the Potential of Weed Biomass for Fermentable Sugar Production

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To observe the potential of the lignocellulosic feedstock for bioethanol production, the main chemical composition of lignocellulosic biomass were determined using National Renewable Energy Laboratory (NREL) standard methods from three weed species including *Imperata cylindrica* (cogon grass), *Sorghum halepense* (johnson grass), and *Amaranthus viridis* (slender amaranth). The results indicated that the total solid of *I. cylindrica* (90.37 ± 0.02%) was significantly higher than those obtained from *A. viridis* (88.91 ± 0.01%) and *S. halepense* (84.17 ± 0.02%). However, the highest amount of cellulose and hemicellulose contents were observed from *S. halepense* (51.67 ± 3.78% and 30.13 ± 2.14%) followed by *I. cylindrica* (46.48 ± 1.25% and 23.14 ± 0.66%) and *A. viridis* (29.88 ± 2.61% and 11.93 ± 0.95%). Moreover, the amount of lignin content which was lesser than 20% was achieved from *I. cylindrica* (17.47 ± 0.05%) and *A. viridis* (15.33 ± 0.01%) while *S. halepense* gave the most significant amount of lignin content (20.52 ± 0.11%). The cellulose/lignin ratio is one of the critical indicators for biomass. Among weed species, the cellulose/lignin ratio of *I. cylindrica* (2.66) was slightly higher than *S. halepense* (2.52) but the lowest this ratio was obtained from *A. viridis* (1.95). The potential of three weed biomass for bioethanol production was predicted by the theoretical ethanol yield, which was estimated from cellulose and hemicellulose contents. It found that various amount of ethanol yield was produced from *S. halepense* (593.47 L/ton), *I. cylindrica* (504.69 L/ton) and *A. viridis* (302.77 L/ton), respectively.

Keywords: Bioethanol, Cellulose, Fermentable Sugar, Weed Biomass

Seed and callus cryopreservation of Hom Mali Daeng Rice (*Oryza sativa* L. 'Hom Mali Daeng')

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Rice landraces of Thailand are a valuable heritage and worth of conservation. Suitable protocol of seed and callus cryopreservation of Hom Mali Daeng rice, one of rice landraces of Thailand was investigated. For seed cryopreservation, experiments were divided into 3 groups. Group 1: gradient freezing at 0°C and -20°C for 30 minutes, respectively before immersing in liquid nitrogen. Group 2: directly immersing in liquid nitrogen. Group 3: room temperature storage (control group). All three groups were stored for 1, 3 and 5 months prior to germination for 14 days. The results showed that both preserved period and process affected on germination percentage, stem length, fresh weight and dry weight. After 5 months of storage period, directly immersed in liquid nitrogen seed presented higher root length, fresh weight and dry weight than the control and gradient freezing seeds. For callus cryopreservation using vitrification technique, calli were exposed in PVS2 and PVS3 solutions for 0, 20, 40, and 60 minutes before immersing in liquid nitrogen for 24 hours. After thawing and regrowth, cryopreserved calli were cultured on MS medium with 1 mg/l NAA (1-Naphthaleneacetic acid) and 3 mg/l BAP (6-Benzylaminopurine) for 6 weeks. The results revealed that calli exposed in PVS3 for 0 minute (calli added PVS3 before immersing in liquid nitrogen immediately) provided the highest survival percentage (100.00%). The second survival percentage was shown in calli exposed in PVS2 for 40 minutes (75.00%). These results will be used as a database for further conservation of rice landraces.

Keywords: Cryoprotectant, Liquid nitrogen, Rice germplasm, Seed germination

Indole 3-Acetic Acid Production by Phylloplane Yeast and Its Application

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Indole-3-acetic acid (IAA) is a common plant growth hormone of the auxin class. IAA biosynthesis in a basidiomycetous yeast *Rhodosporidiobolus fluvialis* DMKU-CP293 was investigated in this study. The yeast strain showed tryptophan (Trp)-dependent IAA biosynthesis when grown in mineral salt medium supplemented with 0.1% L-tryptophan. Identification of the pathway intermediates of Trp-dependent IAA biosynthesis was carried out using gas chromatography–mass spectrometry. The results indicated that tryptamine (TAM), indole-3-acetamide (IAM) and tryptophol (TOL) were the main intermediates. However, only feeding of indole-3-pyruvic acid (IPA) to the culture medium resulted in IAA peak detection in the culture supernatant. Key enzymes of IAA biosynthetic routes via IPA, IAM and TAM were investigated and results showed that the activities of tryptophan aminotransferase, tryptophan 2-monooxygenase and tryptophan decarboxylase were observed in cell crude extract. This suggested that IAA biosynthetic in this yeast mainly occurred via the IPA route with an involvement of IAM and TAM pathways.

IAA production by *Rhodosporidiobolus fluvialis* DMKU-CP293 was also investigated using one-factor-at-a-time (OFAT) approach and response surface methodology (RSM). IAA production was initially studied and optimized in shake-flask cultivation using a cost-effective medium (4.5% crude glycerol, 2% CSL and 0.55% feed-grade L-tryptophan). The optimized medium resulted in an improvement in IAA production and a reduction in cost compared with those obtained with a non-optimized medium. IAA production in a pilot-scale (100-L) bioreactor was carried out and 3,569.32 mg/L of IAA was successfully produced based on the constant impeller tip speed (V_{tip}) strategy. Evaluation of the effect of crude IAA on *Cyperus rotundus* L. growth indicated that the weed growth could be inhibited by 50 mg/L of crude IAA. This revealed the possibility of using yeast IAA for weed control.

Keywords: yeast, indole-3-acetic acid, IAA biosynthesis, pilot scale, weed control

Use of thermal imaging to study physiological response of RD6 rice seedling under alkaline stress conditions

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Alkaline stress due to the excess level of Na_2CO_3 had several effects on plant growth and physiology. Leaf temperature is one of the indicators of physiological status of plants in response to abiotic stress. Thermography is a non-destructive analysis based on infrared imaging that can be used to detect leaf temperature. In this research, the effects of alkaline conditions on seed germination and the changing temperature together with the physiological responses in seedling of RD6 rice cultivar were studied. Rice seeds germinated on germination paper were subjected to various concentrations of Na_2CO_3. The results showed that seeds under 10-30 mM Na_2CO_3 germinated slowly than those of 0-5 mM Na_2CO_3 as indicated by lower coefficient of velocity of germination and mean germination rate, and higher mean germination time. Seventeen-day-old seedlings were imposed to alkaline conditions by adding 0, 5, 10, 15, 20, 25 and 30 mM Na_2CO_3 to the nutrient solution. The alkaline stress reduced relative water content and had deleterious effect on shoot and root growth. Membrane injury was detected, as shown by escalated electrolyte leakage and MDA content. Thermal images showed high leaf temperature in seedlings exposed to alkaline conditions. Additionally, crop water stress index and stomatal conductance index were significantly changed in these seedlings (P<0.05). Based on the results from this research, the injurious effects of alkaline stress on seed germination and seedling growth were observed by increasing Na_2CO_3 concentrations. Moreover, thermography can be used to indicate the relationship of plant temperature and physiological changes under alkaline stress.

Keywords: thermography, alkaline stress, sodium carbonate, leaf temperature

Effect of environmental stresses on physiological responses, phytochemical contents, and *DsCGT1* gene expression of *Dendrocalamus* sp.

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Effects of environmental stresses on physiological responses, phytochemical contents and *dsF2H* gene expression of *Dendrocalamus* sp.

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Effect of phosphorus deficiency on allelophathic activity of rice (*Oryza sativa* L.)

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Allelopathy is a phenomenon when a donor plant releases biochemicals to a receiver plant. These biochemicals are known as allelochemicals, and they can stimulate or inhibit the germination and growth of the receiver plant. Several studies have examined the effect of environmental stress factors, such as weed, salinity, pathogen and nutrient deficiency, on allelochemicals released by plants and found that stress factors affect both growth and allelopathic activity of plants. In this study, two rice cultivars, i.e. Niaw look pueng and Nang loy, were grown in the nutrient solution with two levels of phosphorus supply for 14 days. Growth parameters as well as phosphate and total phenolic content were measured, and the allelopathic activity of shoot and root water extracts were tested with lettuce (*Lactuca sativa* L.) seeds for three days. The results showed that under phosphorus deficiency stress, the greenness of leaves (SPAD unit) of both rice cultivars was increased and phosphate contents in shoot and root tissue of both rice cultivars were decreased, while its allelopathic activity was increased. Extracts from rice shoot had higher inhibition on germination and growth of lettuce seedlings than extracts from rice root and extracts from Nang loy cultivar had higher inhibition on germination and growth of lettuce seedlings than extracts from Niaw look pueng cultivar. However, phosphorus deficiency did not affect the total phenolic content of both rice cultivars.

Keywords: allelopathy, *Lactuca sativa*, *Oryza sativa*, phosphorus deficiency

Detected level of paraquat in Huai Yang Reservoir and its biological effects to watermeal (*Wolffia globose* (Roxb.) Hartog & Plas)

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Paraquat contamination, one of the environmental concerned issues, is globally due to its long half-life and high toxicity to organisms. Paraquat has been banned in Thailand since 2020, but its remaining levels in nature still require monitoring. Therefore, this research aims to survey paraquat levels using the paraquat-aptasensor in the Huai Yang reservoir, which collects water discharges from agricultural and residential areas near the Suranaree University of Technology. The results showed that six of eleven locations in Huai Yang reservoir were paraquat-detected in a range of 12.0 - 14.4 nM. Also, watermeal (*Wolffia globose* (Roxb.) Hartog & Plas), the edible aquatic plant, was used as a study model for paraquat effects. Paraquat exhibited the toxicity and growth inhibition effects on watermeal in a dose-dependent manner. It caused a significant reduction of chlorophyll A, chlorophyll B, and carotenoid contents. It also caused significant reductions in superoxide dismutase, catalase, and glutathione reductase activities. These results suggested the negative effects of paraquat, even at low concentration, on the edible Watermeal plant, implying low sustainability of this plant in a paraquat-contaminant habitant.

Keywords: Detection, Oxidative stress, Paraquat, Watermeal

Effects of Thai Herbal Extracts on Reducing Cadmium Toxicity

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When Design Meets Biology

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Advances in synthetic biology allow us to engineer more sophisticated biological systems at much lower cost and shorter time than ever before. Such technological capabilities not only open a wide range of possibilities in re-designing living organisms to serve human needs but also reduce a barrier of entry for educators, artists, designers, and entrepreneurs to take part in governing the directions future biotechnologies. In this talk, I will summarize recent history of biotechnology that gave rise the age of designed biology as we know today. I will also briefly share my personal experience on synthetic biology / biodesign research and educational projects, ranging from sequence specific antimicrobials to agricultural biocontrol, engineering aquaculture live feeds, DNA data storage for space mission and a biohacker workshop for teenagers.

Keywords: synthetic biology, biodesign, hacking biology

Cytogenetic analysis of whiskered myotis (*Myotis muricola*, 1846) by conventional staining, Ag-NOR staining and Fluorescence *in situ* hybridization techniques

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Whiskered myotis (*Myotis muricola*, 1846) is similar morphological characteristics to other *Myotis* species and also one of the most karyotypically conservative genera. Thus, it is essential to find important characteristics to support the classification. Whiskered myotis form Maha Sarakham province was investigated in this research. Mitotic chromosome was prepared directly from bone marrow of specimens after *in vivo* colchicine treatment. Conventional staining technique was applied to stain the chromosome with 20% Giemsa's solution. Ag-NOR staining and Fluorescence *in situ* hybridization were used to detect chromosome markers. The results showed that the number of diploid chromosomes of whiskered myotis was $2n = 44$, fundamental number (NF) was 53 in male and 54 in female. The types of chromosomes were 6 large metacentric chromosomes, 2 small submetacentric chromosomes, and 34 small telocentric chromosomes. The sex determination was XY system which X chromosome was a large metacentric chromosome and Y was a small telocentric chromosome. Secondary constrictions were located on centromere of q arm of chromosome 8th and 16th. The hybridization $d(CGG)_{10}$ was distributed all of chromosome as well as whole genome, while $d(GC)_{15}$ repeat was specifically presented on chromosome 1st, 4th and 10th. The karyotype formula for whiskered myotis is as follow:

$$\mathbf{2n\ (44) = L^{m}_{6} + S^{sm}_{2} + S^{t}_{34} + Sex\ chromosome}$$

Keywords: chromosome, fundamental number, chromosome markers, secondary constriction, karyotype

Identification of putative toxin genes from the stinging nestle caterpillar, *Parasa consocia,* transcriptome

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Lepidoptera is a highly diverse insect order with 160,000 described species. The caterpillars of more than 100 species from 12 families are venomous, which causes mild to severe symptoms to humans in contact. The stinging nettle caterpillar, *Parasa consocia*, possesses local effect venom that causes dermatitis, allergic reaction, and pain. Previously, neurotoxins that activate pain receptors have been identified from this species, but the total composition of the toxin genes has not been fully characterized. This study aims to identify all candidate toxin genes from its transcriptome generated from its publicly available RNAseq reads. Our assembly has 179,043 contigs with 745.69 bp average contig lengths and 1,359 bp N50 contig length. We identified 113 genes encoding toxins commonly found in venomous animals. The largest group is proteolytic enzymes, including serine protease, peptidase, and metalloproteinase. The second-largest group is peptidase inhibitor, including, serpin, kazal-type inhibitor, and trypsin inhibitor-like (TIL). We also found carboxylesterase, CAP superfamily, acid phosphatase, antimicrobial peptide, lipocalin, and phospholipase A2. Furthermore, we identified 14 knottin-like toxins, which have six conserved cysteine residues. The predicted 3D structures of these proteins are similar to neurotoxins from spiders, scorpions, and cone snails. This study provides new knowledge about toxin proteins from a caterpillar in the family Limacodidae. They can be a new source for drug discovery and the development of caterpillar antivenom.

Keywords: caterpillar envenomation, urticating dermatitis, venomics

Evaluation of ticagrelor as a novel bacterial lysis for nucleic acid extraction from hard-to-break bacteria

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Nucleic acid extraction is a fundamental process in the study of genetics and molecular biology. To disrupt the bacterial cell, several methodologies have been currently using. The properties of extracted DNA depend on disruption method and complexity of bacterial cell wall. Ticagrelor is a drug for treating patients with acute coronary syndromes. Surprisingly, the durg also displays antibacterial activity in Gram-positive bacteria possibly via cell wall disruption. Thus, the aim of this study is to evaluate the use of as a potential cell disruption agent for DNA extraction of hard-to-break bacteria. Different concentrations of ticagrelor were applied for nucleic acid extraction, and compared with those were extracted by sonication and bacterial nucleic acid extraction kit. The nucleic acid extract was determined for quality and quantity by nano drop and PCR. DNA concentration, and absorption ratio of 260 and 280 were evaluated. DNA extraction from *Clostridioides difficile* (*C. difficile*) extracts with 80 µg/ml of ticagrelor were observe to be 88.9 ng/µl which showed to be the highest among other concentrations tested. Incubation of the samples at 45°C improved yield of extracted DNA. Whereas, ticagrelor did not enhance the DNA extraction efficiency in *Mycobacterium smegmatis* (*M. smegmatis*). For the quality examination using, the sample of *C. difficile* with 60 µg/ml of ticagrelor at room temperature and those obtained from extraction kit seem to be low quality. For *M. smegmatis*, all samples with ticagrelor showed to have good quality. Moreover, all DNA extracted could be used for PCR. We found no potential to apply ticagrelor for improving cell lysis in DNA extraction process.

Keywords: Cell lysis, Hard-to-break bacteria, Nucleic acid extraction, Ticagrelor

CRISPR/Cas12a-mediated Genome Editing to Induce Fetal Hemoglobin Expression for Beta-thalassemia Treatment

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Beta-Thalassemia, one of the most common genetic blood disorders worldwide, is characterized by reduced or absent production of beta-globin chain and adult hemoglobin (HbA; $alpha_2beta_2$), leading to anemia. Clinical and experimental studies have shown that the severity of beta- thalassemia can be ameliorated through increased expression of fetal hemoglobin (HbF; $alpha_2gamma_2$), which is normally expressed during fetal stage and silenced soon after birth. Therefore, reactivation of HbF expression is a well-defined therapeutic strategy for beta-thalassemia. Recently, a clinical study has shown that a CRISPR/Cas9-mediated disruption of erythroid specific enhancer of a gamma-globin repressor *BCL11A* increased a therapeutic level of gamma-globin and HbF, leading to clinical improvements of a beta-thalassemia patient. Here, we developed an alternative genome editing technology to disrupt *BCL11A* erythroid-specific enhancer by using CRISPR/Cas12a as a therapeutic strategy for beta-thalassemia. Three guide RNAs (gRNAs), gRNA1 gRNA2 and gRNA3, were designed to target *BCL11A* erythroid-specific enhancer located in *BCL11A* intron 2 and cloned into pU6-Lb-crRNA, a *Lachnospiraceae bacterium* gRNA-expressing plasmid. The pU6-Lb-crRNA containing gRNA sequences and pcDNA3.1-hLbCpf1, a Cas12a-expressing plasmid, were transfected into a human embryonic kidney 293T (HEK293T) cells for evaluating gRNA cleavage efficiency by T7 endonuclease I (T7EI) assay. The results showed that all gRNAs mediated insertions and deletions (indels) with average cleavage efficiencies of 29.19%, 38.90% and 46.97% for gRNA1, 2, and 3, respectively. Although, this study demonstrated that the designed gRNAs effectively target the enhancer of *BCL11A*, further investigations of their HbF induction efficiencies in erythroid progenitor cells would be required.

Keywords: beta-thalassemia treatment, CRISPR/Cas12a, BCL11A, HbF induction

Development of rapid cadmium-detection system based on DNA aptamer couple with gold nanoparticles

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Cadmium contamination is one of the most globally concerned issues due to its highly toxic to humans and organisms in the environment. Traditional methods for cadmium detection are complicated laboratory analyses, causing a simple onsite method still in demand. This work aims to develop a colorimetric aptasensor for cadmium detection based on aptamers and gold nanoparticles (AuNPs). The spherical AuNPs of about 13 nm were obtained from a synthesis, which their identity was confirmed by UV–Vis spectrum and selected area diffraction (SAED) analyses. Six novel aptamers of 12 nucleotides were designed; A1-A6. Among these, the A6 aptamer exhibited the highest binding to cadmium ions, so it was chosen to develop an aptasensor. In this system, the reaction color turned from red to blue with cadmium presence in a dose-dependent manner. These changes were due to the specific binding between aptamer and cadmium ions, resulting in the unprotected AuNPs being salt-induced aggregation. This developed A6-aptasensor could detect cadmium in the linear range of 2.5 to 50 µM with the limit of detection (LOD) at 1.72 µM. It was selective for cadmium and not significantly bound other metal ions (copper, iron, lead, manganese, nickel, silver, and zinc). The A6-aptamer showed a high recovery rate of cadmium detection in a range of 92.0-103.6% and the relative standard deviation values less than 5% in cadmium-spiked tap and pond water. The results of this work demonstrated the potential application of A6-aptasensor as the simple, rapid, and sensitive system for onsite cadmium detection.

Keywords: Aptamer, Aptasensor, Cadmium, Detection

Cytogenetic and erythrocyte morphology of Indochinese caecilian (*Ichthyophis bannanicus*) and dark-sided frog (*Sylvirana nigrovittata*) from Chiang Mai University

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This study analyzed the cytogenetics and erythrocyte morphology of female Indochinese caecilian (*Ichthyophis bannanicus*) and dark-sided frog (*Sylvirana nigrovittata*) collected from Chiang Mai University. The metaphase chromosome preparation was obtained from gastrointestinal tissue in caecilian, bone marrow and testes in frog. The chromosomes were stained by Giemsa staining and Ag-NOR banding techniques. The blood preparation was directly obtained from cardiac puncture. The blood smear was stained by Wright-Giemsa for blood morphology observation. The results showed that the diploid number (*2n*) of female Indochinese caecilian and dark-sided frog were 42 and 26, respectively. There was no different size of chromosome related to sex. The karyotype of female Indochinese caecilian presented 18 metacentric 4 submetacentric and 20 telocentric chromosomes, while the karyotype of dark-sided frog revealed 12 metacentric and 14 submetacentric chromosomes. For the erythrocyte morphology of female Indochinese caecilian, the area of respective erythrocyte and nucleus were 432.69 μm^2 and 114.35 μm^2, hence the nucleocytoplasmic ratio was 0.27. In part of dark-sided frog, the area of respective erythrocyte and nucleus were 202.38 μm^2 and 33.84 μm^2, hence the nucleocytoplasmic ratio was 0.17. Decreasing in size and nucleocytoplasmic ratio of erythrocyte can illuminate the adaptation of dark-sided frog to more activity level (e.g., jumping and swimming) leading to use higher consumption of oxygen than Indochinese caecilian which rarely moves around and has low activity level. Moreover, these results support that dark-sided frog is able to habit in varied environment. This study will be useful for the further studies related to adaptation, evolution and taxonomy of amphibians and related to environmental disturbance in particular area.

Keywords: cytogenetics, erythrocyte, *I. bannanicus*, *S. nigrovittata*

Genetic anthropology at a glance: DNA of Lanna

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Thailand geographically locates at the main crossroad of the modern human's "Out of Africa" migration, either north to northern Asia and subsequently America, or south to Australia and Oceania. Archaeological evidence revealed that this region has been inhabited by humans since prehistoric time. Thailand had passed several ancient civilizations, some following one after the others and some were contemporaneous. Thailand and adjacent nations were involved in at least three major waves of human migration through Southeast Asia, according to recent research of ancient genomes from skeletal remains in Thailand, Vietnam, Myanmar, and Cambodia. Hunter-gatherers first arrived some 45,000 years ago. During the Neolithic, early Austroasiatic-speaking migrants from southern China brought cultivation to mainland Southeast Asia. Then, around 3,000 years ago, another wave of Austronesian migrants came in Myanmar from China, arriving in Vietnam around 2,000 years ago, and Thailand about 1,000 years ago. Various ethnic groups currently residing in Thailand are genetically identified as offspring of prehistoric ancestors and have a different structure than the mainstream Thai population.

Northern part of Thailand had been residences of human being since the prehistorical period. The Hariphunchai kingdom, a state-level civilization of the Mon people, was created in the seventh century A.D. The Hariphunchai was at its golden age in the early thirteenth century A.D. but fell in 1292 A.D. to an armed force of Tai-speaking group marching from northward. The Lan Na kingdom was then founded, and it became the Tai civilization's centre. The results of Y-chromosomal and mitochondrial DNA lineage investigations showed two key findings concerning Thais living in the north. First, the Austro-Asiatic group has lower genetic diversity and heterogeneity than the Tai-Kadai. Second, significant genetic heterogeneity was discovered across populations belonging to the same ethnolinguistic group but living in different locations.

Thus, the genetic differences among the people of Lan Na had been established by genetic anthropology, an emerging area of research that integrates DNA testing with archaeological, historical, and linguistic information. Future research on the spread of founder mutations linked to genetic illnesses or disease predisposition will benefit from this knowledge.

Keywords: population structure, ethnic group, Northern Thailand, genetic anthropology

Monitoring of coral reefs status after the spread of 2019 Coronavirus Diseases (COVID-19) at Hat Chao Mai National Park.

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Coral reefs in Hat Choa Mai National Park were healthy and beautiful especially some areas of Ko Kradan and Ko Cheuk. It has been attracting a lot of tourists travelling into the areas. The ecosystems were threatened from extensive tourism activities. It has driven directly to coral degradation. However, in 2020, there have been facing the Coronavirus Diseases (COVID-19) pandemic that cause the number of tourists decreased and reduced damage on corals. In this study, we monitored the status of coral reefs after the epidemic of COVID-19 in Hat Chao Mai National Park. We set up a photo belt transect in Ko Kradan and Ko Cheuk and utilized Coral Point Count with Excel extensions (CPCe) software to estimate the percent cover of coral reef. The status of coral reef in 2017-2020 are calculated from the photos collected from the same method from Marine National Park Operation Centre No. 3, Trang. The results showed that the decrease of tourism activities has not yet changed the status of coral reef. Ko Kradan still classified as demonstrate healthy coral reefs and threat coral reef in Ko Cheuk. However, the coral reef in Ko Cheuk has been recovered from disturbance revealed by the significantly increased of the percent cover of coral reef (significance F = 0.01 and r2= 0.89). Furthermore, there were a higher number of coral genera recruited in the reef compared to the previous years. Recovery is not found in Ko Kradan since coral reefs in this area have previously got a higher intensity level of disturbance than coral reefs in Ko Cheuk.

Keywords: Status of coral reef, Hat Choa Mai National Park, Photo belt transect, CPCe, COVID-19

Quantifying habitat patterns and riparian corridors for Asian small-clawed otter (Aonyx cinerea)

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The Asian small-clawed otter (*Aonyx cinereus*) is a small mammal and vulnerable species. Owing to anthropogenic activities especially habitat loss and fragmentation, populations of this otter have declined rapidly. An assessment of habitat connectivity patterns is one of the management methods to conserve wildlife species. It can facilitate movement and gene flow among populations. My goal was to evaluate habitat connectivity patterns for the Asian small-clawed otter in Khlong Saeng - Khao Sok Forest Complex. First, I identified suitable habitat patches in seven protected areas within the forest complex using water body with 300-meter buffer, elevation, slop, and annual precipitation. Second, I assessed habitat connectivity base on circuit theory analysis using Circuitscape software. Finally, I applied a probability of connectivity index (PC) using Conefor Sensinode 2.2 based on graph theory to assess the relative importance of each suitable habitat patch and dispersal corridor. As a result, I identified 28 suitable habitat patches and two potential dispersal corridors in Khlong Saeng - Khao Sok Forest Complex. However, most suitable habitat patches were isolated and only five patches connected to Ratchaprapha Dam with two potential dispersal corridors. I also found that the dam was the most imperative habitat patch maintaining the connectivity network in the forest complex with PC = 99.06%. In conclusion, suitable habitat patches were fragmented and only one habitat connectivity network was found adjacent to the Ratchaprapha Dam to maintain populations of the Asian small-clawed otterin Khlong Saeng - Khao Sok Forest Complex Thus, increasing potential habitat connectivity and improve habitat quality are crucial for a viability of the species.

Keywords: Circuit theory, Graph theory, Habitat connectivity, Small mammal

Phosphorus leaching from soil treated with hydroxyapatite nanoparticle

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Hydroxyapatite nanoparticles are natural, environmentally friendly and cheap compounds. Hydroxyapatite nanoparticles contain calcium and phosphorus which are the macronutrients of plants. Therefore, hydroxyapatite nanoparticles have potential to be developed as a fertilizer for agriculture in the future. However, environmental problems from phosphorus leaching remain a concern. In this study, we measured leaching of total dissolved phosphorus (TDP) which includes dissolved organic phosphorus (DOP) and dissolved inorganic phosphorus (DIP) during 10 days in undisturbed soil columns. The soils were SUT potting soil purchased from SUT Farm. The soil samples were treated with hydroxyapatite nanoparticle (1000 mg/kg) and a commercial fertilizer. Deionized water was applied at the rate of 200 ml/day. The leachate was analyzed for TDP. The results showed that TDP was more dissolved from commercial fertilizer than from hydroxyapatite nanoparticle. However, when the data was analyzed statistically, there was no significant difference at $p<0.05$.

Keywords: Dissolved phosphorus, leaching, Hydroxyapatite nanoparticles, spectrophotometry

Taxonomy of a caprine (Mammalia: Bovidae) from Satun: implication for paleobiogeography of Caprinae

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Currently, the Chinese goral **(***Naemorhaedus griseus***)** is endangered species in Thailand and has been declared a protected wildlife under the Wild Animal Reservation and Protection Act, BE 2535**.** It lives in high mountain grassland that found distributed in the Eastern and Southern of China, Myanmar, Vietnam to the Northern of Thailand. Here we study an unknown caprine specimen found from a cave in Satun Province, Southern Thailand. The morphological studies of the fossil that it was assumed to be a Chinese goral. Therefore, to identify species, sex and age by the bone and tooth of fossil was described and CT Scanned. Then it was analyzed and compared with other caprines and bovines, as well as cervids from museums and literatures. The study of the paleobiogeoography distribution of the caprines reveals the distribution at that time. In addition, 3D imaging techniques from photographs are also used to create digital databases. The specimen shows bovid characters. It was assigned here to the Caprinae based on morphology of the teeth and size of the mandible which resembles *Naemorhedus griseus* and the HI-index too. However, paleontological distribution is closer to *Capricornis sumatraensis* than *N. griseus*. The study will shed light to the more further work of paleodiversity.

Discriminatory power of DNA markers in epiphyllous liverworts genus *Leptolejeunea* from Thailand

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Leptolejeunea is a genus of epiphyllous liverworts that grow on leaves. Their small size makes it difficult to identify to the species level by morphology. Therefore, we need the DNA barcoding technique to help identify species, which would allow for automated identification with metabarcoding in the future. Therefore, this project focuses on comparing the efficiency of DNA markers 3 markers (*rbcL, trnL-F,* and ITS2) in discrimination of *Leptolejeunea* species. *trnL-F* was the most efficient in discriminating a species. It could discriminate *L. vitrea, L. elliptica, and L. subdentata* (3 out of 8 species) and had significantly higher interspecific distance than intraspecific distance, as their P-value is less than 0.05. However, not all species can be discriminated with the *trnL-F*, potentially because of the problem with DNA markers not being specific with *Leptolejeunea*, poor sequence quality, or problematic species circumscription.

Keywords: DNA barcoding, DNA markers, epiphyllous liverwort

Discrimination among some of *Dendrocalamus Nees* genotypes using Start codon targeted (SCoT) markers

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DNA markers have numerous applications in genetic diversity studies. Start codon targeted (SCoT) marker is one of the techniques used to assess genetic diversity studies. SCoT marker was developed based on the short conserved region in plant genome surrounding the ATG start codon. SCoT marker was used for the first time to identify and investigate the genetic relationship of *Dendrocalamus Nees* in Thailand. Thirty six primers were used to screen all of the DNA samples. Ten primers were selected and used for genetics DNA fingerprint of 32 genotypes of *Dendrocalamus Nees.* A total 10 primers generated 142 polymorphic bands with average of 14.2 bands per primer. The polymorphic informatics content (PIC), effective multiplex ratio (EMR) and marker index (MI) values were 0.26, 15.8 and 4.17 respectively. The clustering analysis by unweighted pair group method with arithmetic mean (UPGMA) was performed and the samples were grouped into two main groups. Three samples of Pai bong yai and Pai bong yai nor whan were grouped together, while Pai bong kai was segregated out. The present study shows that SCoT markers can be used for the genetic diversity studies in *Dendrocalamus Nees.*

Keywords: Bamboo, Genetic relationship, DNA marker, SCoT marker and *Dendrocalamus Nees.*

EXPOSURE TO TRAFFIC-GENERATED AIR POLLUTANTS ON ANGIOTENSIN II RECEPTOR EXPRESSION AND BLOOD BRAIN BARRIER INTEGRITY IN WILDTYPE MICE ON EITHER A HIGH OR LOW FAT DIET

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Exposure to vehicle traffic is associated with the exacerbation of cerebrovascular disorders, including stroke. Previous studies have been reported that exposure to mix vehicle exhaust (MVE) resulted in increased blood brain barrier (BBB) permeability. We have previously reported inhaled exposure to MVE promotes BBB disruption in C57BL/6 mice on a high fat diet. While one signaling pathway that has been reported to alter BBB integrity via Angiotensin II type 1(AT_1) receptors have not been completely understood. Thus, we tested the hypothesis that inhalation of MVE exposure mediates increased Angiotensin II (Ang II) production and AT_1 receptor expression in the cerebral microvasculature of C57BL/6 mice, which is exacerbated by consumption of high fat diet. 3 mo-old male C57BL/6 mice on a high fat (HF) or vs. low fat (LF, standard chow) diet were randomly assigned to be exposed by whole body inhalation to either filtered-air (FA) or MVE: 30 µg PM/m^3 diesel exhaust + 70 µg PM/m^3 gasoline exhaust for 6 hrs/d for 30 d. Treatment with the sodium fluorescein (Na-F) showed a 3-fold increase in Na-F transport from the systemic circulation into the brain parenchyma in MVE+HF animals, compared to MVE+LF or FA+LF controls, indicating increased BBB permeability. This alteration in BBB permeability was associated with a significant increase in plasma Ang II and induced expression of AT_1 receptors in the cerebral microvasculature of MVE+HF mice. Furthermore, tight junction (TJ) protein claudin-5 expression significantly was decreased in the cerebral microvasculature of MVE+HF mice. The results of BBB co-culture treated with plasma from mice exposed MVE on HF diet showed that transendothelial electrical resistance (TEER) and TJ protein expressions were decreased. However, TEER and the level of claudin-5 expression were maintained when endothelial cells were pre-blocked by AT_1 blocker or Losartan. Additionally, the levels of inflammatory cytokines including interleukin-6 and transforming growth factor-β were elevated in astrocytic media when treated with plasma of mice exposed MVE on HF diet, whereas the gene expressions of Aryl hydrocarbon receptor and Glutathione Peroxidase 1 were depleted in astrocytes. Such findings indicate that inhalation exposure to traffic-generated air pollutants, combined with a high fat diet, results in increased the inflammation of BBB co-culture and the alteration of BBB integrity, which was mediated through the Ang II via AT_1 receptors.

Keywords: Traffic pollution, High fat diet, Blood brain barrier, Tight function proteins, Angiotensin II type 1 receptors

Mathematical model of the cytotoxic effect of cold plasma activated phosphate buffered saline (pPBS)on oral squamous cell carcinoma cells (OSCCs)

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The effect of *Centella asiatica* on immunostimulant activity in *Macrobrachium rosenbergii* by quantitative assessment of Alpha2-macroglobulin (*Mr-2α2M*) gene expression

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The *Macrobrachium rosenbergii* as known as giant freshwater prawn has become economically important of aquatic animal in Thailand and Southeast Asia. However, the problem of cultivating industry is an infectious disease, which caused by a lot of pathogens species. Presently, disease prevention using antibiotics makes consumers concern about food produced from shrimp. It is residue in food products from shrimp. The aim of this study used a medicinal plant for replacement antibiotic. Gene expression of Alpha2-macroglobulin (*Mr-2α2M*) in hepatopancreas and gills was performed by Real-Time RT-PCR. The shrimps were feed by commercial food combined with the crude powder extract of *Centella asiatica* at concentration 1, 5, 10 g/kg, which extracted by 95 % ethanol for 7 days. The samples were collected for RNA extraction at 12, 24, 48, 72 hour and 7 days. The result showed hepatopancreas and gills were fed by 10 g/kg at 48 hour and gills were fed by 10 g/kg at 7 days had the highest expression level of *Mr-2α2M* gene, expression after feeding for 48 hours and 7 days, respectively. In this study, crude powder extract of *C. asiatica* could be the option to increase the immunity of giant freshwater prawn developing the recipe.

Keywords: *Macrobrachium rosenbergii*, *Centella asiatica*, Alpha2-macroglobulin, Immunostimulant activity and Real-Time RT-PCR

A pilot study of anxiolytic effects of *Lactobacillus plantarum* SF21 in zebrafish

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Anxiety disorder is the emotional disorder that is able to affect anyone. The treatments for this disorder still need to be improved due to suboptimal efficacy. Several studies revealed the anxiolytic effects of probiotics including *Lactobacillus plantarum*. According to anxiolytic activity of *L. plantarum*, the present study aimed to investigate the anxiety related behaviours in zebrafish by novel tank diving test after daily administration of *Lactobacillus plantarum* SF21 (LPSF21) for 14 days and stress inducing by chronic unpredictable stress paradigm for the last 7 days of LPSF21 administration. The results found that there were no significant differences between the zebrafish of LPSF21 administrated group and the control group in all measured parameters including latency to enter the top (*p*-value 0.437), time spent to the top (*p*-value 0.716), number entries to the top (*p*-value 0. 922) and average entry duration (*p*-value 0.109). This could be indicated that anxiolytic effects might not be found in short-termed *Lactobacillus plantarum* administration, compared with the previous studies.

Keywords: Anxiety, *Lactobacillus plantarum*, Probiotics, Zebrafish

Bowman-Birk inhibitors production for antiproliferation

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Bowman-Birk inhibitors (BBI), found in legumes such as soybean, pea, lentil, and chickpea, is a protease inhibitor (PI) with the ability to inhibit proteasomal trypsin and chymotrypsin-like activities that cause apoptosis induction in cancer cells. Here, we have demonstrated BBI from Bambara groundnut (*Vigna subterranea*). Cloning the BBI gene from Bambara groundnut to *E coli* and expression of BBI gene fragments was studied by designing 3 types of recombinant DNA: full-length (mBBI), pre-protein (mSLKL), mature-protein (mBBIN). Full-length expressed protein with a molecular weight of 13 kDa was found conversely, pre-protein expressed at 10 kDa and mature-protein expressed at 8 kDa. From the experiment, it was found that only mSLKL could be expressed. The recombinant proteins were purified by Ni-NTA affinity column chromatography. The result showed that BBI protein can inhibit proteasome enzyme. Moreover, cytotoxicity of BBI forward human colorectal adenocarcinoma cells (Caco-2 cell) was performed by MTT assay. The results showed that the cytotoxicity effects of BBI protein on Caco-2 cell was found at the concentration of 25 µg/ml after 24 hr treatment.

Keywords: (Bowman-Birk inhibitors (BBI), recombinant protein, *E coli*, Caco-2 cell)

From plant physiology to climate change research

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Despite being one of the key nature climate solutions, coastal primary producers such as mangroves, seagrasses and macroalgae are threatened by anthropogenic pressure and by a changing climate. Among the stressors imposed by climate change, ocean warming seems to be the most significant driver affecting the primary producers in the tropical regions where the upper thermal threshold is nearly reached. Controlled experiment is an effective approach to investigate physiological responses to extreme warming events, differential vulnerability among species and populations as well as interactions with other biotic or abiotic stressors occurring in the natural habitat. It was found that tropical marine primary producers are able to maintain their physiological function across a range of temperature until the tipping point is crossed. Here a drastic collapse was observed followed by mortality while local stressors were found to exacerbate the negative impacts. Physiological processes such as photosynthesis and defense mechanisms are highly responsive to stress, providing a valuable tool necessary for monitoring, for predicting the organism's fate in future scenarios and for effective management.

Keywords: Coastal ecosystems; Climate Change; Photosynthsis; Biomarkers

Reducing Reactive Oxygen Species (ROS) Accumulation and Browning in Fresh-cut 'Kim Ju' Guava Fruit by Melatonin

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Imbalance of reactive oxygen species (ROS) production and antioxidant defense system during storage induces postharvest disorders. The purpose of this study to evaluate the efficiency of melatonin (MEL) in reducing browning of fresh-cut 'Kim Ju' guava fruit, focusing on ROS accumulation and detoxification. Fresh-cut guava fruit were dipped in 0 (control), 0.01, 0.05, 0.1 and 0.5 mM MEL solution for 5 minutes. After dipping the fruits were packed in polyethylene trays covered by plastic bag with air-pore and stored at 25±1°C with a relative humidity of 82±5% for 48 hours. The results show that the fruit treated with MEL had lower browning index (BI), browning enzyme activities (polyphenol oxidase and peroxidase), but higher L* (lightness) and b* (yellowness) values than those of the control group during storage for 24 hours. The quality of all MEL-treated groups was higher than those in control group during storage. MEL at a concentration of 0.1 mM was the most effective in reducing browning and maintaining fruit quality. MEL significantly reduced ROS accumulation (superoxide radical, hydrogen peroxide and hydroxyl radical) and enhanced antioxidant enzyme activities (superoxide dismutase, catalase, ascorbate peroxidase and glutathione peroxidase). The decreases in ROS accumulation and activation of antioxidant enzyme activities by MEL were closely associated with the reduction in browning. These results suggested that MEL could reduce ROS free radical and enhance antioxidant enzyme activities, resulting in reducing in browning and quality loss of fresh-cut 'Kim Ju' guava during storage.

Keywords: Antioxidant Enzyme, Browning Reaction, Melatonin, Reactive Oxygen Species (ROS)

Antibacterial activity, phytochemical stability and toxicity studies of Caesalpinia sappan and Mansonia gagei heartwood extract

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Comparison of the soil organic carbon and carbon storage in rubber agroforestry and rubber monoculture in Southern Thailand.

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Rubber plantation agroforestry is an approach to agriculture that is coming to play a role for rubber planters. They are transforming the principles of sustainability of the national forest system as a way of making agriculture. The measurement of organic carbon in the soil is one of the indicators of the abundance in different areas. Therefore, The purpose of this study are1) to compare the organic carbon content of the soils in rubber agroforestry and rubber monoculture and 2) to measure the growth of other forest trees in agroforestry rubber plantations to predict the changes in the amount of organic carbon accumulated in the form of altered intercrop. The study area was in Songkhla and Nakhon Si Thammarat provinces. It was found that the organic carbon content in the rubber agroforestry and rubber monoculture areas in each province was not significantly different. However the organic carbon content in the soil in Nakhon Si Thammarat area was higher than that in Songkhla Province. This is because the soil in Nakhon Si Thammarat is a sandy clay soil, which is more suitable for storing organic carbon than the soil in Songkhla, which is sandy loam. According to the statistical tests using linear regression analysis, it was found that only Champathong trees were intercrop that could be used as a model growth prediction. The resulting model was linear with a positive slope. This means that as the age of the Champatong plant grows, the girth and height can increase with age in a constant manner. Nevertheless, the data collection and age diversity of the Champathong and other intercrops is needed to improve the accuracy of more efficient modeling.

Keywords: Agroforestry, Monoculture, Rubber plantation, Organic carbon, Intercrop

Invited Speaker BIO3-2

Development of *Panagrellus redivivus* As Novel Model Host for The Study of Gram Negative Bacteria Pathogenesis and Antibiotics Efficacy

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Caenorhabditis elegans has been widely accepted as a model organism in studying developmental, behavioral and bacterial infection mechanisms. Unfortunately, *C. elegans* cannot be grown at human physiological temperature of 37°C which makes it less suitable for studying the pathogen infection. In this work, we aimed to develop an easy-to-grow, tropical nematode, *P. redivivus*, as a novel model organism for investigating gram-negative bacterial infection including, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. *P. redivivus* were either treated with bacterial cell, supernatants and bacterial cell supplemented with antibiotics including amikacin, imipenem, colistin, sulbactam, ciprofloxacin and ceftazidime. The results showed that all three bacteria could infect the worms between 10^5 -10^9 CFU/ml and caused mortality within 24 hours at 37 °C. In addition, all three bacterial supernatants of overnight growth also displayed virulent to worms in concentration dependent manner. However, worms were sensitive to some antibiotic treatments such as colistin. Results from bacterial infection followed by antibiotics treatment showed that *P. redivivus* model could be used to screen the efficacy of particular antibiotics towards multi-drug resistance bacterial infections. Therefore, we demonstrate the proof of principle and establish *P. redivivus* as a potential model to study the disease caused by multi-drug resistance bacterial infections and antibiotic sensitivity.

Keywords: *Acinetobacter baumannii, Klebsiella pneumoniae,* model organism, *Panagrellus redivivus, Pseudomonas aeruginosa*

GENERATION AND CHARACTERIZATION OF *Clostridioides difficile* L-FORMS

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Production and Purification of Porcine Epidemic Diarrhea Virus (PEDV) Spike Protein in Tobacco (*Nicothina benthamiana)*

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Porcine Epidemic Diarrhea Virus (PEDV) is a member of the genus *Alphacoronavirus* infecting swine and causing severe diarrhea, dehydration, and piglet death. The PEDV infection contributes to economic loss for the livestock industry worldwide. The S1 domain of spike plays a crucial role in binding with a receptor in the host cells. Also, it contains the epitope site for neutralizing antibodies. Previous reports have shown that suckling piglets could acquire passive lactogenic protection from colostrum. Thus, the production of viral protein to quantify the antibodies in colostrum could aid the development of an effective preventive protocol in the farm. This project is aimed to develop an effective approach for protein production in a plant using a transient expression scheme. Such method could potentially offer a low-cost alternative mean to achieve a high yield production of recombinant proteins in a short period of time. Transient expression was performed using *Agrobacterium* in *N. benthamiana* to produce viral protein, S1 domain, and its truncated PEDV spikes. The expression of the recombinant proteins was accumulated at 110, 200, and 140 ng per gram of leaf fresh weight for the S1, S1-CTD, and S1-sCTD, respectively. Then the binding affinity was tested with colostrum containing IgA anti-PEDV of the immunized sow. The S1-CTD demonstrated a high binding affinity as much as the S1 protein. In contrast, the S1-sCTD had low efficiency to bind with the IgA in colostrum. So, the S1-CTD could be a candidate for utilizing as diagnostic reagent in the strip due to its smaller size than the S1 lead to more rigidity and stability.

Keywords: colostrum, *Nicothina Benthamiana*, Porcine Epidemic Diarrhea Virus (PEDV), transient expression

Biodiversity of Mayfly Larvae (Ephemeroptera) in Thailand

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Mayflies (Ephemeroptera) are one of the most common components of aquatic assemblages in freshwater environments and contribute to ecosystem services. They have been widely used as indicators of water quality and are frequently an important component of biomonitoring protocols. They exhibit a decrease in taxa richness with increased stream or river pollution and degradation. They are commonly used in combination with stoneflies (Plecoptera) and caddisflies (Trichoptera) for bioassessment programs. Nineteen families, 63 genera, and approximately 140 species of mayfly larvae were reported from Thailand. The families Baetidae and Heptageniidae are the most diverse and widespread groups of Thai mayflies. However, the number of genera and species seems to be lower than the species diversity estimation. Knowledge about the diversity of Thai mayflies has steadily increased in the present decade. New genera (*Sangpradubina* and *Cymbalcloeon*), new species and new record of mayflies were continuously discovered in Thailand. Nevertheless, it must be kept in mind that there are still several undescribed genera and species. Studies on systematics and ecology of mayflies are increasing in recent years. DNA barcoding can provide a powerful supplement to the traditional morphological approach to species identification. Further efforts to assess the conservation status of mayfly species are required. Thus, mayflies diversity and ecological requirements data could be used as tools to evaluate environmental impacts on water resources and drive future research for biodiversity conservation management strategies.

Keywords: bioindicator, systematics, new genus, DNA barcode

Allelic frequency and genetic structure of the Akha in Northern Thailand: Analysis by autosomal and Y chromosomal microsatellites

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The Akha is one of the officially recognized hill tribes in Thailand. The Akha's langauge is placed in the Sino-Tibetan family, like the Karen. The Akha historically migrated from southern China into northern Thailand and settled in Chiang Rai Province around 120 years ago. Previous genetic studies of the Akha were limited compared to other northern Thai hill tribes. Therefore, the present study investigated genetic structure of the Akha from Wiang Phang Kham Sub-district, Mae Sai District, Chiang Rai Province (25 males and 13 females) using forensic microsatellites (23 loci from autosome and 27 loci for Y-chromosome. The results showed that *Penta E* (H_E = 0.86) and *D2S1338* (H_E = 0.86) showed high heterozygosity for autosomal microsatellites whereas *DYS385-1* (H_E = 0.73) had greatest heterozygosity value for Y chromosome. Overall, the results of forensic parameters indicated that the studied microsatellites exhibited high power of discrimination within populations that can be useful for personal identification and paternity test. Analysis of genetic affinity and genetic structure of the Akha compared with other northern Thai populations revealed similar genetic structure between the Akha and the Tai–Kadai speaking groups, mirrored previous gene flow among them that occurred either before or during the settlement period.

Keywords: Akha, autosomal microsatellites, Y-chromosomal microsatellites, gene flow

Genetic Variation of *Bidens pilosa* in North-Eastern of Thailand by Start Codon Targeted (SCoT) Markers

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Bidens pilosa L. is an invasive plant in the family Asteraceae, which have an effect on the biodiversity of native plants. Consequently, the objective of this study is to study the genetic variation of *B. pilosa* in the north-eastern of Thailand. Genetic variation of a total of 25 individuals of *B. pilosa* collected from Loei, Khon Kaen, Udon Thani, Nong Kai, and Nakhon Ratchasima were studied using SCoT markers. Four SCoT primers which produced a clear and scorable bands, including SCoT7, SCoT9, SCoT15 and SCoT24 were selected for this study. The results showed that these primers produced 66 bands, of which 65 are polymorphic bands, exhibiting 97.22% polymorphism. The average of Polymorphic Information Content (PIC) was 0.3092. The total genetic differentiation among groups was low (G_{ST} = 0.22) and the estimate of gene flow among the groups was high (N_m = 1.78). Moreover, the analysis of molecular variance (AMOVA) showed that the genetic variation within groups (88%) was higher than between groups (12%). The results of cluster analysis by Unweighted Pair Group Method with Arithmetic Mean (UPGMA) and Principal Coordinate Analysis (PCoA) methods classified *B. pilosa* into 2 clusters, however these clusters do not correspond with their distribution.

Keywords: Alien plant, Asteraceae, *Bidens*, Genetic diversity, Genetic markers

Genetic Structure of Northern Thai Hill Tribes: Revealed by Autosomal STRs

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The hill tribes of northern Thailand comprise nine officially recognized groups: the Austroasiatic-speaking (AA) Khmu, Htin and Lawa; the Hmong-Mien-speaking (HM) IuMien and Hmong; and the Sino-Tibetan-speaking (ST) Akha, Karen, Lahu and Lisu. Except the Lawa, the rest of the hill tribes migrated into their present habitats only very recently. The Thai hill tribes were of much interest to research groups focusing on study of cultural and genetic variation because of their unique languages and cultures. So far, there have been several genetic studies of the Thai hill tribes. However, complete forensic microsatellite database of the Thai hill tribes is still lacking. To construct such database, we newly generated 654 genotypes of 15 microsatellites commonly used in forensic investigation that belong to all the nine hill tribes and also non-hill tribe highlanders from northern Thailand. We also combined 329 genotypes from previous studies of northern Thai populations bringing to a total of 983 genotypes, which were then subjected to genetic structure and population relationships analyses. Our overall results indicated homogenous genetic structure within the HM and Tai-Kadai (TK) speaking groups, large genetic divergence of the HM-speaking Hmong but not IuMien from the other Thai groups and genetic heterogeneity within the ST- and AA-speaking groups, reflecting different population interactions and admixtures.

Keywords: hill tribe, microsatellites, autosome, genetic relationship

Invited GEO-1

Formation of Takhli Soil Series and Petrology of Parent Rocks at Ban Chonduae, Tambon Takhli, Takhli District, Nakhon Sawan Province

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Takhli soil series at Ban Chonduae, Tambon Takhli, Takhli District, Nakhon Sawan Province overlay on limestone and a small amount of clastic rocks. Takhli soil series were analyzed for soil profiles and their composition to construct a deposition model. Soil profiles have a thickness of 5-20 meters and consist of two soil layers. The upper soil is dark and strongly reacts with hydrochloric acid. It has a thickness about 1-3 meters contains pebbles and organic matters in a small amount. The lower soil is yellowish-white, strongly reacts with hydrochloric acid and contains pedogenic carbonate. The pedogenic carbonate is as the calcrete which increases in size and volume with depth and found the 1.5-meter-thick laminar cap. Moreover, a weathered quartz-epidote vein was found in some area. The mineral composition analyzed by XRD and SEM, and the result shows that the studies soils contain quartz, calcite, and montmorillonite. The amount of calcite in the lower horizon is greater than the upper horizon. Petrography of pedogenic carbonate samples can be divided into two groups, PC1 and PC2, according to the mineral composition and allochem. PC1 group contains more than 80 percent of sparite, whereas PC2 group contains less than 80 percent of sparite and more than 30 percent of allochem and other minerals. Petrography of the limestone parents was divided into four groups, including sorted biosparite, sorted intrasparite, poorly washed biosparite, and intraclast-bearing micrite. The result of this study suggests that the Takhli soil series was occurred by transportation as the calcic horizon. The parent rocks are made up mostly of limestone from the Tak Fa Formation with a small amount of clastic sedimentary rock and felsic igneous rock.

Keywords: calcrete, limestone, pedogenic carbonate, soil

Geology of Paleozoic Basement Rocks and Suthep – Inthanon Metamorphic Complex at Tambon Samoeng Tai, Samoeng District, Chiang Mai Province

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The study area is located in the western side of Chiang Mai city at Tambon Samoeng Tai, Samoeng District, Chiang Mai Province, which is a part of the Chiang Mai-Chiang Rai Suture Zone. A published geologic map shows the Paleozoic basement rock units that coexist with the Suthep-Inthanon metamorphic core complex. These Paleozoic basement rocks are expected to preserve geologic evidence of the Paleo-Tethys closure during the Latest Permian to Earliest Jurassic. The objectives of this study are to map the distribution of rocks, and to delineate the relationship between the Paleozoic basement rocks and their respective lithology. The methods are based on geomorphological, petrographical, and structural analysis where the main concern given in exposed outcrops along the surveyed routes. It comprises Ordovician calc-silicate, Ordovician crystalline limestone, Carboniferous sedimentary rock, and Triassic granite with mylonitic deformation. Petrography analyses show the difference between calc-silicate and crystalline limestone are from the different deformation events associated which the former ones related to granitic batholith. An analysis of the paleo-stress from the folding structure shows the plate motion direction of the Sibumasu block subducted northward beneath the Indochina block. The structural contact between the Paleozoic basement rocks is interpreted as a reverse fault where the Ordovician limestone thrusts over the Carboniferous sedimentary rocks. Interpretation of fault is related to the exhumation of the metamorphic core complex along the detachment of the Chiang Mai Low-Angle Normal Fault.

Keywords: Indosinian Orogeny, Paleozoic Basement Rocks, Metamorphic Core Complex, Samoeng

Petrography and Geochemistry of Lithium-bearing Minerals in Granite at Tambon Tam and Tambon Kalai, Takua Thung District, Phang Nga Province

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Granitoids in the study area at Tambon Tam and Tambon Kalai, Takua Thung District, Phang Nga Province contain lithium minerals. Undermicroscope, the 15 studied rock samples can be separated to 4 groups; monzogranite, syenogranite, quartz-rich granitoid, and granodiorite. The XRF analysis, the studied rocks consist of major oxides percent by weight, including SiO_2 (63.024 - 73.122), Al_2O_3 (16.976 - 24.042), Na_2O (0.103 - 6.034), and K_2O (3.085 - 7.450) and trace elements ppm by weight, including Ba (584.11 - 771.21), Rb (4346.75 - 10279.87), and Y (997.46 - 2383.17). XRD analysis, 5 rock samples are composed mostly of the samples consisted of quartz, alkali feldspar (orthoclase), plagioclase (albite), and mica (lepidolite). SEM-EDS, shows the chemical composition of lepidolite which the mineral formula is obtained as $K_{1.84}(Li_{1.71}Al_{3.47})(Si_{7.51}Al_{0.49})O_{20}(OH,F)_4$, which can determine the amount of lithium oxide of lepidolite as 5.993 - 6.032 percent by weight. Rock samples contain the average content of lithium is 1.116 - 1.123 percent by weight. The content of lithium oxide by weight depends on the proportion of fluoride or water in the mineral formulation, that could not be obtained from the tool used in this study.

Keywords: Lithium-bearing Minerals, Granite of Thailand, Petrography, Geochemistry

Petrography of The Plutonic Rock in Doi Pa Sak and Doi Pha Ruea, Tambon Tha Khao Plueak, Mae Chan District, Chiang Rai Province

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The plutonic rocks in Doi Pa Sak and Doi Pha Rua, Tambon Tha Khao Plueak, Mae Chan District, Chiang Rai Province are expected to be part of the central granite rock of Thailand. The petrographic studies were divided into 2 groups as felsic plutonic rocks and mafic plutonic rocks. The felsic plutonic rocks are the tonalite and granodiorite. They can be divided into 3 groups according to the accessory minerals: garnet-biotite tonalite, biotite tonalite, and low accessory minerals granodiorite. The essential minerals found are plagioclase, quartz and potassium feldspar and the accessory minerals are biotite, apatite, zircon, garnet, muscovite, cordierite, and opaque minerals. The mafic plutonic rocks are classified as gabbro/olivine gabbro composed of essential minerals such as plagioclase, pyroxene, olivine, and hornblende with an accessory mineral opaque minerals. Evidence of the accessory minerals was found in plutonic rocks can identify the s-type rock in an area, but further geochemical data is needed to identify evidently.

Keywords: petrography, plutonic rocks, S-type granite, Thailand

Petroleum exploration in Thailand: Current perspectives and future of science

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Petroleum exploration remains an essential part of geoscience. It provides national energy resources that have been increasing every year in Thailand, but domestic petroleum production has been insufficient. Although, alternative energy (e.g. bio-fuel, hydro power, wind power, solar power and geothermal energy) is considered to be an optional energy supply in order to avoid fossil fuels such as oil, natural gas and coal in Thailand. The main goal of the nation plan is to enhance the use of renewable energy by 30% in total energy consumption by 2036. Thus, we cannot ignore the activity and research on petroleum exploration in Thailand to secure Thailand energy supply. In order to take advantage of this potential, new knowledge and technology must be developed in order to keep petroleum resource place in the national energy picture.

There are still many disagreements, uncertainties and gaps in our knowledge regarding the petroleum exploration of many basins throughout Thailand and surrounding regions of Southeast Asia. Recent advances in our understanding of petroleum and subsurface geoscience in the region has been led by rapid advances in technology, new data, new ideas as well as a fresh look at old data and previous work. There is also an increasing concern within the geoscience community in Thailand regarding the practice and application of their discipline and the future of the profession. Thus, a young scholar should play important role on this research area in the future by integrating modern and traditional methods in petroleum exploration.

Keywords: Petroleum exploration, Geoscience, Energy resource

Geomorphology and Tectonic Geomorphology of Khuang Kom and Ban Kho Faults, Lampang Province

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Khuang Kom and Ban Kho Faults located in Lampang Province, Northern Thailand are considered as active faults in Phayao Fault Zone. The study characterizes drainage patterns, geomorphic features of active faults, and seismic activities using geomorphic indices i.e. mountainous front sinuosity (Smf) and stream length gradient (SL) indices. The results show that most drainage patterns across the study site are parallel and rectangular drainage patterns that are the results of structural control of joints or faults in bedrock. The dominant geomorphic features are triangular facets, fault scarps, offset streams, and hot spring indicating that Khuang Kom and Ban Kho Faults are oblique faults. The analysis of geomorphic indices has confirmed that Khuang Kom and Ban Kho faults are active faults; 1) the Smf varies from 1.0175 – 2.0407 that 88.57% of faults are highly active (Smf 1.0-1.6), and 11.43% of faults are moderately active (Smf >1.6), and 2) SL index is moderate near mountain front. These geomorphic indices indicate the tectonic uplift and/or subsidence associated with active oblique Khuang Kom and Ban Kho faults.

Keywords: Phayao fault, mountainous front sinuosity, stream length gradient

Lithofacies and depositional environments of the Laem Sing Formation in Chanthaburi Province

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Geological attractions are important places for tourism and education. Nowadays, people are increasingly interested in geotourism and skeptical about geological history of those geological attractions, inferred from sedimentary rocks. Pink Stone in Chanthaburi Province, a geological attraction and the study area, shows distribution of the Laem Sing Formation. The formation was divided into six lithofacies. They consist of grain-supported granular to pebbly conglomerate facies, matrix-supported granular to pebbly conglomerate facies, grain- to matrix-supported granular to pebbly conglomerate interbedded with fine-grained gravelly sandstone facies, very fine- to fine-grained gravelly sandstone facies, laminated very fine- to fine-grained gravelly sandstone facies, and cross-laminated very fine- to fine-grained gravelly sandstone facies. These lithofacies were interpreted to represent alluvial fans. This research project provides geological information to support other researches related to the Laem Sing Formation. The results of the project can be a geological database for development and promotion of geological attractions and geoparks in Chanthaburi.

Keywords: alluvial fans, conglomerate, gravelly sandstone, Pink Stone

Seismic Reflection Survey at Ban Pang Phraya, Mae Le sub-district, Mae Wong district, Nakhon Sawan Province

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This research is based on a study of aerial photographic interpretation and geomorphology that indicate faults, such as triangular facet and offset stream in the area of Ban Pang Phaya, Mae Lay Sub-district, Mae Wong District, Nakhon Sawan Province. This incident led to this research work that uses a shallow seismic reflection survey to explore the subsurface of the study area in Ban Pang Phaya, Mae Lay Sub-district, Mae Wong District, Nakhon Sawan Province. There are 6 survey lines with a length of 142 m and 72 channels 28 Hz geophone were used. The results of the survey show the subsurface geological structure and found evidence of fault that expected to be a northwest-southeast normal fault at a depth of about 10 meters. From the data obtained, It can be useful for determining the use of the area to be safe from an earthquake disaster.

Keywords: Normal fault, Seismic, Reflection, Nakhon Sawan

Low-Salinity Enhanced Oil Recovery Using Imbibition Test in Sandstone from Ban Pong Tai, Tambon Ban Pong, Hang Dong District, Chiang Mai Province

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Low-salinity waterflooding is one of enhanced oil recovery techniques. The present work aims to examine factors that influence crude oil displacement in sandstone samples taken from Ban Pong Tai, Tambon Ban Pong, Hang Dong District, Chiang Mai Province. The rock samples have been characterized its composition by X-ray diffraction (XRD) technique and rock 2D porosity by scanning electron microscope (SEM) images of its thin sections. Liquid saturation method was also used to determine bulk 3D porosity of the rock samples. Oil recovery performance was then studied by spontaneous imbibition technique with different brine concentrations (0.01 – 1 M) and species (NaCl and $CaCl_2$). The XRD result suggests that principal minerals of sandstone sample are quartz and microcline with minor of clay minerals (e.g. kaolinite, illite and montmorillonite). 2D porosities of thin sections differs: 10.6% in parallel and 6.6% in perpendicular to bedding direction, while 3D porosity by liquid saturation method was determined to be 2.2%. Imbibition results show the highest oil recovery at 0.01 M of $CaCl_2$, while the lowest oil recovery was found at 1 M of NaCl. Although previous study found monovalent brine at 0.01 M producing the highest oil, the present study observed a contradict result which the highest oil recovery was obtained at 0.1 M monovalent brine. This is thought to be due to influences of rock compositions and oil components, which are much difference from literature.

Keywords: low-salinity oil recovery; enhanced oil recovery; spontaneous imbibition; flow in porous media

Seismic Tectono-Stratigraphy From 2-Dimensional Seismic Data of Carboniferous to Triassic Successions in Sakon Nakhon Basin, Northeast Thailand

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Sakon Nakhon basin in northern Khorat Plateau, northeastern Thailand represents one of the frontier areas for petroleum exploration. The Khorat Plateau is believed to have many deformation events that possibly influenced the timing of petroleum system element formations, especially faults and fractures in the Permian carbonate reservoirs. Therefore, this study is proposed on interpreting tectonic evolution during Carboniferous to Triassic in the southern Sakon Nakhon basin by using two-dimensional seismic interpretation. The results reveal several geological structures observed in the study area including low-angle planar normal fault, high angle normal fault, domino normal fault, detachment imbricated thrust fault, reverse fault, and fault propagation fold. The predominant trend of structural styles is WNW-ESE to NW-SE trend. Based on the results, it is summarized that there are three phases of tectonic evolution during Carboniferous to Triassic, namely: (1) Late Carboniferous to Middle Permian extension influenced by subduction of Paleo-Tethys Ocean under Indochina block; (2) Late Permian to Middle Triassic compression mainly affected by South China and Indochina collision and (3) Late Triassic rifting. There are three tectonostratigraphic units related to tectonic evolution including pre-rift unit as Si That and Pha Nok Khao Formation, syn-kinematic unit as Hua Na Kham Formation, and syn-rift unit as Lower Nam Phong Formation. The tectonic evolution during the Carboniferous –Triassic plays an important role in controlling petroleum system elements in the study area.

Keywords: Sakon Nakhon basin, Seismic interpretation, Seismic tectono-stratigraphy, Tectonic evolution

Replicating effects of zinc oxide catalyst surfaces on diuron adsorption by AFM force spectroscopy

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To experimentally seek the insight into the interactions between reactant molecules and the catalyst surface, we explore a model of the heterogeneous catalytic reaction based on diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] photo-degradation over a zinc oxide (ZnO) particle catalyst. We used atomic force microscope (AFM)-based force spectroscopy under ambient conditions to determine interactions between individual functional groups of diuron (NH2, Cl, and CH3) and surfaces of ZnO particles (polar Zn and O-terminated, and nonpolar Zn-O terminated). Deriving from various force-distance curves of functionalized probe/surface pairs, we identified the two polar surfaces of conventional ZnO particles and the nonpolar surface of ZnO nanorods. With a thorogouh anlysis of these force-distance curves, we postulated that the reaction involved physisorption and the diuron adsorption behavior was dictated by van der Waals interactions, which infered diuron adsorption configurations during contact with each ZnO facet. The results were also interpreted through the characteristics of the obtained reaction intermediates and the obtained rate of degradation.

Keywords: Force spectroscopy; Atomic force microscopy; Adsorption; Diuron; Zinc oxide

Dimensionality reduction in quantum channels

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Calculating physical properties of complex quantum channels requires a lot of computing resources. Previous work has shown that resources for calculating system's energy eigenvalues can be reduced to correlation at a point of interest. In this work, we extend our finding to investigation of changes in the correlation function of time-dependent wave function due to dimensionality reduction in the geometrical construction of quantum channels. The correlation functions give signatures that point to dominant eigen energies in all dimensions when the channel evolves from a 2D finite well to approach a 1D long one. On the other hand, when we introduce an obstruction in the channel, we found that the signatures only point to the dominant eigen energies in the dimension along the width of the obstruction. Those correspond to the other dimension along the length of the channel have eigen energies mixed and their statistical properties need further investigation. This setup demonstrates quasi-bound states in quantum channels.

The study of binding parameters from co-sedimentation assays on two-ligand system

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Ligand-macromolecule reaction is the crucial part of the biological process such as signal transmission and intracellular transport. The key parameters of ligand-macromolecule reaction at equilibrium are the dissociation constant and the stoichiometry, which is the ligand per binding sites on macromolecule. These two parameters are the key parameters to find the probability of inserting a new ligand. However, in the case of the large ligand binding on macromolecule, the large ligand will cover more than one binding site thus, the concentration of free binding site on macromolecule may depends on the sizes, concentration of ligands and dissociation constants. We interested the two-ligand binding on the same macromolecule system by considering from homogeneous system. We considered the probability of inserting a new ligand of McGhee and von Hippel equation in one-dimension. We found that the probability of the binding reaction depends on the size of the ligands, the dissociation constant and the total concentration of ligand two kinds. The different size of ligand affects to the macromolecule coverage of L_1 (ρ_1) and L_2 (ρ_2) by the smaller ligands can bind on macromolecules more than the bigger ligands. The higher total concentration will have more chance to bind on macromolecule caused by the ligand concentration which is indicated to the number of ligands. And, the higher equilibrium constant will bind on macromolecule better than the low equilibrium constant.

Keywords:
1. Ligand is a substance that forms a complex with a biomolecule to respond a biological purpose**.** Ligand may be a small molecule, ion, or small protein.
2. Macromolecule is a very large molecule. The most common macromolecule in biochemistry are biopolymers, for example, proteins and carbohydrates.
3. The dissociation constant is a specific type of equilibrium constant that measures the propensity of a larger object to separate (dissociate) reversibly into smaller components, defined as K_d where $1/K_d$ indicates the ligand-macromolecule affinity.
4. The stoichiometry is the ratio of the number of ligands per the number of binding sites, defined as n.

Multiple Phases Plasma-Assisted Chemical Vapor Deposition Growth of Carbon-Based Nanomaterials

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Carbon-based nanomaterials have been in the center of the research community thanks to the material's excellent optoelectronics properties. One scalable way to grow these carbon-based nanomaterials is Chemical Vapor Deposition (CVD). The aims of this project are to study and analyze the effects of substrate position results on carbon-based nanomaterials properties in the CVD tube which would experience different local flow rate and temperature. In this study, the carbon-based nanomaterials were synthesized by plasma assisted CVD using Argon and ethanol plasma generated from their gaseous forms in an attempt to grow samples on cover glass substrates. In this work, Cu wires were also used to ease the plasma generation. The cover glass position was varied to study its effects on carbon-based nanomaterial's characteristics. Scanning electron microscopy (SEM) was used to spectate the morphology of the carbon-based nanomaterials. The samples were also inspected by electron dispersion X-ray spectroscopy (EDS) to analyze chemical characterization of the samples. Raman spectroscopy technique was performed to investigate the carbon-based nanomaterial's characteristics such as D, 2D, D3, D4 and G peaks. The obtained spectra were thoroughly fitted and analyzed for the peak intensity and the FWHM. The Raman spectra and SEM results revealed that the samples were consisted of the multiwall carbon nanotubes (MWCNTs), crystalline carbon flakes materials and carbon black which caused by the different gas flows and temperature. The results also showed that the amount carbon-based nanomaterials increase with the distance from the plasma ignition point.

Keywords: Carbon-Based Nanomaterials, Multiple Phases, Plasma-Assisted Chemical Vapor Deposition

Energy conversion of electrostrictive Poly (vinylidene fluoride-co-hexafluoropropylene) /Graphene composites

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Energy conversion based on electrostrictive properties of poly (vinylidene fluoride-co-hexafluoropropylene), (P(VDF-HFP)) polymer filled with graphene nanoplatelets (GNPs) was investigated. All samples were fabricated by the solution casting method. In fact, the electrostrictive property of polymers is indicated by its electrostrictive coefficient that depend on the dielectric constant. Thus, the LCR meter was used to determine the dielectric behavior in a range of frequencies. The photonic sensor was used to investigate the electrostrictive coefficient by detecting the displacement of the samples in a varying electric field. After that, the energy conversion with vibration conditions was measured. The results revealed that dielectric constant, and electrostrictive coefficient significantly increased when the GNPs fillers were increased. Accordingly, the voltage output and generated current from the composite films also increased with the GNPs content. This work showed that the GNPs fillers can enhance the electrostrictive properties based on dielectric behavior that cause the composite films to be good efficiency of electromechanical conversion.

Keywords: Poly (vinylidene fluoride-co-hexafluoropropylene, Graphene nanosheet, Dielectric materials, Electrostrictive materials, Energy conversion of electrostrictive property

Mathematical model of magnetic nanoparticle delivery in microvessels

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This study developed a mathematical model for tracking drug carrier containing superparamagnetic nanoparticles (SNPs) in microvessel of tumor under influences of magnetic field applied by external magnet, blood flow and random processes (diffusion and collisions with red blood cells). The equation of motion of individual carrier was solved numerically by using Euler's method to obtain its trajectory on a plane parallel to microvessel's axis and pass through vessel's diameter. Capture behaviors of drug carriers in microvessel by external magnetic field were investigated. Simulation parameters were volume fraction of SNPs contained in the carrier (ω_{Imp}), radius of the carrier (r_{p}) and the distance between the vessel and the near surface of external magnet (d). It is indicated, by comparing our simulation result with an in-*vitro* experimental result, that our model was valid for low blood speed condition which was commonly found in microvessel such as vanule. Percent retention of drug carriers in microvessel tend to increase with ω_{Imp} , r_{p} and decreasing d. The simulation results also indicated that random processes affected significantly on capture behaviors of drug carreirs. Random processes limited percent retention of the carriers but distributed the captured carriers over all the length of the vessel.

Keywords: Superparamagnetic nanoparticles, Magnetic drug delivery, Mathematical model, Euler's method.

Fabrication of Polypropylene Fibers by Using 3D Melt Electrospinning Technique

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Nonwoven polypropylene (PP) fibers can be used a wide variety of industrial and health-care applications, especially for production of face masks. Most industries use melt blown technique for fabrication of the PP nonwoven fabrics. However, the melt blown usually leads to a 2D-deposition of PP fibrous. In this work, we report on the use of a 3D melt electrospinning technique to build controlled 3D-structures made of PP fibers. This is achieved by combining 3D printing with melt electrospinning technique. The modified nozzle used here was assembled by applying a heating part and a high voltage. In addition, the modified nozzle can move in the *x*-*z* axis, while the fiber collector (build plate) can be set in along the *y*-axis. PP filament with diameter of 1.75 mm was used and characterized by thermogravimetric analysis (TGA). The negative terminal of the high voltage was connected to the nozzle, while the positive terminal was connected to the 3D printer build plate. Effect of the applied voltage, the working distance, and the heating temperature have been investigated. The PP nonwoven fibers were characterized with a scanning electron microscope (SEM). The results show that the PP can be electrospun at the nozzle temperature of 360 °C. In addition, the average diameters of the PP fibers are 71.46, 28.30, and 35.88 um when applying with high voltage of 35, 40, and 45 kV, respectively. This study concludes that increase of high voltage can reduce the diameter of PP fiber in 3D melt electrospinning technique.

Keywords: 3D melt electrospinning, 3D printing, Melt electrospinning, Polypropylene

Invited PHY2-1

Optical properties of green emitting phosphors

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This research aimed to study the properties of phosphor, i.e., $SrAl_2O_4$: Eu, Dy laboratory phosphor and commercial phosphor. The chemical composition of commercial phosphor was characterized by Energy Dispersive X-Ray Spectroscopy (EDS) method. We found that the chemical compositions of commercial phosphor similar to laboratory phosphor. The wavelength of phosphorescence spectrum of both phosphors was measured by using the spectrometer. We found that their wavelength at maximum light intensity was 523 nm which is the green-emitting phosphor. The light intensity and emitting time of phosphor were measured after turn off the light source for 10, 5, 1 minute and 30 seconds. The light source such as 20,000, 10,000 and 5,000 lux were exposed to the samples, respectively. The phosphor powder distributed on a circular area of 1 and 2.4 cm in diameter. The phosphor powder mixed to perform the resin with the ratio of resin 13 g per hardener 1 g and also including a phosphor powder 0.5, 1 and 1.5 g, respectively. Our results showed that both phosphor intensities decreased with the exponential decay. As the ratio of phosphors increases, the emitting intensity of the mixture is also increased.

Keywords: Green phosphor, Phosphorescence, Photoluminescence, Strontium aluminate

Effect of Oxygen Concentration on Structural, Electrochemical, and Mechanical Properties of Silicon Oxide (SiOy) Materials for Li-Ion Battery Anodes: A Molecular Dynamics Study

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Silicon has been recognized as a promising anode material for Li-ion batteries (LIBs) due to its remarkably high specific capacity. Despite its advantage, practical uses of silicon-based LIBs are still impeded by the major limitation involving a poor cycling retention caused mainly by an excessively large volumetric strain (up to 300%) during lithiation. To overcome this challenge, a ton of research studies have been devoted by implementing several strategies including silicon composites and silicon oxide (SiO_y) compounds. In this study, we aim to understand the effect of oxygen concentration in SiO_y on structural evolution, lithium storage, lithium diffusion, and mechanical degradation of the material during lithiation/delithiation cycles to establish the most appropriate oxygen content. To do this, we used molecular dynamics (MD) simulations with a reactive ReaxFF force field, which is capable of capturing bond breaking and bond formation processes using the concept of bond order. Various geometries of lithiated Li_xSiO_y ($0 \leq y \leq 2$, and $0 \leq x \leq 4$) have been created and were subjected to equilibration simulations at various temperature to obtain the information on structure and Li diffusion behaviors. The prepared systems were also subjected to a tensile test modeling as well as Li extraction simulation for investigating their mechanical property and structural reversibility. We found that increasing oxygen content in SiO_y although results in a lower volume expansion, it decreases the diffusivity of lithium due to a strong interaction between Li-O. Moreover, a larger number of Li atoms are likely to be trapped inside the anode materials containing the larger amount of oxygen during delithiation process, which in turn degrades the mechanical ductility of the material. Our simulations suggest a low fraction of oxygen ($y \sim 0.5$) suitable for balancing these effects and for improving the cycling stability of the Si-based anodes.

Keywords: Li-ion batteries (LIBs), Molecular Dynamics (MD), Silicon Oxide, Anodes

Fabrication and electrical properties of layer-by-layer electroactive polymer for energy storage

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Ferroelectric materials are one of the dielectric materials for capacitive energy storage because they provide high dielectric constants (ε_r) and high energy densities (U_e). In this work, the dielectric properties and energy storage capacity of polymers were studied. The bilayer polymer films of Poly(vinylidene fluoride-co-hexafluoropropylene)(P(VDF-HFP)) and polyurethane (PU) were prepared by the layer-by-layer method in various layer thickness. The dielectric constant of bilayer films was found to be in a range of 3.4-4.1 at 1 Hz. While the dielectric constant of single-layer P(VDF-HFP) film was about 3.2. Moreover, the electrical breakdown strength (E_b) of the bilayer with P70/PU30 films reached 379 V/μm which are higher than the single-layer films. Therefore, the energy density (U_e) and the energy storage efficiency (η) of the bilayer were 0.59 J/cm^3 and 77%, respectively.

Keywords: Bilayer films, Energy storage, PU, P(VDF-HFP)

Quality Control of Magnetic Resonance Imaging (MRI) by Computer Programming with Python

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Magnetic Resonance Imaging (MRI) is one of the essential medical equipment for imaging inside humans. The MRI quality control (MRI QC) is strictly to retain the accuracy and efficiency. The usually quality control processes consist of the scanning of ACR Phantom with localizer and T1 axial technique and the manual analysis of the MRI images. In this study, the researcher has written a program on Python 3.8 – 3.9 to record and analyze the scanned images. The program was initially aimed to process the images for the 8 protocols defined by the Department of Medical Science, Ministry of Public Health. However, at this stage, the final program can only process by 6 out of the 8 protocols. Two protocols, the High-Contrast Spatial Resolution, the Low Contrast Detectability, still need to be examined by users. The dataset provided by Srinagarind Hospital was analyzed by the written program. The obtained results are: 189.6875 millimeters and 188.75 millimeters in Geometric Accuracy, passed 1.0 millimeters in High-Contrast Spatial Resolution, 4.72 millimeters in Slice Thickness Accuracy, 3.75 millimeters in Slice Position Accuracy, 85.90 percent in Percent Image Uniformity, 38 spokes in Low Contrast Detectability, 0.00059 in Percent-Signal Ghosting and 1146.893 in Signal to Noise Ratio. According to the results, the program can provide the outputs which are approximate to those obtained from the manual testing on the same dataset but uses much shorter time to complete the task. This means the program can be very useful for performing quick MRI QC tests.

Keywords: MRI, Python (Programming Language), QC

Fabrication and characterization of van der Waals material based on MoS_2

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Molybdenum disulfide (MoS_2) is one of the most studied 2D material from family of transition metal dichalcogenides (TMDs). It possesses many fascinating properties such as its high transparency, super strong, durable, flexible, and super thin. Monolayer MoS_2 is a semiconductor with a direct bandgap of 1.8 eV very high compared to other semiconducting 2D materials. All of the aforementioned properties are essential for many applications, such as energy conversion and storage, wearable electronics and optoelectronics. In addition, stacking of 2D materials to create van der Waals heterostructure especially the stacking of two single-layer flakes of MoS_2 may be able to provide new functionalities. In this thesis, we attempt to fabricate and study two type of 2D van der Waals heterostructure based on MoS_2. First, Raman spectrum of twisted bilayer ($tMoS_2$) is fabricated using pick-up technique and its Raman spectrum is investigated. The peak frequency difference between the two Raman modes of $tMoS_2$ has a value between single-and bi-layer MoS_2 and the peak intensity of $tMoS_2$ is lower than that of bilayer MoS_2. This indicates that the $tMoS_2$ has different characteristics from its single-and bi-layer counterparts. Second, we fabricated field effect transistor from single layer MoS_2/BN van der Waals heterostructure. We measure two-probe electrical conductivity and a function of mobility and find mobility of 2.25 cm2V-1s-1 at room temperature.

Keywords: van der Waals heterostructure, twisted bilayer MoS_2, Raman spectrum

Effect of firing temperatures on phase formation, microstructure and electrical properties of 0.97BNKT-0.03BNbT lead-free ceramics synthesized via the solid-state combustion method

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In this research, the effect of firing temperatures on phase formation, microstructure and electrical properties of $0.97Bi_{0.5}(Na_{0.84}K_{0.16})_{0.5}TiO_3$-$0.03Ba(Nb_{0.01}Ti_{0.99})O_3$ or 0.97BNKT-0.03BNbT ceramics synthesized via the solid-state combustion method was examined. The $Bi_{0.5}(Na_{0.84}K_{0.16})_{0.5}TiO_3$; BNKT and $Ba(Nb_{0.01}Ti_{0.99})O_3$; BNbT powders were calcined in range of 600 - 800°C and 1100 - 1300°C, respectively, and the 0.97BNKT-0.03BNbT ceramics were sintered between 1050°C and 1150°C. The pure perovskite phase was observed in the BNKT powders and BNbT powders at the calcination temperature of 700°C and 1150°C, respectively, for 2 h. The microstructure of the BNKT and BNbT powders exhibited the average particle size around 308 – 357 and 328 – 398 nm, respectively. All ceramics presented a single perovskite structure with tetragonal phase. The average grain size increased with increasing sintering temperature. The density, maximum dielectric constant (ε_m) and remnant polarization (P_r) increased with increasing sintering temperature up to 1125°C, thereafter they decreased. At a sintered temperature of 1125°C, 0.97BNKT-0.03BNbT ceramic showed the highest density of 5.88 g/cm^3, ε_m of 6485 and high P_r of 8.34 μC/cm^2. In addition, all ceramics exhibited a pinched hysteresis loop indicating relaxor behavior and increase in sintering temperature make an increase in loops pinching, indicating that high thermal can be disturbed long-range order in ferroelectric ceramics.

Keywords: 0.97BNKT-0.03BNbT; solid-state combustion; phase formation; microstructure; electrical properties

Dark Matter Search by Cherenkov Telescope Array (CTA)

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Despite striking evidence for the existence of dark matter from astrophysical observations, dark matter has still escaped any direct or indirect detection until today. Therefore, a proof for its existence and the revelation of its nature belongs to one of the most intriguing challenges of nowadays cosmology and particle physics. In this talk, I will explain how to investigate the nature of dark matter through Cherenkov Telescope Array (CTA). I will focus on gamma rays from dark matter annihilation. I will explain how we provided constraints on dark matter annihilation cross-section and the mass of dark matter particles from gamma rays that will be measured by CTA.

Keywords: Dark matter, Gamma rays, Cherenkov Telescope Array (CTA)

Penrose diagram for black hole solutions

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This research aims to construct the Penrose diagram and study the causal structure of Schwarzchild and Kerr blackhole. The method which change coordinates to finite range is call conformal transformation. The result show that Penrose diagram for Schwarzchild and Kerr solutions can be plotted with conformal coordinate. Moreover, causal structure can be showed in Penrose diagram.

Keywords: Penrose diagram, causal structure, conformal transformation, conformal coordinates, causal

Modified Gravity with Interacting Dark Energy Dark Matter in Dynamical System Approach

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In this work, we employ the $f(R)$ gravity as the alternative explanation of Dark Energy (DE) to study an interaction between DE and Dark Matter (DM) by using the dynamical system approach. The autonomous system of the dynamical system analysis is constructed from the Friedmann's equation with the inhomogeneous energy-momentum conservation with Q where the Q variable stands for the energy-mass transfer between DE and DM and we will use the simple model as $Q = 3\alpha H\rho_m$. The cosmological evolution of the viable $f(R)$ gravity models is studied in detail. We also find a modification behavior of viable $f(R)$ gravity models from the interacting DE and DM, Q. As a result, some viable model gives incorrect cosmological evolution deviating from the LCDM because of the additional fixed points and their eigenvalues from the stability matrix depending on Q. While some viable $f(R)$ models are still compatible with the LDCM. In addition, the interacting DE-DM parameter α also modifies the ranges of the parameters in the viable $f(R)$ gravity models.

Keywords: $f(R)$ Gravity, Dark matter, Dark energy, Dynamical system

An investigation of Aharonov-Bohm effect in curved space-time and its application to the gravitational wave detection

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The great discovery of Gravitational wave was manifested to the world by the large collaboration project LIGO. Although this experiment possesses high potential and precision to detect the wave, there is still a limit on minimizing the order of the wave strength. In this project, we investigate an alternative way to detect the gravitational wave using the concept of Aharonov-Bohm experiment in curved space-time. Our system consists of an electron beam which is split into two beams passing opposite sides of the solenoid and producing interference patterns while the magnetic field is fixed uniformly. The change in interference patterns through the phase shift can be observed if the system is perturbed by the gravitational wave and can be used to trace back to the nature of the gravitational wave. Our system is described in Minkowski space-time with the wave propagating in the direction either perpendicular or tangent to the solenoid cross-section. The results show that the tangent wave could produce more significant phase shift than the perpendicular wave. This system is therefore could potentially be used to detect gravitational wave travelling in the tangent direction to the solenoid cross-section area.

Keywords: Aharonov-Bohm effect, General relativity, Gravitational wave, Phase shift, Quantum mechanics

Tracking Origins of Gamma Rays in the Milky Way Galaxy by Fermi-LAT All Sky Maps

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The Milky Way galaxy distribution is a major issue in astronomy. One of the methods to study galactic activities is light detection due to lights or photons can be produced by astrophysical objects and phenomena. Photons have wide ranges of energy and gamma-ray is an unclear range. To study the Milky Way distribution, we have studied photons in the range 0.3 to 300.0 GeV from Fermi-LAT. We have used all-sky maps of gamma-ray to estimate parameters of the emission coefficient in our model. The model aims to explain the gamma-ray distribution in the galaxy by cylindrical and spherical distributions, which represent the gamma-ray from astrophysical sources and halo objects such as dark matter. Parameters have been found from fitting data with the model by the least chi-square method. As the result, the coefficients are variable up to the gamma-ray energy, but the thickness of the galactic disk is 5 to 10-time larger when compared with previous studies. In addition, the parameter values can explain the galactic maps, so the spherical parameter values can apply to constrain astrophysical objects or the particles in the halo of the Milky Way galaxy.

Keywords: The Milky Way galaxy, Distribution, Gamma ray, Emission coefficient equation

Atmospheric Extinction at Thai National Observatory

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The electromagnetic emissions from celestial objects in space penetrate the earth and pass layers of the atmosphere. Therefore, the light is partially absorbed and scattered. This process causes attenuation of the light called atmospheric extinction. In astronomy, accurate values that indicate the extinction at observing sites are needed for studying ground-based astronomical photometry, to determine the intrinsic brightness of celestial objects. According to the measurement of the atmospheric extinction coefficients at Thai National Observatory (TNO) for 13 nights in 7 months from November 2019 to May 2020, the observations of standard star fields observed via U, B, V, R, and I photometric filters were performed. The 2.4-meter Thai National Telescope (TNT) is mounted with a 2K x 2K charge-coupled device (CCD), while the 1-meter Thai National Telescope (TNT) is mounted with a 4K x 4K CCD. From the data analysis of 13-nights observations, the atmospheric extinction coefficients partly agree with the coefficients based on theoretical calculation. Most results from 13 nights have a variation trend based on least-square fitting for I, R, V, B, and U filters. The medians of atmospheric extinction coefficients are 0.044 ± 0.029, 0.086 ± 0.032, 0.150 ± 0.086, 0.279 ± 0.038 and 0.624 ± 0.295 for I, R, V, B and U filters, in 8 nights, 13 nights, 13 nights, 12 nights and 4 night observations, respectively. This variation might be caused by variation in meteorological situations, e.g, dust pollution according to regional seasons in Northern Thailand. The variation trend of atmospheric extinction coefficients at TNO generally agrees with those from other observatories.

Keyword: airmass, atmospheric extinction coefficient, instrumental magnitude, photometry, standard star

Use of Quantum Well for holes in an N-Type Layer to Reduce the Recombination Rates of electrons and holes

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This project was examined quantum well embedded in N-type semiconductors to reduce the recombination rates of electron and hole to increase the efficiency of PN-junction solar cells. The embedment GaAs layer in N-type semiconductor is $Al_xGa_{1-x}As$ which create quantum wells for hole. The calculation of the value of electron wave function and hole wave function used Runge-Kutta 4th Order Method. Afterward, calculate the recombination rates of electron and hole which directly proportional to the square of overlap integral between electron and hole wave function. The calculation is for analyzing the results of width, potential energy depth, and volume fraction of quantum wells embedded in the material on recombination rates between electron and hole. The quantum wells embedded structure width is 10 Å, 25 Å, and 40 Å that have 0.200 eV, 0.300 eV ,and 0.400 eV energy depth. The findings show that the quantum wells embedded structure has more efficiency on decrease recombination rates of electron and hole than without quantum wells. The quantum well that was embedded in the proportion of volume less than 8% of the total volume is efficient to practical application because there is no effect on to absorption property of PN-junction solar cells. In addition, the structure embedded in the material that has appropriate width, potential energy depth, and volumetric proportions can decrease the recombination rates of electron and hole up to 60% show that quantum well for holes embedded in N-type can improve the efficiency of PN-junction solar cells.

Keywords: PN-junction solar cells, Quantum wells, Recombination rates, Semiconductor devices

Invited PHY1-2

Study of turbulent transport critical gradients effects on L- H transition based on bifurcation approach

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This work investigates the effects of critical pressure and density gradients of turbulent transport in fusion plasma using two-field bifurcation model. The thermal and particle transport equations, combining the effect of neoclassical and turbulent transports are solved simultaneously, resulting in time evolution profiles of plasma pressure and density. The velocity shear is used as suppression effect, which acts only on the turbulent channel. The results show that plasma can transit from low (L-mode) to high (H-mode) confinement modes, edge transport barrier (ETB) width profile versus critical pressure gradient and critical density gradient are used to demonstrate their effects. In summary, the lower critical gradients of pressure and density, the higher plasma loss which prevents the plasma to transit to H-mode. In addition, the increase of critical pressure and density gradients enhances ETB width.

Keywords: critical gradient, turbulent transport, ETB width

Design and Construction of Energy Spectrometer System for 4 MeV Electron Linear Accelerator

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The electron spectrometer is designed, constructed, and installed in the accelerator system which consists of a steering magnet, a fluorescent screen, and an IP camera. The energy of the electron beam is determined by the position of the electron beam that shifts due to the magnetic field. To analyze the energy from the image, Suriya 4 MeV Energy Analyzer Program 2.0 (SEA 2.0) has been developed using the Hough Circles method to locate the beam profile position. Although the Hough Circle method might not represent the average of energy when inside the beam has many spots with different groups of energy, each spot can be analyzed using the local peak of beam projection. Moreover, the old spectrometer system cannot analyze an increase of energy when increasing the RF power from each group of the beam with the current resolution. The SEA 2.0 can evaluate electron beam energy from both data sets but it has an extensive error. In this project, a new steering magnet is designed, and the length of the vacuum tube between steering and screen is extended to improve the resolution with the size of 100x26 mm and 255 turns of wire. The new spectrometer system shows a better resolution than the old spectrometer system. At electron beam energy of 4 MeV, the resolution of the new system improves around five times from 0.39 MeV/pixel to 0.08 MeV/pixel.

Keywords: electron spectrometer, energy analyzer program, steering magnet

The study of thermal and particle transport coefficient affect on L - H transition based on Bifurcation model and machine learning

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In the present, plasma fusion research still needs improvements in many areas, e.g., material or plasma stability problems. One of the most challenging problems in fusion research is to increase energy confinement time without sacrificing the fusion rate. One possibility is for the plasma to have the formation of an Edge Transport Barriers (ETB), resulting in the plasma to transit from low confinement mode (L-mode) to high confinement mode (H-mode). This work uses simulation techniques to solve a coupled thermal and particle transport equations based on bifurcation model for a time evolution profiles of plasma pressure and density. The simulation results are used as database for machine learning models to predict the confinement mode. As a result, increase of neoclassical heat and particle transport coefficients causes plasma transition back from H-mode to L-mode. On the other hand, increase of anomalous heat and particle transport coefficients cause plasma transition from L-mode to H-mode and back to L-mode again if they are too high. The best machine learning model amongst 3 models; Logistic Regression, Support Vector Machine and Decision tree is Decision tree which has the AUC score equals to 0.997.

Keywords: Bifurcation model, high confinement mode, low confinement mode, machine learning

The study of branching process on COVID-19 outbreak and control strategies

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The current Coronavirus (COVID-19) situation was better in China that was the first country of COVID-19 outbreak started but was worse in some countries such as in Europe and the Americas. The global cases of COVID-19 were more than 30,675,000 confirmed cases. In Thailand, the present situation was better than in March. There were only 3,506 total cases during October 2020. From June to October 2020, the confirmed cases were found in the state quarantine. However, the effect of isolation and contact tracing on the COVID-19 outbreak was vague. So, we would like to study that the isolation of cases and the contact tracing can help the COVID-19 situation be better. In this study, we considered the effect of the initial case number, reproduction number (R0), probability of asymptomatic, and delay to isolation in each contact tracing on the COVID-19 outbreak in 3 months. We found that when the percentage of contact tracing increased, the number of cases decreased lead to reduced effective reproduction numbers.

Keywords: Contract tracing, COVID-19, Branching process

On a study of magnetization fluctuation noise in magnetoresistive heads.

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A magnetoresistive read head consist of two layers made by soft magnetic material separated by an insulating layer. When the external magnetic field (H) is applied, the magnetization direction of those layers are moved according to the direction of the applied field that, in turn, causes a change in its resistance. As the size of the current technology read head is small (in an order of nanometer), any thermal energy applied to the read head can result in the fluctuation of magnetization direction that in turn impacts the read head instability. This is one of fundamental limits on the performance of hard-disk-drive (HDD) magnetic storage. In this research, thermal-induced magnetization fluctuation noise of magnetoresistive read heads was experimentally investigated. The noise was measured in a term of the standard deviations (SD) of the resistance of the read heads obtained over a long period of time. We focused on 3 main heat sources, i.e., the biased voltage, the applied magnetic field and the thermal-fly-height-control heater (called TFC heater). Results showed that the read heads behave like the metal as when the biased voltage/current increases, the head resistance decreases. For the next, the applied magnetic field causes fluctuation in the two layers as standard deviations increase when magnetic field increases but, in some cases, standard deviations decrease in fail read head because of magnetization direction flips. The last heat source, magnetization fluctuation noise due to the voltage of TFC heater is dependent on the read head design. For model A, the standard deviations of the head resistance tend to increase when the voltage of TFC heater increases. On the other hand, the TFC heater showed less impact on the fluctuation noise for model B.

Invited PHY2-2

Fabrication of sugarcane leaves-derived activated carbon by a hydrothermal carbonization process as a supercapacitor electrode

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Activated carbon (AC) derived from sugarcane leaves was prepared by hydrothermal and chemical activation. First, hydrochar (HC) was synthesized from sugarcane leaves by hydrothermal processes using HCl as a catalyst at 180°C for 8 h. Then, HC was activated by KOH, NaOH and H_2SO_4 (AC-KOH, AC-NaOH and AC-H_2SO_4) in tube furnace at 800°C for 1.5 h under Argon environment. The crystal structure and morphology of all activated carbon samples were investigated by X-ray diffraction and scanning electron microscopy. They have the amorphous structure. HC and AC-H_2SO_4 samples has spherical shape, AC-KOH and AC-NaOH samples has the porous surface. The electrochemical performance of all activated carbon electrodes was investigated by galvanostatic charge/discharge technique in 6M KOH electrolyte. HC, AC-KOH, AC-NaOH and AC-H_2SO_4 electrodes have the specific capacitance of 1.59, 63.54, 53.19 and 42.41 F g^{-1} at a current density of 0.5 A g^{-1}, respectively. The AC-KOH electrode has the excellent capacitance retention of 98.5% after 3,000 charge/discharge cycles.

Keywords: Activated carbon, Sugarcane leaves, Supercapacitors

Study the effect of the violet laser patterning on Raman spectrum shift and conductivity in nitrogen-doped reduced graphene oxide (NrGO)

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Although supercapacitors are considered one of the alternative energy storage devices for future usage due to their considerable power density, fast charging-discharging rate, and long life cycles, the greatest obstacle is energy density ten times less than that of conventional Li-batteries (Huang, Zhu, Sarkar, & Zhao, 2019). The previous studies exposed that the nitrogen-doped graphene-based electrodes significantly enhance the specific capacitance of pristine graphene (Yadav & Devi, 2020). For the recent research, our laboratory found that after the violet laser patterning on nitrogen-doped reduced graphene oxide (NrGO), the G-band from Raman spectroscopy is shifted to a lower wavevector, and its conductivity is enhanced. However, the role of N-doping and the effect of laser patterning on reduced graphene oxide (rGO) are still unclear. Therefore, the density functional theory (DFT) was used to investigate these phenomena. Here, we calculate the formation energies of various nitrogen-doped graphene structures to screen the possible forms, the density of state (DOS) of possible forms, and their Raman spectrum compared with the experimental results. Our calculations show that the more removed oxygen, the G-band peak of Raman spectra is shifted to the lower frequency. Furthermore, the conductivity is significantly increased by N doping and the removal of oxygen. Hence, the mechanism and electronic structure for describing conductivity enhancement and the shift in the G-band is due to the removal of oxygen atoms during the laser patterning, which consistent with the experimental results will be presented.

Keywords: density functional theory, laser patterning, nitrogen-doped graphene oxide, Raman spectra, supercapacitor

First-principles investigation on mechanical and elastic properties of Mg-doped hydroxyapatite.

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Hydroxyapatite (HAP) is a candidate material that has been used as an effective and safe substitute for artificial bones and teeth. One of its primary structural characteristics is its ability to accept a great variety of isomorphic substitutions in the Ca site to observe the mechanical properties of α-HAP and β-tricalcium phosphate (TCP). This research will study Magnesium (Mg)-doped, a well-known cationic component in natural bone in HAP and β-TCP. The experiment found that Mg has induced the β-TCP phase when doping Mg in HAP and improve Vickers hardness. This research proposes the first-principles calculation to study and calculate the important mechanical properties based on the Density functional theory (DFT) implemented in VASP code. Our calculation found that the average bulk modulus of pure and Mg-doped: α-HAP 80.285 GPa, 1Mg-doped in α-HAP 77.168 GPa, and 2Mg-doped in α-HAP 81.116 GPa. While bulk modulus of β-TCP 72.089 GPa, and Mg-doped in β-TCP 79.105 GPa. These results indicate Mg can significantly enhance the bulk modulus of HAP with added Mg. The calculated elastic constants of α-HAP C_{11} and C_{33} which represent the elasticity in length are larger than the elasticity in shape, which represent by the elastic constants C_{12}, C_{13}, C_{44}, and C_{66}. The deformation resistances along the axial direction are stronger than deformation resistances in shape. Poisson's ratio 0.286 shows that the hexagonal α-HAP behaves as a ductility material.

Keywords: Hydroxyapatite (HAP), Tricalcium phosphate (β-TCP), first-principles, mechanical properties

Development of Josephson Parametric Amplifiers for Superconducting Circuit Experiments

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Superconducting circuits have become one of the leading candidates for building large-scale quantum computers. Their main advantage lies on their integrable and scalable circuit elements, which makes them analogous to electric transistors in a classical computer. Quantum superconducting circuits manipulate vary weak signals consisting of few photons of microwave field. This complicates the measurement process because the energy of microwave photons is very difficult to detect with classical electrical detectors. This detection requires the use of a special first-stage amplifier that can be placed very close to the quantum computer (at mK temperatures) and is quantum limited, i.e. introduces the smallest amount of noise allowed by the laws of quantum mechanics. In superconducting circuits, these amplifiers are known as Josephson Parametric Amplifiers (JPA), which use Josephson junctions as their workhorse. The Josephson junction acts as a nonlinear inductor, making the electrical circuit behave like a driven nonlinear oscillator which can be used to amplify signals. In this research project, we study the theory of linear amplification and the performance of three types of JPAs: phase-preserving, phase-conjugating, and phase-sensitive amplifiers. By numerically simulating their output states from arbitrary bosonic microwave input states, we can investigate JPA response under different parameter configurations and optimise to achieve maximum gain. The results of this work will be used to design and fabricate a custom JPA based on a set of input signal specifications and output signal requirements, leading to a better precision in measuring behaviors of the superconducting circuits.

Keywords: Josephson parametric amplifier, Microwave photon, Quantum system, Superconducting circuit

Molecular Dynamics Simulations of Lithiation and Delithiation Processes in Porous Silicon Electrode Material for High-Performance Li-Ion Batteries

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Reducing of capacity fading is one of the improvements in lithium-ion batteries (LIBs). Porosity in silicon has reduced the capacity fading in Si-based LIBs. We used a molecular dynamics (MD) method to establish the understanding of how porosity can mitigate the capacity fading in Si-based LIBs. We created the structure of non-porous silicon nanowire (SiNW) with a radius of ~20 Å and a length of ~43 Å. The geometry of porous silicon nanowire (p-SiNW) was constructed to have the internal and external radii of ~15 Å and ~27 Å, respectively. At each step of lithiation, 100 Li atoms were randomly deposited on the surface of the well-equilibrated SiNW and p-SiNW followed by an NVT equilibration at 900 K for 5 ps. For the delithiation process, 100 Li atoms located within the outermost shell of the nanostructure were randomly deleted accompanied by a 5 ps-relaxation simulation. We found that volume expansion upon Li uptake of p-SiNW is significantly less than SiNW. Calculations of the formation energy suggests that Li insertion process in porous structure is energetically more favorable. In addition, our simulation and analysis reveal that the presence of pore in the nanostructure can mitigate the stresses during charge and discharge processes, which is beneficial for improving the structural stability.

Keywords: Molecular dynamics, Li-ion batteries, Silicon-based anode, Silicon nanowire

Study classification imaging using machine learning for Proton Computed Tomography simulation

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Proton therapy is one of the treatments that can reduce the number of healthy tissues and organs, complications, and side effects of treatment. But protons, radiotherapy, have problems arising from proton scattering as protons move towards cancer cells, so machine learning is used to help predict cell locations. By simulating the function of Proton Computed Tomography (pCT), a machine used proton for imaging modality. Simulated in the Geometry And Tracking (Geant4) then create a phantom that replicates a human organ. The protons are shot pass through phantom. Collect data at the track to create a picture for use in the machine learning process classification by binary image classifier using Convolutional Neural Network (CNN). The results showed that The model was effective in sorting images of organs of different thicknesses at 47%. The highest model training accuracy was 0.896, the training loss highest was 0.794, and the validation accuracy highest was 0.500. It will take time to learn and develop.

Keywords: Machine Learning, Proton therapy, Proton Computed Tomography

Latitude Surveys of a ship-borne neutron monitor for Antarctic trips during 2018-2020 and upcoming plans

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Ground-based neutron counters are a standard tool for detecting atmospheric showers from GeV range primary cosmic rays of either solar or galactic origin. Bare neutron counters, a type of lead-free neutron monitor, function much like a standard neutron monitor (NM64) but have different yield functions primarily because they are more sensitive to lower energy neutrons. When operated together with standard monitors, the different yield functions allow estimates to be made of the energy spectrum of galactic or solar particles. In Thailand, we developed a ship-borne "Changvan" neutron monitor with three counters for latitude surveys to investigate cosmic ray spectral variations. This uses the NM64 design, except the middle counter lacks the lead producer, so we call this a "semi-leaded" neutron monitor. The Changvan was operated on two voyages on the Chinese icebreaker Xue Long between China and Antarctica during 2018-2019 and 2019-2020. The standard measurement during a latitude survey is the count rate as a function of geomagnetic cutoff, i.e., the response function of the total count rate. Repeated measurements with the same detector over different solar cycle phases provide precise information about cosmic ray spectral variation. In my talk, I will give a detailed overview of an international collaborative network led by Thai researchers in the field of cosmic rays through the story behind the Changvan monitor. The plans of establishing the Thai Space Radiation consortium (SpaRC) and building another shipborne-neutron monitor, nicknamed "Thimon: Thailand-Hawaii Monitor," will be informed.

Keywords: Changvan; semi-leaded neutron monitor; GCR spectrum; solar modulation; yield function; latitude survey

Quantum Entangled Photons source

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Quantum entanglement is a strange and interesting phenomenon that applied to quantum information in various ways. This project aims to build quantum entangled photon source with a laser 405 nm using spontaneous parametric down conversion process and BBO, a nonlinear crystal to generate photon pairs. Result of detection is the source can generate 346.7112 cc/s nonentangled photon pairs maximally in 3 ns delay time, polarization state of photon pairs are $|HH\rangle$ and a state fidelity of 0.933 is measured.

Keywords: Nonlinear crystal, Polarization, Quantum entanglement, Spontaneous parametric down conversion, State fidelity

Preparation and electrostictive properties of polyurethane thin films filled with polypyrrole-Carbon Black

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This project aims to study dielectric and electrostrictive properties of polyurethane (PU) thin films filled with polypyrole-carbon black (PPy-CB) at different concentrations (0.25%wt, 0.50%wt, 0.75%wt and 1.00%wt). All samples were prepared by using a film-casting process. The results showed that the dielectric constant, loss tangent, and conductivity of PU/PPy-CB film composites increased when concentration of PPy-CB was increased. The dielectric constant of PU/PPy-CB film at 1% was 6.8 times compared with PU film. Moreover, the electrostrictive coefficient also increased with more concentration of PPy-CB. The electrostrictive coefficient of PU/PPy-CB film is directly related to the dielectric properties. Furthermore, it was found that electrical breakdown strength decreased with more concentration of PPy-CB which may be attributed to a rise in electrical conductivity of the composites.

Keywords: Carbon black, Electrostirctive properties, Polypyrrole, Polyurethane

Another eigenstate set of a two-dimensional hydrogen atom

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The radiation response of *Cholangiocarcinoma* cell growth in two and three-dimension cultures

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Cholangiocarcinoma (CCA) is a silent cancer that hard to treat because the patients are diagnosed at advanced stage with unresectable. Chemotherapy and radiotherapy are alternative treatment for these patients to improve quality of life and their survival. Nowadays, radiotherapy with heavy ions and proton therapy have gained increasing interest in cancer treatment including CCA. Here, we aim to 1) set up two dimensional (2D; monolayer) and three dimensional (3D; Matrigel) cultures of CCA cell lines for radiobiological study and 2) simulate the survival curve of *Chinese hamster ovary* cell lines (CHO-K1) in various beams for radiobiological study. To obtain the optimum CCA cell culture system before irradiation test with X-ray, heavy ions, and proton. Cell growth test, plating efficiency test, and optimum cell numbers for both cell cultures in CCA cell lines were performed and compared with those of CHO-K1and *Human cholangiocyte* cell line (MNNK-1) which have been demonstrated in our previous study. In present study, the growth rate and plating efficiency of CCA cell line was lower than that of CHO-K1and MNNK-1. The cell number at 15,000 and 20,000 cells per well were suitable for growing the CCA cell line in 96-well plate for both 2D and 3D culture. The survival curve of CHO-K1 in different beams obtained relative biological effectiveness (RBE) values significantly disparate. In conclusion, we obtain the optimum conditions of CCA cell cultures in both 2D and 3D and we also have the reference survival curve of CHO-K1 for further study on radiobiological treatment plan verifications.

Keywords: Cholangiocarcinoma, Radiotherapy, CHO-K1, MNNK-1, Matrigel, 3D cell culture, survival curve

Investigating the radiation protection ability of $CaCO_3$ precipitated by bacteria *Lysinibacillus* sp. under simulated mars conditions.

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In this work, we investigated the mechanical and optical properties of calcium carbonate ($CaCO_3$) precipitated by bacteria *Lysinibacillus* sp. YL towards the potential use for Mars habitats. The changes in elastic and optical property of biogenic calcium carbonate under a wide range of simulated Mars conditions are calculated. The experimental X-ray diffraction (XRD) spectra of the biogenic calcium carbonate was analyzed to obtain the corresponding crystal structure. Next, the structure of $CaCO_3$ was input to Vienna Ab initio Simulation Package (VASP) to determine the change of structure and its properties under simulated Martian temperature and pressure. The results show that *Lysinibacillus* sp. strain YL grown with three different calcium sources could precipitate $CaCO_3$ all in space group of R3c (calcite). The optical property was calculated by the first-principles method. Absorption coefficient and reflectivity are used to imply to the radiation protection ability of the biogenic calcite. Furthermore, elastic property, including bulk modulus, shear modulus, Young's modulus and Poisson's ratio, are calculated using the Voigt-Reuss-Hill (VRH) approximation method in order to discuss on the application for Mars habitats.

Keywords: calcite, elastic property, Mars, optical property

รายชื่อผู้เข้าร่วม

ดร.กฤช เศรษฐการ	คณะกรรมการ
ดร.กอบัว ไชยศิวามงคล	คณะกรรมการ
ดร.กัลยาวัสถ์ วังคะวงษ์	คณะกรรมการ
ดร.เกศสิริ คงมนัส	คณะกรรมการ
ดร.จันฒิมา มากมูล	คณะกรรมการ
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ดร.ชณัท อ้นบางเขน	คณะกรรมการ
ดร.ณราศักดิ์ พันเดช	คณะกรรมการ
ดร.ณัชชา กุลจิราธนโชติ	คณะกรรมการ
ดร.ณัฐวัชร เชื้อนพรัตน์	คณะกรรมการ
ดร.ดวงฤทัย จารุกานนท์	คณะกรรมการ
ดร.ตฤณ อินทรประสงค์	คณะกรรมการ
ดร.ธรรมนูญ ทวีชัย	คณะกรรมการ
ดร.ธันฐภัทร์ บุญช่วย	คณะกรรมการ
ดร.ธานินทร์ จันทรโชต	คณะกรรมการ
ดร.นริศรา ปิยะแสงทอง	คณะกรรมการ
ดร.นฤทธิ์ ตรีอำนรรค	คณะกรรมการ
ดร.นัทธวัฒน์ เสมากูล	คณะกรรมการ
ดร.ปรียารัตน์ เจริญสำราญ	คณะกรรมการ
ดร.ปิยฉัตร ศรีประทักษ์	คณะกรรมการ
ดร.พนิชากรณ์ ใจยงค์	คณะกรรมการ
ดร.พรรณนรี ศรีน้อย	คณะกรรมการ
ดร.พรสวรรค์ สุทธินนท์	คณะกรรมการ
ดร.พิทักษ์สิทธิ์ ดิษบรรจง	คณะกรรมการ

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ดร.มงคล พงษ์สุชาติ	คณะกรรมการ
ดร.มณีเนตร เวชกามา	คณะกรรมการ
ดร.รัชธิดา เดชอุดม	คณะกรรมการ
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ดร.วรนพ สุขภารังษี	คณะกรรมการ
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ดร.ศรัญพงศ์ ยิ้มกลั่น	คณะกรรมการ
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ผศ.ดร.อรอุษา คำสุข	คณะกรรมการ
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รศ.ดร.จงดี บูรณชัย	คณะกรรมการ
รศ.ดร.จตุพล คำปวนสาย	คณะกรรมการ
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รศ.ดร.ธีระพงษ์ สุขสำราญ	คณะกรรมการ
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รศ.ดร.สุธี บุญช่วย	คณะกรรมการ
รศ.ดร.สุปรีดิ์ พินิจสุนทร	คณะกรรมการ
รศ.ดร.อดิศักดิ์ บุญชื่น	คณะกรรมการ
รศ.ดร.อุษณีย์ ลีรวัฒน์	คณะกรรมการ
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นางสาวนงลักษณ์ ประขันธ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนุชติยาพร สุวรรณตรากิจ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวเบญจวรรณ คำสุข	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวมาริสา ดวงจันทร์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาววรัญญา สมอุดร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศิรินภา สุลำนาจ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอรทิมา พันธุ์คูณ	นักเรียน นิสิต นักศึกษา พสวท.

นางสาวอรปรียา มาวัน	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอาลิษา เจนจริง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอินทิพร มิ่งสกุล	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤษกร ต่อสกุลแก้ว	นักเรียน นิสิต นักศึกษา พสวท.
นายครรชิต ระแหง	นักเรียน นิสิต นักศึกษา พสวท.
นายนพกร ผ่องสนาม	นักเรียน นิสิต นักศึกษา พสวท.
นายปฏิพัทธ์ ลัทธิวรรณ	นักเรียน นิสิต นักศึกษา พสวท.
นายปวีณ ปิยะตระกูลชัย	นักเรียน นิสิต นักศึกษา พสวท.
นายพีรพัฒน์ เสาวัตร	นักเรียน นิสิต นักศึกษา พสวท.
นายพุทธานุภาพ ศิลแสน	นักเรียน นิสิต นักศึกษา พสวท.
นายภาณุพล อันทรบุตร	นักเรียน นิสิต นักศึกษา พสวท.
นายเมธาชาญ อุปถัมภ์	นักเรียน นิสิต นักศึกษา พสวท.
นายวงศกรณ์ วงศ์ลา	นักเรียน นิสิต นักศึกษา พสวท.
นายวัชรวิทย์ สอนกระสินทร์	นักเรียน นิสิต นักศึกษา พสวท.
นายศุภวิชญ์ เพชรประดิษฐา	นักเรียน นิสิต นักศึกษา พสวท.
นายสัณหณัฐ ไชยบุระ	นักเรียน นิสิต นักศึกษา พสวท.
นายสุกฤษฎิ์ เพชรประดิษฐา	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกอบกุล เขียวสนวน	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกัญญารัตน์ เรืองบุญ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวจิรัชญา คำแก้ว	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวจิราพา ใจคำ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชุติมณฑน์ พิระลัย	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวณัฐธิดา แก้วอาจ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวธนาภรณ์ สืบสุยะ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวธันย์ชนก ยุติธรรมสถิต	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนัทธ์ชนัน ปราบหงษ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปาลิตา กุญชร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวรัชนีวรรณ สุมาลย์กันต์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศิริรัตน์ คำแสง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสิวาภรณ์ ภูมิโชติ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวหินดา อ้อเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นายกิตติชัย จันทร์สม	นักเรียน นิสิต นักศึกษา พสวท.

นายเจษฎากร องคุลี	นักเรียน นิสิต นักศึกษา พสวท.
นายชนสรณ์ พึ่งเงิน	นักเรียน นิสิต นักศึกษา พสวท.
นายชาญวุฒิ แสงโพธิ์	นักเรียน นิสิต นักศึกษา พสวท.
นายณัฐ พรหมมา	นักเรียน นิสิต นักศึกษา พสวท.
นายธนกร นันตา	นักเรียน นิสิต นักศึกษา พสวท.
นายธนพงษ์ กุนะคำ	นักเรียน นิสิต นักศึกษา พสวท.
นายปณวัฒน์ วัฒนาพร	นักเรียน นิสิต นักศึกษา พสวท.
นายปิยวัฒน์ ฉัตรชัยชมภู	นักเรียน นิสิต นักศึกษา พสวท.
นายพีรณัฐ วินิจมโนกุล	นักเรียน นิสิต นักศึกษา พสวท.
นายรัฐยุทธ นันต๊ะน้อย	นักเรียน นิสิต นักศึกษา พสวท.
นายวริทธิ์ นิไทรโยค	นักเรียน นิสิต นักศึกษา พสวท.
นายไวทิน สินธุอุไร	นักเรียน นิสิต นักศึกษา พสวท.
นายศรีวงศ์ บุญประคม	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกนกพร เรืองศรี	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกมลวรรณ กองโฮม	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกมลวรรณ ขันธสมบัติ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกาญจนา ศิริรักษ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวทักษพร พรมจักร์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวทาริกา ศรีตระกาล	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวธวัลยา คำทอง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนฎา สมสวัสดิ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปวริศา ปุสุรินทร์คำ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวภัควรรณ กมลกลาง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวยุวดี มะลาด	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศศิธร เศียรกระโทก	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสุชาดา ชีระปฏิยุทธ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอรณัชชา วงศ์จอม	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤษณกานต์ บูรณะ	นักเรียน นิสิต นักศึกษา พสวท.
นายชิติพัทธ์ ดีเสมอ	นักเรียน นิสิต นักศึกษา พสวท.
นายถิรณัฐ บำเหน็จพันธุ์	นักเรียน นิสิต นักศึกษา พสวท.
นายธนยศ งอนสำโรง	นักเรียน นิสิต นักศึกษา พสวท.
นายนันทวัฒน์ โทอะรัญ	นักเรียน นิสิต นักศึกษา พสวท.

นายพงษ์ปณต พรมวงษา	นักเรียน นิสิต นักศึกษา พสวท.
นายภิเษก สัจจภาณี	นักเรียน นิสิต นักศึกษา พสวท.
นายมนัสวี ศรีโชค	นักเรียน นิสิต นักศึกษา พสวท.
นายรพีพัฒน์ ยศสูงเนิน	นักเรียน นิสิต นักศึกษา พสวท.
นายวิชญ์พล พลึกรุ่งโรจน์	นักเรียน นิสิต นักศึกษา พสวท.
นายศิลปชาติ พึ่งป่า	นักเรียน นิสิต นักศึกษา พสวท.
นายอนาวิล ประจิตร์	นักเรียน นิสิต นักศึกษา พสวท.
นายอภิวัฒน์ มือขุนทด	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวจีรนันท์ ป้องท้าว	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชนิดาภา วินาลัย	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวธันย์ชนก หลินเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวบัณฑิตา เถื่อนกูล	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปรายฟ้า โกษศิริศิลป์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปวริศา แข็งขัน	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวภัทรลดา สระทองแป้น	นักเรียน นิสิต นักศึกษา พสวท.
นางสาววิไลวรรณ ชัยขัณฑ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสุกฤตา จันทร์ทิพย์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสุวนันท์ วงษ์เลี้ยง	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤติธี เกตุมะ	นักเรียน นิสิต นักศึกษา พสวท.
นายชาญณรงค์ นาศฤงคาร	นักเรียน นิสิต นักศึกษา พสวท.
นายฐิติพัฒน์ กลิ่นสุวรรณ	นักเรียน นิสิต นักศึกษา พสวท.
นายธนลภย์ วงเดช	นักเรียน นิสิต นักศึกษา พสวท.
นายนฤสรณ์ สมานพงษ์	นักเรียน นิสิต นักศึกษา พสวท.
นายพิธิวัฒน์ เหลืองวิชชเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นายพีรพัฒน์ อินตะคำ	นักเรียน นิสิต นักศึกษา พสวท.
นายวิชญ สมศรี	นักเรียน นิสิต นักศึกษา พสวท.
นายศุภวิชญ์ จินดาเนตร	นักเรียน นิสิต นักศึกษา พสวท.
นายอภินันท์ โพธิ์ตุ่น	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกร ธรรมศิริ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวเจสริน คล้ายสุข	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวณิชกานต์ โล่ห์สถาพรพิพิธ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวตรีรัตน์ ศรีวิพัฒน์	นักเรียน นิสิต นักศึกษา พสวท.

นางสาวพรรษา หลีเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวแพรพรรณ ลาภไพศาล	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวภูรีธ์ยาน์ พิชญวรรธน์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาววริษา วายุเหือด	นักเรียน นิสิต นักศึกษา พสวท.
นางสาววัชราภรณ์ สีหุ้น	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศศินา เปรมใจชน	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอภิชญา อายุการ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอัญวรรณ ทับดารา	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวอิงครัศม์ อติโรจน์วาณิช	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤตนันท์ จันทร์ถอด	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤติพงษ์ ประจัญพล	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤษณะ แซ่โก	นักเรียน นิสิต นักศึกษา พสวท.
นายชยพล ติยะจามร	นักเรียน นิสิต นักศึกษา พสวท.
นายชัพวิชญ์ เตียตระกูล	นักเรียน นิสิต นักศึกษา พสวท.
นายณัฐพงศ์ จันทร์ทิพย์มณี	นักเรียน นิสิต นักศึกษา พสวท.
นายณัฐวุฒิ คำแจ่ม	นักเรียน นิสิต นักศึกษา พสวท.
นายธนเศรษฐ์ กิติธีระกุล	นักเรียน นิสิต นักศึกษา พสวท.
นายธนา อนุสันติ	นักเรียน นิสิต นักศึกษา พสวท.
นายปรมัตถ์ เชียรวิชัย	นักเรียน นิสิต นักศึกษา พสวท.
นายพีรวัส จิรโรจน์วัฒน	นักเรียน นิสิต นักศึกษา พสวท.
นายภาสวิชญ์ อินโสม	นักเรียน นิสิต นักศึกษา พสวท.
นายยูโนะ โอซึกะ	นักเรียน นิสิต นักศึกษา พสวท.
นายอนวัช ไตลังคะ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกฤตยา อักษรนำ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวฉันทมาลินี ฉันทรางกูร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวฉันทลักษณา ฉันทรางกูร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชนิดา จักรหวัด	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชุติมา รัตนสุภา	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนลินี คงแก้ว	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนาเดีย นาถปุตรี	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนูรุลซาฟีลาร์นาเรีย เบ็ญจ์วรรณมาศ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปองกมล ประยงค์กุล	นักเรียน นิสิต นักศึกษา พสวท.

นางสาวปิยนุช ราชพิบูลย์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวมัตติกา ทวีสุวรรณศักดิ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวหัสยา หนูแก้ว	นักเรียน นิสิต นักศึกษา พสวท.
นายเกียรติยศ พิบูลย์	นักเรียน นิสิต นักศึกษา พสวท.
นายธันวา ทองเกลี้ยง	นักเรียน นิสิต นักศึกษา พสวท.
นายปัญลักษณ์ เดชรัตนวิไชย	นักเรียน นิสิต นักศึกษา พสวท.
นายรามราช ปนัดสาโก	นักเรียน นิสิต นักศึกษา พสวท.
นายวรต เสาวโค	นักเรียน นิสิต นักศึกษา พสวท.
นายศุวิจักขณ์ พันธนิตย์	นักเรียน นิสิต นักศึกษา พสวท.
นายสรธัญ จ๋วนเจนกิจ	นักเรียน นิสิต นักศึกษา พสวท.
นายเสรี วนานิยกุล	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกรประภา โชติศิริคุณวัฒน์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวจุฑาทิพย์ เจนจบเขต	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชมพูนุช รวมสิน	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชลธิชา คชกาษร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวณัฐธิดา อินทร์พรหม	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวธมลวรรณ เพ็ญพร	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปุณรดา ธาดาตันติโชค	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวพรพรรณ ยงพาณิชย์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวพริมา เตียวไพสิฐพงษ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวเพชรรัตน์ สิริศักดิ์วิสุทธิ์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศิรินทิพย์ ทองเอีย	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวศิวพร เหมศาสตร์	นักเรียน นิสิต นักศึกษา พสวท.
นายกษิดิ์เดช ธัญญะเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นายคณนาถ เสียงเสนาะ	นักเรียน นิสิต นักศึกษา พสวท.
นายจิรกฤต เกษดี	นักเรียน นิสิต นักศึกษา พสวท.
นายณภพ ณ ระนอง	นักเรียน นิสิต นักศึกษา พสวท.
นายณัฐพงศ์ ขจิตเมธี	นักเรียน นิสิต นักศึกษา พสวท.
นายธนะพล แซ่เล้า	นักเรียน นิสิต นักศึกษา พสวท.
นายภคินทร์ ทาสี	นักเรียน นิสิต นักศึกษา พสวท.
นายสุกฤษฎิ์ ชนรดีณิชกุล	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวกนกวรรณ ชูดำ	นักเรียน นิสิต นักศึกษา พสวท.

นางสาวกุลวรรณ หิรัญชุฬหะ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชนิภรณ์ ไชยผลอินทร์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวชนิสรา ชูเส้ง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวณัชชา รสิตานนท์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวณัฐชยา ปาละคะเชนทร์	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวทัชนีม ซอรี	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวนันทนัช ชัยทอง	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปภัชญา เขียวย้อย	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปภัสสร ชื่นพาณิชย์กิจ	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวปิยะวดี ขาวเอี่ยม	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวภีมสินี พวงมาลา	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวรมิตา ล่าดี้	นักเรียน นิสิต นักศึกษา พสวท.
นางสาววรรษา บิลโหด	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสิริณัฐ ขวัญซ้าย	นักเรียน นิสิต นักศึกษา พสวท.
นางสาวสุภิกา อาคาสุวรรณ	นักเรียน นิสิต นักศึกษา พสวท.
นายกิตติพงษ์ ทองหัตถา	นักเรียน นิสิต นักศึกษา พสวท.
นายคณิศร นวลเต็ม	นักเรียน นิสิต นักศึกษา พสวท.
นายจักรกฤษ หนูมาก	นักเรียน นิสิต นักศึกษา พสวท.
นายธณาธรณ์ ชูบุญลาภ	นักเรียน นิสิต นักศึกษา พสวท.
นายธนาวิทย์ ชูกูล	นักเรียน นิสิต นักศึกษา พสวท.
นายธัชนนท์ ศิณโส	นักเรียน นิสิต นักศึกษา พสวท.
นายธิติ อึ๋งเจริญ	นักเรียน นิสิต นักศึกษา พสวท.
นายนพวิชญ์ สุขพันธุ์	นักเรียน นิสิต นักศึกษา พสวท.
นายพลกฤต อิสระดำเกิง	นักเรียน นิสิต นักศึกษา พสวท.
นายภูมิพัฒน์ ชัยกำธร	นักเรียน นิสิต นักศึกษา พสวท.
นายมนัสพล จิตมนัส	นักเรียน นิสิต นักศึกษา พสวท.
นายรชานนท์ คงช่วย	นักเรียน นิสิต นักศึกษา พสวท.
นายโรจณศักดิ์ รวดเร็ว	นักเรียน นิสิต นักศึกษา พสวท.
นายสิริวัชร ยิ่งยงสกุล	นักเรียน นิสิต นักศึกษา พสวท.
นายอัฟฟาน แวมง	นักเรียน นิสิต นักศึกษา พสวท.
นายกฤษณะ แซ่โก	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวกัณฐิกา นพคุณ	นิสิต นักศึกษา (ไม่เสนอผลงาน)

นายวรัญญู พงษ์พานิช	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายภูรินทร์ สุรโชติมงคล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวธมลวรรณ โชคมหาศาล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวประภัสสร หลุบเลา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวมณีฉัตร์ พัฒนพาณิชย์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวโยษิตา หลวงเรื่อง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาววิภาพร ทนันชัย	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวศุภกานต์ จันทรแสง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายกษิดิศ ศรีมหาจริยะพงษ์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายธิติวุฒิ ไชยะโท	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายธีร์ธวัช พรหมทอง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายภาคภูมิ วารินทร์ศิริกุล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายภานุพงศ์ คงเพชร	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายภูริณัฐ ตรัยศิริมงคล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายวิชญา เอื้อวิชญาแพทย์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายศราวุธ เทิดจันทึก	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายอันดามัน เขาสูง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาววรรัตน์ ศรีสุรัตน์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวปุณรดา ธาดาตันติโชค	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวกวิสรา ศรีท่าดินแดง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายชวิศ ศักกะวัฒนา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวจิดาภา ละครวัฒน์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวพันธิตรา หนูน้อย	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวศุทธวดี จรรยากูล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวศุภวรรณ จงเกษกรณ์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายนพดล เสนีย์วงษ์ ณ อยุธยา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวจิตรตรี แสวงวงค์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวจุฑามาศ ประกอบดี	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวนันทนา มนต์คาถา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวเบญจวรรณ คำสุข	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวภนิดา เทพวัตร์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวภัททรียา ภูมาศ	นิสิต นักศึกษา (ไม่เสนอผลงาน)

นางสาวรติพร กลับสุข	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวสุพัตตรา อินทรบุญญา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวอารยา ฮามคำฮัก	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายชินดนัย บุบผาทาเต	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายณัฐพล ราชพิลา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายพงศกร ทวีทรัพย์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายศักดิ์รพี นามศักดิ์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายอรรณพ จบปาน	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวจิราพา ใจคำ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวชุติมณฑน์ พิระลัย	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวธนาภรณ์ สืบสุยะ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวปาลิตา กุญชร	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวรัชนีวรรณ สุมาลย์กันต์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวรุจิรา ฟองมูล	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวสถิรดา พาหุรัตน์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวสิวาภรณ์ ภูมิโชติ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายกษิดิศ ต.เจริญ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายเจษฎากร องคุลี	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายตินดิกร กันทะ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายรัฐยุทธ นันต๊ะน้อย	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายวรนารถ ยารังษี	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายวิชัย แซ่ม้า	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวกมลวรรณ กองโฮม	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวธวัลยา คำทอง	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวบัณฑิตา เทียมญาติ	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวประภัสรา ม่วงโสภา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวพัชราภา ศรีโชค	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวศศิธร สันติกุลธานี	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นางสาวสุกัญญา จันขุนทด	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายจิรภัทร พงศ์ประยูร	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายณภูมิ ธูปพนม	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายถิรณัฐ บำเหน็จพันธุ์	นิสิต นักศึกษา (ไม่เสนอผลงาน)

นายรพีพัฒน์ ยศสูงเนิน	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายศฤงคาร ศรีพรหม	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายออมทรัพย์ จรูญรักษ์	นิสิต นักศึกษา (ไม่เสนอผลงาน)
นายอานนท์ บุญทา	นิสิต นักศึกษา (ไม่เสนอผลงาน)
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