



2024

# FORECAST

"Advancing Science & Technology Innovation for National & Regional Development"



AUGUST 14 - 16 2024

Website: <https://forecastconference2024.org/>

## Our Sponsors:



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FORECAST 2024 marks the second joint conference hosted by the Science Faculties of The University of the West Indies (Cave Hill, Mona, St. Augustine), the University of Technology, Jamaica, the University of Guyana, and the University of Trinidad & Tobago. At the heart of this year's theme, "**Advancing Science and Technology Innovation for National and Regional Development**," lies the recognition that science and technology are pivotal in addressing the complex issues that societies face today.

This biennial conference brings together thought leaders, researchers, policymakers, and industry pioneers to foster a collaborative environment where ideas can flourish and groundbreaking solutions can emerge. FORECAST 2024 serves as a platform for exchanging knowledge, sharing best practices, and forging partnerships that will propel science and technology to new heights. From enhancing healthcare and education to driving economic growth and environmental sustainability, integrating cutting-edge innovations is essential for building resilient and prosperous communities. By leveraging the latest scientific discoveries and technological advancements, nations and regions can unlock new opportunities, improve quality of life, and ensure a more equitable and inclusive future for all.

The Conference encompasses:

- *The 7th Faculty of Science and Technology Conference of The UWI, Cave Hill Campus*
- *The 13th Faculty of Science and Technology Conference of The UWI, Mona Campus*
- *The 2nd Faculty of Science and Technology Conference of The UWI, St. Augustine Campus*
- *The 7th International Science Conference of the UTech, Ja.*

FORECAST 2024 will showcase the 3<sup>rd</sup> Student Grand Innovation Challenge, where students are tasked With developing feasible community-based innovations aligned with the theme "**Resilience and Transformation: Innovating Connected Caribbean Communities.**"

# Organizing Committee

## Deans

<i>Dean FST</i>	Dr Brian Cockburn	(UWI, St Augustine)
<i>Dean FST</i>	Dr Jeanese Badenock	(UWI, Cave Hill)
<i>Dean FOSS</i>	Professor Kamilah Hylton (To April 2024)	(UTech, Ja.)
	Professor Samson Omoregie (Since May 2024)	(UTech, Ja.)
<i>Dean FST</i>	Professor Michael Taylor	(UWI, Mona)
<i>Dean FNS</i>	Professor Abullah Adil Ansari	(UoG)
<i>Programme Leader</i>	Kerry Dollaway	(UTT)
<i>Academy of Sport</i>		

## Conference Chair and Co-Chairs

<i>Chair</i>	Dr Marcia Blair-Thomas	(UTech, Ja.)
<i>Co-Chair</i>	Dr Andrew Lamm	(UTech, Ja.)
<i>Co-Chair</i>	Dr Debbie Devonish	(UTech, Ja.)
<i>Co-Chair</i>	Professor Samson Omoregie (To April 2024)	(UTech, Ja.)
<i>Co-Chair</i>	Dr Curtis Busby-Earle	(UWI, Mona)
<i>Co-Chair</i>	Ms Natasha Corbin	(UWI, Cave Hill)
<i>Co-Chair</i>	Dr Ricardo Clarke	(UWI, St Augustine)
<i>Co-Chair</i>	Professor Abullah Adil Ansari	(UoG)
<i>Co-Chair</i>	Dr Kerry Dollaway	(UTT)

## Sub-committee Chairs

<i>Abstract Review &amp; Technical Programme</i>	Dr Alexa Redway	(UTech, Ja.)
<i>Technology</i>	Mr O'Brien Brown	(UTech, Ja.)
<i>Finance &amp; Fundraising</i>	Dr Peter Ruddock	(UTech, Ja.)
<i>Logistics &amp; Programming</i>	Mr Damian Nesbeth	(UTech, Ja.)
<i>Marketing &amp; Communications</i>	Mr Nodley Wright	(UTech, Ja.)
	Mr Ivor Bennett	(UTech, Ja.)
<i>Grand Innovation Challenge</i>	Dr Melissa Sanderson	(UTech, Ja.)
<i>Secretariat</i>	Dr Debbie Devonish	(UTech, Ja.)

## Sub-committee Members

### *Abstract Review & Technical Programme*

Dr Adonna Jardine-Comrie (UTech, Ja.)  
Dr Adriene Williams (UWI, Mona)  
Dr Alexa Redway (UTech, Ja.)  
Dr Candice Thomas (UTT)  
Dr Cecelia Waugh-Hall (UTech, Ja.)  
Dr Donna-Marie Wynter-Adams (UTech, Ja.)  
Dr Dawn Fox (UoG)  
Dr Debbie Devonish (UTech, Ja.)

Dr Janak Sodha (UWI, Cave Hill)  
Dr Louis-Ray Harris (UWI, Mona)  
Dr Marhoun Ferhat (UWI Mona)  
Dr Natala Burnett (UTech, Ja.)  
Mrs Sabraham Green-Smith (UWI, Mona)  
Dr Tannice Hall (UWI, Mona)  
Professor Raymond Jagessar (UoG)  
Mr Raymond Martin (UTech, Ja.)

### *Finance & Fundraising*

Mrs Ave-Marie McIntosh (UTech, Ja.)  
Dr Debbie Devonish (UTech, Ja.)  
Mrs Diana Passley-Robinson (UTech, Ja.)  
Mrs Elesia Myers (UWI, Mona)  
Dr Joel Paul (UTT)

Ms Marylyn Wright (UWI, Mona)  
Ms Paula Sinclair (UTech, Ja.)  
Dr Peter Ruddock (UTech, Ja.)  
Mrs Tracia Johnson-Blair (UWI, Mona)

### *Grand Innovation Challenge*

Dr Kathleen Lobban (UTech, Ja.)  
Dr Melissa Sanderson (UTech, Ja.)  
Dr Savannah Lloyd (UWI, Mona)

Mrs Vanessa Dillon (UTech, Ja.)  
Mrs Laura Rambaran-Seepersad (UWI St. Augustine)  
Dr Zeyar Min (UTech, Ja.)

### *Logistics & Programming*

Mrs Andrea Fender-Longman (UTech, Ja.)  
Mr Damian Nesbeth (UTech, Ja.)  
Mrs Diana Passley-Robinson (UTech, Ja.)  
Mr Garth Dawkins (UTech, Ja.)

Mrs Rosalene Simmonds (UWI, Mona)  
Mrs Sabraham Green-Smith (UWI, Mona)  
Mrs Terry-Ann Collins-Fray (UWI, Mona)

### *Marketing & Communications*

Ms Alaina McGhie (UTech, Ja.)  
Mr Ivor Bennett (UTech, Ja.)  
Malik Dixon (UTech, Ja.)  
Ms Natasha Corbin (UWI Cave Hill)

Mr Nodley Wright (UTech, Ja.)  
Ms Racquel Simpson (UTech, Ja.)  
Ms Josann Green (UWI St. Augustine)  
Mrs Terry-Ann Collins-Fray (UWI, Mona)

### *Secretariat*

Dr Debbie Devonish (UTech, Ja.)  
Ms Paula Sinclair (UTech, Ja.)

Mrs Diana Passley-Robinson (UTech, Ja.)

### *Technology*

Mr Carlyon Russell (UTech, Ja.)  
Mr Erinski Easy (UTech, Ja.)

Mr O'Brien Brown (UTech, Ja.)



# Welcome Messages

## Principal's Welcome



FORECAST 2024 promises to be an exciting engagement of scholars and practitioners in science and technology as they gather over the next few days to deliberate on matters that are germane to local, regional and global developments. Indeed, science and technology is crucial to the advancement of our societies, especially in the Caribbean region, as our small size makes it difficult for us to compete on the global stage using traditional industries that depend on economies of scale and scope. For indeed, the knowledge economy is where we will have to build our competitiveness as a region, and core to this is the role of science and technology, critical elements to help us drive innovation and move us up the value chain. It is not surprising, therefore, that the

theme: *“Advancing Science and Technology Innovation for National and Regional Development”* is quite fitting to anchor the deliberations over the next few days.

Topics such as; Artificial Intelligence, Bioinformatics, Climate, Disaster Resilience and Risk Management, Health Technologies among others are all critical to the discourse on Caribbean development. Our vulnerabilities to climate change, sea level rise, data security among others, will put major industries such as tourism, agriculture, financial services etc., at risk and threaten the livelihood of vast numbers of our citizens. Therefore, science and technology will be critical to help us design solutions to combat these vulnerabilities.

I am confident that FORECAST 2024 will provide insights into these issues so that we can be closer to solutions that will impact the lives of our citizens. I will, therefore, take this opportunity to congratulate the organizers of this second staging of the conference and pledge The UWI Mona's continued support of this multi-stakeholder organized event. The partnership among the high quality tertiary educational institutions in the Caribbean region is a testimony of the positive outcomes that can emanate from collaboration for the greater good of nation building.

I wish you all a happy conference and look forward to the outputs that will help us to drive policy and practical solutions to pressing national and regional problems.

A handwritten signature in black ink that reads "D. Williams".

Professor Densil Williams  
Pro-Vice-Chancellor and Principal  
The University of the West Indies, Mona

## President's Welcome



Welcome to FORECAST 2024, hosted by the University of Technology, Jamaica, in collaboration with The University of the West Indies campuses in Jamaica, Barbados, along with the University of Trinidad & Tobago and the University of Guyana. As Jamaica's premier STEM institution, UTech, Ja is pleased to facilitate this cutting-edge conference.

FORECAST 2024 promises significant contributions to Caribbean science and technology. As we navigate the Fourth Industrial Revolution, characterized by rapid technological integration, this conference aims to offer practical solutions and insights crucial for achieving Sustainable Development Goals 9 and 11 - promoting innovation and fostering sustainable cities and communities.

Under the theme "**Advancing Science and Technology Innovation for National and Regional Development,**" our discussions will focus on emerging technologies, climate resilience, food security, healthcare advancements, and associated challenges. As we continue to innovate to be future ready and resilient, we're empowering participants to drive sustainable growth across our region.

Special recognition goes to the 2024 FORECAST planning committee for engaging regional university students through the Grand Innovation Challenge. This initiative encourages active participation in solving socio-economic challenges hindering regional development.

Let's seize this opportunity to learn from our expert speakers and prepare our future leaders to build a resilient, prosperous Caribbean society. Together, we can ensure our region thrives economically and socially.

Welcome to FORECAST 2024.

Dr Kevin Brown  
President  
University of Technology, Jamaica

## Deans' Welcome (The University of the West Indies)

The Deans of the Science and Technology faculties at the Cave Hill, Mona, and St. Augustine Campuses of The University of the West Indies (UWI) are delighted to extend a warm welcome to the Frontiers of Research and Caribbean Science and Technology (FORECAST) conference 2024. This collaborative event represents the second biennial staging of a conference uniting the Science and Technology Faculties of the UWI (Cave Hill, Mona and St Augustine Campuses), the University of Technology, Jamaica and the University of Guyana. The conference will be conducted in a hybrid format focused on the theme "**Advancing Science and Technology Innovation for National and Regional Development**".

FORECAST 2024 provides valuable opportunities to observe the significant impact and fascinating appeal of science and technology in the region and beyond. The event will explore the untapped potential in the region and promote renewed interest in science and technology through collaborative efforts.

During the next three days, there will be plenary lectures, oral and poster presentations by participants, including our students, workshops, and the 3rd Grand Student Innovation Challenge with the theme '**Resilience and Transformation: Innovating Connected Caribbean Communities**'. Participants will share original research findings across disciplines including, but not limited to, medical science, natural and applied sciences, sports, artificial intelligence, data privacy and protection, climate and disaster resilience, energy and sustainability.

The Conference will conclude with a high-level panel discussion on "**Science and Technology Innovation Imperatives for National and Regional Development: Priorities for Economic Development.**"

Our diverse lineup of speakers, panelists, and presenters for this three-day event promises to offer valuable insights and stimulate thought-provoking discussions.

Your participation is integral to the success of this event. We encourage you to engage fully, share your expertise, and seize the opportunity to network with fellow professionals and scholars. Through this collaborative enterprise we will advance the frontiers of knowledge and practice.



Dr Jeanese Badenock  
Dean, Faculty of Science and Technology  
The University of the West Indies, Cave Hill

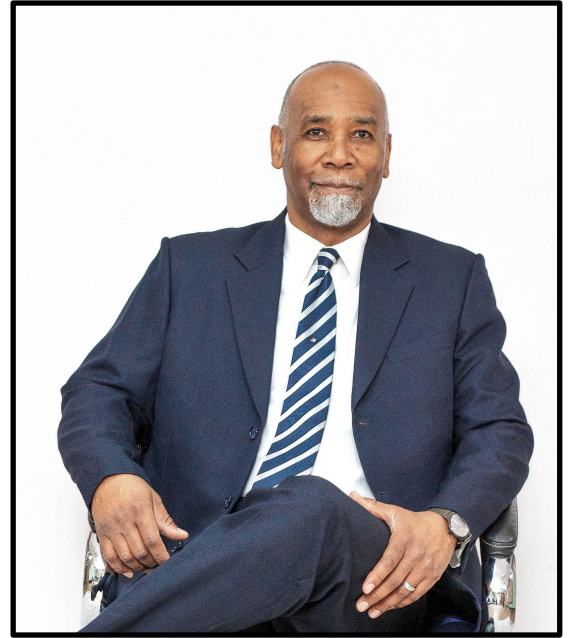


Professor Michael Taylor  
Dean, Faculty of Science and Technology  
The University of the West Indies, Mona



We extend our heartfelt gratitude to our organizing committee and the many committee members and volunteers who have worked tirelessly for the past months to make this conference possible. A special thank you is also extended to our many sponsors, speakers, moderators, presenters, chairpersons, and participants, as well as our high-level panelists, for participating and making this event impactful for the region.

We welcome you all to **FORECAST CONFERENCE 2024**.



**Dr Brian Cockburn**  
Dean, Faculty of Science and Technology  
The University of the West Indies,  
St. Augustine

## Dean's Welcome (University of Technology, Jamaica)



I welcome you with great pleasure to our second Frontiers of Research in Caribbean Science and Technology (FORECAST) Conference. As we focus our attention this year on “Advancing Science and Technology Innovations for National and Regional Development”, I take the opportunity to laud our decision to cooperate and collaborate to achieve such a goal together at this critical time in our history. The contemporary world has been witnessing the surge in advancement of nations and regions in making economic progress and attaining heightened strengths through deliberate dedication to investment in and reaping the benefits of scientific research. Such commitment has led to the plethora of scientific and technological discoveries, inventions, and innovations, the implementation of which have helped the societies integrally involved to soar to new heights of development in many fronts of human endeavours. It is therefore commendable that we in the Caribbean are seeing the need to forge academic alliances, engage in partnerships, and pursue collaborations

aimed at working together to make discoveries, produce inventions, and achieve enhancements through indigenous innovations that will help to propel our region to new heights of development and advancement. With this move, there is no telling the heights to which we can climb on the global stage. I therefore challenge us to look out, look around, and look within, to see the advancements happening in the world, discover the resources to tap into, for staking the Caribbean region in the race for development, and utilize our talents, skills and abilities for advancements in the global setting. Yes, we can do it. Let us positively bond together and utilize our various fields in the scientific and technological arenas to take our nations and the entire Caribbean region to the capacity of industrialization that will create a niche for us in the worldwide market and economy for production and productivity. I believe that such a pursuit will, through collaboration with our governments and the private sector, afford us the space to sell and make overflowing profits. It all begins here, at this scientific and technological research conference, where we can share our research ideas, efforts, and findings, and sharpen one another's vision for enabling achievement of higher goals. I enjoin you to make the most of the moments that we spend together and let us set the stage for achievement of our national and regional development and economic advancement in the modern world.

Professor Samson Omoregie  
Dean, Faculty of Science and Sport  
University of Technology, Jamaica

## Conference Chair's Welcome



On behalf of the Organizing Committee, I am honored to extend to everyone a warm welcome to the Frontiers of Research in Caribbean Science and Technology (FORECAST) 2024 Conference.

FORECAST 2024, the 2<sup>nd</sup> biennial conference executed jointly by the faculties with responsibility for Science and Technology at the University of Technology, Jamaica, and The University of the West Indies, aims to strengthen scientific research and collaboration toward new research and development opportunities to drive national and regional development. Importantly, the regional reach of the 2024 iteration of the conference has been expanded, to include partnerships with the University of Guyana and the University of Trinidad and Tobago. We welcome their participation and look forward to continued collaborations.

I take this opportunity to acknowledge and thank all the members of the Organizing Team across all institutions for their hard work, dedication, and tireless efforts to ensure the staging of this important event. Special thanks also to the Deans and Management Teams of the participating institutions for their guidance and support. The commitment and confidence of our sponsors of this event is a hallmark of their support for regional development through scientific research and technology.

It is anticipated that we will have an exciting and educational array of oral and poster presentations under the theme “Advancing Science and Technology Innovation for National and Regional Development,” and our keynote address, plenary sessions, workshops, and panel discussion will be most engaging and will showcase science and technology as a pillar of national and regional development. We also look forward to the presentation of the finalists of the Grand Innovation Challenge.

Again we extend a warm welcome to you and wish for you a very informative, engaging, and enriching conference.

Dr. Marcia Blair-Thomas  
Conference Chair

## DAY 0: TUESDAY AUGUST 13, 2024

5:00 - 7:00 p.m.  
(6:00 - 8:00 p.m. ET)

### Cocktail (**Amphi Theatre, Shared Facilities**)

**Moderator: Dr. Andre Coy**

#### **Welcome**

*Professor Samson Omoregie, Dean, Faculty of Science and Sport, University of Technology, Jamaica*

#### **Overview of the conference**

*Dr Curtis Busby-Earle, Co-Chair, Organizing Committee, FORECAST Conference*

#### **Cocktail**

#### **Light music entertainment**

*UWI Panoridim Steel Orchestra*

#### **Closing Remarks**

*Dr Debbie Devonish, Co-Chair, Organizing Committee, FORECAST Conference*





<b>DAY 1: WEDNESDAY AUGUST 14, 2024</b>	
8:00 – 9:00 a.m. (9:00 - 10:00 a.m. ET)	Registration
9:00 – 10:30 a.m. (10:00 - 11:30 a.m. ET)	<p style="text-align: center;"><b>Opening Ceremony (LT-50)</b> <b>Chair: Dr. Peter Ruddock</b></p> <p><b>Welcome and Introductory Remarks</b> <i>Dr Marcia Blair-Thomas, Chair, Organizing Committee, FORECAST Conference</i></p> <p><b>Greetings</b> <i>Dr Kevin Brown</i> <i>President, University of Technology, Jamaica</i></p> <p><i>Professor Marvin Reid</i> <i>Deputy Principal, The University of the West Indies, Mona</i></p> <p><i>Professor Winston Moore [Online]</i> <i>Deputy Principal, The University of the West Indies, Cave Hill</i></p> <p><i>Professor Paloma Mohamed [Online]</i> <i>Vice Chancellor, University of Guyana</i></p> <p><b>Introduction of Keynote Speaker</b> <i>Professor Michael Taylor, Dean, Faculty of Science and Technology, The University of the West Indies, Mona</i></p> <p><b>Keynote address: Frontiers of Research in Caribbean Science and Technology (FORECAST) 2024 Conference</b> <i>Hon. Fayval Williams, Minister of Education and Youth</i> <i>(Representing the Prime Minister of Jamaica)</i></p> <p><b>Vote of Thanks</b> <i>Dr. Curtis Busby-Earle, Co-Chair, Organizing Committee, FORECAST Conference</i></p>
10:30 – 10:50 a.m. (11:30 - 11:50 a.m. ET)	<b>COFFEE BREAK</b>

<p>10:50 – 11:50 a.m. (11:50 - 12:50 p.m. ET)</p>	<p><b>PLENARY SESSION 1 (LT-50)</b></p> <p><b>Chair: Gunjan Mansingh</b></p> <ul style="list-style-type: none"> <li>● <b>Unlocking the Power of Gen AI for applications and economic development of the Caribbean</b> <i>Pat Tomlinson, Country Leader, IBM World Trade Corporation, Jamaica Branch</i></li> </ul>
<p>11:50 – 12:10 p.m. (12:50 - 1:10 p.m. ET)</p> <p>12:10 – 12:30 p.m. (1:10 - 1:30 p.m. ET)</p>	<p><b>SESSION 1: ADVANCING BIOTECHNOLOGY (LT-50)</b></p> <p><b>Chair: Gunjan Mansingh</b> <b>Co-Chair: Desireina Delancy</b></p> <ul style="list-style-type: none"> <li>● <b>A Rapid and Efficient Method for Monitoring the Growth of Mycelium in Psilocybin Containing Fungi: Determining Optimum Liquid Cultivation Media</b> <i>Kimberley Foster, The University of the West Indies, Mona</i></li> <li>● <b><i>Nocardia iowensis</i> DSM 45197T: A Bacterium with an Interesting Past, Present and Future [Online]</b> <i>Andrew Lamm, University of Technology, Jamaica</i></li> </ul>
<p>12:30 – 1:30 p.m. (1:30 - 2:30 p.m. ET)</p>	<p><b>LUNCH BREAK</b></p>
<p>1:30 – 2:30 p.m. (2:30 - 3:30 p.m. ET)</p>	<p><b>PLENARY SESSION 2 (LT-50)</b></p> <p><b>Chair: Tannecia Stephenson</b></p> <ul style="list-style-type: none"> <li>● <b>The Growing Challenge of Climate Change and The Role of Sustainable Development [Online]</b> <i>Trent Ford, Illinois State Climatologist and Assistant Scientist, Illinois State Water Survey, Urbana-Champaign, Illinois</i></li> </ul>
<p>2:30 – 2:50 p.m. (3:30 - 3:50 p.m. ET)</p>	<p><b>AFTERNOON BREAK</b></p>

<p>2:50 – 4:10 p.m. (3:50 - 5:10 p.m. ET)</p> <p>3:10 – 3:30 p.m. (4:10 - 4:30 p.m. ET)</p> <p>3:30 – 3:50 p.m. (4:30 - 4:50 p.m. ET)</p> <p>3:50 – 4:10 p.m. (4:50 - 5:10 p.m. ET)</p>	<p><b>SESSION 2: ADVANCING TECHNOLOGY (LT-49)</b></p> <p><b>Chair: Zeyar Min</b> <b>Co-Chair: Karlus Redway</b></p> <ul style="list-style-type: none"> <li>● <b>Towards Speedup in Internet of Things Networks Using Multiple Fungible and Non-Fungible Paths</b> <i>David White, University of Technology, Jamaica</i></li> <li>● <b>A Dynamic Highlight Function for The Brightstart Reading Tutor [Online]</b> <i>Jared Heeralal, The University of the West Indies, St. Augustine</i></li> <li>● <b>Enhancing Pronunciation in Trinidadian English Synthesis: Leveraging DTTE/C and IPA notation [Online]</b> <i>Keshan Moosai, The University of the West Indies, St. Augustine</i></li> <li>● <b>Using AI to Navigate Qualitative Analysis: Impacting Research Culture at UTech, Jamaica</b> <i>Debbie Devonish, University of Technology, Jamaica</i></li> </ul>	<p><b>SESSION 3: ADVANCING SCIENCE (LT-50)</b></p> <p><b>Chair: Vanessa Dillon</b> <b>Co-Chair: André McGlashan</b></p> <ul style="list-style-type: none"> <li>● <b>Beyond Visual Inspection: A Comprehensive Approach to Assessing Firefighter Turnout Gear Post-Fire using Portable Raman Spectroscopy</b> <i>Dawin Morna, The University of the West Indies, Mona</i></li> <li>● <b>Analysis of the Jamaica Stock Exchange Trends using Mathematical Models</b> <i>Tamika Royal-Thomas, The University of the West Indies, Mona</i></li> <li>● <b>The Shooting Star Catcher: A Prototype of an Affordable Machine Learning Based all Sky Camera System for Meteor Detection.</b> <i>Jevaugn Dixon, The University of The West Indies, Mona</i></li> <li>● <b>Thermodynamics of Native Defects in Beta-Silver Selenide Thermoelectric Material</b> <i>Olha Shyiko, The University of West Indies, Mona</i></li> </ul>
<p>4:10 – 5:00 p.m. (5:10 - 6:00 p.m. ET)</p>	<p><b>POSTER SESSION</b> <b>(CORRIDOR BEHIND LT-48 &amp; LT-49)</b></p> <p><i>Posters should be posted on the poster boards by 1:30 p.m. on Day 1.</i></p>	

**DAY 2: THURSDAY AUGUST 15, 2024**

<p>8:00 – 9:00 a.m. (9:00 - 10:00 a.m. ET)</p>	<p>Registration</p>	
<p>9:00 – 10:00 a.m. (10:00 - 11:00 a.m. ET)</p>	<p><b>PLENARY SESSION 3 (LT-50)</b></p> <p style="text-align: center;"><b>Chair: Adonna Jardine-Comrie</b></p> <ul style="list-style-type: none"> <li>● <b>Food Security and Nutrition: The Role of Science and Technology Innovation [Online]</b> <i>Soroush Parsa, Food and Agriculture Organization (FAO) Science &amp; Innovation Officer, FAO Regional Office, Chile</i></li> </ul>	
<p>10:00 – 10:20 a.m. (11:00 - 11:20 a.m. ET)</p>	<p style="text-align: center;"><b>COFFEE BREAK</b></p>	
<p>10:20 – 10:40 a.m. (11:20 - 11:40 p.m. ET)</p> <p>10:40 – 11:00 a.m. (11:40 - 12:00 p.m. ET)</p> <p>11:00 – 11:20 a.m. (12:00 - 12:20 p.m. ET)</p>	<p><b>SESSION 4: ADVANCING HEALTH CARE (LT-49)</b></p> <p style="text-align: center;"><b>Chair: Sacha Campbell</b> <b>Co-Chair: Lanceford Sterling</b></p> <ul style="list-style-type: none"> <li>● <b>Unlocking the Mechanism of Oleic Acid and Succinic Acid: A Dynamic Duo for Combating Type 2 Diabetes in Sprague-Dawley Rats</b> <i>Kemmoy G Lattibeaudiere, University of Technology, Jamaica</i></li> <li>● <b>A Comprehensive Evaluation of The Task Group 119 Protocol for Intensity Modulated Radiation Therapy Commissioning with a Thermo-Luminescent Dosimeter Gelatin [Online]</b> <i>Barrington Brevitt, The University of The West Indies, Mona</i></li> <li>● <b>Distribution of Cancer of the Brain in Jamaica 2008</b> <i>Laten Mclish, University of Technology, Jamaica</i></li> </ul>	<p><b>SESSION 5: ADVANCING SCIENCE (LT-50)</b></p> <p style="text-align: center;"><b>Chair: Andrew Lamm</b> <b>Co-Chair: Rochelle Daley</b></p> <ul style="list-style-type: none"> <li>● <b>Status of Surface Water at Three Selected Areas of Coastal Guyana (South America) and The Treatment of the Respective Water with a Suitable Adsorbent. [Online]</b> <i>Raymond Compton Jagessar, University of Guyana</i></li> <li>● <b>STI for National &amp; Regional Development - What does that mean for Caribbean Territories? [Online]</b> <i>Andrea Barrett, University of Technology, Jamaica</i></li> <li>● <b>Using Digital Technology to Augment Access to Natural Heritage</b> <i>Suzanne Davis, Natural History Museum of Jamaica</i></li> </ul>



<p>11:20 – 12:20 p.m. (12:20 - 1:20 p.m. ET)</p>	<p><b>WORKSHOP 1 (LT-49)</b></p> <p><b>Chair: Peter Nelson</b></p> <p><b>Bridging the Gap between Research and Industry for Real-World Impact</b> <i>Paul Suite, Analogic Solutions</i></p>	<p><b>WORKSHOP 2 (LT-50)</b></p> <p><b>Chair: Debbie Devonish</b></p> <p><b>Research Ethics &amp; Data Protection: Implications for research</b> <i>Copeland Stupart, Patricia Robinson and Gillian Mignott, University of Technology, Jamaica</i></p>
<p>12:20 – 1:20 p.m. (1:20 - 2:20 p.m. ET)</p>	<p><b>LUNCH BREAK</b></p>	
<p>1:20 – 2:20 p.m. (2:20 - 3:20 p.m. ET)</p>	<p><b>PLENARY SESSION 4 (LT-50)</b></p> <p><b>Chair: Marcia Blair-Thomas</b></p> <ul style="list-style-type: none"> <li>● <b>Jamaica, the Wakanda of the Caribbean: Building Innovative Health Technologies for Spine Surgery and beyond</b> <i>Professor Kingsley Chin, CEO of Kingsley Investment Company, Former Chief Spine Surgeon, Penn Medicine, University of Pennsylvania Health System</i></li> </ul>	
<p>2:20 – 2:40 p.m. (3:20 - 3:40 p.m. ET)</p> <p>2:40 – 3:00 p.m. (3:40 - 4:00 p.m. ET)</p> <p>3:00 – 3:20 p.m. (4:00 - 4:20 p.m. ET)</p> <p>3:20 – 3:40 p.m. (4:20 - 4:40 p.m. ET)</p> <p>3:40 – 4:00 p.m. (4:40 - 5:00 p.m. ET)</p>	<p><b>SESSION 6: ADVANCING AGRICULTURE (LT-50)</b></p> <p><b>Chair: Marcia Blair-Thomas</b> <b>Co-Chair: Rochelle Daley</b></p> <ul style="list-style-type: none"> <li>● <b>A Polyculture model for Growing Rice, Barley and Crayfish in Barbados [Online]</b> <i>Shamar Ward &amp; Deandra Crawford, United Nations Developmental Programme Accelerator Lab, Barbados and Eastern Caribbean</i></li> <li>● <b>Intestinal Helminth Infections in Jamaican Domesticated Poultry</b> <i>Cecelia Waugh-Hall, University of Technology, Jamaica</i></li> <li>● <b>The Fermentation of Sugar Beet in Boiled and Unboiled State [Online]</b> <i>Raymond Compton Jagessar, University of Guyana</i></li> <li>● <b>Population Estimates, Ecology and Behaviour of Parrots and Parakeets (Psittaciformes) on The UWI, Mona Campus</b> <i>Noel Ellis, The University of The West Indies, Mona</i></li> <li>● <b>Cicadellidae Collected by Sweep Netting in Jamaica</b> <i>Desireina Delancy, The University of The West Indies, Mona</i></li> </ul>	
<p>4:00 – 4:20 p.m. (5:00 - 5:20 p.m. ET)</p>	<p><b>AFTERNOON BREAK</b></p>	

<p>4:20 - 4:40 p.m. (5:20 - 5:40 p.m. ET)</p> <p>4:40 - 5:00 p.m. (5:40 - 6:00 p.m. ET)</p>	<p><b>SESSION 7: ADVANCING SCIENCE (LT-49)</b></p> <p><b>Chair: Peter Ruddock Co-Chair: Melinda Levy</b></p> <ul style="list-style-type: none"> <li>● <b>An Assessment of Electrodeposited Bimetallic and High Entropy Oxides for Third Generation Concentrated Solar Power Plants [Online]</b> <i>Medeba Uzzi, Florida International University</i></li> <li>● <b>Cell Phone Radiation Exposure Level and Potential Health Impact on Jamaican Students: A Cross-Sectional Quantitative Study</b> <i>George Ferriera, University of Technology, Jamaica</i></li> </ul>	<p><b>SESSION 8: ADVANCING INNOVATION (LT-50)</b></p> <p><b>Chair: Adrienne Williams Co-Chair: Olha Shyiko</b></p> <ul style="list-style-type: none"> <li>● <b>Machine Learning-Driven Optimization of Residence Time for Enhanced Hydrogen Production via Catalytic Pyrolysis of Natural Gas and Biomass</b> <i>Vishal Persaud, Florida International University</i></li> <li>● <b>Improved Solar Cell Efficiency by using AgInSe<sub>2</sub> layer with Si Device [Online]</b> <i>Kevin Gurbani Beepat, The University of the West Indies, St. Augustine.</i></li> </ul>
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Day 3: Friday August 16, 2024		
8:00 – 9:00 am (9:00 - 10:00 a.m. ET)	Registration	
9:00 – 10:00 a.m. (10:00 - 11:00 a.m. ET)	<p><b>PLENARY SESSION 5 (LT-50)</b></p> <p style="text-align: center;"><b>Chair: David White</b></p> <ul style="list-style-type: none"> <li> <b>Ensuring a Tightened Cybersecurity for a Smooth Economic Development in the Caribbean</b>  <i>Lt. Col. (Ret) Godphey Sterling, Head of Jamaica Cyber Incident Response Team</i> </li> </ul>	
10:00 – 10:20 a.m. (11:00 - 11:20 a.m. ET)	<b>COFFEE BREAK</b>	
10:20 – 12:00 p.m. (11:20 - 1:00 p.m. ET)	<p style="text-align: center;"><b>3<sup>rd</sup> Student Grand Innovation Challenge (LT-50)</b>  <i>“Resilience and Transformation: Innovating Connected Caribbean Communities”</i></p> <p style="text-align: center;"><b>Chair: Laura Rambaran-Seepersad</b></p> <p><b>Welcome and Opening Remarks</b>  <i>Melissa Sanderson, GIC Co-chair</i></p> <p><b>Overview of the Grand Innovation Challenge</b>  <i>Vanessa Dillon, GIC Co-chair</i></p> <p><b>Presentations by Finalists</b></p> <p><b>Messages from Sponsors</b></p> <p><b>Vote of Thanks</b>  <i>Vanessa Dillon, GIC Co-chair</i></p> <p><b>Closing Remarks</b>  <i>Melissa Sanderson, GIC Co-chair</i></p>	
12:00 - 1:00 p.m. (1:00 - 2:00 p.m. ET)	<p><b>WORKSHOP 3 (LT-50)</b></p> <p style="text-align: center;"><b>Chair: Natala Burnett</b></p> <p><b>Harnessing AI for Research Excellence: Practical Tools, Strategies, and Ethical Consideration</b>  <i>Zeyar Min, University of Technology, Jamaica</i></p>	<p><b>WORKSHOP 4 (LT-49)</b></p> <p style="text-align: center;"><b>Chair: John Hall</b></p> <p><b>Intellectual Property Rights 101: What researchers need to know</b>  <i>Adrienne Thompson, Jamaica Intellectual Property Office</i></p>

<p>1:00 - 2:00 p.m. (2:00 - 3:00 p.m. ET)</p>	<p><b>LUNCH BREAK</b></p>
<p>2:00 - 3:00 p.m. (3:00 - 4:00 p.m. ET)</p>	<p><b>Panel Discussion (LT-50)</b></p> <p><b><i>“Science and Technology Innovation Imperatives for National and Regional Development: Priorities for Economic Development”</i></b></p> <p><b>Moderator:</b> <b>Mr. George Davis, Deputy Executive Producer/Editor, <i>Nationwide News Network</i></b></p> <p><b>Panelists:</b></p> <p><i>Dr. Kevin Brown</i> <i>President, University of Technology, Jamaica</i></p> <p><i>Professor Marvin Reid</i> <i>Deputy Principal, The University of the West Indies, Mona</i></p> <p><i>Professor R Clive Landis [Online]</i> <i>Principal, The University of the West Indies, Cave Hill</i></p> <p><i>Hon. Floyd Green, MP</i> <i>Minister of Agriculture, Fisheries and Mining</i></p> <p><i>Professor Paloma Mohamed [Online]</i> <i>Vice Chancellor, University of Guyana</i></p>
<p>3:00 - 3:20 p.m. (4:00 - 4:20 p.m. ET)</p>	<p><b>AFTERNOON BREAK</b></p>



<p>3:20 - 3:40 p.m. (4:20 - 4:40 p.m. ET)</p> <p>3:40 - 4:00 p.m. (4:40 - 5:00 p.m. ET)</p> <p>4:00 - 4:20 p.m. (5:00 - 5:20 p.m. ET)</p> <p>4:20 - 4:40 p.m. (5:20 - 5:40 p.m. ET)</p>	<p><b>SESSION 9: ADVANCING ENVIRONMENTAL SUSTAINABILITY (LT-50)</b></p> <p><b>Chair: Damian Nesbeth</b> <b>Co-Chair: Amoy Campbell</b></p> <ul style="list-style-type: none"> <li>● <b>Does the Seagrass Habitat’s Nearest Neighbour Factor in Fish Distribution?</b> <i>Nikki Bramwell, University of Technology, Jamaica</i></li> <li>● <b>Assessing Structural and Floristic Characteristics within a Section of Urban Forest on A University Campus: A Comparative Study after 30 years</b> <i>Nicholas A Lee, The University of the West Indies, Mona</i></li> <li>● <b>Comparative Analysis of Epiphyte Diversity and Host Preferences in two Botanical Gardens of Jamaica</b> <i>Mariah Medrano, The University of the West Indies, Mona</i></li> <li>● <b>Exploring Jamaica’s Natural Products through the NPRL, UTech</b> <i>Andrew Lamm, University of Technology, Jamaica</i></li> </ul>
<p>4:40 - 5:00 p.m. (5:40 - 6:00 p.m. ET)</p>	<p><b>Closing and Awards Ceremony (LT-50)</b> <b>Chair: Professor Samson Omoregie</b></p> <ul style="list-style-type: none"> <li>● <b>Presentation of Awards</b> <ul style="list-style-type: none"> <li>○ <i>Best Graduate Oral Presentation</i></li> <li>○ <i>Best Graduate Poster Presentations</i></li> <li>○ <i>Student Grand Innovation Challenge</i></li> </ul> </li> <li>● <b>Vote of Thanks and Closing Remarks</b> <i>Professor Samson Omoregie, Dean, Faculty of Science and Sport, University of Technology, Jamaica</i></li> </ul>

## Keynote Speaker



Mrs. Fayval Williams is a Chartered Financial Analyst (CFA) by profession. She has an MBA with a concentration in Finance from the Wharton Business School at the University of Pennsylvania and a BA (cum laude) in Economics from Harvard University in Cambridge, Massachusetts.

Mrs. Williams has been a Member of Parliament for the St. Andrew Eastern constituency since March 2016 and has served in a number of government posts including those of Minister of State in the Ministry of Finance and the Public Service, Minister of Science, Energy and Technology. Mrs. Williams is currently the Minister of Education and Youth in Jamaica.

She is a former Executive Director of Kingston Properties Limited and prior to that she served as Chief Investment Officer of JMMB Limited from March, 2005 to September, 2007 with investment responsibilities spanning the trading department, investment research, and pensions. Also, during the period September 2002 to February 2004, Mrs. Williams consulted with JMMB in the areas of market risk management and investment research where she led that company's efforts to develop investment research capabilities.

In 2004, Mrs. Williams consulted with the Financial Services Commission (FSC) in the area of Research and Policy. Prior to returning to Jamaica, Mrs. Williams was Senior Vice President at Putnam Investments, in Boston, a top-10-global mutual fund manager. Her investment work spanned a broad cross-section of industries. She also had portfolio management responsibilities for an equity portfolio product and led Putnam's efforts to incubate a market neutral hedge fund.

Mrs. Williams' investment experience also includes approximately five years as Vice President at Wellington Management Company in Boston, Massachusetts, where her focus was on fixed income securities investments. Prior to Wellington, she was a Fixed Income Analyst at Northwestern Mutual Life Insurance Company in Milwaukee, Wisconsin and shared portfolio management responsibilities for a US\$3 billion portfolio.

She is married to Leo Williams and they have two children.

### **The Honourable Fayval Williams**

Member of Parliament

Minister of Education and Youth

# Plenary Speakers

## PLENARY SESSION 1

### Unlocking the Power of Gen AI for applications and economic development of the Caribbean



Pat Tomlinson is currently Country Leader for IBM World Trade Corporation – Jamaica Branch, and an advocate for business transformation and innovation in Jamaica. He started his career at IBM in 1990 as an Associate Systems Engineer, subsequently working in various sales and services delivery roles. Prior to joining IBM, Pat worked briefly with Jamaica Telephone Company (now FLOW) as a Systems and Application Programmer in the Network Fraud Control Department, and a Systems Programmer at Computer Services and Programming (CSP).

In his current role as Country Leader, Pat is responsible for managing the efforts of the professionals engaged in the sales and delivery of IBM solutions in Jamaica. He acts as the Senior IBM representative to local Clients, integrating IBM for Clients, and aligning IBM with the country's national agenda for economic development. He is also tasked with developing and planning business strategies and collaborating closely with all IBM business units, brand sellers/management, delivery teams, and Business Partners to meet required Client and IBM objectives.

Today, Pat is heavily focused on collaborating with colleagues and Partners to help local companies scale generative AI across their enterprises. He recently competed in the 2024 IBMer watsonx Challenge to gain hands-on experience with watsonx (IBM's AI and data platform built for business) and related foundation models, and accelerate IBM's work with this transformative technology.

He is a past student of William Knibb Memorial High School and Munro College, and has a B.Sc. (General) and an MBA degree from the University of the West Indies. He also holds a Master of Computer Science (MCS) degree from the Technical University of Nova Scotia (merged into Dalhousie University from April 1997).

Pat previously served on the board of the Jamaica Information Technology and Services Alliance (JITSA) and is a Past (Distinguished) President of the Kiwanis Club of Liguanea, St. Andrew.

#### **Pat Tomlinson**

Country Leader  
IBM World Trade Corporation  
Jamaica Branch

## PLENARY SESSION 2

### The Growing Challenge of Climate Change and The Role of Sustainable Development



**Dr. Trent Ford**

Climatologist and Assistant  
Scientist

Illinois State Water Survey  
Urbana-Champaign, Illinois

Trent Ford is the Illinois State Climatologist and has been with the Prairie Research Institute at the University of Illinois since 2019. He is an expert in climate and climate change and its interactions and impacts, especially as they relate to water.

Trent leads climate and drought monitoring, research, and data collection for the state of Illinois. He and his team work with communities, industries, and state agencies on issues related to climate change in Illinois, and engage the general public through online, media, and educational outreach.

A native of Roanoke, Illinois, Ford earned a bachelors in geography from Illinois State University before completing his masters and PhD at Texas A&M University.

## PLENARY SESSION 3

### Food Security and Nutrition: The Role of Science and Technology Innovation



**Dr. Soroush Parsa**

Food and Agriculture  
Organization (FAO)  
Science & Innovation Officer, FAO  
Regional Office, Chile

Soroush Parsa is FAO's Science & Innovation Officer for Latin America and the Caribbean, and the Founder of the AgTech Coop Academy, an incubator program seeking innovative business and scaling models to close the AgTech gap for smallholder farmers in Latin America and the Caribbean. He previously served as a Lead Innovation Scientist at the CGIAR, and as a Science and Technology Policy Fellow at the USDA Agriculture Research Service, where he helped create ARSX, the agency's first program for high-risk high reward innovation.

Soroush holds a PhD in Ecology, and a M.S. in Integrated Pest Management from UC Davis, and brings over 20 years of international experience in agriculture research, development, innovation, and policy. His work has been recognized by prestigious awards, including earning the Top Visionary title of the Food Systems Vision Prize.

## PLENARY SESSION 4

### Jamaica, the Wakanda of the Caribbean: Building Innovative Health Technologies for Spine Surgery and beyond



Meet Dr. Kingsley R. Chin, a pioneer in the field renowned for his ground-breaking advancements in minimally invasive techniques with 20+ years igniting spine technology revolution. Notably, he introduced the game-changing MANTIS technology, reshaping how spine surgeries are performed and garnering acclaim upon its acquisition by Stryker Spine in 2005. As the Founder and CEO of KIC Ventures, Dr. Chin leads the charge in advancing outpatient Less Exposure Spine Surgery (LESS™) technologies, with a steadfast commitment to enhancing patient outcomes.

Dr. Kingsley R. Chin's journey from a small town in Jamaica to becoming a trailblazing CEO leading the spine surgery technology revolution is nothing short of remarkable. Raised in Buff Bay by a single mother alongside his siblings, Dr. Chin learned the invaluable lessons of resilience and determination early on.

His ascent began with a scholarship to Columbia University, where he excelled both academically and athletically, leaving an indelible mark as an engineering standout and the Ivy League Player of the Year in soccer and president of his senior class. Dr. Chin's ability to overcome adversity and seize opportunities propelled him to success, laying the foundation for his future endeavours.

Transitioning to the corporate world, Dr. Chin honed his skills at prestigious institutions like AT&T Bell Labs and Accenture, where he tackled complex challenges for companies like Goldman Sachs and Cigna Insurance. This diverse experience equipped him with a unique blend of engineering prowess and business acumen, setting the stage for his ground-breaking innovations in the medical field. Armed with advanced degrees from Harvard Medical School and Harvard Business School, Dr. Chin's transformation to the realm of medicine was a natural progression. As the Chief Spine Surgeon at the University of Pennsylvania, he pioneered innovative approaches that revolutionized spine surgery, earning accolades for his visionary leadership and transformative impact.

In 2006, Dr. Chin laid the foundation for KIC Ventures with a personal investment of \$100,000, targeting unique spine technologies. His strategic vision and commitment have led him to invest an estimated \$40+ millions of his own capital and attract an additional \$25 million from external investors over time. Today, KIC Ventures boasts an impressive valuation of \$300 million, with Dr. Chin owning more than 50%—demonstrating a remarkable 3,000x return on his initial investment. Dr. Chin emphasizes that now is the optimal time for investors to join, as many initial risks have been mitigated, and KIC Ventures is positioned for global expansion and pursuing US IPOs for its portfolio companies. A prime example of this success is NANISX, which has shown consistent profitability since 2021, maintaining a positive EBITDA. The highly anticipated 2025 release of Axiomed's lumbar disc replacement to US surgeons is expected to further accelerate growth, with an ambitious target to elevate the company's valuation to \$5 billion. Dr. Kingsley R. Chin's remarkable journey from a small town in Jamaica to becoming a trailblazing CEO in the spine surgery technology revolution is a testament to his resilience, determination, and visionary leadership. Dr. Chin's early life instilled in him the values of hard work, perseverance and family. His academic excellence is proof of his intellectual curiosity. His relentless pursuit of innovation, coupled with his deep understanding of both medical and business realms, makes him a leader investor simply can't afford to overlook. Dr. Kingsley R. Chin is not just transforming spine surgery – he's shaping the future of healthcare.

#### **Professor Kingsley Chin**

CEO of Kingsley Investment Company,  
Former Chief Spine Surgeon, Penn Medicine,  
University of Pennsylvania Health System



Colonel Sterling served in the Jamaica Defence Force (JDF) for more than 24 years in a number of staff and command roles. Fifteen of those years were spent in various ICT and Cyber related roles. During that time he worked with the Mitre Corporation and United States Southern Command (US SOUTHCOM) to create the Caribbean Information Sharing Network (CISN) leading its Technical Working Group from 1998 to 2007. This facility morphed over the years into what is now known as the Security Cooperation and Intelligence Information Exchange System (SCIIES).

He led, or participated in, the project teams that were responsible for all major technology changes in

the JDF between 1998 and 2019 culminating in his leading the Disaster Assistance and Response Team (DART) to the Commonwealth of the Bahamas, in the aftermath of the devastation wreaked by hurricane Dorian, in 2019 for which he was appointed to the rank of Colonel (Local).

More recently he has served as the Deputy Managing Director of Operations (DMD Ops) at the state-owned Jamaica Urban Transit Company (JUTC) where he spearheaded the company’s response to the COVID-19 Pandemic by designing and implementing the JUTC’s Contagious Virus Response Plan (CVRP). As the Director of the Jamaica Cyber Incident Response Team Division, he manages National Security Operations Centre (NSOC) and Jamaica’s Cyber Incident Response Team (JaCIRT). Additionally, he and his team triage, categorise, refer, respond to and document cyber incidents on the government’s behalf. As the lead implementer of the National Cybersecurity Strategy 2015 the team spearheads the legal and regulatory, technical, human resource and capacity building as well as the public education and awareness efforts of the Jamaican Government. He also sits as Jamaica’s Representative on the Project Steering Committee developing the CARICOM Cyber Resilience Strategy 2030.

Col. Sterling holds certificates in Cybersecurity from the US Army War College and the IEEE, and the Hebrew University of Jerusalem; Diplomas in Systems Automation from the US Army Signal School, Florida International University, Carnegie Mellon University, and the George Marshall Centre for Security Services, Germany; a Bachelor’s degree, with honours, in Computer Science (University of Technology, Jamaica) and Master’s Degrees in Defence from the Universidad Isabelle I in Madrid, Spain.

**Lt. Col. (Ret) Godphey Sterling**

Head

Jamaica Cyber Incident Response Team



# Panel Discussion

## “Science and Technology Innovation Imperatives for National and Regional Development: Priorities for Economic Development”



**Moderator**

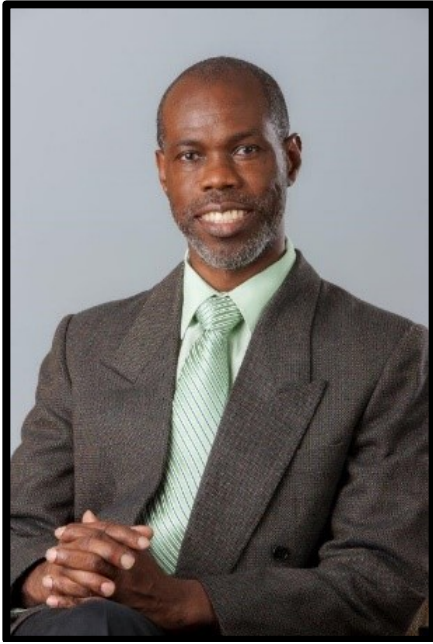
Mr. George Davis  
Deputy Executive Producer/Editor  
Nationwide News Network



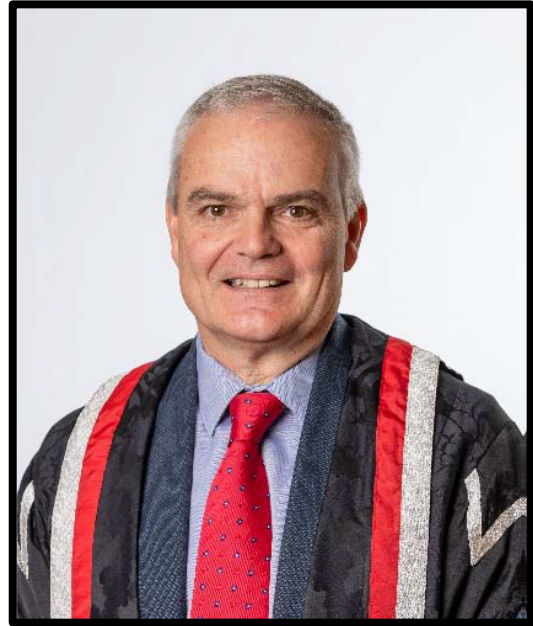
**The Honourable Floyd Green**  
Minister without Portfolio  
Office of the Prime Minister  
Government of Jamaica



**Dr Kevin Brown**  
President,  
University of Technology, Jamaica



**Professor Marvin Reid**  
Deputy Principal  
The University of the West Indies, Mona



**Professor Clive Landis**  
Principal  
University of the West Indies, Cave Hill



**Professor Paloma Martin**  
Vice Chancellor  
University of Guyana

# Grand Innovation Challenge

The 3rd Grand Innovation Challenge at The FORECAST Conference 2024 marks the continuation of a successful series, building on the achievements of the previous two challenges. As a platform for fostering innovative ideas and solutions, this year's challenge aims to promote collaboration among researchers, students, and industry professionals to address pressing local and regional issues. By encouraging the development of sustainable and scalable solutions, the challenge seeks to inspire participants to push the boundaries of their creativity and technical expertise, driving forward technological and scientific advancements.

The theme for this year's challenge, "Resilience and Transformation: Innovating Connected Caribbean Communities," highlights the urgent need for strengthening resilience and fostering transformative growth within Caribbean communities. This challenge seeks innovative solutions that align with key United Nations Sustainable Development Goals (SDGs), particularly those that support the resilience and sustainable development of these communities against environmental, economic, and societal challenges. Participants are encouraged to think creatively about how to leverage technology and science to create a positive impact on the environment and society.

The future of innovations looks promising, with the Grand Innovation Challenge aiming to establish a tradition of excellence within the region, making it a cornerstone event for the local and regional scientific community. The challenge enhances the visibility and support for emerging technologies and innovative practices that contribute to economic growth and societal well-being. It also aims to create a pipeline for continuous innovation, encouraging ongoing participation and engagement from diverse sectors.

We extend a heartfelt thank you to our sponsors for their generous support and commitment to fostering innovation and development. Their contributions are instrumental in providing resources, mentorship, and opportunities for participants to bring their ideas to life, playing a crucial role in the success of the challenge and the future of innovation in our community.

The 3rd Grand Innovation Challenge is not only a testament to the growing importance of innovative thinking in our region but also a beacon of hope for a sustainable and resilient future. We look forward to witnessing the groundbreaking ideas and solutions that will emerge from this year's event.

***The winning team will be announced during the Closing and Awards Ceremony on Friday, August 16, 2024.***

# Abstracts for Contributed Talks

## A RAPID AND EFFICIENT METHOD FOR MONITORING THE GROWTH OF MYCELIUM IN PSILOCYBIN CONTAINING FUNGI: DETERMINING OPTIMUM LIQUID CULTIVATION MEDIA

Kimberley Foster<sup>1,2\*</sup>, Isaac Morrison<sup>1,2</sup>, Marshall Tyler<sup>1</sup> and Rupika Delgoda<sup>1,2</sup>

<sup>1</sup>Future Wellness, University of the West Indies, JAMAICA <sup>2</sup>Caribbean Centre for Research in Bioscience, University of the West Indies, Mona, Kingston, JAMAICA.

**Background:** The study of psychedelic fungi has gained significant attention in recent years due to their potential medicinal and therapeutic properties. Tracking the growth of mycelia as a key indicator of growth provides a useful handle for researchers and cultivators. Mycelial growth is traditionally measured as an increase in dry weight of the mycelium [1]. However, this study presents a rapid and efficient method using submerged mycelium in liquid culture seeded in a 96-well microplate to determine the speed of growth. The growth of five different *Psilocybe* species was monitored using this method in this study. Additionally, mycelium growth was compared in two commonly used liquid culture media, potato dextrose broth (PDB) and malt extract broth (MEB). The average level of tryptamine produced in mats was also measured.

**Aims:** To generate growth curves for five *Psilocybe* species and to identify the preferred liquid media for mycelial growth and tryptamine production.

**Methods:** Cultures were initially maintained on Potato Dextrose Agar, PDA (Neogen). Inocula for liquid cultures were prepared from agar cultures using mycelial circles of diameter 10 mm cut from the PDA plates using a sterile biopsy puncher (Robbins Instruments). The mycelial circles were then transferred to a 50 mL centrifuge tube containing 25 mL sterile Potato Dextrose Broth (Neogen) and 25 mL sterile Malt Extract Broth (Difco) where they were homogenized for 30 seconds. 100 µL of this homogenate was subsequently seeded into the wells of the 96-well plate in replicates. The plate was incubated at room temperature for 12 days and the absorbance readings were measured each day

at 600nm using a microplate reader. The remainder of each culture was allowed to remain stationary in the 50 ml centrifuge tubes and form a mycelial mat at the surface of the liquid. The stationary cultures were collected on day 12, and the mycelial mats were harvested, weighed, dried and used for HPLC analysis of the tryptamines.

**Results:** Growth curves were generated for five *Psilocybe* species namely *P. cubensis*, *P. allenii*, *P. subtropicalis*, *P. mexicana* and *P. oviodeocystidiata*. MEB was the preferred media as all species entered the log phase in a shorter time when compared to those incubated in PDB. The fastest growing species was *P. cubensis* which reached log phase by day 3 in MEB in comparison to the slowest growing species *P. allenii* which reached log phase at day 8. MEB also gave heavier mycelial mats and higher tryptamine content averaging 0.15% weight when compared to 0.08% weight in PDB.

**Conclusions:** This study demonstrated that rapid, optical density measurements were an efficient way to monitor the growth of mycelia in submerged liquid media. Using such measures, MEB was found to be the most effective medium for mycelial growth and tryptamine production, with *P. cubensis* being the most successful *Psilocybe* species cultivated. Our results ultimately contribute to the advancement of psychedelic fungi research and cultivation practices.

### References:

- [1] Xiao, Qiuyun, et al. "Differential proteomic profiles of *Pleurotus ostreatus* in response to lignocellulosic components provide insights into divergent adaptive mechanisms." *Frontiers in microbiology* 8 (2017): 480.

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# NOCARDIA IOWENSIS DSM 45197<sup>T</sup>: A BACTERIUM WITH AN INTERESTING PAST, PRESENT AND FUTURE

Andrew S. Lamm\*

Natural Products Research Laboratory, University of Technology, JAMAICA

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**Background:** A bacterium, first named *Nocardia* spp NRRL 5646 was isolated from garden soil in Osceola, Iowa, USA. It was found to be rich in glycocinnamoylspermidine antibiotics. Further research later revealed its extensive ability to perform the biotransformation of xenobiotic substances. With such a diverse biotechnological profile the organism was formally studied and taxonomically classified as a novel species and was named, *Nocardia iowensis* DSM 45197<sup>T</sup> [1]. Three significant features identified within *N. iowensis* include the first fully characterized carboxylic acid reductase (CAR) [2] and the first bacterial nitric oxide synthase (NOS) system.

We continued to explore various aspects of this microorganism and obtained its whole genome sequence [3] to better explore its relationship to other actinomycete such as pathogenic *Nocardia* and other disease-causing microorganisms

**Aims:** To present the body of work done on *Nocardia iowensis*.

**Methods:** The presentation will discuss the discovery, utilization, exploration and future possibilities of *N. iowensis*. Focus will be placed on its ability to: a) produce antibiotics; b) perform the biotransformation of a wide range of xenobiotics; c) produce biocatalytic enzymes which were cloned and heterogeneously expressed for research and commercial purposes [4]. Additionally, we will discuss the formal classification of this microorganism and its whole genome sequencing. Only significant methodologies will be presented due to the myriads of different techniques and protocols employed throughout this body of work.

**Results:** *N. iowensis* produced five antibiotics, as well as numerous enzymes with biocatalytic applications.

*N. iowensis* has a genome size of 8.95 Mbp where about 46% of the coding sequences have no known homologues in other bacteria and were labeled as hypothetical proteins [3]. This implies further potential for biomedical and biotechnological research applications.

**Conclusions:** *N. iowensis* has been shown to be a versatile microorganism with close relations to pathogenic *Nocardia* which cause the disease, nocardiosis. However, given the array of useful enzymes and processes with the examined genome, it is clear that more research is needed to better understand its full potential.

**Acknowledgments:** We thank the Center for Biocatalysis and Bioprocessing, University of Iowa and the University of Technology, Jamaica.

## References:

- [1] A. S. Lamm, et al. "*Nocardia iowensis* sp. nov.: An organism rich in biocatalytically important enzymes and nitric oxide synthase." *International Journal of Systematic and Evolutionary Microbiology*, 59: 2408-14, 2009.
- [2] A. S. Lamm, et al. "Carboxylic Acid Reductase". In *Science of Synthesis. Biocatalysis in Organic Synthesis 2*. Thieme, Stuttgart. ISBN: 978-3-13-174161-5 (Softcover, 636 pages, 2015)
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# TOWARDS SPEEDUP IN INTERNET OF THINGS NETWORKS USING MULTIPLE FUNGIBLE AND NON-FUNGIBLE PATHS

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**Background:** As the countries in the region push for national and regional development, connectivity has been and will continue to be a key enabler. In particular, leveraging Internet of Things (IoT) technologies can enable better public policymaking, faster monitoring, and response to changes in the environment, real-time analysis, feedback and faster decision-making in industrial and consumer applications, and the move towards smart societies. Recent research has shown that the real and projected growth of IoT device connections in the region has grown exponentially, though not as astronomically as on the international stage in the more developed regions. Research has also shown that an enormous amount of data is transmitted over these IoT connections, and the amount continues to increase. This scenario calls for more bandwidth and/or better use of existing bandwidth to handle the phenomenal growth in IoT deployment and IoT data transmission and to achieve speedup.

**Aims:** To determine if dynamically deploying multiple fungible and non-fungible paths could achieve efficient and effective speedup in IoT data communications.

**Methods:** We employed a quantitative research design which included experimental research. We designed a set of Directed Acyclic Graphs (DAGs) to represent how multiple and non-fungible paths could be deployed in an IoT network. We then derived mathematical formulations to predict the speedups we

expected from the models, and graphed the results of output from the theoretical mathematical models when we applied a 4 MB plaintext copy of the King James Bible to them. We extrapolated the results to determine the nature of the speedups as the number of fungible and non-fungible paths increased. We then designed and implemented asymptotically efficient algorithms (for which we presented mathematical proofs) to transmit and receive the data over the number of available paths. We designed apparatus to test our IoT network which included a Raspberry Pi 4 running the Raspbian OS, an HP notebook 14 running Ubuntu Linux, and an array of Category 5 Ethernet cables connecting both devices. We also used Bluetooth BLE to connect both devices wirelessly to each other. Furthermore, we then ran experiments hundreds of times to determine the speedup in transferring the 4 MB file from sender to receiver as we increased the number of paths used.

**Results:** Our results revealed that we were able to achieve speedups dynamically and asymptotically efficiently using multiple fungible paths with diminishing returns, as our models had predicted. These results were statistically significant and repeatable. However, the results from our experiments using multiple non-fungible paths were inconclusive.

**Conclusions:** Dynamically deploying multiple fungible paths can achieve efficient and effective speedup in IoT data communications.



# A DYNAMIC HIGHLIGHT FUNCTION FOR THE BRIGHTSTART READING TUTOR

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**Background:** Establishing early reading skills is crucial, particularly in linguistically diverse environments. Traditional text-highlighting techniques, used in literacy software, aid comprehension but often fail to address the needs of young learners from varied linguistic backgrounds [1]. In the Caribbean, where linguistic diversity is prominent, conventional methods fall short in accommodating accents, dialects, and cultural contexts [2]. The Dynamic Highlight Function (DHF) offers an adaptive solution by synchronizing text highlighting with synthetic speech, personalized to individual pronunciation styles and reading paces. This approach replicates one-to-one literacy specialist sessions, enhancing engagement and fluency in young readers[3].

**Aims:** To create and evaluate an adaptive highlighting tool for the Brightstart Reading Tutor that offers visual (word tracking) and auditory stimuli to a learner during an online reading lesson.

**Methods:** The Dynamic Highlight Function (DHF) employs a user-friendly, online reading interface, primarily built using React.js and Bootstrap. This interface communicates with a Python, Flask-based API, which handles the parsing and processing of input files to produce an object called a DHF Reading Lesson. MongoDB was chosen as the data storage solution due to its scalability and secure data management capabilities.

The DHF algorithm was evaluated through two experiments. The first examined the DHF's robustness and reliability by synchronizing highlights with synthetic speech from 24 samples at various reading speeds. The second experiment was a pilot study that explored the user experience of the DHF among young English-speaking Caribbean children. Feedback on the DHF's performance and its impact on reading experience was collected through an online questionnaire, consisting of 15 participants .

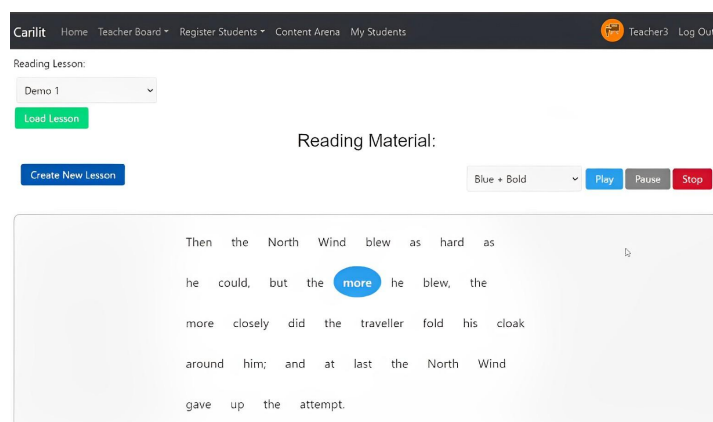
**Results:** The Dynamic Highlight Function demonstrated a high word detection accuracy of over 95 percent for both fast reading speeds (above 75 word count per minute) and medium reading speeds (44.5 to 75 word count per minute). However, at slower reading speeds (less than 44.5 word count per minute), the accuracy is lower (84

percent) due to limitations in the speech-to-text API. Highlighting effectiveness varied, with more misfires occurring at slower speeds. The user experience study revealed a preference for a blue highlighter with bold text (85.71 percent) and male synthetic voices (53.33 percent). Children generally found the highlighting speed appropriate for fast-paced reading but too slow for medium-paced reading.

**Conclusions:** The Dynamic Highlight Function is effective for fast and medium-paced readers and shorter reading content. The user feedback provided valuable insights for future improvements in the graphical interface, reading pace, and voice type options. Further research is suggested to enhance the word detection and comparison algorithm and the overall performance, specifically in identifying and differentiating words at slow reading speeds.

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**Figure 1:** Screenshot of the Brightstart Reading Tutor utilizing the Dynamic Highlight Function with blue high- lighting.

# ENHANCING PRONUNCIATION IN TRINIDADIAN ENGLISH SYNTHESIS: LEVERAGING DTTE/C AND IPA NOTATION

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**Background:** This study examines the comprehensibility of Trinidadian vocabulary words generated by a speech synthesis program, SynthTnT, using the Dictionary of the English/Creole of Trinidad and Tobago (DTTE/C) [1]. Building on previous works in multilingual Text-to-Speech (TTS) systems for under-resourced languages [2] and International Phonetic Alphabet (IPA)-based pronunciation accuracy [3], this research aims to address the unique challenges of synthesising natural-sounding Trinidadian accented English using the IPA.

**Aims:** To investigate user acceptance of the pronunciation accuracy, clarity and naturalness of Trinidadian accented English when generated by a speech synthesiser using IPA.

**Methods:** The foundation of this research established the technical infrastructure for SynthTnT by making DTTE/C accessible through a Representational State Transfer (REST) Application Programming Interface (API), allowing access to Trinidadian English vocabulary words and their corresponding IPA symbols.

IPA metadata was then converted into Speech Synthesis Markup Language (SSML) for use with IBM Watson’s TTS service to produce high-quality synthetic speech. A web-based interface was developed to facilitate user interaction with SynthTnT.

Over 30 users evaluated 10 synthesised audio samples, each containing a consonant-vowel-consonant (CVC) word from varying socio-linguistic contexts, using a five-point Likert scale. Evaluator agreement was assessed using Krippendorff’s Alpha,  $\alpha = \frac{p_a - p_e}{1 - p_e}$ , and Fleiss’ Kappa,  $K = \frac{p - p_e}{1 - p_e}$ , to measure sample set reliability [4].

**Results:** Despite overall acceptance of the model’s pronunciation, as seen by the overall satisfaction rating in figure 1, user evaluations regarding its clarity, accuracy and naturalness suggest that there is much room for improvement.

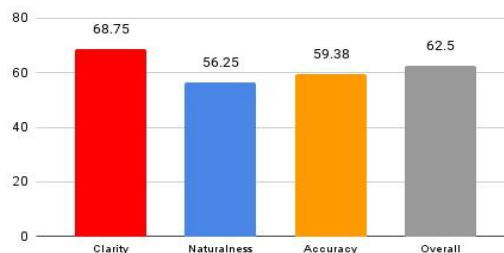
Further analysis revealed Fleiss’ Kappa values of 0.242, 0.449, 0.581, 0.469, 0.426, 0.533, 0.397, 0.514, 0.255 and 0.459 for the 10 samples, indicating overall “moderate” reliability of the evaluators’ responses.

Additionally, the sample set produced Krippendorff’s Alpha values of 0.0115, -0.0063, -0.0162, 0.0022, -0.0103, -0.0111, -0.0049, -0.0085, 0.0136 and 0.0116. This implies a “slight” or even “poor” agreement amongst evaluators.

**Conclusions:** Moderate reliability of user evaluations confirm that generation of Trinidadian accented English using IPA metadata requires broader lexical comprehension and future evaluation methods that consider dialect variability, due to an unacceptable level of agreement amongst evaluators.

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**Figure 1:** User ratings of synthesis clarity, naturalness and accuracy of Trinidadian accented English produced by SynthTnT.

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# USING AI TO NAVIGATE QUALITATIVE ANALYSIS: IMPACTING THE RESEARCH CULTURE AT UTECH, JAMAICA.

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**Background:** Educational institutions generate vast amounts of data suitable for research. Artificial Intelligence (AI) and machine learning tools can be harnessed to gather and analyse these data.

Qualitative research methodologies delve deep into the complexities of human experiences, offering rich insights that quantitative methods might miss (Creswell & Creswell, 2018). Analysing large volumes of qualitative data can be a time-consuming and arduous task. AI can empower researchers by offering innovative tools and techniques to streamline and enrich qualitative analysis, making the process less labor-intensive, more explicable, and potentially more equitable (Anis & French, 2023). However, researchers need to be aware of potential pitfalls associated with AI use (Anis & French, 2023). Jiang et al. (2021) highlight the need for further exploration of the benefits of AI tools in qualitative research, considering the diverse methodological practices and collaboration dynamics involved.

The University of Technology, Jamaica through its office of Graduate Studies Research and Entrepreneurship, is mandated with promoting a research culture in the university. Daily, “data ripe for research” is created by the teaching and learning process. Hence this case will illustrate how two researchers used AI-collaboration to navigate the rich depths of data which was created on a discussion board (a digital online platform for asynchronous communication) in a university module.

**Aim:** To showcase how researchers can develop and utilize AI-powered collaboration methodologies to analyse qualitative data generated in educational settings, fostering a research culture at the University of Technology, Jamaica (UTech Jamaica).

**Methods:** Step 1: Accessing the Qualitative Data. Compilation provided a 7,000-word document on thumb sucking from Behavioural Dentistry students for analysis. Step 2: Individual Thematic Analysis. Researchers explored themes individually. Researcher 1 conducted a manual analysis (Creswell, 2009) which took several hours (6), while Researcher 2 used AI (Claude AI, Sonnet 3) to suggest themes based on Researcher 2 specific commands. Step 3: Consolidating and Refining Themes. This was executed by initial consolidation and refining of themes with AI by each researcher separately. Then both researchers met for the Collaborative Phase.

Step 4: Reviewing and Validating Themes. Step 5: Adequacy Check. The collaboration process between both researchers, which involved manual coding, AI exploration, and iterative refinement, took less than an hour in the second collaborative phase.

**Finding:** Verified themes captured key discussion board insights. AI enriched analysis by identifying unexpected themes, refining existing ones, and accelerating sub-theme exploration. This facilitated fruitful research collaboration, highlighting the potential of AI for qualitative data analysis in educational settings.

**Conclusion:** AI-collaboration streamlines thematic analysis of rich educational data, fostering research at UTech, Jamaica. Independent researcher assessment and peer validation ensure theme credibility.

Keywords: Qualitative analysis, AI collaboration, Thumb sucking

**Acknowledgement:** The analysis process presented herein is derived from a broader research initiative by the author

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# BEYOND VISUAL INSPECTION: A COMPREHENSIVE APPROACH TO ASSESSING FIREFIGHTER TURNOUT GEAR POST-FIRE USING PORTABLE RAMAN SPECTROSCOPY

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**Background:** Firefighter turnout gear is a critical component of firefighter protection, providing thermal insulation and shielding against heat, flames, and chemicals. However, exposure to extreme heat and flames during firefighting operations can cause damage to the gear, compromising its effectiveness and safety. Accurate assessment of turnout gear post-fire exposure is essential to safeguard firefighters' well-being [1]. Existing methods for evaluating gear, including visual inspection and physical testing, have limitations and may not provide a comprehensive analysis [1]. Developing a tool for assessing gear condition post-fire is essential for accurate evaluation and informed decision-making. Such a tool would enable timely maintenance, repair, or replacement of damaged gear, reducing risks to firefighter safety. This study aims to explore the potential of portable Raman spectroscopy as a tool for post-fire assessment of firefighter turnout gear.

**Aims:** The aim of the project is to develop a portable Raman spectroscopy-based tool for rapid and accurate assessment of firefighter turnout gear integrity post-fire exposure.

**Methods:** The material used in this study was the outer (flame retardant) shell of the coat which is comprised of 100% Nomex. The methodology included laboratory testing of the material according to the experimental setup employed by NFPA 1971, 2018 edition, for heat and thermal testing [2]. Four, 3.5 cm x 3.5 cm squares of the material were prepared and labelled A to D. Sample A was used as a control while samples B to D were each suspended and exposed to 150°F, 250°F and 350°F respectively, in a Quincy Lab Model 40 lab oven for 5 minutes. The samples were allowed to cool to room temperature, then prepared for Raman analysis.

Raman spectra were collected for each sample using a portable Raman system comprising of an Innovative Photonics Solutions Fat Boy Laser Module (I0785MM0350MF) and an Ocean Optics QE65 Pro spectrometer. The laser power was adjusted to produce the finest spectrum and an integration time of 4 s was used. Seven Raman spectra were obtained for each sample and averaged to reduce spectral variations (28 spectra in total). The resulting 21 spectra from samples B to D were then compared against the control spectrum to identify changes

In the spectral profile. The spectra acquired from samples A to D were all baseline-corrected using the Spectragryph software, version 1.2.16.1.

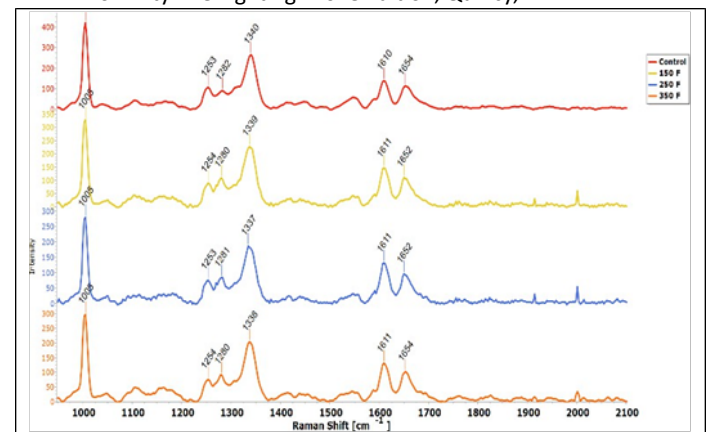
**Results:** Initial findings suggest that Raman spectroscopy can detect changes in the outer layer of the coat, through characteristic peaks at  $1007\text{ cm}^{-1}$ ,  $1610\text{ cm}^{-1}$ , and  $1652\text{ cm}^{-1}$ . These peaks show sensitivity to material alterations caused by extreme heat exposure. The subtle changes in the spectra can be seen in Fig. 1 which depicts the changes in the Raman spectra at different temperatures.

**Conclusions:** The reduction in the spectra as a response to exposure to extreme temperatures suggests their utility in tracking gear condition. Significant changes in the spectra are evidenced only at large differences in temperatures and will require multivariate analysis to detect smaller changes and support the development of a predictive tool for turnout gear assessment.

**Acknowledgments:** We thank the Jamaica Fire Brigade for the use of a firefighter turnout gear for this study.

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**Figure 1:** Changes in the Raman spectra of outer shell firefighters turnout gear at various temperatures.

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# ANALYSIS OF THE JAMAICA STOCK EXCHANGE TRENDS USING MATHEMATICAL MODELS

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**Background:** There are different patterns and underlying forces that shape the stock price movements over time. It is important for investors, policymakers, researchers among others to understand the trends in the stock prices. In this longitudinal research study, a comprehensive analysis of historical stock price data, spanning years, is embarked on to uncover long-term trends, recurring patterns, and the factors driving market volatility. By delving deep into the longitudinal trajectory of stock prices, this study aims to shed light on the complex dynamics of financial markets and provide valuable insights for informed decision-making in the ever-evolving landscape of investments.

The factors influencing stock prices are a puzzle all investors would love to crack. Previous researchers have identified relationships between company-specific factors such as profit, revenue, and earnings per share and by extension many investors have used these relationships to drive their decisions. Although there are some merits to this research, information as well as research combining those factors with other factors are essentially lacking. This research aims to somewhat fill that gap by creating a mathematical model to comprehensively highlight the relationship between company-specific factors like revenue and other factors such as the exchange rate and interest rate.

**Aims:** To analyse the stock prices on the Jamaica Stock Exchange and examine how they are affected by exchange rates, interest rates and company revenue using longitudinal modeling.

**Methods:** This research comprises data collected from a wide range of sources. A sample of ten companies was randomly selected from the Jamaica Stock Exchange (*Main market* 2023). The quarterly end price of each stock was recorded, as well as the revenue. The exchange rates and interest rate at the end of each quarter were also recorded as reported by the Bank of Jamaica. These variables were observed and recorded over a ten-quarter period beginning the third quarter of 2021 and ending the

fourth quarter of 2023. A variety of models as applied to Longitudinal Analysis were then utilized to model patterns and trends among these variables and the results analysed [1].

Linear Mixed Models (LMMs) were used to create mathematical models, which were applied to the data. The LMM, which contains both fixed and random effects is given by [2],

$$Y_i = x_i \beta + z_i d_i + e_i$$

Where,  $y_i$  –  $n_i \times 1$  vector of  $n$  observations on the  $i$ th subject

$\beta$  –  $p \times 1$  vector of unknown, fixed population parameter  
 $x_i$  –  $n_i \times p$  known, constant design matrix for the  $i$ th subject  
 $d_i$  –  $q \times 1$  vector of unknown, random individual parameters  
 $z_i$  –  $n_i \times q$  known, constant design matrix for the  $i$ th subject corresponding to the random effects  $d_i$   
 $e_i$  –  $n_i \times 1$  vector of random effect terms

**Results:** It was discovered that there is a negative relationship between stock price and interest rate while adjusting for exchange rate and company revenue. The models with the lowest AIC and BIC were Price versus Interest rate and Exchange Rate (AIC of 738.940 and BIC of 751.814) and Price versus Interest Rate (AIC of 737.150 and BIC of 747.490).

**Conclusions:** This research showed that there is a negative relationship between interest rate and stock prices on the Jamaica Stock Exchange.

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# UNLOCKING THE MECHANISM OF OLEIC ACID AND SUCCINIC ACID: A DYNAMIC DUO FOR COMBATING TYPE 2 DIABETES IN SPRAGUE-DAWLEY RATS

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**Background:** Type 2 diabetes mellitus (T2D) poses a significant health crisis in the Caribbean, with reports of one of the fastest-growing prevalence globally [1]. The medical condition is defined as a chronic illness characterized by initial insulin insensitivity followed by a deficiency in insulin action [2]. One contributing factor to the sharp rise is the cost associated with its treatment which partially explains the epidemic within the region. As an alternative to pharmaceuticals, nutraceuticals are being proposed to mitigate this problem, with the expectation of greater affordability and efficacy. Common organic acids such as oleic acid (OA) and succinic acid (SA) are found in local plants and are notorious for their health benefits. The duo has been reported as a potent supplement in retarding the progress of T2D in Sprague-Dawley (S-D) rats [3]. However, the mechanism of action is underreported and warrants exploration.

**Aims:** To investigate the mechanism of action of a supplement of OA and SA in the treatment of T2D in S-D rats.

**Methods:** Eighteen S-D rats were rendered diabetic through intraperitoneal injection of streptozotocin (40 mg/kg body weight [BW]) and subsequently divided into three groups (n=6): diabetic control, diabetic treatment, and diabetic positive control. Additionally, 12 S-D rats were acquired and categorized into two groups: the normal treatment and normal control. The animals received daily treatments of either vehicle (10% Tween 20, control), OA+SA (1:1, 800 mg/kg BW), or glibenclamide (10 mg/kg BW, positive control) for a duration of 28 d. Blood glucose levels (BGLs) were monitored weekly, and upon completion of the experiment, the animals were euthanized using sodium pentobarbital (0.3 mL, 65 mg/kg BW). Blood samples were collected from the renal arteries and analysed for serum glucagon and insulin levels, while samples of pancreas and liver tissues were harvested and preserved for subsequent analysis. These assessments included the assay of hepatic carbohydrate metabolic enzymes and oxidative stress markers, along with the

examination of the sizes of the pancreatic islets and morphology using light microscopy.

**Results:** A synergy of OA and SA significantly attenuated glycaemic control in T2D S-D rats through improved glucose metabolism. The cocktail of organic acids resulted in a  $35.69 \pm 4.22\%$  ( $p=0.006$ ) reduction in BGL when compared with a  $20.10 \pm 13.57\%$  increase in BGL in the diabetic control group. The exacerbated state of unregulated glycaemic control in the DC animals stemmed from an increase in serum glucagon which ultimately increased the activity of glucose 6 phosphatase (G6P,  $p<0.05$ ). Moreover, there was a significant increase in pancreatic degeneration due to oxidative stress. The OA+SA treated diabetic group depicted a significant decrease in G6P, while increasing the expression of glucose catabolic enzymes such as glucose 6 phosphate dehydrogenase (G6PD,  $p=0.043$ ) and pyruvate kinase (PK,  $p<0.001$ ). Furthermore, the supplement protected against oxidative degeneration of pancreatic islets and increased the size of these islets, consequently resulting in improved insulin production.

**Conclusions:** The supplement effectively retarded the progression of diabetes by ameliorating hepatic glycaemic control, enhancing metabolic regulation, and improving pancreatic morphology and function. These findings suggest that the supplement could potentially serve as a therapeutic approach for improving diabetic conditions in humans.

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# A COMPREHENSIVE EVALUATION OF THE TASK GROUP 119 PROTOCOL FOR INTENSITY MODULATED RADIATION THERAPY COMMISSIONING WITH A THERMO-LUMINESCENT DOSIMETER GELATIN PHANTOM

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**Background:** Intensity Modulated Radiation Therapy (IMRT) has become a standard treatment technique in radiation therapy (RT) due to its ability to deliver highly conformal dose distributions to the gross tumor volume (GTV) while sparing surrounding organs at risk (OARs)<sup>1</sup>. However, ensuring the accurate delivery of IMRT requires rigorous testing and quality assurance (QA) procedures<sup>2</sup>. Task Group 119 (TG-119) of the American Association of Physicists in Medicine (AAPM) has established a set of commissioning tests and instructions for planning, measurement, and analysis for IMRT planning and delivery systems<sup>1</sup>. This is achieved by performing a thorough evaluation of IMRT commissioning parameters, including dose calculation accuracy, delivery accuracy, and investigating the dosimetric accuracy of various IMRT delivery methods, such as step-and-shoot, dynamic, and volumetric modulated arc therapy (VMAT). A comparative analysis will be done with a thermo-luminescent gelatin phantom (TLD-GP) which in a previous study was identified as a viable alternative for conducting QA checks for the treatment unit and a solid water phantom and ion chamber (SWP-IC) to assess its suitability for IMRT evaluations.

**Aims:** To compare a TLD-GP to SWP-IC to assess its suitability in evaluating the accuracy of planning and dosimetry systems used in the evaluation of IMRT delivery guided by the TG-119 protocol.

**Methods:** Three treatment plans were prepared; a mock prostate, a multi target and mock head and neck. These plans were created by contouring structures onto simulated images of the GP and SWP according to TG119. The GP consisted of slabs similar to the SWP to accommodate the placement of the TLDs. The high-dose region (isocentre) and low-dose region were then calculated and measured. Comparative analysis was done for the measured doses of the TLD-GP and SWP-IC. An evaluation was also done to assess the response of TLD-GP and the SWP-IC to the dose calculated during treatment

planning.

**Results:** The standard deviation between the calculated dose and measured doses by both systems was within 3%. A regression analysis also indicated a strong relationship between the calculated dose and the measured response of the TLD-GP and SWP-IC ( $p < .001$ ). It was observed that the deviations between the measured doses of the TLD-GP were all within 2% of the mean measured dose, highlighting the sensitivity and reproducibility properties of the TLD-GP system.

**Conclusions:** It can be concluded that the TLD-GP is suitable for evaluating point dose measurements as indicated by TG-119 for the evaluation of IMRT delivery and treatment planning systems.

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**Table 1:** Treatment Plan Parameters

<i>Plans</i>	<i>Beam Arrangement</i>	<i>Dose (Gy)</i>
Mock Prostate	6 MV , 7 fields 50o intervals from vertical	75.6
Multi Target	6 MV, 7 fields 50o intervals from vertical	50
Mock Head and Neck	6 MV 40o intervals from vertical	50

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# RX ON THE FLY: DRONE DELIVERY OF PHARMACEUTICAL PRODUCTS IN CENTRAL JAMAICA

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**Background:** The COVID-19 pandemic accelerated the advancement and adaptation of drone technology across various industries, including the health sector (Mohsan et al., 2022). The use of Zipline drones to deliver medicine has been a revolutionary approach to transforming healthcare access in Rwanda. Limited access to essential medications remains a critical challenge in Jamaica's rural communities. Traditional ground transportation often faces challenges such as geographical barriers and logistical hurdles, leading to stockouts and delays in crucial healthcare services (Ministry of Health & Wellness, Jamaica, 2023). Haughton's Pharmacy in Central Jamaica has a largely elderly customer base. There is an unmet need for the efficient delivery of pharmaceutical products in rural Jamaica. Consequently, Jamaica is in a prime position to explore the engagement of drone delivery for medical purposes.

**Aims:** The paper aims to explore the use of drone technology to improve access to pharmaceutical delivery in central Jamaica.

**Methods:** An unmanned DJI Mavic 3 drone with a range of 15 km, was modified and used to conduct the drone deliveries. The drone, without attachments, has a reported battery life of 46 minutes and a capacity of 5000 mAh. A payload-release dropping device was attached to the underside of the drone without obstructing the downward sensor. The attached payload has a capacity of 0.5 kg.

The pharmaceutical items to be dispatched were prepackaged in small cardboard boxes, bound with paracord (400 lbs capacity) and then a 3 feet length of the cord was attached to the payload device using metal key rings and keychain hooks as can be seen in Figure 1.

A flight operation permit was granted by the Jamaica Civil Aviation Authority, which allowed for test deliveries from the Pharmacy, located in the town of Mandeville, Jamaica.

Test deliveries were conducted within a radius of 2 km from the roof of the commercial complex where the pharmacy is located. The drone was controlled by a DJI RC controller with 5.5-inch full high definition (FHD) screen

having a brightness of 700 nits. It has a maximum battery life of 4 hours and communicates with the drone using the O3+ transmission system.

All test deliveries were conducted during the daytime, in manual mode, and below 400 feet in height. Once the drone arrived at the clients' location, its camera was rotated to the 90-degree position which allowed the pilot to see directly below the drone. The drone was then descended to the lowest possible height that still allowed communication with the controller, and at the same time avoided obstacles like trees, motor vehicles, and utility wires. The customer was alerted by telephone to acknowledge the arrival of the drone and to determine if it was safe to release the package at its current location.

When confirmation was received from the customer, a preprogrammed button on the controller was depressed which activated an auxiliary light on the drone resulting in the release of the package.



Figure 1: (left) Drone with payload attached.

**Conclusions:** The use of unmanned drones is feasible for the delivery of pharmaceutical supplies. Deliveries done were faster than traditional methods and with little risk to the aircraft or persons on the ground.

**Acknowledgments:** We thank the Development Bank of Jamaica for the financial support that enabled the purchase of the equipment involved.

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# STATUS OF SURFACE WATER AT THREE SELECTED COASTAL GUYANA (SOUTH AMERICA) AND THE TREATMENT OF THE RESPECTIVE WATER WITH A SUITABLE ADSORBENT

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**Background:** Water is a universal solvent that sustains all life forms. Surface water is water on the surface of the planet, such as in a stream, river, lake, wetland, or ocean which plays a very vital role in economics and the functioning of ecosystems [1-7]. Providing sufficient quantities of high-quality water to satisfy our domestic, industrial and agricultural needs is an ongoing global problem. Increasing population size, climate change and pollution will only exacerbate the global status. There is no physical shortage of water on the planet Earth as it covers 70% of the globe. In Guyana, surface water is primarily used for agricultural, industrial and commercial purposes. However, Guyana's water needs continual monitoring to assess the concentration of toxic cations and anions as industrialization and development proceed [8]. Pollution of surface water, due to industrial effluents and municipal waste in water bodies is a major concern in Guyana. With the view to prevent environmental pollution and prevent disaster risk, there is a need to monitor the status of surface water in Guyana and any other country.

**Aims:** Thus, to this end, the surface water at Atlantic Gardens, Block X Liliendaal, Pattensen, Turkeyen, Guyana (South America) was tested for the presence of heavy metal cations and anions, physical parameters such as electrical conductivity, EC, turbidity and salinity in the presence and absence of an adsorbent, ground coconut midrib in its uncarbonized state.

**Methods:** Metal cations tested for were:  $\text{Fe}^{3+}$  and  $\text{Al}^{3+}$ . Anions tested for were  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$  and  $\text{Cl}^-$ . The adsorbent, prior to being used, was ground, extracted with hexane and subjected to aerial drying. It was applied to the collected water, stirred and filtered. Both treated and untreated water were digested with 5%  $\text{H}_2\text{SO}_4$  to prevent interference from organic matter. The digested filtrate was diluted to the required concentration and analysed.

**Results:** The coconut midrib in its uncarbonised state, was effective in extracting  $\text{Fe}^{3+}$ ,  $\text{Cl}^-$ ,  $\text{Al}^{3+}$ ,  $\text{PO}_4^{3-}$  and  $\text{NO}_3^-$ . Salinity also decreased. For example, the status of the surface water prior to the use of the adsorbent was:  $\text{Al}^{3+}$ : 0.689mg/L;  $\text{PO}_4^{3-}$ : 0.90mg/L;  $\text{NO}_3^-$ : 10.18mg/L; Salinity; 0.01mg/L. For the water treated with the adsorbent, the

respective concentrations were:  $\text{Fe}^{3+}$ : 0.01mg/L;  $\text{Cl}^-$ : 0.00mg/L;  $\text{Al}^{3+}$ : 0.20mg/L;  $\text{PO}_4^{3-}$ : 0.40mg/L and  $\text{NO}_3^-$ : 4.56mg/L. Salinity was registered at 0.0 mg/L.

**Conclusion:** Thus, the adsorbent in its uncarbonized state, was effective in removing cationic and anionic pollutants from the selected surface water. In addition, the concentration of cations and anions in the selected surface water was below WHO standards. The use of coconut midrib in its pulverized state as an adsorbent is contemplated.

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# STI FOR NATIONAL & REGIONAL DEVELOPMENT -WHAT DOES THAT MEAN FOR CARIBBEAN TERRORIES?

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## Background:

The islands of the Caribbean and territories located on the South American continent have struggled to get a seat at the technological development and be present to reap some of the benefits of developments in innovation whether it is new/changes in products, processes and/or shifts in business models to meet demand-driven value propositions of community groups living within territories of the Caribbean Region. Various strategic sectors of each economy need to shift the paradigm in their respective business operations to create cost-effective and innovative products, processes and services demanded by consumers. There is also the demand for more efficiency in business operations for productivity gains. To maximize on these we need to develop and implement relevant policies and infrastructure to stimulate and sustain supporting innovation initiatives.

**Aims:** To share a perspective on the STI policy for social and economic development of economies within the Caribbean.

## Methodology

Through a detailed literature review which will be sources of theoretical constructs to be applied to secondary data to suggest frameworks toward a pathway to socio-economic development

## Results:

Investments in Science Technology and Innovation (STI) initiatives have demonstrated significant economic growth, social inclusion and reduce inequality among

various disadvantaged groups among communities. The sustainability of these STI activities creates sustainability in communities contributing to territories of the Caribbean attaining a subset or all of the SDGs.

**Conclusions:** The contribution of STI to several emerging economies has been well documented. These gains have transformed several economies to sustained economic growth and prosperity. However, these gains are with purposeful investments in infrastructure across macro and micro institutions.

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## USING DIGITAL TECHNOLOGY TO AUGMENT ACCESS TO NATURAL HERITAGE

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**Background:** The Natural History Museum of Jamaica (NHMJ) has programmes of scientific research, information management, public education and outreach which are fortified by digital technology. These encompass biological collections management, dissemination of information crucial for research and policy development, and fostering environmental consciousness and stewardship. Digital technology has initiated the process of modernizing our programmes and increased our impact on users of our resources. The Museum, despite challenges with human, technical and financial resources continue to embrace digital technology as it further develops its programmes in the 21<sup>st</sup> century.

**Aims:** To elucidate how digital technology amplifies the Natural History Museum of Jamaica's (NHMJ) impact on scientific research, public education, and national development.

**Methods:** Four key digital technologies are highlighted for their instrumental role in augmenting NHMJ's operations, services, and products. Firstly, scanning and imaging techniques, notably facilitated by the Biodiversity Information for Development (BID) Project, are showcased for their contribution to specimen digitization. Secondly,

the application of databases such as the Jamaica Invasive Species Database and the Botany and Zoology Collection databases which employ Specify Software and Geographic Information System (GIS) software to increase efficacy in data management. Thirdly, virtual experiences, such as online tours and the Virtual Herbarium, are emphasized for their role in enhancing accessibility and engagement. Finally, the leveraging of social media platforms, websites, and their integration within the renovated Gallery, is examined for its capacity to extend NHMJ's reach and impact.

**Results and Discussion:** Through the adoption of these technologies, NHMJ has witnessed increased productivity in research endeavours by stakeholders while concurrently realizing cost benefits through reduced physical handling and access to data at lower costs, thereby mitigating travel and research expenses. Furthermore, we outline NHMJ's significant contribution to national development, encompassing the preservation of culturally significant natural heritage, filling critical knowledge gaps at local, national, and international levels, and fostering the interpretation of traditional and contemporary cultural aspects.



# A POLY CULTURE MODEL FOR GROWING RICE, BARLEY AND CRAYFISH IN BARBADOS

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**Background:** Currently food security is a major challenge in the Caribbean. A study conducted by the Caribbean Community (CARICOM) and the United Nations World Food Programme (WFP) indicates nearly 4.1 million people or 57% of the population in the Caribbean face food insecurity [1]. It is therefore important to evaluate the feasibility of well-used grains such as rice and barley in producing these items in local Caribbean environments. In Barbados, there have been experiments done using the upland rice variety through a collaboration between the Government of Barbados in conjunction with the Chinese, Hunan Linshi Agricultural Services [2]. However, wetland farming of rice often requires a substantial amount of water. To address this concern, a polyculture model was developed to grow rice, barley and crayfish together in the same support system increasing the value of the water used.

**Aims:** To develop a sustainable polyculture model capable of supporting the growth of rice, barley and crayfish in a SIDs context.

**Methods:** Seedlings were selected based on phenotypic characteristics such as overall appearance and growth rate. The selected seeds were transplanted into a 7 x 11 structure comprising of concrete blocks and cement shown in Figure 1 and Figure 2. Over the period of three (3) months the propagation and growth rate were examined. The crayfish were fed a mixture of pellets consisting of breadfruit, sargassum and other vegetable/biomass waste. Their mass was examined over the experiment period of 3 months as shown in Figure 3. We also observed their phenotypic and genotypic traits and activity at random 5- minute intervals. Elements such as temperature, salinity, oxygen, chemical composition (nitrogen, pH) and the occurrence of pests in the polyculture system were monitored and adjusted to ensure it remained at recommended levels.

**Results:** It was observed that soaking seeds for 8 hours using 3% hydrogen peroxide plus a water solution gave the best sprouting results for both the rice and barley resulting in 93% and 87% respectively from a pool of 100 seeds each.

Subsequently, 47% of barley and 44% of rice sprouts were selected to be transplanted since they had a growth rate greater than 1.5 inches. Given the drought conditions the barley's growth was affected. It was determined that barley requires continuous moisture and would require a placement in the system where it can be constantly irrigated. However, while the rice was impacted by drought conditions causing stunting of some plants, the majority of the rice reached the bearing stage with stalks yielding 300-600 grains. The crayfish species Australian red claw which was sourced from Trinidad showed the ability to withstand heat and water level fluctuations. Females with eggs, molters and Juveniles were separated from the other crayfish. The crayfish responded well to the feed supplied however it was observed they were foraging the barley sprouts. To counter this the level of water in the system was increased. Additionally, the amount of feed used was increased and a feeding schedule was established. This reduced the foraging as well as predation and conflicts. It was observed that the crayfish weight increased as well as evidence of molting was found.

**Conclusions:** We have successfully designed a polyculture model capable of supporting the growth of rice, barley and crayfish in Barbados. In Figure 4 we show the rice at flowering stage. In future, automated monitoring, rainwater harvesting, and solar power will be introduced to increase its sustainability.

**Acknowledgments:** This project is a collaboration between the UNDP Accelerator Lab for Barbados and the Eastern Caribbean and Barbadian innovator Deandra Crawford.

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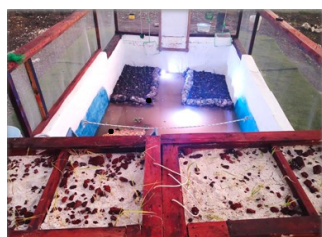


Figure 1 – Polyculture System

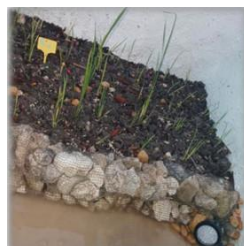


Figure 2 – Transplanted Rice



Figure 3 – Crayfish Weighing



Figure 4 – Rice Bearing

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# INTESTINAL HELMINTH INFECTIONS IN JAMAICAN DOMESTICATED POULTRY

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**Background:** Intestinal helminth infections are a significant concern in poultry production, particularly in developing countries like Jamaica. Impacts associated with helminth (especially nematode) infections include reduced health and production performance due to reduced growth rates/weight loss, reduced egg production and egg quality, intestinal damage, and in severe cases, death [1]. Poultry farming in Jamaica is a vital part of the agricultural sector, providing essential proteins and income for small-scale farmers. However, the prevalence of gastrointestinal parasites poses a threat to this industry, impacting not just the health of the poultry but the economic stability of the communities dependent on it. Helminthiasis in the chicken industry is known to be one of the causes of the high mortality rate among the flock [1], however, there are no published data on gastrointestinal parasites and the overall status of helminths of chickens in Jamaica.

**Aim:** The study aims to provide baseline information on the prevalence, intensity and distribution of major gastrointestinal helminth parasites of chickens reared domestically in Jamaica.

**Method:** The whole gastrointestinal tracts were collected from chickens reared and sold by backyard poultry farmers across eight parishes. The intestines were examined at the University of Technology, Jamaica where they were stored in a freezer at -8°C prior to examination. The contents of the gastrointestinal tracts were washed out using distilled water and the contents were examined with a compound microscope. The walls of the gastrointestinal tracts were examined with the use of a low-power stereo- microscope for the presence of helminth infection. All visible helminths were collected and identified using

a variety of identification keys [2, 3]. The collected helminths were preserved in 70% ethanol for whole-mount or 96% ethanol for future genetic analyses.

**Results:** A total of 283 chicken intestinal tracts were collected from backyard farmers across eight parishes. Fifty-eight intestinal tracts were positive for at least one species of gastrointestinal parasite, representing 20.5% of the sampled population. Infected chickens were collected from seven of the eight parishes. Out of 58 positive cases, 37 (63.8 %) were found positive for nematodes (*Ascaridia galli* and *Heterakis gallinarum*), 22 (37.9 %) were found harbouring cestodes (*Railletina* spp.) and 6 (10.3 %) had mixed infections. No parasitic trematodes were found. The median worm burden was 4 (range 0 - 149) worms per chicken.

**Conclusions:** This study highlights that helminth infections are highly prevalent in Jamaica. These infections pose a threat to poultry health and productivity, with direct implications for food security and the economic well-being of rural communities. Effective parasite management strategies are needed to mitigate these impacts.

**Acknowledgements:** The authors are greatly thankful to the Faculty of Science and Sport, University of Technology, Jamaica and for the facilities made available to us by Dr Andrew Lamm.

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## THE FERMENTATION OF SUGAR BEET IN BOILED AND UNBOILED STATE

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**Background:** To reduce CO<sub>2</sub> emissions and curb global warming, there is a need to transition from fossil fuel to renewable energy in bioethanol. The latter is superior to fossil fuel as it is a cleaner burning fuel with a significant decrease in environmental impact and has low photochemical reactivity. Moreover, due to the increased consumption of conventional fossil fuels and their unpredictable change in prices, this transition is further justified. Fossil oil is associated with global warming, climate change, and several other energy and security problems [1]. Bioethanol has similar properties to gasoline in terms of high-octane content, high flame speed, stoichiometric air-fuel ratio, and low heating value [2]. Its use decreases the consumption of crude oil and reduces the emissions of air pollutants (CO<sub>2</sub>, NO<sub>2</sub>, and SO<sub>4</sub>) released in the atmosphere as a result of fossil fuel combustion [3].

**Aims:** Thus, the focus of this study is to determine the feasibility of sugar beet as a fermentable feedstock in *Saccharomyces cerevisiae* to produce bioethanol.

**Methods:** The sugar beet was examined in two (2) environments: Boiled and un-boiled state, with no additives in either of the conditions it was conducted in. The experiments were carried out in triplicates over a seventy-two (72) hours period in the presence of *Saccharomyces cerevisiae*. Various parameters were monitored such as pH, alkalinity, temperature, etc. Gas Chromatography was used to analyse the % yield of ethanol in the distilled matrix. A mean value

of 2.36% v/v of ethanol in 100ml of the boiled sample and 1.72% v/v of ethanol in 100ml of the un-boiled sample were observed.

**Conclusion:** A low % yield was obtained for ethanol from the boiled and unboiled sugar beet. This indicated that temperature did affect the % yield of bioethanol from fermented sugar beet under the two selected conditions. There is further scope to improve the percentage yield of bioethanol from fermented sugar beet.

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# POPULATION ESTIMATES, ECOLOGY AND BEHAVIOUR OF PARROTS AND PARAKEETS (PSITTACIFORMES) ON THE UWI, MONA CAMPUS

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**Background:** Jamaica has 3 native Psittaciform species, all threatened with extinction on the IUCN Redlist [1], and a few introduced species originating from the pet trade. Anecdotal reports point to an expansion in population and range of Psittaciformes in the Hope Estate area onto the UWI Mona campus, and particularly high numbers of introduced species but research is sparse on species composition and activity for Psittaciformes in urban Jamaica.

**Aims:** To identify species, document behaviour and ecology, and estimate the population size of Psittaciformes on the UWI Mona campus.

**Methods:** The point count method was used for the observation of the Psittaciformes. Thirteen sites on the UWI, Mona campus, at least 200 metres apart and representative of the heterogenous environment were selected and observed using Polaroid 8x50 mm binoculars. At each site counts were carried out for 10 minutes over 5 mornings, beginning 10 minutes before sunrise, and 5 afternoons, ending 10 minutes after sunset. Psittaciform species were identified using the Birds of the World online field guide [2]. Time, location, tree species in which they were present, flight direction and description of behaviour were recorded. The survey process was repeated in July 2023, October 2023, January 2024 and April 2024. Morning and evening counts of birds entering and leaving a 100-metre radius of a roost were done directly following each quarterly survey using video recorded on a smartphone camera.

QGIS was used to generate distribution heat maps. This was done by adding points at which birds were located, weighted by the number of individuals (stationary observations were weighted more than in-flight observations).

Quarterly population estimates for each species were modelled using the *Unmarked* package for RStudio. The distances between the observation point and birds were measured in QGIS, input into the temporary emigration N-mixture model in *Unmarked* and run using a negative binomial mixture.

**Results:** The species composition on the campus consisted of 3 native species being the Yellow-billed Amazon (*Amazona collaria*), Black-billed Amazon (*Amazona agilis*), Olive-throated Parakeet (Jamaican) (*Eupsittula nana nana*), and 2 introduced species being

the Rose-ringed Parakeet (*Psittacula krameri*) and Yellow-naped Amazon (*Amazona auropalliata*). No nesting activity was directly observed in the study. *A. collaria* and *P. krameri* roosted on the campus with average counts of 59 and 300 birds respectively, mainly in guango trees (*Samanea saman*) and royal palm (*Roystonea* sp.). Roost entry and exit times were correlated to sunrise and sunset at different times of the year. *A. agilis* was too rare to effectively model population or distribution.

Distribution heat maps of *A. collaria* and *A. auropalliata* had the species clumped in areas covered by guango trees. They were often in mixed groups of 2-20 and occasional interspecies aggressive calling and swooping was observed between them. They commonly fed on ackee (*Blighia sapida*) and kassod (*Senna siamea*). *E. n. nana* was observed in groups of 2-4 and was more evenly distributed. No interspecies interactions were observed although it fed on ackee, kassod and Manila tamarind (*Pithecellobium dulce*) in some of the same locations. *P. krameri* was highly clumped at the roost location and rarely seen elsewhere on campus.

The model estimated average populations of 71 *A. collaria*, 86 *E. n. nana*, 21 *P. krameri* and 32 *A. auropalliata*. Population size of *P. krameri* was underestimated, likely due to the species staying off campus when not roosting. Except for April, population estimates for *A. collaria*, *E. n. nana* and *A. auropalliata* were similar in each survey. January was the exception in population estimates for *P. krameri*. These exceptions coincided with the breeding season for each species, with the estimates all lower, except for *A. auropalliata* which had a higher estimate.

**Conclusions:** On the UWI, Mona campus *E. n. nana* was widespread; *P. krameri* had a large roost but was active elsewhere while *A. collaria* and *A. auropalliata* had several behavioural and ecological niche overlaps.

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# CICADELLIDAE COLLECTED BY SWEEP NETTING IN JAMAICA

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**Background:** Leafhoppers are of the insect family Cicadellidae (Latreille 1802)<sup>[1]</sup>, in the suborder Auchenorrhyncha, order Hemiptera (Zahniser and Dietrich 2013)<sup>[2]</sup>. Cicadellidae, with 3200 genera, are the most extensive family of plant-feeding insects. Their significance stems from their consumption of plant sap and their role in transmitting plant viruses. Despite documentation of a few species, there is no comprehensive study of leafhoppers and their relatives in Jamaica and the wider Caribbean, leaving their distribution and abundance largely unknown.

**Aims:** The objective of this study was to ascertain the geographic range of different leafhopper species and their potential influence on Jamaica's agricultural sector.

**Methods:** An 18-inch diameter sweep net was used to collect insects from vegetation from various environments (farms, parks, forests, meadows, and residential areas) across all fourteen parishes of Jamaica. Two-minute sweeps were performed at a total of 360 sites.

Identification of leafhoppers was conducted using taxonomic keys and reference specimens housed in museums. The genetic analysis involved the examination of mitochondrial CO1 (MT-CO1) gene sequences extracted from the abdomen and thoracic muscles of specimens preserved in 95% ethanol.

**Results:** Thirteen species have been identified so far. *Hortensia similis* was one of the most well distributed leafhoppers, found in all 14 parishes. *Apophenia sanguinipes* was the rarest find as it was seemingly restricted to neighbouring eastern parishes, Portland and St. Thomas, and northern parish, St. Ann.

Land usage seemed to influence the presence of leafhoppers. Most agriculturally significant leafhoppers like *Empoasca* sp. and *Hortensia similis* were found in association with known host plants like *Saccharum officinarum* and *Amaranthus viridis* on farmland. Notably,

certain species exhibited broad distribution, whereas others showed specificity to regions and host plants.

The phylogenetic tree generated revealed nine distinct taxa grouped into three primary categories. The analysis indicated that two pairs of sister species were present, namely *Protalebrella brasiliensis* and *Camaij* sp., and *Empoasca papayae* and *Empoasca* sp. These pairs share a common ancestor. *Empoasca papayae* and *Empoasca* sp. were found to be more closely related, with a 97% similarity, in contrast to *Protalebrella brasiliensis* and *Camaij* sp., which had only a 59% similarity.

**Conclusions:** The majority of leafhoppers identified are considered pests and were consistently discovered in close proximity to their economically important host plants. By deepening our comprehension of the genetics and ecology of these leafhopper species we can devise more nuanced integrated pest management approaches.

The phylogenetic tree provided the foundation to unlocking the evolutionary linkages of the leafhopper species present within Jamaica as noted that most of the leafhopper species collected were related in some way, branching off from the same common ancestors.

**Acknowledgements:** We would like to thank the UWI Mona Research and Publication Grant, as well as Professor Jeffrey Heilveil from SUNY Oneonta and Dr. Eric Garraway for their invaluable guidance.

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# AN ASSESSMENT OF ELECTRODEPOSITED BIMETALLIC AND HIGH ENTROPY OXIDES FOR THIRD GENERATION CONCENTRATED SOLAR POWER PLANTS

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**Background:** Concentrated Solar Power (CSP) technology can reduce reliance on fossil fuels and potentially realize UNSDG #7 - clean, affordable energy. It presents the prospect of more cost-effective energy through optimization of its power cycle efficiency. The optimization is dependent on the efficiency and durability of the thermal receiver in the power tower [1]. Third-generation CSP (Gen3 CSP) requires materials of the tower receivers to be oxidation resistant, have high solar absorptivity and low thermal emissivity, all at temperatures greater than 750 °C [2, 3]. Bimetallic and high entropy oxide coatings show potential for good thermal efficiency [3, 4] however, their ease of preparation and reproducibility need to be optimized. Exploitation of the desirable thermal properties of the bimetallic and high entropy oxides in Gen3 CSP requires analysis of the coatings to confirm chemical composition, assess morphology and quantify thermal efficiency.

**Aims:** To assess the adherence, morphology and chemical composition of bimetallic and high entropy oxide coatings on 310SS and Inconel substrates.

**Methods:** The 310SS and Inconel coupons of approximately 2 cm<sup>2</sup> were ground and polished to a mirror finish followed by degreasing and ultrasonic cleaning. The coupons were then anodically activated for 2 minutes in 0.2M sulfuric acid at 30mA/cm<sup>2</sup> followed by cathodic activation for 6 minutes in 0.1M HCl at 30mA/cm<sup>2</sup>. The metal oxides were galvanically electrodeposited on the prepared coupons by use of a Gamry Potentiostat. Method was adopted from [5]. The coated coupons were dried, and the coatings were analysed using SEM and EDS techniques to assess their morphology and chemical composition.

Scarpe adhesion and pull-off tests were also conducted to assess adhesion of the coatings.

**Results:** Preliminary results illustrate potential for improved absorptivity and reduced emissivity at elevated temperatures. Bimetallic oxide coatings on 310SS showed good adherence and were able to operate at temperatures between 800 °C and 900 °C .

**Conclusions:** Electrodeposited coatings of bimetallic and high entropy oxides offer improved thermal efficiency of 310SS and Inconel substrates at high temperatures.

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# CELL PHONE RADIATION EXPOSURE LEVEL AND POTENTIAL HEALTH IMPACT ON JAMAICAN STUDENTS: A CROSS-SECTIONAL QUANTITATIVE STUDY

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**Background:** Radio frequency devices (RFDs) have become an inseparable part of human life, however, there is growing awareness of the ubiquitous nature of cell phone radiation. Concerns about potential health risks from prolonged exposure to RF energy<sup>[1]</sup> have increased demands for greater scrutiny of potential health risks especially to young people whose absorption rate is almost doubled that of adults.<sup>[2]</sup> This study investigates student's user-habit, exposure level as well as likely health risks from long-term exposure to radiation from the cell phone and other RF devices.

**Aims:** To evaluate students' user-habit of the cell phone, determine their radiation absorption dose and relative health risks level associated with their exposure time.

**Methods:** A paper-based questionnaire was used to collect information on the cell phone user-habit of 1661 students, from 17 grade 6 Primary/Prep, 17 secondary schools and 3 universities in a cross-sectional study across Jamaica's 14 parishes. Information on demographics, phone brand owned, talk-time on cell phones as well as general user-habit with wireless RF devices was collected. Statistical analysis of the survey data was done using the Statistical Package for the Social Sciences (SPSS) software. The amount of RF energy absorbed by the student's head and relative risk levels determined with the aid of the equations  $\Delta \mathcal{E} = m c \Delta T$ ,  $S = 0.13/d^2$ ,  $\Delta T = (SAR)/C \times \Delta t$  ( $p < 0.0005$ ) than males. Secondary-level female students have the greatest daily RF radiation exposure and have also reported the highest depression level when not in possession of an RF device. The RF energy absorbed by students ranges from 2.9 to 3.7 times the Federal Communication Commission's recommended standard exposure limit. Whilst primary level students encounter daily SA values of 16.5 % below the 'Threshold', tertiary and secondary level students respectively absorb 7.3 % and 6.6 % higher accumulated daily RF radiation to the head than the International Commission on Non-Ionizing Radiation Protection (ICNIRP) threshold value. More than 50 % of the respondents sleep with wireless devices in bed, further increasing their RF energy absorption with female students at a higher relative risk level than males.

**Results:** Students averaged daily cell phone usage time,

ranging from 3.89 hr to 7.69 hr, exposed them to 1.7 to 2.4 times the recommended RF radiation exposure threshold level. Female students in general spend significantly more time using the cell phone ( $p = 0.021$ ), talking with the phone up to their head ( $p = 0.003$ ) and for playing games and  $SA = 0.72 [0.05 + 0.95 (t^{1/2}(s)/360^{1/2})]$ , where  $\mathcal{E}$  is the energy (J),  $m$  the mass (kg) and  $c$  the specific heat capacity of the body ( $Jkg^{-1} \text{ } ^\circ C^{-1}$ ),  $S$  the cell phone's power density transfer to a user ( $W/m^2$ ),  $d$  the distance of the cell phone's antenna from the user's head (m),  $(\Delta T)$  the respondent's body temperature change ( $^\circ C$ ),  $\Delta t$  the exposure time in seconds, SAR, the specific absorption rate ( $Wkg^{-1}$ ) and SA the specific energy absorption of the body ( $kJkg^{-1}$ ). The threshold value, based on 'Basic restrictions' was used as a reference for devising a proposed six-point relative risk level rating scale and students' risk category classification.

**Conclusions:** The absorption level of the secondary level students exceeds the safety threshold level with female students at the greatest potential risk. With no consensus on the likely health impact of continuous exposure to RF radiation, ongoing research is necessary to identify and track any long-term effects of cell phone RF radiation on children. Tertiary and secondary level students absorb 7.3

% and 6.6 % higher accumulated daily RF radiation to the head respectively than that equating to the (ICNIRP's) 2  $^\circ C$  threshold value.

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# DISTRIBUTION OF CANCER OF THE BRAIN IN JAMAICA 2008

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**Background:** Since the inception of the Jamaica Cancer Registry in 1958 the incidence of cancer in Jamaica has been monitored by reports being produced regularly. [1] These reports are based upon the incidence of cancer in males and females in Kingston and St. Andrew which form the population base of the registry. [1, 2] Gibson et al. (2010) determined that the total number of cases of cancer of the brain and nervous system in Kingston and St. Andrew during the period 2003 – 2007 was 31. [2] This present study has been undertaken to examine the distribution of cancer of the brain in Jamaica in the year 2008. This study covered all fourteen parishes and some geological properties were also highlighted

**Aims:** To investigate the distribution of cancer of the brain occurrence in Jamaica during 2008.

**Methods:** This study encapsulated all fourteen parishes. Data was obtained from the Jamaica Cancer Registry located in the Pathology Department of the University Hospital of the West Indies. Population denominators were obtained from the 2011 census taken by the Statistical Institute of Jamaica as the previous census was in 2001. Variables that were obtained from the Jamaican Cancer Registry included cancer code, date of diagnosis, permanent residence, parish of birth, diagnosis, gender, smoker, source of case and date of death. The statistical packages which were used to analyze the collected data were SPSS and Microsoft excel. The data was initially stored in an excel database. The crude incidence rate was also determined as it is an estimate of the probability.

**Results:** A total of 31 cases of cancer of the brain were examined across all parishes. It was determined that the crude incidence rate (4.0) was largest in St. Elizabeth. This can be observed in Figure 1 below. This was followed by St. Ann, Manchester, Portland, Kingston and St. Andrew and St. James. These had

crude incidence rates of 1.7, 1.6, 1.2, 1.2 and 1.1 respectively. Kingston and St. Andrew were treated as one as they are very interwoven. It was also determined that of the 31 persons who were diagnosed with cancer of the brain in 2008, 18 were females and 13 were males. Figure 2 below shows the distribution of bauxite in Jamaica. Uranium tends to be prevalent where bauxite soil is located.

**Conclusions:** This study has revealed that persons are more prone to develop cancer of the brain in St. Elizabeth, Manchester and St. Ann than in any other parishes in Jamaica. There is an indication that radioactive elements in the soil may be predisposing individuals to develop cancer of the brain. This study has also further confirmed that females are more prone to develop carcinoma of the brain than males. It is therefore imperative that a more exhaustive study be done since cancer can be caused by a multiplicity of factors.

**Acknowledgements:** I wish to thank Professor Mitko Voutchkov for his continued guidance. I also wish to express posthumous thanks to Professor Barrie Hanchard who provided insightful suggestions and access to the Jamaica Cancer Registry located in the Pathology Department of the University Hospital of the West Indies.

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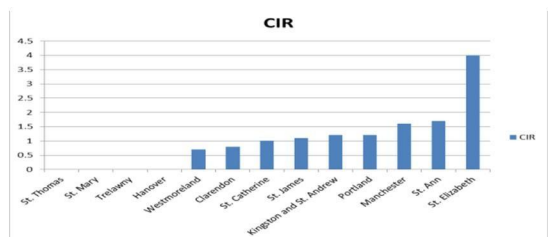


Figure 1: Bar chart comparing the CIR of all parishes

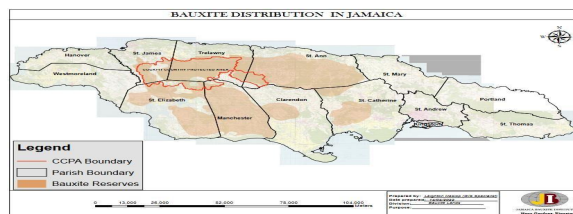


Figure 2: Distribution of bauxite in Jamaica

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# MACHINE LEARNING-DRIVEN OPTIMIZATION OF RESIDENCE TIME FOR ENHANCED HYDROGEN PRODUCTION VIA CATALYTIC PYROLYSIS OF NATURAL GAS AND BIOMASS

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**Background:** The pursuit of sustainable energy sources has become the forefront of research and development worldwide. Hydrogen has emerged as a promising energy vector [1]. However, conventional hydrogen production methods are far from carbon-free. Catalytic pyrolysis of natural gas and biomass is seen as a favorable route for sustainable hydrogen production, yet optimization of the process parameters, particularly residence time, remains a challenge [2]. Residence time is crucial in influencing the yield and selectivity of desired products. Conventional experimental approaches to determine the optimal residence time can be time-consuming and resource-intensive, failing to capture the intricate interrelationships between various process parameters.

**Aims:** This study introduces a novel approach to optimize residence time by harnessing the power of machine learning techniques. This innovative method enhances hydrogen production through catalytic pyrolysis of natural gas and biomass. The objectives include developing predictive models, interpreting the influence of input features on residence time and hydrogen yield, and identifying the optimal residence time through optimization algorithms.

**Methods:** A comprehensive dataset encompassing experimental data from catalytic pyrolysis with varying features such as residence times, feedstock compositions, catalyst properties, and temperature was collected. This dataset was then preprocessed to ensure its quality and consistency. Feature engineering techniques such as normalization, label encoding, and feature scaling extract critical features and train supervised machine learning models. These models include Random Forest regression, Support Vector Machines (SVM), artificial neural networks, and ensemble methods. The performance of these models is evaluated using appropriate metrics, such as mean squared error (MSE), mean absolute error (MAE), and R-squared, and the best-performing model was selected through cross-

validation techniques. Interpreting the selected models provides insights into the importance and influence of input parameters on residence time and hydrogen yield. Sensitivity analysis and partial dependence plots are used to understand the relationship between residence time and other process parameters. Finally, optimization algorithms, including grid search and Bayesian optimization, enable the identification of the optimal residence time that maximizes hydrogen production.

**Results:** Preliminary findings indicated that machine learning models accurately predict the optimal residence time with an  $R^2 > 0.95$  and an  $MAE < 15\%$ . Interpretation of the models revealed the importance and influence of different input features on the residence time and hydrogen yield. The findings show the correlation between feedstock composition, feedstock conversion rates, catalyst deactivation, and temperature effects on hydrogen yield.

**Conclusions:** This study demonstrates the potential of machine learning techniques in optimizing process parameters for catalytic pyrolysis of natural gas and biomass. Integrating machine learning with domain knowledge and experimental data provides fundamental insights into the catalytic pyrolysis process. This data-driven optimization process can be a game-changer in the field of sustainable energy production.

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# THE SHOOTING STAR CATCHER: A PROTOTYPE OF AN AFFORDABLE MACHINE LEARNING BASED ALL SKY CAMERA SYSTEM FOR METEOR DETECTION.

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**Background:** For a developing island state, a meteor strike poses a relatively low probability risk, with an extremely high impact, as an explosion in the atmosphere could cause significant damage to the land, even if the meteor does not hit the ground. Early warning capability is therefore useful, but the costs involved in setting up conventional tracking systems are prohibitive. Also, the inability to track meteors leads to lost opportunities, such as the potential acquisition of valuable minerals, as well as global research collaboration.

**Aims:** We present the Shooting Star Catcher in order to bridge this gap. Each station in the Catcher consists of a relatively inexpensive camera system that is aimed at the sky and feeds a process that extracts events of interest using Computer Vision techniques combined with a custom Convolutional Neural Network.

**Method:** The Shooting Star Catcher applies a three-stage detection process, as modeled in Figure 1. First, motion detection is applied, followed by application of the Hough transform for line detection. Resulting Regions of interest are passed to a two-stage CNN classifier that determines if an object under consideration is a meteor or not. The first stage of the classifier filters objects that are very dissimilar to

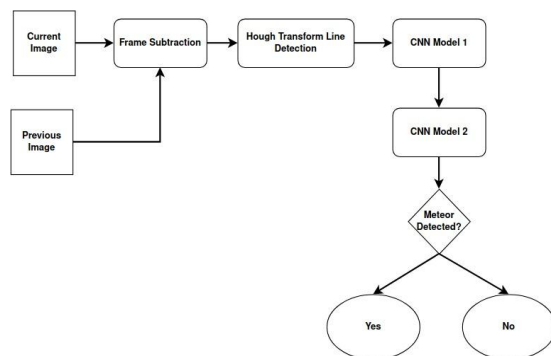


Figure 1: Design of the processing behind the All Sky Camera system

meteors, such as moon glares, cloud cover changes and birds. The second stage tests if an object under consideration is a meteor or an aircraft.

**Results:** The resulting models are small, with a size of approximately 20Mb for the stage 1 detector and 15 Mb for the stage 2 detector. This suggests they can likely be used directly on an embedded system, and reduce required bandwidth and processing capability of any central server. With an inference time of about 15 ms each, detections are near real-time. Validation accuracy is at 0.9 and 0.95 for sub stages 1 and 2 respectively. While these values are comparable with solutions in industry, we believe they be improved using more training data, modifying the convolutional network, and using higher quality cameras

**Conclusions:** Cost barriers have limited the potential of developing states to take innovative measures that head off disasters and capitalize on opportunities for too long. Techniques presented here demonstrate the feasibility of judicious investments in technology to achieve high-performing systems. For the problem directly addressed, a deployment of Shooting Star Catchers across the region should require limited investment, and bring to bear an efficient early warning system for meteor events, as well as allow for recovery.

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# DOES THE SEAGRASS HABITAT'S NEAREST NEIGHBOUR FACTOR IN FISH DISTRIBUTION?

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**Background:** A seascape consists of a continuum where distinct habitats merge with others. The complex interactions among organisms at habitat boundaries are important to understand, as they differ from those within the distinct component homologous ecosystems.

**Aims:** To determine the degree to which the distribution of seagrass fish communities is comparatively impacted by the type of unique habitat adjacent to it. Secondly, we seek to determine if the responses to the type of habitat edge of the fish is comparable to that of their respective prey. Thirdly, the study attempted to decipher whether one edge type or adjacent habitat imposed a greater effect on seagrass fish distribution.

**Methods:** The distribution of the fish assemblage was investigated in *Posidonia australis* seagrass beds adjacent to two distinct habitats i.e., rocky reef and unvegetated sediment in Jervis Bay, New South Wales. We used a seine net and GoPro video footage to elucidate how fish-feeding guilds were distributed with respect to the distinct habitat edges, sampling at distinct intervals within the bed (Figure 1). Zooplankton composition and density, benthic invertebrate assemblage, and seagrass epiphyte load were also measured with respect to habitat edge type. The direction and strength (referred to as the "sensitivity") of the edge response of both the fish and prey taxa were also determined from data analysis.

**Results:** Our data revealed that the direction and strength of the edge response of the benthic invertebrate feeding and herbivorous fish reflected those of their respective prey items. Interestingly, even though the direction of the edge response of the zooplanktivores was dissimilar to that of the zooplankton prey, the strength of the response was similar to that of the prey. Generally, the more sessile fauna demonstrated greater sensitivity to edge than more mobile ones. Additionally, when comparing both edge types, the presence of the rocky reef exerted a more consistent and noticeable effect on the assessed seagrass fauna in comparison to the presence of the unvegetated sediment.

**Conclusions:** This study demonstrates how essential the structure of an adjacent habitat is when deciphering faunal relationships and distributions within focal habitats. This importance goes beyond merely considering "edge" as a factor in itself, but rather carefully considering habitat types at edges. The intricate relationships and differing microclimatic conditions at different edge combinations likely influences the distribution of the seagrass fish prey fauna which will in turn determine the distribution of the fish themselves.

**Acknowledgments:** We would like to thank Australia Aid (AusAID) for providing the PhD scholarship for the principal author that made this study possible. We would also like to acknowledge the UTS (University of Technology, Sydney) lab technical staff, primarily Peter Jones, Gemma Armstrong, and Susan Fenech for providing necessary support. We would also like to acknowledge Dr. Tapan Rai from UTS for providing guidance in the statistical analyses involved in this study.

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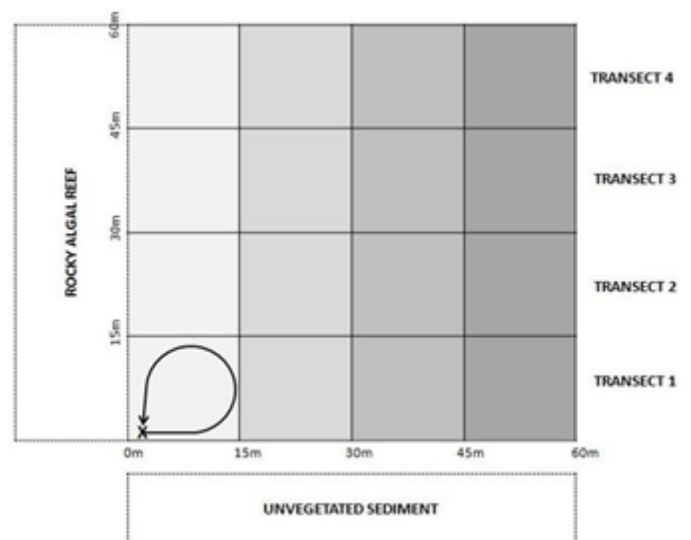


Figure 1: Fish Sampling Transect

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## EXPLORING JAMAICA'S NATURAL PRODUCTS AT THE NPRL, UTECH

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**Background:** The Natural Products Research Laboratory (NPRL) at the University of Technology, Jamaica was established in the Faculty of Science and Sport between 2010 and 2012 through competitive internal and external grant funding. The context and purpose behind the creation of the laboratory are outlined in this paper as well as some of its accomplishments. Emphasis on the need for the exploration of Jamaica's biodiversity especially as it relates to the Cockpit country is discussed. Over the relatively short existence of the NPRL, it has uncovered several interesting compounds in keeping with its mission to investigate the unexplored natural product resources within the Cockpit Country; train and develop scientists; disseminate its findings through publications and public forums; and influence policy formulation.

**Aims:** To present the context, concept and achievements of the Natural Products Research Laboratory (NPRL) at the University of Technology, Jamaica while highlighting its future prospects.

**Methods:** The work of the NPRL was collated, analyzed and extrapolated to ascertain the tangible contribution of this research center. [1-4]

**Results:** The data presented will showcase the: 1) projects undertaken and some specific results; 2) collaborators, coworkers and students involved in the center's work; and 3) the impact of this work on national and professional development.

**Conclusions:** Overall, the NPRL continues to fulfill its original objectives and more. Most notably, it has expanded on the exploration of the rich natural biodiversity of Jamaica to include the freshwater and marine environments; it has created a repository of

extracts for further scientific study; it has supported the entrepreneurial and scientific community through data-driven research; and has, and continues to train the next generation of scientists at all levels of society. The NPRL highlights the immense potential within Jamaica's ecosystems (its forests, aquatic systems, and even its landfill areas) and by extension the capacity and capability of the University of Technology, Jamaica to undertake bold projects, successful collaborations and produce outstanding results at the local and international level.

**Acknowledgments:** We are grateful for funding from the United Nations Development Programme's (UNDP), Global Environment Facility-Small Grants Programme (GEF-SGP) and the Environmental Foundation of Jamaica (EFJ). We acknowledge the contribution of our various collaborators across the globe. We thank the Institute of Jamaica and the University of Technology, Jamaica for their support over the years

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# COMPARATIVE ANALYSIS OF EPIPHYTE DIVERSITY AND HOST PREFERENCES IN TWO BOTANICAL GARDENS OF JAMAICA

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**Background:** Vascular epiphytes are “hanging resources” that provide water, food and shelter for living organisms such as frogs, the larval stages of invertebrates along with nectar for birds and bats<sup>1</sup>. Assessment of urban epiphyte biodiversity, distribution patterns and host preferences are limited in Jamaica. Moreover, within urban spaces, epiphytes can serve as bioindicators to understand anthropogenic effects such as air pollution and climate change<sup>2,3</sup>.

**Aims:** To determine diversity and tree host structural preferences of vascular epiphytes at two botanical gardens of Jamaica located in an urban and peri-urban environment.

**Methods:** Surveys were carried out at 2 sites, peri-urban-Castleton Gardens (CG) and urban- Hope Botanical Gardens (HG), on trees  $\geq 30$ cm diameter at breast height (DBH) that host vascular epiphytes. Epiphytes were identified using binoculars and photography, with voucher specimens collected and confirmed at the Institute of Jamaica's herbarium. Tree species were classified based on origin (native vs exotic) and based on bark structure (i.e., rough vs smooth).

Proportional abundance of vascular epiphytes and Shannon-W and Simpson's Diversity Indices were calculated. Mann-Whitney U test was used to compare diversity between 1) site and 2) tree origin, Pearson's Chi-squared test analyzed differences in epiphyte proportions based on 1) tree origin and 2) bark structure.

**Results:** Multiple vascular epiphytes (v.e.) species were commonly found on a single tree. As a result, 27 vascular epiphyte species from 9 families were found on 72 trees (CG=33 and HG=39) across both sites. Family Bromeliaceae and genus *Tillandsia* were the most abundant and diverse. Epiphyte species richness was significantly higher at the peri-urban site (CG= 22 spp) versus the urban site (HG= 10

spp), with five species being common to both sites. *Tillandsia recurvata* was the most dominant species at the Hope Gardens site whereas *Tillandsia setacea* was the most dominant at Castleton Gardens. Overall, epiphyte diversity and abundance were not significantly related to tree size or tree origin as species showed no preference between native and exotic trees.

Native tree species were predominantly rough barked while exotic species had more smooth bark individuals. Consequently, native tree species had higher vascular epiphyte species richness, however, exotic trees had greater vascular epiphyte abundance.

**Conclusions:** There are differences in vascular epiphyte species richness between an urban site and peri-urban site which may be due to (but not limited to) differences in environmental quality. Native trees support richer epiphyte communities, while exotics host more abundant species, while bark texture may influence the host preference of vascular epiphytes. Vascular epiphyte species composition may be good indicators/predictors of habitat quality and/or long-term changes in environmental conditions.

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# IMPROVED SOLAR CELL EFFICIENCY BY USING AgInSe<sub>2</sub> LAYER WITH Si DEVICE.

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**Background:** Solar cells have been the topic of increased interest as a means of providing carbon-free, sustainable electricity. The semiconductor materials used in this study are silicon (Si) which has a bandgap of 1.1eV [1] and silver indium selenium (AgInSe<sub>2</sub>) (AIS) which has a bandgap of 1.2eV [2]. Although AIS is promising for its use in solar cells there is a fundamental lack of understanding of interface and junction properties, and compositional variations in the film leaving room for continued research in its solar cell applications. As a result, this study investigates the difference between a p-Si/n-Si solar cell and p-Si/AIS device using COMSOL Multiphysics to demonstrate the potential of AIS in solar cells.

**Aims:** To study and explain the difference in performance between a p-Si/n-Si solar cell and a p-Si/AgInSe<sub>2</sub> device.

**Methods:** Two solar cells were simulated using COMSOL Multiphysics. The first was a Si solar cell and the second was a p-Si/AgInSe<sub>2</sub> device as shown in Fig. 1 (right). For the material properties, COMSOL Multiphysics provided the parameters for Si while the properties of AgInSe<sub>2</sub> were obtained from the literature. Semiconductor physics was added with a user defined photo-generation given by

$$G(z) = \int_0^{\infty} \alpha(\lambda)\phi(\lambda) \exp(-\alpha(\lambda)z) d\lambda$$

where  $z$  is the device's depth from the surface,  $\lambda$  is the wavelength,  $\alpha(\lambda)$  denotes the absorption coefficient and

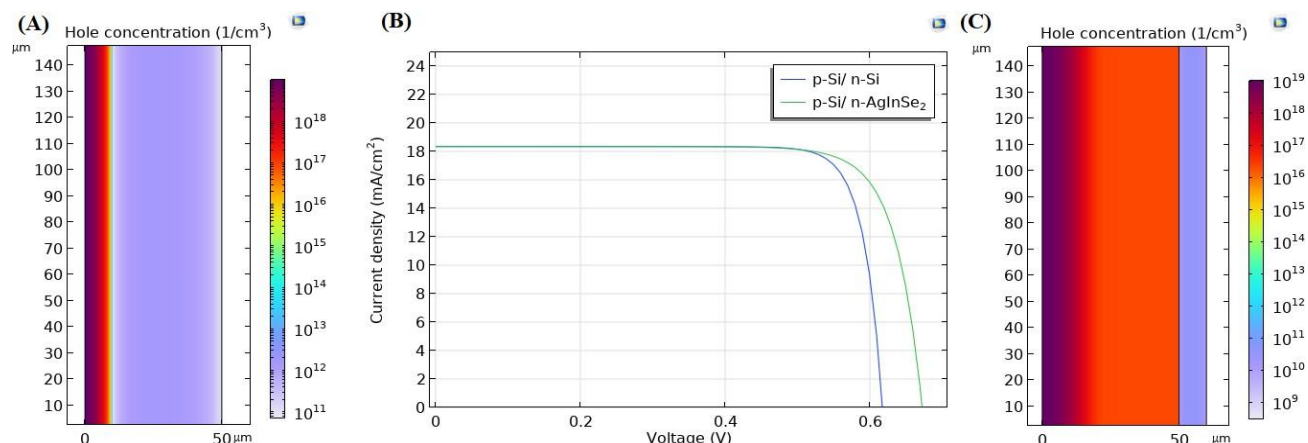
$\phi(\lambda)$  is the photo-generation rate. A mapped mesh was used since this was a 2D simulation and the device was scanned through a voltage sweep of 0 – 0.7 V.

**Results:** The p-Si/AgInSe<sub>2</sub> device had a higher power conversion efficiency (9.83%) than the p-Si/n-Si device (9.46%). The increase in PCE may be explained by looking at the distribution of charge carriers within the devices. The p-Si/AgInSe<sub>2</sub> device had a greater electron-hole distribution than the p-Si/n-Si device which means that more charge carriers were present to deliver the charge. In addition, the p-Si/AgInSe<sub>2</sub> device had a greater open-circuit voltage (VOC) than the p-Si/n-Si device going from 0.618V to 0.673V which could also be explained by the fact that the p-Si/AgInSe<sub>2</sub> device had a greater charge carrier distribution which lowered its overall resistivity.

**Conclusions:** The increased carrier concentration of the p-Si/AgInSe<sub>2</sub> device lowered its electrical resistivity allowing the VOC to increase causing it to have a higher PCE of 9.83% as compared to a p-Si/n-Si device which had a PCE of 9.46%.

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**Figure 1:** (A) Geometry and hole concentration of p-Si/n-Si solar cell (B) J-V graph comparing p-Si/n-Si solar cell to the p-Si/AgInSe<sub>2</sub> device. (C) Geometry and hole concentration of p-Si/AgInSe<sub>2</sub> device.

# ASSESSING STRUCTURAL AND FLORISTIC CHARACTERISTICS WITHIN A SECTION OF URBAN FOREST ON A UNIVERSITY CAMPUS: A COMPARISON AFTER 30 YEARS

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**Background:** University campuses offer a distinctive urban forest ecosystem due to their complex and unique structural and floristic characteristics and the multitude of ecosystem benefits they provide. However, research on their ecological dynamics and how they change over time is limited in the Caribbean. Understanding the structural and floristic composition and changes in dynamics of urban forests will become more important as climate change effects become more apparent.

**Aims:** (1) To describe the current structural and floristic characteristics of the section of urban forest within the Faculty of Science and Technology. (2) To assess changes in structure and floristic diversity of the section of urban forest within the faculty over 30 years.

**Methods:** Within the boundaries of the Faculty of Science and Technology (FST) all trees with a diameter at breast height (DBH)  $\geq 5$ cm were georeferenced using a Garmin 66SR GPS device. Each tree was identified to species level and DBH recorded. Structural characteristics (average DBH, basal area, stem density and DBH size class distribution) and diversity indices were determined.

Tree map data from 1993<sup>[1]</sup> was georeferenced to the 2023 base map to make comparisons between trees that were present across both surveys. 30y comparative analysis of forest structure and floristics were limited to trees  $\geq 10$ cm as was measured in 1993.<sup>[1]</sup> Floristic differences were assessed using a diversity t-test.<sup>[2]</sup> Importance value indices (IVI) and family importance values (FIV) were calculated for both periods.

**Results:** A total of 673 trees representing 139 species within 40 families were noted in 2023. Results indicate that at present the faculty possesses high levels of tree diversity with structural characteristics representing a mixed-aged stand. Despite the limited scope of the study area, the structural and floristic characteristics (density, species diversity and family richness) of the FST are comparable to those reported for other campus-wide university surveys. These high levels of diversity increase the resistance and resilience of urban forests to environmental threats and ensure continued ecosystem service provision.<sup>[3]</sup>

There was an overall shift in forest structure over the 30-year period indicated by an increase in basal area (107.9%) and tree density, accompanied by a 144.7% increase in the number of trees (DBH  $\geq 10$  cm). Additionally, there was a

significant increase in species diversity since 1993, and despite no change in ranking of the most important species and family, there is more evenness among taxa present on the campus in 2023. However, the two species with the highest importance values in 2023 (*Samanea saman* and *Blighia sapida*) both exceed 10% importance which may indicate excessive dependence on those species for structural and functional benefits.<sup>[4]</sup> Palms (Family Arecaceae) increased considerably in dominance to become the second most dominant family in 2023. This may have implications as substituting large shade trees for smaller mast trees such as palms results in lower rates of carbon sequestration, less shading and cooling, and increased risk of catastrophic loss, among others.<sup>[3]</sup>

**Conclusions:** The faculty has high levels of tree diversity, with structural characteristics indicative of a mixed-aged stand with sufficient young individuals to maintain ecosystem services. The most dominant species and family remained unchanged over the 30-year period; however, overall importance was more evenly dispersed in 2023. Palm abundance increased notably with overall tree diversity significantly increasing over the 30-year period.

There was a shift in the overall structure of the section of urban forest within the faculty indicated by an increase in tree density and basal area since 1993 along with a change in size class distribution to one more representative of an uneven-aged stand in 2023.

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## 01| *PHORODON CANNABIS* (HEMIPTERA: APHIDIDAE) ON *CANNABIS SATIVA* IN JAMAICA

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**Background:** The cultivation and usage of *Cannabis sativa* L. is synonymous with Jamaican culture. In 2015, the government decriminalized cannabis and established a regulated medical cannabis market. In 2022 farmers in the western region reported the presence of an aphid. This was identified to be *Phorodon cannabis* Passerini (Hemiptera, Aphididae). Further assessments have indicated its presence in many other cannabis production regions throughout the island. The aphid species, *P. cannabis* is a known pest in Florida, Europe and other Asian countries<sup>1</sup> where it is monoecious and holocyclic. In Jamaica the anholocyclic life cycle is expected, as with most aphids living in tropical environments. *Phorodon cannabis* from cannabis plants grown in a research facility at the UWI Mona campus were collected, identified, and reared so the life history could be investigated.

**Aim:** To characterize *Phorodon cannabis* on *Cannabis sativa* in Mona, Jamaica by describing the morphology, colony characteristics, lifespan, and fecundity.

**Methods:** 4-week-old *Cannabis sativa* seedlings (Emerald Fire OG strain) were used as the host to determine the fecundity, colony size, life span and life history of *Phorodon cannabis*. The seedlings were grown in the Botany Garden, UWI Mona, Jamaica using a sterile germination medium (Biobizz Light Mix). Aphids for all observations were sourced from a colony on a flowering cannabis plant from the same location.

Colony sizes were determined from counts made up to 30 days after an adult aphid was placed on 3 replicate seedlings. Time from birth to fecundity was determined from newly born nymphs placed on 5 replicate seedlings. They were monitored to determine the days on which they molted until they became fecund.

Fecundity over the lifespan was determined as the number of nymphs produced after newly born nymphs was placed on 17 replicate seedlings. At each observation after they became fecund, the nymphs produced were counted, then removed from the colony. Lifespan was determined from the same 17 aphids.

Morphology of *P. cannabis* was determined from observation of colonies on mature plants. Morphometric

data was obtained from observation of wholemounts of cleared, macerated adult alate and apterous specimens.

**Results:** *P. cannabis* was found on stems, petioles and adaxial surface of leaves of the host. Colonies started from a single aphid and reached up to 60 aphids in 30 days. Colonies had mainly apterous viviparae with only a few alate viviparae observed within that time. *Phorodon cannabis* was confirmed by the projection on the antennal tubercles and capitate hairs<sup>2</sup>. On average, for the aptera, body length was 1.5 mm; siphunculi 0.75 mm; antenna 1.73 mm; rostrum 0.51 mm and cauda 0.54 mm. The alate was smaller with a forewing length 2.4 mm.

Lifespan of the apterous viviparae was  $28.76 \pm 3.87$  days. They became fecund as early as 7 days old, and over the lifespan, had 2-10 nymphs per day for between 8 and 17 days, but nymph production was not always contiguous.

**Conclusions:** *Phorodon cannabis* is now islandwide so cultivators of cannabis should be vigilant to prevent colony development. The morphology data provided here will help stakeholders identify the aphid. Knowledge of the aphid's life history in the local environment can be used in the planning of pest management strategies.

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## 02| INVESTIGATING QUALITY ASSURANCE IN JAMAICA'S REGULATED MEDICINAL CANNABIS MARKET

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**Background:** In 2015 Jamaica introduced the Dangerous Drugs (amendment) Act (DDAA), which decriminalized cannabis, setting the foundation for its legal medicinal cannabis industry. The political vision for this was for the creation of a legal medicinal cannabis industry that allowed for informed decision-making in medicinal ganja consumption<sup>1</sup>. The Jamaican cannabis market, however, faces challenges akin to emerging markets globally, and one such problem of concern is Jamaica lacks any Quality Assurance (QA) processes and standards<sup>2</sup> which are necessary for informed decision-making within the cannabis industry. Given mounting evidence supporting the idea that the absence of QA in a medicinal cannabis industry leads to inaccurate reporting and discrepancies with testing and safety, the role of regulatory bodies has become ever more crucial. Cannabis samples of high and low THC potency from six cannabis dispensaries in Kingston, Jamaica, were collected and tested to investigate QA within the regulated medicinal cannabis industry.

**Aims:** To evaluate quality assurance of cannabis sold in Jamaica's legal medicinal cannabis market.

**Methods:** A list of cannabis dispensaries was compiled using publicly available sources and recommendations. Each dispensary was contacted, and we inquired about their cannabis products and recorded the responses. We purchased two 1g samples from each dispensary. The samples were transferred to the laboratory and stored in a cool dark place at a temperature of 18-20°C, with a humidity of <50%. All samples were processed within 24 hours of purchase.

The Total Aerobic Bacterial Microbe Count (TAMC) and the Total Yeast and Mold Count (TYMC) were determined using serial dilution and in vivo culture methods. Samples were prepared using sterile techniques. Each dilution was spread on agar plates then plates were incubated to allow for microbial growth. All procedures were conducted in a Class II Safety cabinet to maintain sterility.

The NeoScanner\_22120006 NIR spectrometer was used in conjunction with Valenveras cannabis models to analyze the total % cannabinoids, terpenes moisture content in the sample as well as water activity within a margin of error of  $\pm 0.15\%$ . The samples were prepared, then ground to a homogeneous consistency. The ground samples were transferred to the scanner's holding tray, compressed lightly

to eliminate airspaces, and scanned continuously for 1 minute.

**Results:** We observed ignorance in dispensary bud tenders, insufficient cannabis product information and inconsistencies in dispensary knowledge and QA practices. Samples all passed our water activity and moisture content acceptance criteria; however some failed their microbial contamination tests. The total terpenes were low across all samples (<1%).

All samples reported THC % was inflated as we observed significant discrepancies between the reported and actual THC potency ( $\alpha=0.05$ ,  $p = 0.017$ ). The reported THC potency range was 14% - 50% THC while the observed THC potency range was 8.3% - 21.4%.

Excluding one dispensary in the TYMC and two dispensaries in the TAMC test, all other dispensaries had one sample of minimal or intermediate (<100,000 CFU/g) and one sample with a large number ( $\geq 100,000$  CFU/g) of TYMC and TAMC. The range of TYMC contamination was 0 – 29, 200,000 CFU/g while the range of TAMC contamination was 720 – 36,800,000 CFU/g.

**Conclusions:** Given discrepancies in THC potency and microbial contamination, we recommend establishing a QA framework and legislation mandating its use to ensure consumer safety and informed decision-making.

**Acknowledgments:** We would like to express gratitude to the Department of Life Sciences at the UWI, Mona for funding our research.

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## 03| ANTHELMINTIC ACTIVITY OF ERYNGIAL-RELATED ALCOHOLS AND ALDEHYDES USING *STRONGYLOIDES STERCORALIS* INFECTIVE LARVAE

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**Background:** With the emerging phenomenon of parasitic worms developing resistance against commercially available drugs [1], there is an ongoing need to search for potential new sources of treatment against such infections. The plant-derived bioactive compound eryngial (*trans*-2-Dodecenal) has demonstrated significant anthelmintic activity that is comparable with that of ivermectin using *Strongyloides stercoralis* infective larvae (L3i) *in vitro* [2]. Related and/or derived organics of bioactive compounds may also demonstrate activity against target organisms. This is the basis of the current study where related alcohols and aldehydes of *trans*-2-Dodecenal were investigated *in vitro* for their anthelmintic activity using *S. stercoralis* L3i.

**Aims:** To investigate the anthelmintic activities of *trans*-2-Dodecenal-related compounds and carry out a comparison with *trans*-2-Dodecenal *in vitro*.

**Methods:** The aldehydes investigated were *trans*-2-Hexenal, *trans*-2-Octenal, *trans*-2-Decenal, *trans,trans*-2,4-Decadienal and *trans*-2-Dodecenal (all purchased), and the alcohols were *trans*-2-Hexenol, *trans*-2-Octenol, *trans*-2-Decenol, *trans,trans*-2,4-Decadienol and *trans*-2-Dodecenol, all of which were synthesized from their respective aldehydes. Bioassays were conducted *in vitro* following the outlined procedure (2) to determine 48 hr LD<sub>50</sub> values (doses: mg/mL) of the compounds.

**Results:** Tables 1 and 2 show 48 hr LD<sub>50</sub> values of the aldehydes and alcohols, respectively using *S. stercoralis* L3i. *trans*-2-Decenal, *trans*-2-Octenal and *trans,trans*-2,4-Decadienal were significantly more effective at killing the larvae than *trans*-2-Dodecenal (Table 1) while *trans,trans*-2,4-Decadienol was the only alcohol that was significantly more effective than *trans*-2-Dodecenal (Table 2).

Table 1. Doses (mg/mL) of eryngial-related aldehydes required to kill 50% (LD<sub>50</sub>) of *S. stercoralis* infective larvae (L3i), respectively after 48 hr.

Compound (mg/mL)	48 hr LD <sub>50</sub> ± 95 % Confidence Limits
<i>trans</i> -2-Decenal	0.004 (0.002 – 0.005)
<i>trans</i> -2-Octenal	0.011 (0.008 – 0.015)
<i>trans,trans</i> -2,4-Decadienal	0.019 (0.017 – 0.020)
<i>trans</i> -2-Dodecenal	0.069 (0.058 – 0.085)
<i>trans</i> -2-Hexenal	0.078 (0.043 – 0.117)

Table 2. Doses (mg/mL) of alcohols (derivatives of their aldehydes) required to kill 50% (LD<sub>50</sub>) of *S. stercoralis* infective larvae (L3), respectively after 48 hr.

Compound (mg/mL)	48 hr LD <sub>50</sub> ± 95 % Confidence Limits
<i>trans,trans</i> -2,4-Decadienol	0.011 (0.0 – 0.056)
<i>trans</i> -2-Dodecenol	0.0982
<i>trans</i> -2-Hexenol	0.514 (0.479 – 0.551)
<i>trans</i> -2-Octenol	2.5 (2.4 – 2.6)

**Conclusion:** The results indicated that some aldehydes along with *trans,trans*-2,4-Decadienol were significantly more effective at killing the infective larvae than *trans*-2-Dodecenal.

**Acknowledgments:** We thank Slippery Rock University for funding.

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## 04| EVALUATING CAFFEINE'S IMPACT ON ZEBRAFISH PERFORMANCE, SWIM COORDINATION, AND GLUCOSE UPTAKE

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**Background:** Caffeine, commonly found in beverages like coffee and tea, is known for its potential to enhance alertness, memory, and metabolism, with implications for weight control and insulin sensitivity. Despite extensive research in human and animal models, there is a gap in understanding its effects on Zebrafish.

**Objective:** This study aimed to investigate how caffeine affects the Zebrafish performance, swim coordination, and responses to simulated stimuli in the Zebrafish.

**Methods:** Pairs of healthy Zebrafish were exposed to varying caffeine concentrations (25- 150 mg/L) in fish water, with or without glucose supplementation (110 mM). After a 30-minute treatment, their swim speed, coordination, response to simulated stimuli, and performance against increasing water flow speeds were measured.

**Results:** Caffeine exhibited a concentration- dependent negative impact on Zebrafish performance, swim coordination, velocity, and responsiveness to simulated stimuli. Peak negative impact was observed at caffeine concentration of 100mg/L and beyond. However, supplementation with glucose in the fish water attenuated these negative effects.

**Conclusion:** Supplementing glucose in caffeine- treated Zebrafish restored the normal activity, indicating caffeine's role in enhancing glucose uptake. This suggests a potential therapeutic application of caffeine in managing diabetes.

Nevertheless, caution is advised due to the potential adverse effects such as elevated blood pressure and sleep disturbances, particularly for individuals with diabetes and heart conditions.

**Acknowledgments:** We are thankful for the financial support given The University of the West Indies, Mona campus, Kingston Jamaica, in the form of research grant.

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Key words: Caffeine; Glucose; Performance; Zebrafish; Diabetes

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## 05| PHYSICAL, OPTICAL, THERMAL, ELASTIC AND RADIATION SHIELDING PARAMETERS OF Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub>- TeO<sub>2</sub> GLASS SYSTEM MODIFIED WITH TITANIUM DIOXIDE

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**Background:** The amount of radiation humans is exposed to has increased. In some scenarios, the level of exposure is potentially harmful to health, as is the case for healthcare professionals operating nuclear medicinal equipment [1]. This requires the use of materials such as lead or most commonly concrete to shield persons from harmful radiation. However, these materials have drawbacks including toxicity and bulk among others that render them untenable for applications such as nuclear medicinal equipment [2] [3]. Prior literature shows that heavy metal oxide glasses can serve as a replacement, with Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub>-TeO<sub>2</sub> glasses being especially promising thanks to their good radiation shielding and thermal stability among others [4]. Dopants are often introduced into these heavy metal oxide glasses to induce or reinforce desired traits in the material, with transition metals often yielding good results as dopants [5]. To the best of our knowledge, this work examines a novel glass system.

**Aims:** Doping a bismuth boro tellurite glass system with Ti in hopes of producing good radiation shielding material with other desirable material properties

**Methods:** The present glass samples were prepared by the conventional melt quenching technique. The mixture of the chemical compounds was melted in a platinum crucible in a PID electric furnace. The masses of prepared glasses were measured in Ohaus digital balance with a precision of 10<sup>-4</sup> g. The prepared glass densities ( $\pm 0.0001 \text{ g/cm}^3$ ) measured by Archimedes principle, by using O-xylene liquid. Thermal behaviour of glasses was studied in the temperature range 35- 1000 °C with heating rate of 10 °C/min was studied by DTA analysis (Netzsch STA 449 F1 Jupiter). Nitrogen atmosphere (5.0 purity) and corundum crucibles /empty corundum crucible was used as reference. The Raman spectrum was measured between 100 and 4100 cm<sup>-1</sup> at a resolution of 0.5 cm<sup>-1</sup> with a QE65 pro spectrometer. The Raman spectrum is deconvoluted with the Fityk software using Gaussian peaks that are fitted via the Levenberg-Marquardt method. Optical absorption was measured at a resolution of 0.5 nm using a Cary 5000 UV/Vis/NIR spectrometer between 200 and 3300 nm using the polished samples. X-ray diffraction was carried out using a PANalytical XPERT-PRO with Cu K $\alpha$ , (45 kV accelerating voltage,  $\lambda = 1.5406 \text{ \AA}$ ), through the angle 2 $\theta$  between 10° and 80°, with a step size of 0.05° s<sup>-1</sup> was used. Mass attenuation coefficients of samples were derived using data from NIST XCOM program.

Samples were exposed to Cs-137 to experimentally evaluate the gamma radiation shielding. The Makishima and Mackenzie model was used to determine elastic properties.

**Results:** Doping with TiO<sub>2</sub>: decreased radiation shielding; however, radiation shielding was still greater than concrete [4], decreased density, increased elastic properties increasing stiffness and physical damage resistance, increased thermal stability and glass forming ability [5], decreased cross-link density; TiO<sub>2</sub> severs cross-linkages to form non-bridging oxygen(s) (NBOs) [6], decreased optical band gap and UV-VIS transmittance, increased refractive index and Urbach energy. XRD confirmed amorphous nature of the samples. Raman spectra show disruption of structural units with doping.

**Conclusions:** TiO<sub>2</sub> affected various material properties. Radiation shielding ability surpasses concrete.

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# 06| A DIVE INTO THERMOELECTRIC OCEAN THERMAL ENERGY CONVERSION (TE-OTEC): POTENTIAL OF IMPLEMENTATION IN JAMAICA

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**Background:** Ocean thermal energy technology is not a new concept; it has been implemented and used to generate electricity since the 1900's in Hawaii and Japan, and Jamaica at the time of the energy crisis showed interest in the development of the technology through research from local and international parties. As stated in the Jamaica National Energy Policy 2009-2030 and the Sustainable Development Goals (SDG), there is a need for energy independence (access to clean, modern energy) from imported fossil fuel sources, and a way to directly reduce electricity cost for consumers. Solar and wind energy both present limitations for Small Island Developing States (SIDS) such as Jamaica which have inadequate land space, limited resources, and other reasons.

**Aims:** To determine the potential and the feasibility of Ocean Thermal Energy Conversion (OTEC) as a viable and sustainable source of energy for a small island setting as in Jamaica. A systematic comparison with the main actual renewable energy adopted in the island (solar and wind) as it relates to cost, energy output and efficiency was performed. Finally, we discuss the new concepts of introducing compact thermoelectric heat exchanger, as a promising alternative to the actual Rankine cycle.

**Methods:** We perform a detailed analysis of the available technical, economical and geophysical references for the potential of OTEC, with a special emphasis on its potential to Jamaica. A comparative study was done with existing renewable options already adopted for the energy mix in the island (such as solar and wind) to assess its feasibility on practical grounds. The paper also show preliminary results of simulations of realistic thermoelectric generators

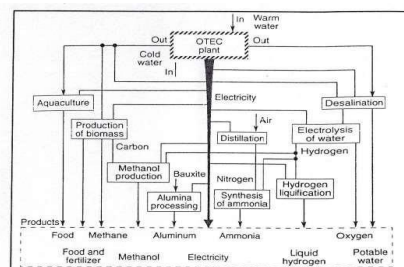
(TEG), which could be integrated greatly simplify its design as they are the only devices which can directly convert heat to electricity.

**Results:** Our analysis shows that, indeed OTEC coupled with thermoelectric technology, present a real potential for the northern and western parishes in Jamaica, where the ideal depth of 1000 m and distance from the shores below 2.5km could be economically highly viable (see Figure 1 (left)).<sup>[1]</sup> This could be even more attractive if OTEC could be integrated into much larger integrative development projects capable of providing answers to many global issues such as access to clean water, irrigation, advancements in aquaculture, Energy and HVAC supports for the tourism sector and many more as can be seen in Figure 2 (right).<sup>[2]</sup>

**Conclusion:** The present analysis study shows that OTEC combined with thermoelectric technology is indeed a very attractive and sustainable option to mitigate the energy needs for a small island such as Jamaica. Products from OTEC commercialisation perfectly meet many of Jamaica's SDG and naturally those of the entire Caribbean region.

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**Figure 1:** (left) Image showing the bathymetry contour of Jamaica; depth greater than 1000m (bleu) and less than 1000m (Grey)[1]. (Right) Potential products of OTEC commercialisation [2].

# 07| ENHANCED ANTIBACTERIAL PROPERTIES OF CERIUM OXIDE DOPED CALCIUM SILICATE BISMUTH PHOSPHATE BIOACTIVE GLASS FOR DENTAL APPLICATIONS

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**Background:** Bioactive glasses are a class of materials that have been extensively studied over the past few decades due to their unique properties and biomedical applications [1]. These glasses have the ability to bond with bone tissue, which makes them attractive for use in bone regeneration and dentistry applications. The biocompatibility and bioactivity of bioactive glasses are attributed to their unique compositions and structures, which usually consist of a network of SiO<sub>2</sub>, CaO, Na<sub>2</sub>O, and P<sub>2</sub>O<sub>5</sub>. Based on the glass' composition it may bond to bone, teeth, both, or neither [2]. The bioactivity of the glass may also be enhanced by doping in metal oxides. A bioactive glass was synthesized and doped in cerium oxide. Cerium oxide is chosen as a dopant because of its exceptional chemical reactivity, high thermal stability, hardness, and capacity to absorb UV radiation [3]. Physical parameters were computed, and both the chemical and structural compositions analyzed. Additionally, Raman Spectra, optical absorption measurements, and antibacterial activity of the glasses were documented and evaluated. Bioactive glasses are the future with ongoing studies to improve their bioactivity.

**Aims:** To improve the bioactivity and antibacterial properties of calcium silicate bismuth phosphate bioactive glasses doped with cerium oxide.

**Methods:** The samples have been prepared by melt quenching technique. The raw materials, including calcium oxide, sodium oxide, bismuth oxide, silicon dioxide, and phosphorus pentoxide, were selected and weighed in 30g batch mixtures. They were thoroughly mixed in a mortar and melted in a platinum crucible; the mixture was heated to 1000°C at a rate of 20°C/min. They were stirred and placed in the furnace and allowed to heat up to 1430°C at the same rate. Cerium oxides are added as dopants to enhance the glass' bioactivity and other properties. Some

computed were density,  $\rho$  (g/cm<sup>3</sup>) =  $\left(\frac{W_a}{W_a - W_w}\right) \times \rho_w$ , the average molecular weight AMW (g/mol) =  $\left(\frac{M \times \text{mol}\%}{100}\right)$  and ionic concentration, Ni (mol/cm<sup>3</sup>) =  $\frac{[(A_v)(\rho)(\text{mol}\% \text{ of CeO}_2)]}{AMW}$  where A<sub>v</sub> is Avogadro's number [4].

of the physical parameters

The density measurements were done using distilled

water as the immersing liquid. The QE65 pro spectrometer was used to obtain the Raman shifts in a range of 100 to 1400 cm<sup>-1</sup>. Fityk software was used for deconvoluting the raman spectrum and optical absorption was measured using a Cary 5000 UV/Vis/NIR spectrometer between 350 and 2000 nm using the polished samples.

**Results:** The glass of composition 41SiO<sub>2</sub>-(22-x)CaCO<sub>3</sub>-22NaCO<sub>3</sub>-6P<sub>2</sub>O<sub>5</sub>-9Bi<sub>2</sub>O<sub>3</sub>: xCeO<sub>2</sub> (1 ≤ x ≤ 4 wt.%) was chosen and synthesized. The physical parameters mentioned, indicated the presence of the dopant by the increasing. The Scanning Electron Microscopy (SEM) indicated effective enhancement by confirming the presence of the hydroxyapatite layer (the layer formed in the presence of human plasma which allows bonding). The Energy Dispersive X-ray Spectroscopy (EDS) confirmed the presence of cerium and increased oxygen in the samples. Raman Spectra results revealed that the intensity and concentration were proportional, and the optical absorption (UV) illustrated that the optical bandgap of the doped glass system is reduced by increased cerium oxide doping.

**Conclusions:** The glass composition chosen was suitable for bioactivity. The presence of the cerium oxide enhanced its bioactivity and antibacterial properties.

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# 08| A DENSITY FUNCTIONAL THEORETICAL AND EXPERIMENTAL INVESTIGATION INTO THE HYDROLYTIC DEGRADATION KINETICS OF N-(2'-HYDROXY)BENZYLIDENEANILINES

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**Background:** Imines are environmentally ubiquitous, existing as biochemical intermediates and as xenobiotics which pollute terrestrial and aquatic ecosystems [1]. Hence, it is critical that their rate of hydrolytic cleavage be understood. Indeed, the hydrolysis of such compounds is well-studied in some respects, the results of which reveal that their hydrolysis rates can be tailored through structural modifications [2]. For benzylideneanilines, a specific class of imine bearing aromatic rings on either side of the imine linkage, the presence of a 2'-hydroxy group has been reported to enhance their hydrolysis rates [3]. However, there is paucity of literature on the kinetics of these processes and their constituent mechanistic steps. Hence, herein, we report the investigation into the hydrolytic degradation kinetics of a strategically designed set of benzylideneanilines using a combination of experimental and high-quality density functional theoretical (DFT) techniques.

**Aims:** To investigate the hydrolysis kinetics of a set of N-(2'-hydroxy)benzylideneanilines and assess the effects of electronic and steric factors on their hydrolysis.

**Methods:** The hydrolysis for all compounds was studied in a 90% (v/v) acetonitrile: water mixture using UV-Vis spectroscopy. Pseudo first order rate constants were determined by fitting the data obtained to the exponential form of the integrated first order rate equation represented as follows:

$$At = (A_0 - A_\infty)e^{-kt} + A_\infty$$

Carrying out such experiments at four temperatures in the range 30 – 37 °C allowed for the calculation of kinetic parameters ( $\Delta G^\ddagger$ ,  $\Delta H^\ddagger$  and  $\Delta S^\ddagger$ ) using Eyring's model given by:

$$k = \kappa \frac{k_b T}{h} e^{-\frac{\Delta G^\ddagger}{RT}}$$

DFT/B3LYP-6-31++g(d,p) level to map the hydrolysis mechanism for all compounds. Transition state structures were calculated using a quasi-synchronous transit (QST3) approach

**Results:** These studies revealed an alternative pathway for their hydrolysis, PB, which was both kinetically and thermodynamically favoured relative to the generally accepted mechanism for the hydrolysis of imines, PA. The latter pathway was determined to be associated with the rate-limiting addition of water across the C=N linkage of the non-hydrogen bonded (NHB) conformer of the compound, proceeding *via* a four membered transition state. Alternately, PB commences with the more stable intramolecular hydrogen bonded (IMHB) form which transforms to the carbinolamine intermediate through an activated zwitterionic intermediate. Thereafter, the carbinolamine adduct undergoes a rate-limiting decomposition to the lysis products through a bicyclic transition state consisting of fused four-membered and seven-membered rings.

**Conclusions:** Overall, this study revealed that the hydrolysis of N-(2'-hydroxy)benzylideneanilines will proceed mostly *via* PB leading to their accelerated hydrolysis whereas benzylideneanilines without this structural feature will hydrolyse *via* PA.

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Molecular modelling calculations were done at the



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## 09| IMPACT OF GENDER AND ENVIRONMENTAL ENRICHMENT ON LEARNING AND RETENTION OF AN AVERSION DRIVEN TASK IN MICE FOLLOWING EXPOSURE TO A CANNABIS EXTRACT

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**Background:** Research has shown that delta-9-tetrahydrocannabinol ( $\Delta^9$ -THC) has effects on memory, which are often pervasive and may be irreversible when drug use is initiated during adolescence<sup>1,2</sup>. Additionally, studies have reported a gender effect of  $\Delta^9$ -THC on memory inhibition (i.e. 'forgetting') and anxiety, with females being more susceptible to its effects. Environmental enrichment involves enhanced social, physical and sensory stimulation to laboratory animals<sup>3</sup>, and has been shown to lessen the negative effects of numerous drugs and/or treatment conditions. Its ability to mitigate the effects of  $\Delta^9$ -THC was investigated in this study by comparing it to standard laboratory conditions using the Plus Maze Discriminative Avoidance Task (PMDAT) to assess learning and memory.

**Aim:** To compare the effect of an acute dose of a  $\Delta^9$ -THC-rich cannabis extract on exploratory behaviour in adolescent mice conditioned to either a non-enriched or an enriched environment.

**Methods:** Forty-eight male and female Swiss albino mice were bred and randomly housed by gender in either the non-enriched (N) environment (FN, n=12 females, MN n=12 males) or the enriched (E) environment (FE, n=12 females and ME n=12 males) for 4 weeks, starting at 21 post-natal days. Behavioural assessment, initially with aversive stimuli (100W light and noise) (Training), and then without aversion (Test), involved successive 10-minute free exploration sessions on the PMDAT prior to cannabis extract administration. Each group was further subdivided, and treatment groups were given a single dose of 2.5 mg/kg of the  $\Delta^9$ -THC-rich cannabis extract dissolved in 0.05mL of coconut oil and added to 0.05g of rodent food (FNTHC, n=6; MNTHC n=6, FETHC n=6; METHC n=6). The vehicle or control groups were given 0.05mL of coconut oil added to 0.05g of rodent food (FNCO n=6; MNCO n=6; FECO n=6; MECO n=6). Memory and learning were assessed without the aversive stimulus on the PMDAT. All statistical analyses were conducted using one-way ANOVA and Tukey's post hoc test.

**Results:** In the training session, all groups exhibited memory acquisition by spending <20% of their total exploration time in the aversive enclosed arm (AEA).

Enriched females made significantly fewer entries into the aversive arm of the maze (AEA) compared to non-enriched females ( $p=0.005$ ) during training. Non-enriched males had significantly fewer entries into the AEA compared with non-enriched females in the training session ( $p=0.000$ ) and spent significantly less time in the AEA in comparison to non-enriched females ( $p=0.011$ ). In the test session, all groups exhibited memory retrieval by spending <20% of their time in the previous AEA following removal of the aversive stimulus. Enriched females spent significantly more time in the previously aversive AEA compared with non-enriched females ( $p=0.046$ ). After the acute cannabis administration, group FN made significantly fewer entries into the previously aversive AEA than they did during the training period ( $p=0.023$ ). Additionally, group FETHC spent less time in the AEA than they did during the test period ( $p=0.003$ ), and less time than the group FECO ( $p=0.007$ ).

**Discussion:** The results indicate that environmental enrichment improved aversive memory retrieval for undrugged female mice as they displayed increased exploration of the AEA in the absence of the aversive stimuli. However, acute exposure to the  $\Delta^9$ -THC-rich cannabis had a negative effect on memory retrieval and learning in female adolescent mice in this study.

**Conclusion:** Environmental enrichment enhanced learning and memory.  $\Delta^9$ -THC had a negative effect on aversive learning and memory which enrichment was able to mitigate especially in female mice.

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## 10| ANTIOXIDANT POTENTIAL OF THREE SELECTED MEMBERS OF THE ZINGIBERACEAE FAMILY

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**Background:** The antiproliferative potential of some members of the Zingiberaceae family, namely: lesser galangal (*Alpinia officinarum*), turmeric (*Curcuma longa*), and ginger (*Zingiber officinale*), have been reported, but without knowledge of the possible responsible factors. However, they have been severally reported independently for use in ethnomedicine as remedies against different types of illnesses. The possession of the ability of some plants to fight against the oxidative activities of free radicals and other toxic agents enables them to serve medicinal purposes in humans.

**Aim:** In this study, the antioxidant/reducing power potentials of the aqueous and ethanol extracts of lesser galangal, turmeric, and ginger rhizomes were examined as a prelude to the possible unraveling of the mechanisms of their antiproliferative potentials and bioactivities against different illnesses.

**Methods:** Extracts of lesser galangal, turmeric, and ginger rhizomes were subjected to the free radical scavenging ability using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay method [1, 2]. An aliquot of 1.0 ml of 0.1 mM solution of DPPH in 95% ethanol was added to 3.0 ml of extract at concentrations between 31.25 and 500.00 µg/ml. The mixture was shaken vigorously, incubated for 30 minutes and its colour change read using the spectrophotometer at the absorbance wavelength of 517 nm. The percentage radical scavenging ability of the sample was then calculated using ascorbic acid as the standard sample. The reducing power assay as reported by Jayanthi, Sripathi and Lalitha [3] was used to corroborate the former assay method to determine the antioxidant ability of the three plants specified above.

**Results:** The ethanol extracts of the three Zingiberaceae plants examined in this study consistently showed greater free radical scavenging capacity than their corresponding aqueous extract counterparts at all the concentrations studied. At 31.25 µg/ml, the ethanol extracts of lesser galangal, turmeric, and ginger showed

the radical scavenging activities of 29.6±1.9%,

24.1±3.3%, and 19.4±2.0%, respectively, whereas the corresponding aqueous extracts of the three plants at this concentration displayed the activities of 23.9±3.7%, 18.7±3.3%, and 17.0±2.4%, respectively. At the highest concentration of 500.00 µg/ml determined in this study, the ethanol extracts of lesser galangal, turmeric and ginger rhizomes had activities of 88.7±3.8%, 83.3±0.8% and 74.8±3.8%, respectively. The aqueous extracts showed slightly lower scavenging activities of 81.5±3.5%, 71.9±1.5%, and 68.4±4.0%, respectively. Similar trends were displayed by the plants in the reducing power assay.

**Conclusion:** Both ethanol and aqueous extracts of the three Zingiberaceae plants displayed appreciable antioxidant potentials. However, lesser galangal rhizome ethanol extracts displayed the greatest antioxidant activities at all concentrations studied, followed by the turmeric, and then the ginger rhizomes, respectively. The ethanol extracts of these plants may possess greater power to fight against oxidative stress in humans.

**Acknowledgments:** We express our gratitude to the Northern Caribbean University for creating the enabling environment for the conduction of this study.

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# 11| EVALUATION OF THE ACCURACY OF ALTIMETER MEASUREMENTS FROM MOBILE PHONE APPLICATIONS

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**Background:** Smartphones are ubiquitous today but are severely underused in research despite numerous built-in sensors. Altitude measurements provided by smartphones could be a cost-effective way to measure altitude. However, the accuracy of phone-based measurements must first be determined.

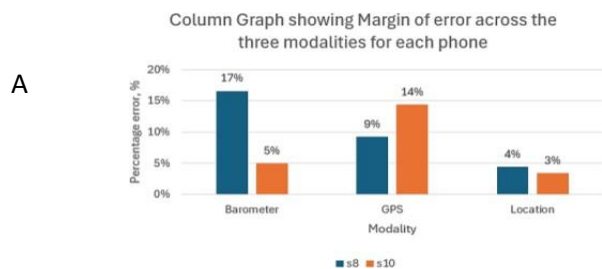
**Aims:** To assess the accuracy of altimeter measurements obtained by 3 modalities: a) Barometric, b) Global Navigation Satellite System, and c) IP geolocation, in 5 locations between UWI Mona and Half-Way-Tree, Kingston.

**Methods:** The Samsung Galaxy S8 and S10 Plus were equipped with four Android applications (Accurate Altimeter by AR Labs, Altimeter by Pixel Prose SARL, and two versions of Altimeter by EXA Tools). A calibration reference test was then done with a barometer at UWI Mona Physics Dept to determine the accuracy of their barometric altitude readings. At each location, the smartphones were positioned flat on the ground to receive the best GPS data and consistent barometric air pressures after a settling time of approximately one minute. Environmental factors such as temperature, wind speed and the satellite signal were also collected.

**Results:** Average altitudes across the five locations ranged from 0.1% to 11.6% margin of error in comparison to the control altitude values provided by the National Land Agency. The margins of error for the barometric altitude data attained from both phones were within a 1% margin of error of an accurate scientific barometer. However, when equation 1 was used without regard for environmental factors, the margin of error grew to 31%.

$$Altitude = 44330 \times \left(1 - \left(\frac{P}{P_0}\right)^{\frac{1}{5.255}}\right) \quad (1)$$

respectively in the S8 and S10 are: IP geolocation at



±4%, ±3%, Barometric altitude at ±17%, ±5% and GPS altitude is at ±9%, ±14%. Temperature (28°C to 31°C) and wind speed (13 km/h to 15km/h) greatly influenced altitude measurements. Higher temperatures were positively proportional to barometric pressure. The Galaxy S8, provided more accurate altitudes than the Galaxy S10 (Figure 1A). Data points across most locations followed a negative skewness distribution curve, and had no evident outliers (Figure 1B).

**Conclusions:** Accuracy of smartphone altitude measurements is based on the modality of the application used —barometric, GPS, or IP geolocation. Previous literature [1,2] and this study suggest that while the barometric method is the most convenient for obtaining altitude data on smartphones, needing no internet, it lacks complete accuracy. GPS-based readings, while mostly available from smartphones, may suffer from signal interference when physically obstructed, making it the least favourable. The Internet-based location services offer the most accurate altitude measurements by referencing existing topographic map data online. However, it requires internet access. In summary, smartphone model, application and modality choice impact accuracy measurements.

## Acknowledgements:

The authors acknowledge the National Land Agency (NLA) for providing the control altitude data used in this study.

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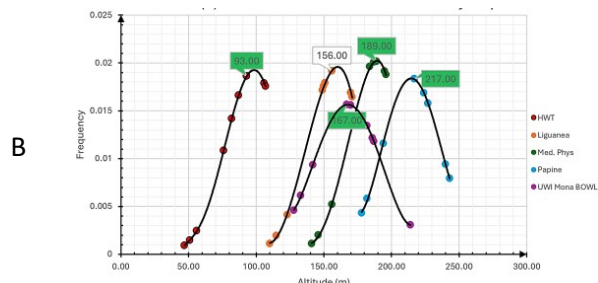


Figure 1: Modalities' margins of error (A) and Frequency distribution curves of collated altitudes for Galaxy S8 phone (B).

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## 12| RECONSIDERING A TECHNOLOGICAL TRANSFORMATION THROUGH THE CONSTITUTIVE NOTION OF CONSCIOUSNESS IN THE CARIBBEAN

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**Background:** The dissertation highlights the view that slavery and colonialism are driving considerations that have been used to inform the narrative that defines who and what the black man is, but instead, I argue that the composite elements of matter and spirit in the structure of human beings are the primary pillars of references that should be engaged to achieve a holistic understanding of the post-colonial self. The conception that writers such as Frantz Fanon used to construct the Caribbean man contradicts the elements that constitute a human being. Sylvia Wynter envisioned and projected the self as an epistemological imperative that must be revisited starting from 1492.

**Aims:** On the contrary, enough focus has not been put on the functionality of the soul/spirit in human beings which is synonymous with the concept of consciousness and is the engine responsible for the operations of the body. This is the constitutive structure that this dissertation adopts to conceptualize the nature of all human beings, including people of color, irrespective of the evolutionary antecedents that contributed to the characteristic features defining their geographical milieu.

**Methods:** The archival approach facilitated the retrieval of data that contained the conceptual and articulated understanding of the structure of the post-colonial self that, writers in Caribbean philosophy embrace. The methodology is appropriate because it provides access to valuable historical records both from the original and reviewed compilation of works of authors and, works about them.

One of the objectives of this dissertation engaged the conceptual analyses of the post-colonial self which prominent Caribbean writers have used to narrate the cultural and ideational factors that identify us as a people. Additionally, the writers' theoretical frameworks were interrogated to determine the veracity of their conclusions. I defend the structural composition of human beings with body and spirit as a more rational and empirical basis to account for cultural production and identity re-creation.

**Results:** This exercise established the inextricable link between human agency and consciousness as suggested by Olufemi Taiwo in his book, and as a more constructive platform on which to narrate the realities of colored people.

**Conclusions:** The conclusion reinforces the need to narrate the self-using the notion of human agency which is synonymous with the element of consciousness in the self.

**Acknowledgments:** We thank The Universities of the West Indies and the University of Technology for this platform to highlight our work. I would like to especially thank my Department of Language, Linguistics, and Philosophy for the valuable support it has given to me.

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## 13| EXAMINATION OF THE EFFICACY OF COFFEE AND CAFFEINE BASED ORGANIC PESTICIDES UNDER CARIBBEAN FIELD CONDITIONS

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**Background:** Caffeine is a naturally occurring insecticidal purine alkaloid compound (1) found commercially in coffee, plants with the highest concentrations found in the seed of the drupe (10.0– 12.0 mg/g). Solution made from coffee extract have been used traditionally to control pest. The extract has been found to contain significant concentrations of caffeine, 5 flavonoids and several polyphenols (2). This extract has been found to be effective in the control of *Spodoptera littoralis*, *Empoasca fabae* *Sitophilus oryzae* (3) and many other common agricultural pests. The importance of access to cheap easily manufactured organic pesticides is of great importance to organic food producers. Caffeine and coffee extracts/solutions may help to fill a niche in this market, however the efficacy of these substances in field trials relative to that of available organic pesticides like neem extract must be determined in field studies.

**Aims:** To determine the minimal and maximal concentrations of coffee and caffeine-based solutions required for effective pesticidal impact under field conditions.

**Methods:** Solutions and emulsions will be used during the testing period. These include coffee extract created from used coffee grounds sourced from brewing /commercial sources, the commercially available neem oil spray, Natria 706250A and caffeine emulsions comprised of vegetable oil, caffeine powder, oleic acid and Sodium Lauryl Sulfoacetate.

Emulsions containing 0%, 0.1%, 0.2% caffeine 0.3% and 0.6% caffeine by weight will be produced for testing. Coffee extract will be produced by use of the Mussatto methodology (4) with the final product added to vegetable oil to form an emulsion with Sodium Lauryl Sulfoacetate. Raised metal test beds will be used to contain 50 seedlings of *Amaranthus viridis* (callaloo). The seedlings will be spaced approximately 30 cm apart and watered via subsurface drip irrigation. The plants will be placed in Coast of Maine Organic Tomato and Vegetable Planting Soil. Samples of the soil will be retained for nutrient analysis.

The area around the raised beds will be treated with molluscicides to remove the impact of mollusc pests on the experiment. Each raised bed will be treated with the chosen insecticidal mixture via spraying once per week for a period of four weeks. Before the weekly application of spray, plants will be examined for the presence and signs of insect pests. Samples of insect fauna will be collected for identification. Plants will be examined for insect related damage and the extent determined. At the end of the four-week period the plants will be removed and the size and complexity of their root systems examined. The average plant weight of leaves and stems will be determined. Leaves will be taken from each plant group for nutritional analysis. Sample of the soil from each bed will be taken and analyzed.

**Expected Results:** The study should demonstrate an increase in insecticidal efficacy of caffeine with concentration, particularly with regards to Lepidoptera. There should be no negative impacts on soil quality due to the use of the biocides used. The caffeine extract should equal or surpass the effectiveness of the neem-based biocide.

**Conclusions:** This study should help to bolster the drive towards the creation of Jamaican branded biocides for use in organic farming. Potential product formulas may be generated from this research.

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## 14| A PILOT STUDY OF TEACHERS' PERSPECTIVES ON STUDENTS' MATH ISSUES

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**Background:** Mathematics is a fundamental subject that plays a vital role in shaping the minds of future generations. However, mathematics education has been plagued by various issues, including: math anxiety, knowledge gap and lack of understanding, "We suggest that the initiatives currently underway to improve STEM involvement and achievement would benefit from educating current and future teachers, parents, and even students about math anxiety, its causes, consequences, and possibilities for amelioration" [1]. The aforementioned issues are just a few from the list the researcher is assessing on the self-developed questionnaire. These issues have resulted in a significant decline in students' interest and proficiency in mathematics, ultimately affecting their performance in science, technology, engineering, and mathematics (STEM) fields.

The importance of mathematics education cannot be overstated, as it is essential for developing critical thinking, problem-solving, and analytical skills. Moreover, mathematics is a language of science and technology, and its understanding is vital for innovation and economic growth.

**Aims:** This research aims to contribute to the existing body of knowledge on mathematics education, ultimately improving teaching practices, student outcomes, and the overall quality of STEM education. Below are two research questions to be considered for this study.

Research Questions:

1. What are the teachers' perspectives on math anxiety, knowledge gap and lack of understanding
2. What is the relationship between math anxiety and knowledge gap and lack of understanding, respectively.

**Methods:** conveniently study a sample of 10 Masters students in math education by administering a self-developed 14-item instrument (i.e., 5 points Likert scale) survey to identify math issues. From which, descriptive statistic will be applied, also, the data will be analysed by employing correlation coefficient.

**Results:** The mean value for math anxiety (MA) is 3.7, median 4, standard deviation 0.82; knowledge gap (KG) is 3.6, median is 4.0, standard deviation is 1.15; lack of understanding (LU) mean value is 3.1, median is 3.0 and standard deviation 1.49. In this case, 3.7, 3.6 and 3.1 are

indicating much MA, KG and LU confirmed from the feedback received from the teachers. Additionally, based on the data provided, the correlation between math anxiety (MA) and knowledge gap (KG) is relatively weak. The correlation coefficient ( $r$ ) is approximately 0.24.

This indicates a slightly positive correlation, meaning that as MA increases, KG tends to increase slightly. However, the correlation is not strong, and there is a lot of variability in the data.

The coefficient of determination ( $r$ -squared) is approximately 0.06, indicating that only about 6% of the variation in KG can be explained by the variation in MA. Keep in mind that this analysis is based on a limited dataset and may not be representative of a larger population. Additionally, correlation does not imply causation, so it's important to consider other factors that may be influencing the relationship between MA and KG.

black and white. Finally, the correlation between MA and LU was inconclusive, because a non-linear graph was interpreted.

**Conclusions:** Bear in mind that this analysis is based on a limited dataset and may not be representative of a larger population. Additionally, correlation does not imply causation, so it's important to consider other factors that may be influencing the relationship between MA and KG. black and white. Finally, the correlation between MA and LU was inconclusive, because a non-linear graph was interpreted. All in all, both research questions were supported by the descriptive statistics and the analysis. Lastly, a recommendation to the stakeholders, teachers and students is pertinent to introduce intervention programs to minimize math anxiety, knowledge gap and lack of understanding math issues for success in STEM education. In fact, math is the structural underpinning to all sciences.

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