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26th MONA SYMPOSIUM
JANUARY 4 - 7, 2016

The Organising Committee wishes to acknowledge the following contributors to the conference:

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The Organising Commitee

Chadwick Anderson
Ainka Brown
Rupika Delgoda
Nadale Downer-Riley
Petrea Facey
Winklet A. Gallimore
Julie-Ann A. Grant
Helen Jacobs
Roy B. Porter
Paul B. Reese (Organising Secretary)
Garfield Williams

All inquiries concerning the programme or future planning of the conference should be directed to:

Paul Reese
Department of Chemistry
University of the West Indies
Mona Campus
Jamaica

Phone: (876) 927-1910
Fax: (876) 977-1835

E-mail: monasymposium@gmail.com
paul.reese@uwimona.edu.jm
Symposium website: www.monasymposium.com

Special Events

The 26th Mona Symposium **Registration & Mixer** commences on Sunday, January 3 from 7:00 pm to 10:00 pm on the Chemistry Lawns adjacent to Chemistry Lecture Theatres 5, 6 and 7.

There will be a **Reception** on Monday, January 4, at 7:30 pm at the Phillip Sherlock Centre for the Creative and Performing Arts.

The Poster Session will be on Tuesday, January 5, during the Poster Session at 4:00 – 5:15 pm. Please set up your poster by 12:00 NOON on Wednesday in the assigned area. There will be an open bar during the session.

Join us on Wednesday, January 6 for the **Conference Day Trip** as we journey out to Ocho Rios in the beautiful parish of St. Ann. Please note that the buses will depart promptly at 8:00 am, so don't be late.

The **Conference Dinner** will be held at the Terra Nova Hotel in the Venetian on Thursday, January 7, beginning at 7:30 pm. A cash bar will be open after dinner.

Message from **Prof. Paul Reese**

Organizing Secretary
Mona Symposium

It gives me great pleasure to address the participants of the 26th Mona Symposium: Natural Products & Medicinal Chemistry. This biennial meeting has been hosted by the Department of Chemistry at Mona in January of even number years since 1966. Hence, we celebrate a half a century of bringing the best Organic Chemists in their field to our shores.

The timing of the year for the gathering is no accident. Many of the overseas participants are happy to escape cold winters to come to the Caribbean to experience our warm weather and hospitality.

Numerous friendships and collaborations have been forged here – some in the lecture hall and others on the day trip to the beach. The visitors also tell me that the fact that our conference themes are fairly broad means that they often meet chemists who are not exactly in their field. Therefore, they get a different perspective on their research from such persons. They are also appreciative of the social programme that entertains and also educates them on our local culture. Those of us at Mona are able to introduce our students to a small international conference with eminent Plenary Speakers and a good supporting package of short papers and poster presentations.

Natural Products are chemicals that are all around us. They are produced by plants, animals and microorganisms (fungi and bacteria) from terrestrial and marine environments. Approximately fifty percent of approved drugs on the market are either derived from natural products or are natural products themselves – hence the link with Medicinal Chemistry. Examples abound. The penicillin antibacterials are derived from the fungus *Penicillium*, while Streptomyces produces the antifungal agent nystatin. The analgesics morphine and codeine are isolated from the opium poppy, *Papaver somniferum*. The Pacific Yew tree *(Taxus brevifolia)* produces the compound paclitaxel (Taxol®), a potent compound used in treatment of ovarian and breast cancers. Vincristine and vinblastine, alkaloids from the Madagascar periwinkle, *Catharanthus roseus* (ramgoat roses) have markedly reduced fatalities from various leukaemias, neuroblastoma and other cancers. The fungus *Tolypocladium inflatum* yields cyclosporine, which is used as an immunosuppressant drug to prevent organ rejection after transplantation. Lovastatin (Mevacor®), from the oyster mushroom *Pleurotus ostreatus* lowers levels of cholesterol in the blood. The antitumour agent discodermolide is derived from the Caribbean sponge *Discodermia dissoluta*.

Artemisinin is the antimalarial agent present in wormwood, *Artemisia annua. Artemisia maritima* produces santonin, a drug that expels intestinal worms. Finally, constituents of *Cannabis sativa* (ganja) include not only the psychoactive tetrahydrocannabinol, but also cannabidiol, an anticonvulsant used to treat patients with epilepsy.

It would not have been possible to continue running this symposium without the backing of present and past staff and graduate students of Department of Chemistry, not only at Mona, but also Cave Hill and St. Augustine. We are grateful to the leaders of the Mona Campus and larger University for encouragement, particularly in the form of funding from the Board for Graduate Studies & Research. We readily acknowledge support from our many sponsors over the years. I appreciate the vision of former Head of Department, Professor Leonard Haynes, as well as Professor Wilfred Chan, our first Organising Secretary, who brought this conference series to a start fifty years ago. The planning skills and great networking abilities of those who succeeded him, Drs. Basil Burke and Keith Pascoe, ensured that the meeting weathered the turbulent 1970s. Regardless, the loudest applause is reserved for the hardworking current and former members of the Organising Committee. It takes more than a year to plan such a conference, and these persons give freely of their time and talents to make the symposium a reality.

I wish all participants a profitable and productive symposium.

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Meet Our 2016 Plenary Speakers

Prof. Raymond Andersen
Department of Chemistry
University of British Columbia

Plenary Lecture Topic: DISCOVERY OF BIOACTIVE NATURAL PRODUCTS

Areas of Research:

- Isolation and str ucture elucidation of novel organic metabolites produced by marine organisms:
- Marine bacteria as a source of novel antibiotics that are active against 'antibiotic resistant' human pathogens.
- Marine invertebrate and microbial extracts as a source of i) novel protein phosphatase and protein kinase inhibitors, ii) novel antimitotic agents, and iii) new cell cycle check point inhibitors.
- Biosynthetic studies on the novel metabolites.
- Using stable isotope methodology to study the de novo biosynthesis of terpenoid and polyketide metabolites by dorid nudibranchs.

Prof. Rob Capon
Division of Chemistry and Structural Biology, Institute for Molecular Bioscience,
University of Queensland

Plenary Lecture Topic: NATURAL PRODUCTS: INSPIRING FUTURE MEDICINES

Areas of Research:

- Marine Biodiscovery: the discovery and study of natural products from Australian and Antarctic marine algae and invertebrates.
- Microbial Biodiscovery: the discovery and study of natural products produced by Australian marine-derived and terrestrial bacteria and fungi. In addition to soil and sediment microbes, our isolates are sourced from Australian venomous creatures.
- Biomimetic Synthesis: the use of biosynthetic pathways to inspire the synthesis of valuable natural products, and related analogues.
- Chemical Ecology: investigations into the ecology, chemistry and pharmacology of toxins and pheromones employed by the cane toad, with a view to developing safe and effective control solutions.

Prof. Erin E. Carlson
Department of Chemistry,
University of Minnesota

Plenary Lecture Topic: EXPLORING THE MASTER REGULATORS OF MICROBIAL BEHAVIOR

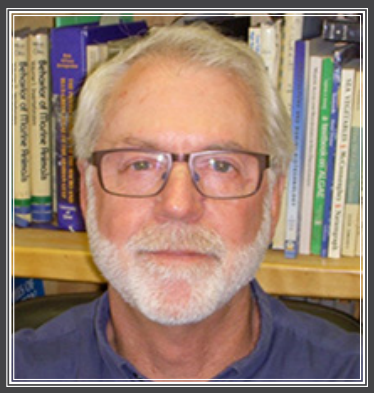
Areas of Research:

- Analysis of the multi-protein systems that dictate bacterial growth, with focus on the penicillin-binding proteins
- Generation and application of methods for the characterization and inhibition of the primary bacterial signal transduction pathways
- Exploration and interpretation of the molecular language used by bacteria to respond to environmental and ecological cues

Prof. Gregory B. Dudley
Department of Chemistry and Biochemistry,
Florida State University

Plenary Lecture Topic: HIGH-VALUE ALKYNES IN THE SYNTHESIS OF MARINE NATURAL PRODUCTS

Areas of Research:
- Natural products synthesis: new strategies, tactics, and best practices for organic chemistry,
- Applications of chemical synthesis to biomedical research.
- Development of new tools for organic synthesis



Prof. William Gerwick
Principal Investigator
Scripps Institution of Oceanography
University of California San Diego

Plenary Lecture Topic: ORTHOGONAL NATURAL PRODUCT STUDIES OF THE JAMAICAN MARINE CYANOBACTERIUM MOOREA PRODUCENS JHB

Areas of Research:
- Discovery of new anticancer, antimicrobial, anti-inflammatory or neurotoxic compounds from marine algae, with a special emphasis on cyanobacteria.
- Manipulation of biosynthetic pathways using genetic engineering so as to create molecules of increased potency and specificity, and in large volume from culture.

Prof. James Gloer
Department of Chemistry,
University of Iowa

Plenary Lecture Topic: COPROPHILOUS AND FUNGICOLOUS FUNGI: UNDEREXPLORED FRONTIERS IN ANTIFUNGAL DISCOVERY

Areas of Research:
- Studies of fungal metabolites involved in interspecies competition within natural ecosystems
- Investigations of fungi that attack, colonize, and damage others as potential sources of antifungal agents.

Prof. Hirokazu Kawagishi
Research Institute of Green Science and Technology,
Shizuoka University

Plenary Lecture Topic: FAIRY CHEMICALS– A CANDIDATE FOR A NEW FAMILY OF PLANT HORMONES AND FOR NEW AGROCHEMICALS

Areas of Research:
- Bioorganic chemical research on bioactive compounds produced by mushrooms
- Biochemical research on lectin produced by mushrooms
- Chemical clarification of mushroom-related natural phenomena
- Searching for compounds that control the life cycle of mushrooms (from spores to mycelia, from mycelia to fruiting bodies (so-called mushrooms), from fruiting bodies to spores)

Prof. Russell Kerr
Department of Chemistry and Department of Biomedical Sciences,
Atlantic Veterinary College, University of Prince Edward Island

Plenary Lecture Topic: COPROPHILOUS AND FUNGICOLOUS FUNGI: UNDEREXPLORED FRONTIERS IN ANTIFUNGAL DISCOVERY

Areas of Research:
- Evaluation of microbial diversity of unique marine habitats to the development of fermentation
- Molecular methods to access cryptic natural product biosynthetic pathways.
- Marine Microbes as a New Source of Ingredients for the Personal Care Industry.
- Identification of novel enzymes involved in the breakdown of plant fiber to be used in the development of a ruminant feed additive.

Prof. Kazuo Nagasawa
Department of Biotechnology and Life Science, Graduate School of Technology
Tokyo University of Agriculture and Technology

Plenary Lecture Topic: COPROPHILOUS AND FUNGICOLOUS FUNGI: UNDEREXPLORED FRONTIERS IN ANTIFUNGAL DISCOVERY

Areas of Research:
- Studies of fungal metabolites involved in interspecies competition within natural ecosystems
- Investigations of fungi that attack, colonize, and damage others as potential sources of antifungal agents.

Prof. Nicola L. B. Pohl
Department of Chemistry,
Indiana University-Bloomington

Plenary Lecture Topic: DEVELOPMENT OF METHODS FOR THE AUTOMATED SYNTHESIS OF OLIGOSACCHARIDE LIBRARIES

Areas of Research:
- Dissecting important roles of sugar and sugar containing materials in defense against disease
- Designing new carbohydrate-based tools to understand the roles of sugars in immune responses against pathogens.

Prof. Robert Williams
Department of Chemistry,
Colorado State University

Plenary Lecture Topic: ENANTIOMERIC NATURAL PRODUCTS: BIOSYNTHETIC, SYNTHETIC AND GENETIC REVELATIONS

Areas of Research:
- Synthesis of select natural products of biomedical significance and the development of synthetic methodology for the construction of complex, biologically intriguing molecules.
- New methodology in the area of asymmetric synthesis of alpha-amino acids in particular to investigate the mechanism of action of anti-tumor agents, antibiotics and substances that affect other critical cellular processes.
- Elucidation of the biogenesis of natural compounds of biomedical relevance in plants, fungi and both marine and terrestrial microorganisms.

More than just Sun, Sea and Sand- What keeps me coming back!

Over the years, The Mona Symposium has had number of conference attendees who have made this event a permanent fixture on their calendar. These scientists do not miss the opportunity to blend excellent science with sun, sea and sand. One such person is Prof. James Cook. Since his first symposium in 1974, he has only missed one!

James M Cook, Ph.D.
Distinguished Professor of Chemistry
University of Wisconsin-Milwaukee

When did you attend your first Mona Symposium?
I attended my first Mona Symposium in January 1974 at the invitation of Basil Burke and Trevor Yee.

What was the experience like?
It was a great symposium where I met Ulrich Weiss and on the bus to University Beach we laid out our plans for a study of his new reaction, now termed the Weiss-Cook reaction. Many people continue to use it to make five-membered ring compounds.

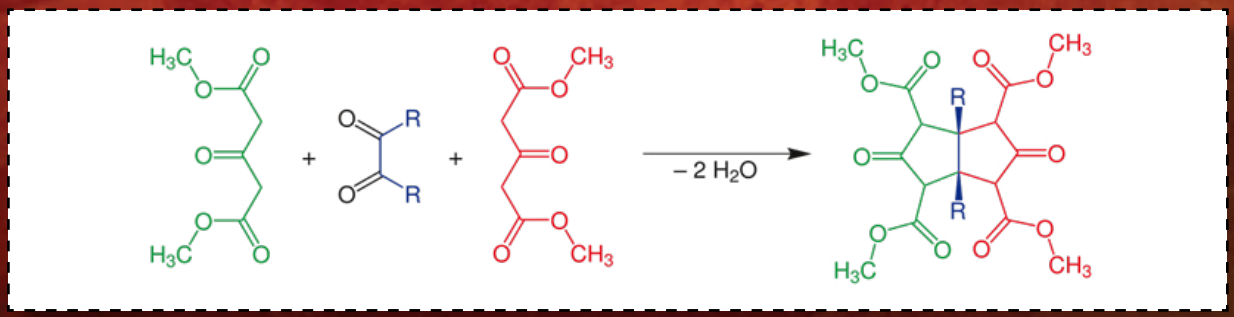
What do you find unique about this conference?
This Mona conference always has had ten to twelve great plenary speakers who are doing cutting edge science and they are from all over the world. The poster sessions and social events are small enough that you can become acquainted with a number of new people, many of which I have later collaborated with.

In addition, as a young scientist, I met famous scientists from around the globe with the perfect opportunity to talk to them. Furthermore, the people in Jamaica are extremely friendly and the Chemistry Department hosts must be the best, or among the best in the world. I have always learned a great deal of new chemistry and had a terrific time as well.

What are your most memorable moments at the Mona Symposium?
In addition to meeting Ulrich Weiss, I fondlyrecall sitting at lunch at the SCR (visitors lodge), and Harry Wasserman came over and sat with me. He said, "I hear you are a new Assistant Professor". After I replied "yes", he spent the next 30 minutes explaining to me how to submit papers, how to rebut referees without offending them and how to write/talk to Editors. Harry did not know me from Adam, but I have successfully used what he taught me for over 40 years. Moreover, I later was lucky enough to collaborate with him years later on his singlet oxygen work.

The networking lunches at the SCR (visitors lodge) have been instrumental in collaborations and friendships which have lasted since 1974 with UWI scientists, and others from all parts of the globe. In the early years Basil Burke, David Cane, Steve Gould, Peter Jacobi and I would take a car and do a three day tour around the island. While at the meeting every time there was a party the graduate students would keep us out dancing until 4:00AM in the morning. It was great because the Jamaican women dance so well, no one even noticed the North Americans stumbling around falling all over ourselves. I have been in many of the homes of the faculty at UWI over the years and have always been made to feel like family. When I come back to JA, it's like coming home, with so many friends here. It's a great island, a great people and a great Department, which continues to do well, even in the midst of all those hurricanes. See you in 2018!

The Weiss-Cook Reaction



Wikipedia.com

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This Winter Tourist Season 2015/2016 is a significant one. The Tourism Enhancement Fund marked Caribbean Tourism Month in November while celebrating ten years of preserving and enhancing Jamaica's tourism product.

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Graphical Timeline/History of Natural Products and Medicinal Chemistry research at Mona

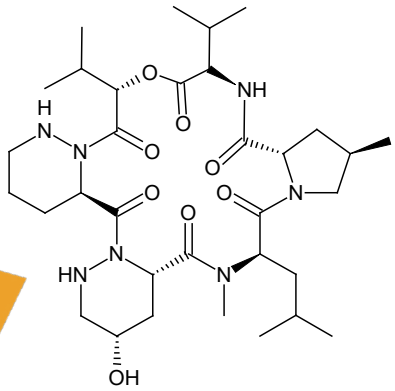
(1966-2016)

Pre-Mona Symposium
The Early Years: (1948-1966)

The Journey begins...
Major emphasis on Natural Products from local plants- Research of local significance.

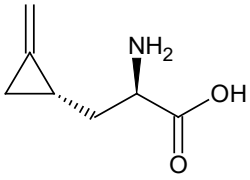
1948

Prof. Cedric Hassall
Pioneered work in Natural Products Research in the Department of Chemistry, UWI, Mona.



1955

The Ackee Story:
Discovery of **Hypoglycin A** lowers blood sugar levels, and cause of vomiting sickness from consuming unripe ackee.

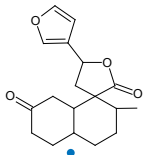


1958

A New Antibiotic Unearthed!
Discovery of the new cyclodepsipeptide antibiotic **Monamycin** from *Streptomyces jamaicensis* which led to the development of the drug Cilazapril (Inhibase/Roche) which is still being used for the treatment of hypertension.

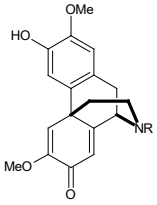
Chester R. Willis

Isolation and structure elucidation of **Crotonin**, a 2-keto-norditerpenoid isolated from *Croton lucidus* L. (Basket hoop)



Dorothy Y. Byfield

New Morphinandienone alkaloids from *Croton flavens* L. Flavinantine (R = Me) and Flavinine (R = H)

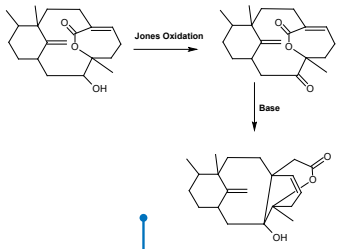


David A. McNeil

Isolation and synthesis of two new glutarimide peptides from *Croton humilis* L. Acid hydrolysis yielded R-(-)-2-methylbutanoic acid, L- (+)-glutamic acid and phenyl ethyl amine. This is the first report of R-(-)-2-methylbutanoic acid from a natural product.

Vidya A. Honkan

Transannular Cyclization reaction uncovered for the oxidation product of Cleomeolide from *Cleome viscose* L. which leads to compounds with modified taxane nucleus ("neotaxane")

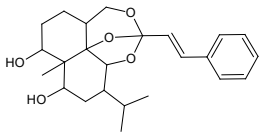


1966 | 1968 | 1970 | 1973 | 1975 | 1980 | 1981

Thaldasine and **Thalrusine**- Novel cyanides isolated from the plants *Thalictrum dasycarpum* and *Thalictrum nigosin* respectively- possesses a CN group which is not bound as a cyanohydrin.

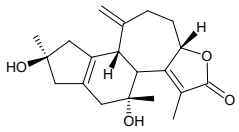
David A. Lee

Rupestrol from *Verbesina rupestris*- The first totally characterized eudesmane with an oxygen functionality at C-9.



Vernon G. S. Box

A novel tricarbocyclic ditertpenoid Crotofolin A isolated from *Croton corylifolius.*



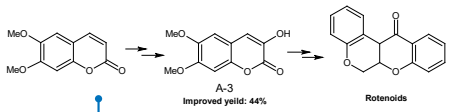
Errol C. Prince

Two new furanditerpenes of the class caesalpins- **Caesalpin F** and **Caesalpin G** isolated from *Caesalpinia bonducella* (Nichol). Seed extract used in Jamaica for hypertension and diabetes

Keith O Pascoe

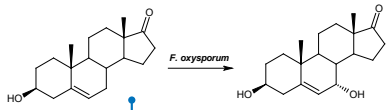
Yvette A. Jackson

Improved synthesis of 3-hydroxy-6,7-dimethoxycoumarin- an important intermediate towards the synthesis of rotenoids.



Maureen R. Wilson

The first report of bioconversion of steroids using the fungus *Fusarium oxysporium* f. sp. *cubense* – **Oxidation Reactions**



Evon A. Bolessa

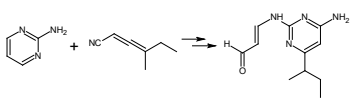
A new method for the synthesis of allenic anilides via the reaction between the aniline Grignard reagents and the allenic esters- **Potential new pesticides!**

Greg O. Buchanan

Bioconversion of the sesquiterpene cadina-4,10 (15)-dien-3-one isolated from *Hyptis verticillata*, with Beavena bassianna ATCC 7159 produces novel sesquiterpenes with phytogrowth inhibitory activities against *Raphanua sativa* L. (radish seeds) and insecticidal activities against *Cylas formicarius elegantus* (sweet potato weevil).

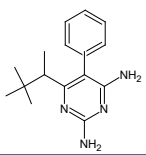
1983 | 1987 | 1989 | 1990 | 1993 | 1998 | 2000

Synthesis of novel pyrinidyl aldehydes from 2-aminopyrinidine and allenic nitriles



Andrew L. S. Johnson

The synthesis of a 6-alkyl-2,4-diamino-5-phenyl-pyrinidine- **A Potential Antimalarial!**



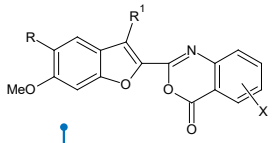
Ralph R. Roberts

Isolation and characterization of 6 new prenylated benzphenones (Plukenetione B-G). Plukenetione E acetate exhibited antibacterial activity against *E. coli* and *S. pyogenes* as well as mosquitocidal activity against *Aedes aegyptii.*

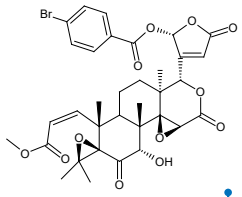
Geneive E. Henry

Karla-Sue C. Marriott

Synthesis of six novel 3,1-Benzooxazin-4-ones. 3,1 Benzooxazinones are potent serine protease inhibitors and potentially useful in combating viral infections such as herpes simplex type 1.

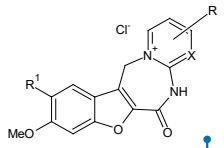


Isolation of a novel seco-ring A-protolimonoids isolated from *Spathelia sorbifolia*



Julie-Ann A. Grant

Synthesis of a potential antidepressant with anticholinergic effects- Tetra cyclic -1,3-diazepinum chlorides. Allylic bromination of methoxy carboxamides followed by chloride exchange and subsequent cyclization.



Andrea M. Goldson

The triglyceride 1,2-dioleylpalmitin from the arilli of *Blighia sapida* (ackee) displays insecticidal activity of against *Cylas* sp. (sweet potato weevil)

2001 | 2002 | 2003 | 2005 | 2007 | 2008

Avril R. M. Chen

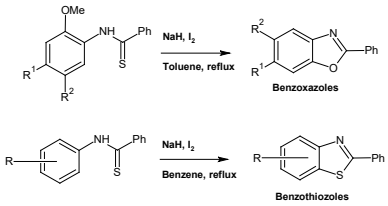
The utility of fungal cells as reusable biological agents for biotransformation. Immobilization of fungal cells employs entrapment in an inert matrix such as calcium alginate which can be reused and are stable in organic solvents.

Glenroy D. Martin

Investigation of the active sites of a cytochrome P450 enzyme system of the fungus *Rhizopus oryzae* ATCC 1145- **Predicting sites of hydroxylation**

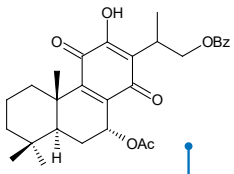
Nadale K. Downer-Riley

A novel reaction of thiobenzamides with iodine to give Benzothiazoles and Benzoxazoles



Duanne A. C. Biggs

A novel abietane diterpene isolated from the roots of *Hyptis verticillata* displayed insecticidal activity against *Cylas* sp. (sweet potato weevil)

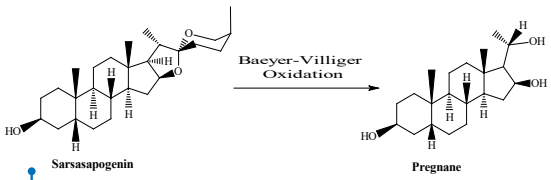


Andrew L. C. Morris

Using Heck conditions to prepare a novel tetracycle 12-chloro-10-methoxy-6H-chromeno [3,4,6] quinoline.

Toni A. Johnson

One-pot Baeyer-Villiger Oxidation of spirostanes as a potential route to more valuable steroids.



2008 | 2010 | 2012 | 2015

Patrice C. Peart

A novel method for immobilizing (entrapment) of filamentous fungi which can be used for mixed culture biotransformation of terpenes in a non-nutrient medium (water only)- **PATENT PENDING!**

Oscene V. Barrett

Development of new methodologies and reactions for the synthesis of benzo-bisazoles and their analogues from thiocarbonyls.

The tradition of excellence continues...

Blast From The Past Flashback Pictorial

The first conference in 1966!

THE DAILY GLEANER, WEDNESDAY, JANUARY 3, 1968.

THE MINISTER of Finance and Planning, the Hon. Edward Seaga declaring open the Second Natural Products Symposium which began yesterday at the Department of Chemistry at the U.W.I. At left is the Vice-Chancellor of the U.W.I. Sir Philip Sherlock, and at right Prof. L. J. Haynes, Dean of the Faculty of Science who was chairman.

At Natural Products Symposium

Seaga urges new areas of research for banana, coconut

The Minister of Finance and Planning, the Hon. Edward served, and as a result the Government had to seek supplies bred. He also mentioned jackfruit, which he said, had

The second conference in 1968

Chillin' on the beach

Jerking chicken on Lime Cay- Chemists are the best cooks!

1984-Conference Attendees

1992-Conference Attendees

2000-Conference Attendees

2014-Conference Attendees

Rising Stars

Over the years, the Department of Chemistry, UWI has produced over 100 graduates with higher degrees in the areas of Natural Products and Medicinal Chemistry. Many have gone on to hones their skills in industry, locally and abroad; while others have transitioned to a career in academia. Let us hear from some of our more recent graduates- Our Rising Stars!

Geneive E. Henry, Ph.D
Professor
Department of Chemistry
Susquehanna University

What is your current area of research?
My research is primarily focused on the isolation and characterization of biologically active natural products from plants, which was also the focus of my PhD studies at UWI, Mona. My current projects involve the discovery of acylphloroglucinol derivatives and resveratrol oligomers from Hypericum (Guttiferae family) and Carex (Cyperaceae) species, respectively.

How did your time at UWI, Mona prepare you for your current position?
I have completed postdoctoral training at Harvard University and Michigan State University. While these opportunities aided significantly in my professional development, it was my time at UWI, Mona that most effectively prepared me for my role as a Chemistry professor at a small predominantly undergraduate university (PUI). At UWI, there were budget and other constraints, which allowed us to find creative ways to move our research projects forward. Despite similar constraints at a PUI, I've been able to "accomplish much with little".

What advice would you give to graduate students/young scientists?
I offer the following advice based on my own journey as a scientist. In the current economy, one is tempted to approach graduate studies with a specific strategy in mind to get become successful. While that is a worthy goal, the key is to become involved in an area of research that will still excite you after two decades. Only then will you be able to instill a love and passion for science in the next generation. One can never understand the excitement I still feel at getting a package of dried "bush", and the anticipation of discovering what natural products are contained in this plant. My current students are able to share in the sense of accomplishment when we solve the structure of a new natural product!

What is your most memorable moment at the Mona Symposium?
I have many fond memories of the Mona symposium, but my most memorable experience came during the 1998 meeting. That meeting marked a pivotal turn in my professional life. During the day trip to Lime Cay, I was offered a postdoctoral fellowship to California Institute of Technology. Three months later, on the day I defended my PhD thesis, I learned that my future PI would be moving his lab to Harvard University.

Karla-Sue Marriott, Ph.D
Associate Professor
Forensic Science Program Coordinator
Savannah State University

What is your current area of research?
My research goal is to contribute to the development of therapeutic agents for use in treating immune and neurodegenerative disorders as well as cancer via interdisciplinary collaborative research. Hopefully this work will contribute to a better understanding of the biochemical mechanisms involved in CNS disorders. I have collaborated on NASA research that was launched into Space on the Space-X 3, Falcon 9 Rocket's Dragon Capsule, eventually docking at NASA's International Space Station (ISS) in 2014. On board this capsule, the mission included the NASA University Research- 1 (UR-1) team's groundbreaking student-based research, focused on the development of benzofuran carboxylic acid derivatives designed for immune system augmentation, restoration of immune cell functions and inhibition of cancer initiation and growth.

How did your time at UWI, Mona prepare you for your current position?
My time at UWI especially as a graduate student in the chemistry research lab under the mentorship of Professor Yvette A. Jackson prepared me to be a motivated, creative and disciplined scientist with a good work ethic. I was told by my lab-mates from day one, never say " I don't have anything to do". I had fun in graduate school at UWI and other students in the lab with me were like extended family. We challenged each other to be better chemists in a healthy civilized manner. Our professors were good examples of how to conduct research with integrity and high ethical standards. Now as a university professor and researcher at Savannah State University, I try to pass this on to my own undergraduate researchers.

What advice would you give to graduate students/young scientists?
Be secure in the fact that you have been gifted world-class education at the University of the West Indies (UWI) from a diverse f aculty of professors. You are prepared for competition anywhere in the world. Do not put limitations on yourself but remain humble. Be creative, take calculated risks grounded in reality and most of all think long-term about your impact on society and the world around you.

What is your most memorable moment at the Mona Symposium?
My most memorable moment at the Mona Symposium was my first oral presentation as a graduate student at the symposium. Professor John W. Huffman from Clemson came and spoke with me after my presentation, and that simple interaction eventually led to me conducting post-doctoral research with him in his research group at Clemson University. And the rest, as they say, is History!

Greg Buchanan Ph.D.
Senior Scientist
Amyris Inc.

What is your current area of research?
I am currently working at Amyris Inc. where we are developing no compromise renewable chemicals for use in fragrance, flavors, skincare, fuels and polymeric materials. My role is to provide scientific expertise in process development and technology transfer that enables the production of quality products.

How did your time at UWI, Mona prepare you for your current position?
My first year and a half of graduate study at UWI was filled with many disappointments that almost cause me quit graduate school. However, those challenging times have help me to stay focus in times of adversity. It has also taught me that hard work and persistent really do pay off.

What advice would you give to graduate students/young scientists?
Never be afraid to take on challenging or difficult projects. It is very important to stay abreast of current literature in your area of research.

What is your most memorable moment at the Mona Symposium?
My most memorable moment at the Mona Symposium at was in 2000 while attending an oral presentation given by Professor Bill Fenical. His talk immediately sparked my interest in the area of marine natural products and later led to me pursuing a post-doctoral studies at the Scripps Institute of Oceanography.

Navindra P. Seeram, Ph.D.
Associate Professor
Bioactive Botanical Research Laboratory,
The University of Rhode Island

What is your current area of research?
The identification of bioactive compounds from medicinal plants and medicinal foods to discover new preventive and/or therapeutic agents for inflammatory mediated diseases.

How did your time at UWI, Mona prepare you for your current position?
Apart from the (astute) scientific training, my time at Mona honed my 'team-building' skills which are critical in my current position.

What advice would you give to graduate students/young scientists?
Similar to natural products which impart a (potentially) competitive advantage to the producing organism, my advice to young scientists is to find a 'niche' within your scientific discipline to give yourself a competitive advantage in a changing work environment-whether your future career goals are academe, industry, or otherwise. This is especially relevant given the increasing difficulty for young chemists to secure jobs in a global economy with a fast evolving (and revolving) work environment where specialization is key and 'working in a team' is a must.

What is your most memorable moment at the Mona Symposium?
I believe that the networking and notoriety of the Mona Symposium 'opened doors' for several of my 'Mona batch-mates" and I to secure jobs in the United States (just as one example) that would not have been possible otherwise. So for me, the most memorable moments were the social events!

Wayne W. Harding, PhD
Associate Professor
Hunter College
City University of New York

What is your current area of research?
My current research focuses on the synthesis and evaluation of compounds with central nervous system (CNS) activity, particularly as ligands for dopaminergic, serotonergic, adrenergic and sigma receptors. Such compounds may serve as valuable tools as well as leads for optimization as therapeutics for neuropsychiatric disorders and drug abuse.

How did your time at UWI, Mona prepare you for your current position?
I was a student at UWI Mona for 8 years - 3 as an undergrad and 5 as a graduate student. I had absolutely amazing teachers as an undergrad - especially for Organic Chemistry which made me develop a passion for the subject. As I lecture in the classroom today, I think back to those days when I was a student at UWI and I try to pass on some of that magical inspiration to my students. During my PhD I worked on isolation, characterization and semi-synthetic studies on natural products, and this developed my hands-on laboratory skills and knowledge in the natural product chemistry arena. Most of the projects that I am working on now utilize natural products as CNS receptor ligands, and the knowledge that I acquired during my doctoral studies is fundamental to my current projects. There are several other aspects of my doctoral studies at UWI that have prepared me for my current position, some of which may be difficult to measure but are undoubtedly significant. For example, my PhD experience taught me how to think and write like a scientist, how to approach solving problems as an individual and as a team, and the power of persistence.

What advice would you give to graduate students/young scientists?
Work hard - persistently and patiently persevere. Keep current with the literature. Take charge of your projects from day one - you need to become "the" expert on whatever it is you are working on. Publications are going to be key for your post graduate career transition, particularly for an academic career. While you immerse yourself in your projects, try to think about what experiments you need to do in order to get your work published.most memorable moments were the social events!

What is your most memorable moment at the Mona Symposium?
The highlight of the symposium for me was going to Lime Cay. It was always great fun to meet and interact with the attendees in a less formal atmosphere, aided of course by hearty libations of Red Stripe beer.

Scientific Programme

MONDAY, JANUARY 4

Morning

8:30 - 9:00	Completion of Registration	
9:00 - 9:30	Opening Ceremony and Announcements	
	Opening Remarks: & Welcome	Dr. Jeanese Badenock (Chairperson) Department of Biological and Chemical Sciences, UWI, Cave Hill
	Greetings:	Prof. Dale Webber - Pro-Vice Chancellor, Graduate Studies and Research
		Dr. Roy Porter - Head, Department of Chemistry, UWI, Mona
	Key Note Address:	Prof. Ishenkumba Kahwa - Deputy Principal, UWI Mona
	Announcements:	Prof. Paul Reese - Dean, Faculty of Science and Technology, UWI, Mona
9:30 - 10:30	**Plenary Lecture #1:**	Robert Capon *"Natural Products Inspiring Future Medicines"*
10:30 - 11:00	COFFEE BREAK	
11:00 - 12:00	**Plenary Lecture #2:**	**Nicola Pohl** *"Development of Methods for the Automated Synthesis of Oligosaccharide Libraries"*
12:00 - 12:30	**Short Paper #1:**	**James Cook** *"Enantiospecific, Stereospecific Total Synthesis of a Series of C-19 Methyl Substituted Sarpagine/ Macroline Indole Alkaloids via an Efficient Method of Copper-Mediated Enolate Driven Cross-Coupling Process"*
12:30 - 2:00	LUNCH BREAK	

Afternoon

	Chairperson:	Professor Yvette Jackson - The University of the West Indies, Mona
2:00 - 3:00	**Plenary Lecture #3:**	Russell Kerr "Accessing Natural Products from Cryptic Biosynthetic Pathways"
3:00 - 3:30	**Short Paper #2:**	Shawntae Rodney "The Application of Pregelatinized Starch Extracted from Artocarpus altilis Parkinson Fosberg) (Breadfruit) as a Direct Compression Binder in Tablets"
3:30 – 4:00	COFFEE BREAK	
4:00 – 5:00	**Plenary Lecture #4:**	Gregory Dudley "High-Value Alkynes in the Synthesis of Marine Natural Products"
5:00 – 5:30	**Short Paper #3:**	John Schaus "The Discovery and Use of Positron Emission Tomography (Pet) Ligands to Image Cannabinoid-1 (cb1) Receptors in Humans"
5:30 – 6:00	**Short Paper #4:**	Greg Buchanan "Challenges Associated with the Use of Bio-Derived Farnesene in the Chemical Synthesis of Squalane"

TUESDAY, JANUARY 5

Morning

Chairperson: Dr Peter Ruddock - Petroleum Corporation of Jamaica

9:00 - 10:00	**Plenary Lecture #5:** Hirokazu Kawagishi - *"Fairy Chemicals A Candidate for a New Family of Plant Hormones and for New Agrochemicals"*

10:00 - 10:30 **Short Paper #5:** Glenroy Martin - *"Experimental and Theoretical Studies of Aromatase Inhibitors Derived from Formestane"*

10:30 - 11:00 COFFEE BREAK

11:00 - 12:00 **Plenary Lecture #6:** William Gerwick - *"Orthogonal Natural Product Studies of the Jamaican Marine Cyanobacterium Moorea Producens JHB"*

12:00 - 12:30 CONFERENCE PHOTO

12:30 - 2:00 LUNCH BREAK

Afternoon

Chairperson: Gregory Buchanan - Amyris Biotechnologies

2:00 - 2:30 **Short Paper #6:** Denise Tulloch - *"Research into the Economics of Locally Grown Castor and Jatropha as Agroenergy Crops, and their Conversion to Biodiesel for Use in the Transport Sector"*

2:30 - 3:30 **Plenary Lecture #7:** Erin Carlson - *"Exploring the Master Regulators of Microbial Behavior"*

3:30 - 4:00 **Short Paper #7:** Sanjay Campbell - *"Brown Algae Stypopodium zonale as a Source of Bioactive Natural Products"*

4:00 – 5:15 POSTER SESSION

5:30 – 7:30 PUBLIC FORUM

THURSDAY, JANUARY 7

Morning

Chairperson: Dr Andrew Lamm - University of Technology, Jamaica

9:00 - 10:00 **Plenary Lecture #8:** James Gloer - *"Coprophilous and Fungicolous Fungi: Underexplored Frontiers in Antifungal Discovery"*

10:00 – 10:30 **Short Paper #8:** Eric Helms - *"Determination of the Carotenoid Content of Wild Autumn Olive (Elaeagnus umbellata) from Western New York State"*

10:30 - 11:00 COFFEE BREAK

11:00 – 12:00 **Plenary Lecture #9:** Kazua Nagasawa "Chemistry in Saxitoxin, a Paralytic Shellfish Toxin"

12:00 – 12:30 **Short Paper #9:** Sharna-kay Daley - *"Oxidative Dimerization of Benzene and Naphthalene Derivatives: A Concise and Effective Route to Bioactive Natural Products"*

12:30 - 2:00 LUNCH BREAK

Afternoon

Chairperson: Dr Julie-Ann Grant - The University of the West Indies, Mona

2:00 – 3:00 **Plenary Lecture #10:** Robert Williams - *"Enantiomeric Natural Products: Biosynthetic, Synthetic and Genetic Revelations"*

3:00 – 3:30 **Short Paper #10:** Mathew Muzi Nindi - *"Challenges of Isolation and Profiling of African Medicinal Plants: Analytical Prospective of Standardization and Quality Control Methods"*

3:30 – 4:00 **Short Paper #11:** Ramakwala Christinah Chokwe - *"Methodology Development of Quality Control, Quality Assurance and Standards for Moringa oleifera Seeds"*

4:00 – 5:00 **Plenary Lecture #11:** Raymond Anderson - *"Discovery of Bioactive Natural Products"*

5:00 – 5:30 **Short Paper #12:** Vusi W. Masilela - *"Isolation of Secondary Metabolites from Dicoma anomala subsp.gerrardii"*

Abstracts of Plenary Lectures & Short Papers

Plenary Lecture #1

NATURAL PRODUCTS: INSPIRING FUTURE MEDICINES

Robert J. Capon1

1Division of Chemistry and Structural Biology, Institute for Molecular Bioscience,
University of Queensland, St Lucia, QLD, Australia
email: r.capon@uq.edu.au

To maintain and improve the quality of life offered by modern healthcare and agriculture requires an ongoing commitment to the development of new therapeutics, to improve and replace those that have become less effective, and to bring to the community safer treatments for an ever-wider array of important diseases. Irrespective of the specific need, the discovery pipeline is critically dependent on access to diverse, high quality molecular libraries. A poor choice of chemistry leads to wasted effort and resources, and no new products! Historically the pharmaceutical and agrochemical industries have relied heavily on natural products, which represent an extraordinarily diverse, pre-assembled pool of biologically active molecules, programmed by evolution to be potent and selective modulators of key biopolymers, cells, tissues, organs, and living systems (plants, animals and microbes). Knowledge of nature's biosynthetic equivalent to "intellectual property" reveals privileged molecular structures that inform and inspire modern discovery, re-purposing ecological advantage for pharmaceutical and agrochemical benefit. This presentation will use selected case studies from the authors laboratory to illustrate how a program of marine and microbial biodiscovery can target future treatments for pain (i.e. isoform selective GlyR potentiators), cancer (i.e. inhibiting K-Ras and P-gp) and infectious diseases (i.e. tuberculosis), and how these studies can simultaneously advance our understanding of basic science, and deliver new protocols that enhance modern biodiscovery.

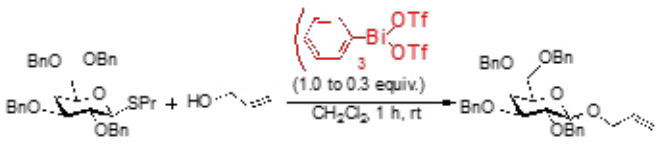
Plenary Lecture #2

DEVELOPMENT OF METHODS FOR THE AUTOMATED SYNTHESIS OF OLIGOSACCHARIDE LIBRARIES

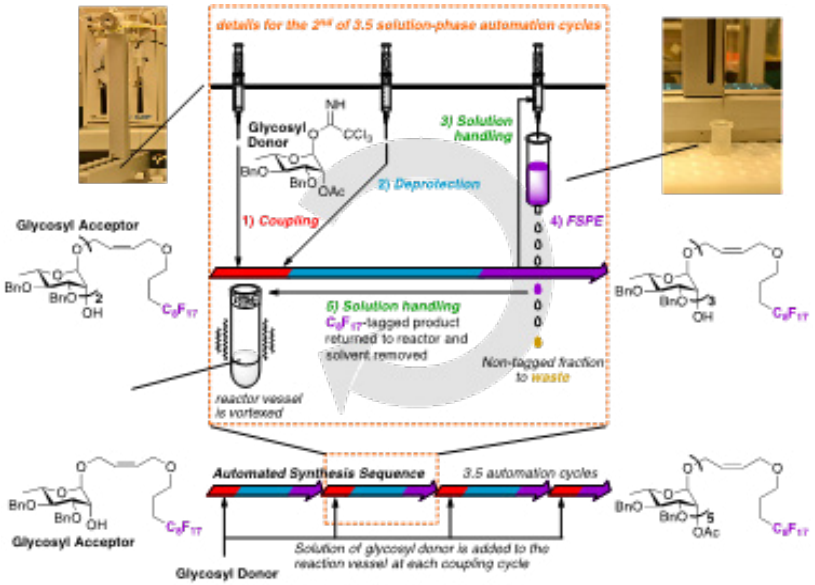
Nicola L. B. Pohl, Manibarsha Goswami, Daniel Kabotso, Keevan Marion, Nishad Thambanchandrika, Gisun Park, and Alyssa Pirinelli

Department of Chemistry, Indiana University-Bloomington, Bloomington, IN 47405 USA
Departments of Chemistry and Chemical and Biological Engineering, Iowa State University, Ames, IA 50011 USA
email: npohl@indiana.edu

Many advances in understanding the role of carbohydrates in biological systems are stalled by the lack of diverse and chemically well-defined glycan structures. For automation to play as vital a role in the synthesis of oligosaccharides as it currently does in peptide and nucleic acid production, the major bottleneck of building block access must be surmounted. One way to shorten the synthesis of the required monomers is by the use of thioglycosides, since the anomeric thiol linkage can be carried through a variety of protection/deprotection reactions to selectively block the remaining hydroxyl functional groups prior to activation of the sulphur linkage.



Unfortunately, thioglycoside activation procedures either are not inert to the alkenes contained in our fluorous linker1 used to automate the iterative oligosaccharide synthesis or require a mixture of activating reagents that make the method less amenable to automated liquid handling protocols. We discovered that a pentavalent bismuth compound could circumvent these issues, however, and successfully activate a thioglycoside.2 Preliminary data show that a solution of this activator can also be used for the automated synthesis of a glycosyl linkage on our automated solution-based oligosaccharide platform3-4 to complement our current strategy outlined below using Schmidt trichloroacetimidate chemistry.



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3. Pohl, N. L. Automated Solution-Phase Oligosaccharide Synthesis and Carbohydrate Microarrays: Development of Fluorous-Based Tools for Glycomics. In Chemical Glycobiology; Chen, X.; Halcomb, R.; Wang, G. P., Eds. ACS Symposium Series 990; American Chemical Society: Washington, DC, 2008,

Short Paper #1

ENANTIOSPECIFIC, STEREOSPECIFIC TOTAL SYNTHESIS OF A SERIES OF C-19 METHYL SUBSTITUTED SARPAGINE/MACROLINE INDOLE ALKALOIDS VIA AN EFFICIENT METHOD OF COPPER-MEDIATED ENOLATE DRIVEN CROSS-COUPLING PROCESS

James M. Cook and Md Toufiqur Rahman

Department of Chemistry & Biochemistry, University of Wisconsin-Milwaukee
Milwaukee, WI-53211, USA
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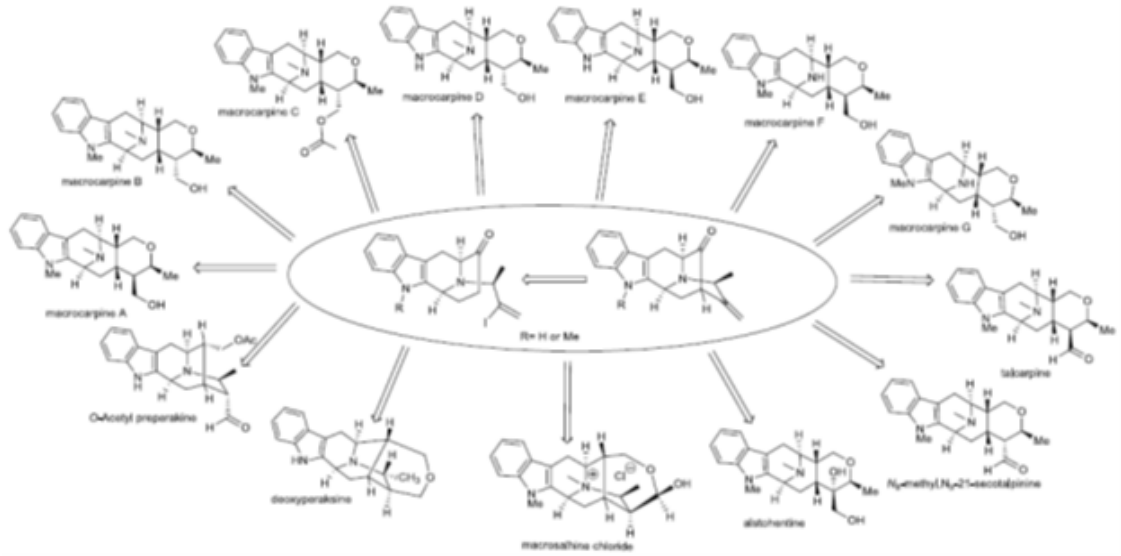
The enantiospecific, stereospecific total synthesis of a series of C-19 methyl substituted sarpagine/macroline indole alkaloids have been completed. A diastereospecific asymmetric Pictet-Spengler reaction, stereospecific Dieckmann cyclization and transition metal mediated enolate driven regiospecific cross-coupling has been employed. An expensive palladium-catalyzed cross-coupling (60-68%) has been replaced by a cheap copper (I) iodide mediated enolate driven cross-coupling (86-89%) to access the key pentacyclic ketone intermediate. The first enantiospecific total synthesis of a number of alkaloids of this series will be discussed. If time allows, the first total synthesis of the oxindole alkaloids (-) macrogentine and (+)-N(1)-demethylalstonisine will be presented.



Scheme 1: Some C-19 methyl substituted sarpagine/macroline indole alkaloids.

Plenary Lecture #3

ACCESSING NATURAL PRODUCTS FROM CRYPTIC BIOSYNTHETIC PATHWAYS

Russell Kerr

Department of Chemistry and Department of Biomedical Sciences, Atlantic Veterinary College, University of Prince Edward Island
email: rkerr@upei.ca

While natural product discovery programs have had enjoyed many successes there are significant challenges that hamper current efforts. One primary issue is the growing frequency of the discovery of known natural products. A second concern is our limited ability to access the vast untapped potential hidden in cryptic biosynthetic pathways. The presentation will review our current efforts to combat these issues. Specifically, the talk will discuss our generation of a diverse and relevant microbial library, a metabolomics method (based on UHPLC-HRMS) to assess targeted and untargeted natural product discovery, and the use of novel induction methods to identify cryptic natural products.

Short Paper #2

THE APPLICATION OF PREGELATINIZED STARCH EXTRACTED FROM ARTOCARPUS ALTILIS PARKINSON FOSBERG) (BREADFRUIT) AS A DIRECT COMPRESSION BINDER IN TABLETS

Shawntae Y. Rodney, Amusa S. Adebayo and 2Cliff K. Riley

College of Health Sciences, University of Technology, Kingston 6, Jamaica, W.I.
Scientific Research Council, Kingston 6, Jamaica, W.I.
College of Pharmacy, Roosevelt University, Illinois, U.S.A.

Direct compression is the preferred method of manufacturing tablets. However, native starch, commonly used as disintegrant, binder and/or filler, tends to possess poor intrinsic compressibility. This makes it less suitable as a direct compression ingredient. With physical and chemical modifications, key physical properties of native starch may be altered, enabling the extension of its utility.

Breadfruit provides a cheap source of high quality native starch. Controlled heating at 65 C was applied to an aqueous suspension of native breadfruit starch (NBS) to produce pregelatinized breadfruit starch (PBS). The fundamental and derived properties as well as compactibility of PBS were evaluated with metronidazole, a drug of poor inherent compressibility, as a model drug active ingredient. The crushing strength, friability, disintegration time and dissolution profiles of metronidazole tablets were used to assess the effect of PBS as a direct compression binder at 20% concentration. Significant ($p<0.05$) differences between the fundamental and derived properties of NBS and PBS were observed. Further, the compression characteristics of NBS, PBS, native corn starch (NCS) and commercial pregelatinized starch (CPS) were compared by assessing the crushing strength of their compacts compressed from 9.8 to 39.2 kN. Compact hardness increased in the order NCS<NBS<PBS<CPS. Assessment of the strength of the compacts made after varying compression and lubricant mixing times revealed that NBS and PBS showed plastic deformation, while NCS and CPS exhibited more elastic deformation. Metronidazole tablets containing PBS binder had a higher mean crushing strength and lower friability than those containing CPS binder. The disintegration time was higher with PBS binder than with CPS binder. Peak dissolution (96%) occurred within 30 minutes with CPS binder while peak dissolution (91%) occurred within 10 minutes with PBS binder. Both binders met Pharmacopoeia requirements for immediate release tablets, suggesting that PBS may be substituted for CPS.

Keywords: breadfruit starch, tablets, pharmaceuticals, binder, direct compression

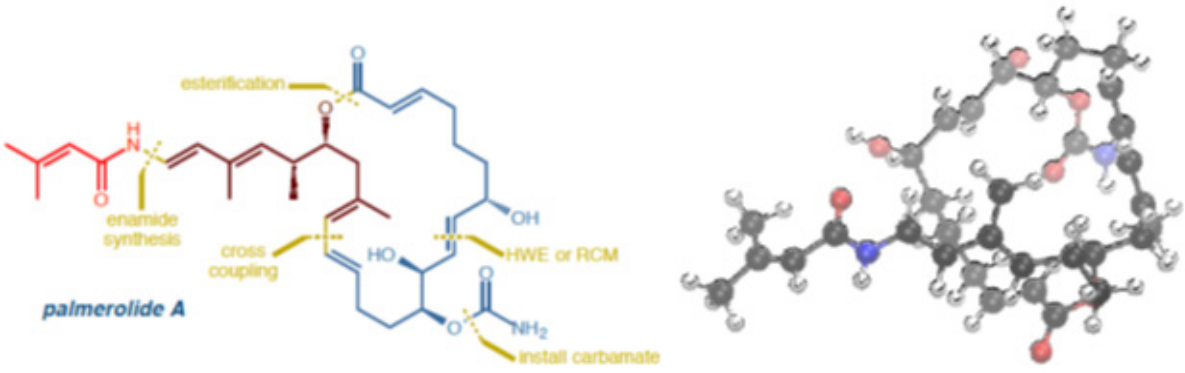
Plenary Lecture #4

HIGH-VALUE ALKYNES IN THE SYNTHESIS OF MARINE NATURAL PRODUCTS

Gregory B. Dudley

Department of Chemistry and Biochemistry, Florida State University, Tallahassee, FL 32306-4390, USA
email: gdudley@chem.fsu.edu

Invertebrate marine natural products regulate interspecies competition and survival, offering clues into how organic chemistry can modulate biological systems. Research in the Dudley Lab is designed to further the science and practice of organic chemistry. Methodology under development includes tandem nucleophilic addition / C–C bond-cleaving fragmentation reactions that generate alkynes. This research seminar will focus on applications of "alkynogenic fragmentation" methodology to the synthesis of marine natural products, including palmerolide A1, 2 and the alcyopterosins.3



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3. Hoang, T. T.; Kramer, N. M.; Dudley, G. B. Synthesis of alcyopterosin A. Manuscript in preparation.

Short Paper #3

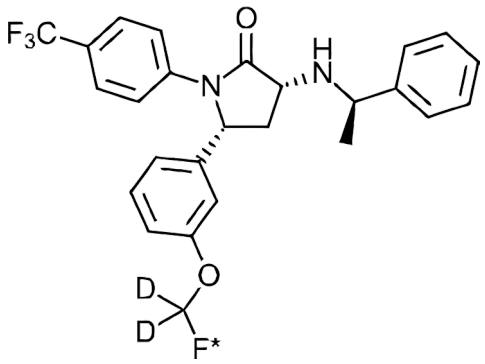
THE DISCOVERY AND USE OF POSITRON EMISSION TOMOGRAPHY (PET) LIGANDS TO IMAGE CANNABINOID-1 (CB1) RECEPTORS IN HUMANS

John M. Schaus

Department of Chemistry, Saint Olaf College, Northfield, MN 55057 USA
email: schausjm2@gmail.com

PET imaging of neurotransmitter receptors has been used to determine receptor density and drug occupancy in living subjects. However, this method is limited by the availability of PET ligands with high brain uptake and specific binding.

A rodent model was developed to determine brain uptake and specific binding following micro-dosing of potential ligands. A series of high affinity CB1 receptor ligands was evaluated to select compounds for PET studies in monkeys and two of these ligands were taken into human studies.1-3 [18F]-FMPEP-d2 was useful to determine brain receptor occupancy of a therapeutic agent and to determine the effects of chronic cannabis and alcohol use on CB1 receptor density in humans.4



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Short Paper #4

CHALLENGES ASSOCIATED WITH THE USE OF BIO-DERIVED FARNESENE IN THE CHEMICAL SYNTHESIS OF SQUALANE

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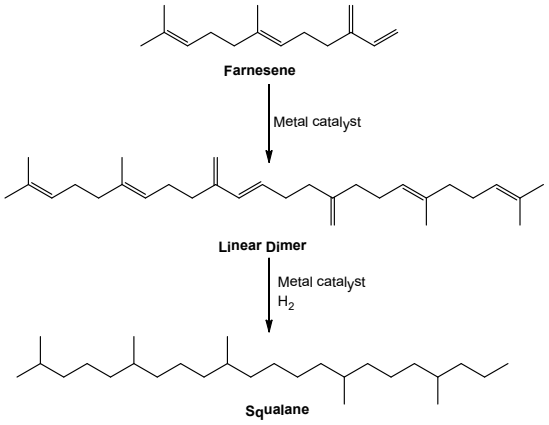
The use of biologically derived compounds as raw materials in chemical syntheses has often proven quite challenging due to the inherent lot to lot variation and changing impurity profiles. At Amyris squalane, a highly desirable emollient is produced commercially by the catalytic dimerization of farnesene, a microbial derived sesquiterpene, followed by subsequent hydrogenation. Miniaturization of the reaction and using a statistical approach to quantify the effects of know impurities led to a significant improvement in the conversion of farnesene to squalane. This has resulted in a robust production process that delivers product of consistent composition. Additionally, the detailed investigation of the cross coupling reaction has led to the establishment of data driven specifications for farnesene and significant cost reduction.



Scheme 1: Catalytic conversion of farnesene to squalane, a very high quality emollient

Plenary Lecture #5

FAIRY CHEMICALS – A CANDIDATE FOR A NEW FAMILY OF PLANT HORMONES AND FOR NEW AGROCHEMICALS –

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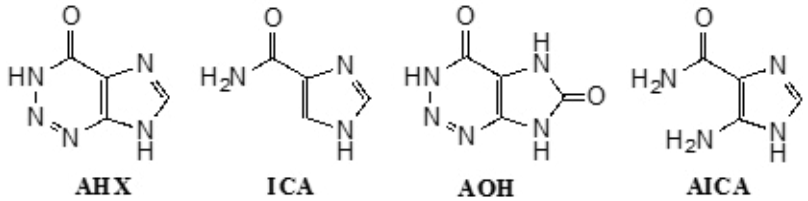
For centuries, people around the world have been mystified by the formation of rings of accelerated plant growth in woodlands and grassy fields. The rings sometimes erupt with mushrooms, adding to the intrigue. Myth led these geometric patterns of plant growth to be called fairy rings. In 2010, we discovered that the "fairy" is a plant-growth regulator, 2-azahypoxanthine (AHX).1 Furthermore, we isolated a plant growth inhibitor, imidazole-4-carboxamide (ICA), from the same fungus.2 In 2014, we reported some new findings.3 Namely, we found a common metabolite of AHX in plants, 2-aza-8-oxohypoxanthine (AOH). AHX is chemically synthesized from 5-aminoimidazole-4-carboxamide (AICA), and AHX can be converted into AOH by xanthine oxidase. AICA is one of the members of the purine metabolic pathway in animals, plants, and microorganisms. However, further metabolism of AICA had remained elusive. Based on these results and facts, we hypothesized that plants themselves produce AHX and AOH through a pathway similar to the chemical synthesis. As a result, we demonstrated the existence of endogenous AHX and AOH and a novel purine pathway to produce them in plants. In addition, these compounds increased the grain yields of wheat and rice in field experiments.4.5
and the alcyopterosins.3



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Short Paper #5

EXPERIMENTAL AND THEORETICAL STUDIES OF AROMATASE INHIBITORS DERIVED FROM FORMESTANE

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Bioconversion of the aromatase inhibitor formestane (4-hydroxyandrost-4-ene-3,17-dione) (1)1 by the fungus Rhizopus oryzae ATCC 111452 resulted in a new minor metabolite 3,5 -dihydroxyandrost-2-ene-4,17-dione (2) and the known 4 ,5 -dihydroxyandrostane-4,17-dione (3) as the major product. The structural elucidation and bioactivities of these metabolites are reported herein. Molecular modeling studies of the interactions between these metabolites and the aromatase protein3 indicated that acidic (D309), basic (R115), polar (T310), aromatic (F134, F221, and W224), and non-polar (I133, I305, A306, V369, V370, L372, V373, M374, and L477) amino acid residues contribute important interactions with the steroidal substrates. These combined experimental and theoretical studies provide fresh insights for the further development of more potent aromatase inhibitors.

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Plenary Lecture #6

ORTHOGONAL NATURAL PRODUCT STUDIES OF THE JAMAICAN MARINE CYANOBACTERIUM MOOREA PRODUCENS JHB

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Marine cyanobacteria have been one of the richest marine sources of novel and highly bioactive natural products. For the most part, they derive from the assembly of amino acids via the non-ribosomal peptide synthetase pathway, acetate units from the polyketide synthase pathway, and the inter-digitation of these two pathways to form 'hybrid' natural products. While these metabolites possess diverse biological properties, many are toxic to cells and therefore have potential applications in cancer. Indeed, one marine cyanobacterial inspired product, monomethyl auristatin E, is the warhead of an antibody-drug conjugate (ADC) which is FDA approved for the treatment of cancer. Our research laboratory has been studying the unique natural products of marine cyanobacteria for 30 years. For example, one collection of Moorea producens JHB (formerly Lyngbya majuscula) from Hector's Bay, Jamaica in August 1996, has been an exceptional source of novel bioactive compounds, such as the jamaicamides1 and hectochlorin.2 Continued study of this organism by orthogonal approaches, such as isotope feeding experiments, new methods in mass spectrometry, genome sequencing, and alternative culture conditions, have broadened our appreciation of its biosynthetic capacities.3 In total, we have isolated and characterized two additional classes of natural products from cultures of this cyanobacterium, as well as several new analogs in both of the previously characterized natural product classes. These in depth and alternative natural product investigations of M. producens JHB will be presented, and considerably expand our knowledge of the exceptional biosynthetic capacities of this marine cyanobacterium.

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Short Paper #6

RESEARCH INTO THE ECONOMICS OF LOCALLY GROWN CASTOR AND JATROPHA AS AGROENERGY CROPS, AND THEIR CONVERSION TO BIODIESEL FOR USE IN THE TRANSPORT SECTOR

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Castor and Jatropha plants produce seeds with oil contents ranging from 40 – 55%. The fatty acids contained in these seeds can be converted to biodiesel using the transesterification reaction process. The Castor bean plant, Ricinus Communis, belongs to the Euphorbiaceous family and grows wild in Jamaica. Several varieties of castor plants from Jamaica, Brazil, China and India were cultivated in local trials on marginal and mined out bauxite lands to compare their productivity and oil content and to research the economics of growing these oilseeds. The castor plant grows best on sandy or clayey loams and is tolerant to dry conditions. In addition to being a feedstock for biodiesel, castor oil has a range of pharmaceutical and cosmetic purposes. The co-products, which are shells, biomass and press cake/meal may be used as fertilizer. Bio char is also a potential bi-product.

Jatropha, Jatropha curcas, grows on a variety of soil types (marginal soils, sandy, gravely or rocky soils) but does not grow well on reclaimed mined out bauxite soils, due to the nature of the plant's root system. Jatropha adapts easily to different climates and can survive long periods of drought. Jatropha biomass and press cake/meal may be used for fertilizer or bio char. The castor and jatropha meals are both toxic, but they can be detoxified.

Over the past four years, the Petroleum Corporation of Jamaica (PCJ), an implementing arm of the Ministry of Science, Technology, Energy and Mining (MSTEM), in collaboration with the Ministry of Agriculture and Fisheries (MoAF) and the Caribbean Agriculture Research and Development Institute (CARDI) have demonstrated the relative yields of various plant varieties and assessed the economics of cultivating and harvesting these plants on 6.5 hectares of marginal and mined out bauxite lands. Researchers have identified the challenges that farmers may face in cultivating these crops as it relates to pests and diseases, animal intrusion, praedial larceny and Climate Change. The extraction and conversion of castor and jatropha oils into biodiesel was done using a four stage process. During the first stage, the oil was expelled from the seeds using a crushing plant, at the second stage, the oil was centrifuged to reduce sediments from the oil, at the third stage, the crude oil was put through an esterification process and at the fourth stage, the oil was put through the transesterification process to convert the fatty acids into methyl esters (biodiesel). This process was designed to meet the requirements of the local biodiesel standard, which is the American Society of Testing and Materials (ASTM) 6751, gazetted by MSTEM in June 2013.

Plenary Lecture #7

ORTHOGONAL NATURAL PRODUCT STUDIES OF THE JAMAICAN MARINE CYANOBACTERIUM MOOREA PRODUCENS JHB

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Although bacterial secondary metabolomes are widely explored, they remain incompletely cataloged by current isolation and characterization strategies. Mass spectrometry has made possible the assessment of crude extracts within minutes; identifying hundreds or even thousands of components from a single sample. However, significant challenges remain between the initial detection of a species of interest and full elucidation of its structure. To identify metabolites residing in unexplored chemical space, we have developed an integrated discovery approach that combines bacterial growth perturbation, accurate mass spectrometry, comparative mass spectra data analysis, and fragmentation spectra clustering for the identification of low-abundant, novel compounds from complex biological matrices. We analyzed the secreted metabolome of the extensively studied Actinomycete, Streptomyces coelicolor M145, and discovered a low-abundant suite of 15 trihydroxamate, amphiphilic siderophores. Incorporation of multi-stage MS (MSn) increases the rate of discovery of new compounds within a natural product subclass by diagnostic fragment and neutral loss comparison. We have demonstrated the importance of such analyses with the trihydroxamate siderophores. We are also working to combine fragmentation analysis with high-resolution, high-information yielding techniques like ion mobility spectrometry to decrease the time and effort required to assign natural product structures. Together, the combination of mass spectrometry, informatics and novel chemoselective enrichment reagents that we have devised create a powerful strategy to explore and interpret the molecular language used by bacteria to respond to environmental cues.

Short Paper #7

BROWN ALGAE STYPOPODIUM ZONALE AS A SOURCE OF BIOACTIVE NATURAL PRODUCTS

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The marine natural environment has provided a wealth of chemically diverse bioactive compounds. The brown algal species Stypopodium zonale from Rio Bueno on Jamaica's north coast was analyzed. Thus far seven compounds have been characterized from the Jamaican brown seaweed as Atomaric acid (1) 2-geranylgeranylbenzoquinone (2), Stypoldione (3), stypoldiol (4), fucosterol (5), Zonaquinone acetate (6), 5', and 7'-Dihydroxy-2'-pentadecylchromone(7) . The bioactivities of two of these compounds have been evaluated with known drugs. Cytotoxic activity was reported in vitro for Zonaquinone acetate against breast cancer and colon cancer cell lines at IC(50) values of 19.22-21.62 μM and 17.11-18.35 μM respectively, comparing favorably with standard treatments tamoxifen (17.22-17.32 μM) and fluorouracil (27.03-31.48 μM).

Also Cytotoxic activity was also reported in vitro for 5',7'-Dihydroxy-2'-pentadecylchromone against prostate cancer and colon cancer cell lines at IC(50) values of 12-17 μM and 40 μM respectively, comparing favorably with standard treatments Ketoconazole (38.5-43.5 μM) and fluorouracil (658.5 – 663.5μM). Therefore, this strongly suggests that marine algal natural products have great potential as prototypes for the pharmaceutical industry for use in anti-cancer drugs. In addition to isolating natural products, structural modification of the isolated metabolite towards improved bioactivity is another aspect of drug discovery. Compound 7 containing the chromone skeleton (4H-benzo-pyran-4-one) exhibited interesting biological properties and has led us to investigate methods for the synthesis and structural modification. These approaches are discussed in the study.

Plenary Lecture #8

COPROPHILOUS AND FUNGICOLOUS FUNGI: UNDEREXPLORED FRONTIERS IN ANTIFUNGAL DISCOVERY

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Fungi are among the most widespread and adaptable organisms on Earth. They are also prolific producers of unique, structurally diverse bioactive natural products, some of which have proven to be of substantial importance to human health and agriculture.1 Even so, species investigated to date represent only a small fraction of estimated fungal biodiversity, suggesting that fungi still offer considerable potential for discovery of useful natural products. At the same time, some fungi can cause human diseases, and fungal infections are among the most problematic to treat. Most clinical antifungal agents suffer from issues of toxicity and side-effects, as well as limited effectiveness and spectrum of activity, and new classes of antifungal agents are needed.2 Interestingly, some of the more important antifungal agents in use today, and a number of other excellent antifungal lead compounds, have arisen through studies of fungal chemistry. This background calls for further studies of fungi as sources of new antifungals.

A variety of issues must be considered in undertaking such work, including selection and acquisition of target fungi for screening, taxonomy, dereplication, numbers, scale, assays, and laboratory growth characteristics. In addition, emerging technologies offer opportunities to incorporate the exploitation of genomic data, with the objective of accessing products of so-called "silent" or "cryptic" gene clusters that are evident in even well-studied fungi. Approaches to this challenge are developing, but much remains to be done before its potential can be realized.

Regardless of the approach taken, identification of promising, but underexplored avenues of fungal diversity to pursue can be valuable in helping to narrow the search. We have explored fungi from several different ecological and taxonomic groups over time, and some appear to show more promise than others. Antagonistic and defensive interactions commonly occur among certain types of fungi in nature. Mycoparasitic and fungicolous fungi have a propensity to attack and colonize others, sometimes producing natural antifungal agents that damage the host.1 Coprophilous fungi inhabit an exceptionally competitive microenvironment (herbivore dung).1,3 Both of these fungal groups have been underrepresented in screening programs, but can be viewed as logical sources to explore in search of new natural products with antifungal activity. This presentation will incorporate background and rationale for this hypothesis, representative supporting results, and discussion regarding future directions for this research.

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Short Paper #8

DETERMINATION OF THE CAROTENOID CONTENT OF WILD AUTUMN OLIVE (ELAEAGNUS UMBELLATA) FROM WESTERN NEW YORK STATE

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The Autumn Olive (Elaeagnus Umbellata) is a deciduous shrub that can grow to 3.5 m tall with strongly arching branches and oval, silvery leaves. In 1830, it was brought to the United States from its native southern Europe and eastern Asia to serve as an ornamental bush, as wildlife habitat, as a windbreak bush, and to restore deforested and degraded land. The bush serves these purposes well in that it is a vigorous grower tolerating a wide variety of growing conditions, fixes nitrogen, and is not subject to herbivory by either insects or deer. Birds love its deep red, silver-flecked berries, spreading the large seeds contained in them. For all of its beneficial properties, Autumn Olive is, however, invasive and is displacing native plants. The Autumn Olive can now be found across wide areas of the eastern United States and has even been reported in the state of Hawaii. Since wild populations of the bush are likely to be impossible to eradicate, we have started to investigate the potential usefulness of the bushes that are already growing in our area. The edible berries Autumn Olive produces have been reported to have a very high carotenoid content, particularly lycopene.1 Lycopene is reported to have many benefits to human health, with current lycopene content in the typical American diet primarily coming from tomato products.2 We will compare our results of looking at the carotenoids in the berries harvested from a feral population of Autumn Olive from rural, western New York State to varieties of the bush grown in Maryland to see if geographic location affects the lycopene content of the berries.3reported in vitro for Zonaquinone acetate against breast cancer and colon cancer cell lines at IC(50) values of 19.22-21.62 μM and 17.11-18.35 μM respectively, comparing favorably with standard treatments tamoxifen (17.22-17.32 μM) and fluorouracil (27.03-31.48 μM).

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Plenary Lecture #9

CHEMISTRY IN SAXITOXIN, A PARALYTIC SHELLFISH TOXIN

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Saxitoxin (STX) is a guanidine alkaloid isolated from paralytic shellfish.1 It shows potent neurotoxicity by binding to the voltage gate sodium channel (NaVCh) similar to tetrodotoxin. The NaVCh is a transmembrane protein, and ten kinds of isoforms have been identified so far. Our group is currently focusing on the development of NaVCh-isoform selective ligands based upon the structure of STX. We have recently disclosed an efficient synthetic strategy for STX via protected saxitoxinol as a key intermediate, and variety STX analogs have been synthesized.2,3 In this presentation, synthesis of STXs and their inhibitory activity against NaVCh will be discussed.
regarding future directions for this research.

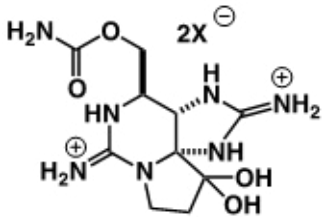

Figure 1: Structure of (+)-Saxitoxin (STX)

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Short Paper #9

OXIDATIVE DIMERIZATION OF BENZENE AND NAPHTHALENE DERIVATIVES: A CONCISE AND EFFECTIVE ROUTE TO BIOACTIVE NATURAL PRODUCTS

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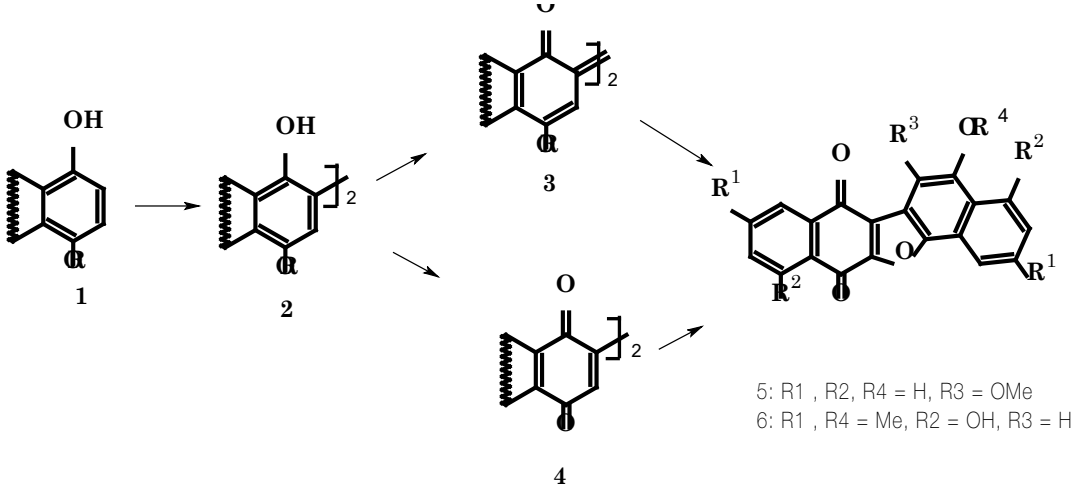
Biaryls and biquinones of types 2 and 4 respectively have been utilized in the pharmaceutical and medicinal industry. They may also act as synthetic precursors to naturally occurring bioactive compounds including balsaminone A (5) and violet quinone (6).1 The synthesis of these biaryls and biquinones is typically achieved via the oxidative dimerization of both benzene and naphthalene derivatives.2,3 However, many of the existing methods employ the use of heavy metals in tandem with oxygen.2 The new strategies developed for the oxidative dimerization of benzene and naphthalene derivatives, as well as their application to the synthesis of bioactive natural products will be presented.



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Plenary Lecture #10

ENANTIOMERIC NATURAL PRODUCTS: BIOSYNTHETIC, SYNTHETIC AND GENETIC REVELATIONS

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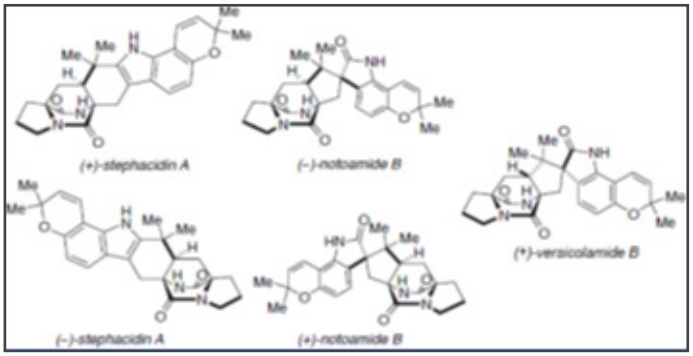
In Nature, chiral natural products are usually produced in optically pure form; however, on occasion Nature is known to produce enantiomerically opposite metabolites. These enantiomeric natural products can arise in Nature from a single species, or from different genera and/or species. Extensive research has been carried out over the years in an attempt to understand the biogenesis of naturally occurring enantiomers, however, many fascinating puzzles and stereochemical anomalies still remain. Our laboratory, in collaboration with Prof. Sachiko Tsukamoto's laboratory at Kumamoto University and Prof. David H. Sherman's laboratory at the University of Michigan, have been particularly interested in the biosynthesis of prenylated indole alkaloids, such as the Paraherquamides, Malbranchemaides, Notoamides and Stephacidins which share a common bicyclo[2.2.2]diazaoctane core. It is believed that this ring system arises biosynthetically, via an intramolecular Diels-Alder type of cycloaddition of an unactivated isoprene-derived vinyl group with an azadiene species generated from the cyclo-didpeptide progenitors. We have successfully completed total syntheses of Brevianamide B, Paraherquamide A, Paraherquamide B, VM55599, Pre-paraherquamide, Stephacidin A, Avrainvillamide, Stephacidin B, Marcfortine C, Versicolamide B, Malbrancheamide, Premalbrancheamide and Notoamides B-E. Our work in this field involves addressing the controversial questions surrounding the putative existence of enzymatic catalysis for the Diels-Alder cycloaddition reaction in secondary metabolic pathways. Recent work in this area will be presented with an emphasis on the insight gained from unraveling the biosynthesis of these agents, which led to the discovery and refinement of biomimetic total syntheses of several members of this family of prenylated indole alkaloids. In particular, we have focused on the interesting and as yet, unexplained quandary that the respective enantiomers of Stephacidin A, and Notoamide B are produced by genetically related Aspergillus sp. obtained in both marine and terrestrial environments. Curiously, only the (+)-enantiomer of Versicolamide B is produced by these Aspergillus sp. whose biogenesis remains an enigma.



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Short Paper #10

CHALLENGES OF ISOLATION AND PROFILING OF AFRICAN MEDICINAL PLANTS: ANALYTICAL PROSPECTIVE OF STANDARDIZATION

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Keywords: Harpagophytum procumbens, Moringa oleifera, isolation, standards, profiling, quality control.

Profiling African medicinal plants is a challenge due to the lack of standards required for quantification. To solve this problem it is necessary for standards to be generated in the laboratory, a process that could be labour intensive and very challenging. Several approaches of isolating material that could be used as standards in large enough quantities and in reasonable purity have been used.

These traditional methods include preparative TLC as one of the key methods. In this presentation, three key isolation techniques, preparative HPLC, Flash Chromatography and High Speed Counter Current Chromatography are presented as solutions to the traditional labour intensive preparative TLC. Using a combination of the three techniques, significantly large quantities of compounds have been isolated in purities greater than 90% for use as standards in the quantitative method development using HPLC-DAD. The developed HPLC-DAD method for example was used for quality control of Devil's claw (Harpagophytum procumbens) and Moringa products found in the market. The standard compounds were used for profiling and quantification of Devil's claw (Harpagophytum procumbens) species. Compounds such as harpagoside, acteoside, isoacteaoside, bioside and procumbide were isolated at high purity using chromatographic techniques. Their purity and identification was confirmed using TLC, 1H-NMR and HPLC.

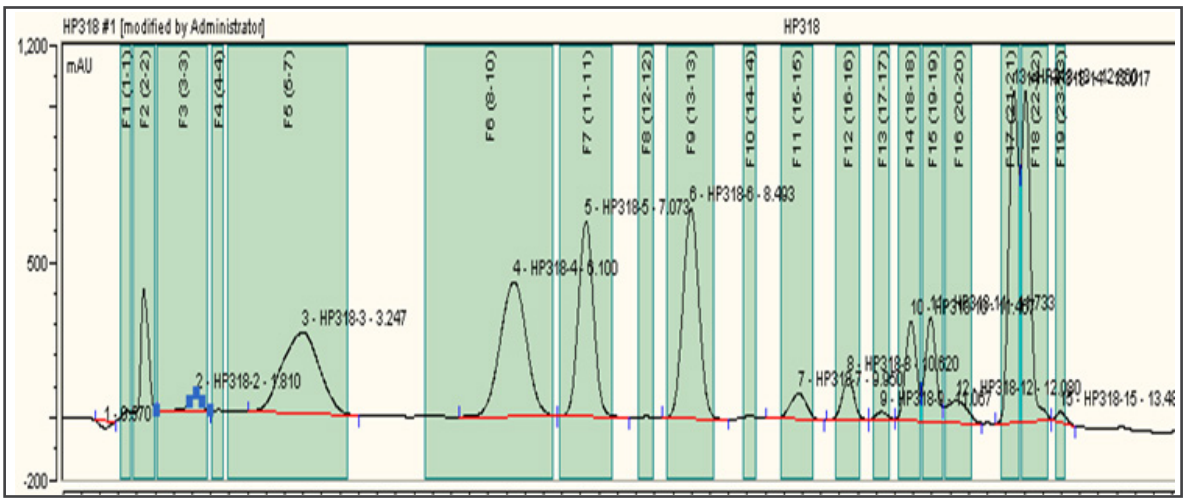

Figure 1: Chromatogram of crude extract of Harpagophytum procumbens using Prep Xterra® MS C18 3.5 µm x 7.8mm x 100 mm, acetonitrile +0.1% Acetic acid: 0.1% Acetic acid in water

Short Paper #11

METHODOLOGY DEVELOPMENT OF QUALITY CONTROL, QUALITY ASSURANCE AND STANDARDS FOR MORINGA OLEIFERA SEEDS

Sharna-kay Daley, Yvette Jackson, Nadale Downer-Riley Ramakwala Christinah Chokwe, Simiso Dube, Mathew Muzi Nindi

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Keywords: Moringa oleifera, phytochemistry, HPLC, reference standards, Method development.

The acquaintance between man and his search for healing drugs in nature originates from antiquity. Moringa oleifera is a plant whose history of medicinal usage dates back to ancient times. The phytochemistry of different parts of the plant has been extensively studied. Pharmacological studies on this plant have shown anticancer, antimalarial, antimicrobial and other activities [1- 3] but information on the distribution of the compounds in the individual parts of the plants is limited. The constituents of pharmaceutical products are carefully quantified and well documented; however, this is not the case with natural products. Such quantification is vital for the safe use of Moringa products that are available in the market.

The focus of this study was to develop and validate an HPLC separation method for quantification of the compounds found in the seeds of Moringa oleifera. Considering that there are no standards for these compounds available in the market, the first part of the study was therefore to isolate and characterize the four isolated compounds. The compounds were then used as reference standards. The identity of these standards was confirmed using NMR, FTIR, and Mass Spectrometry. The HPLC method was validated for linearity (R2 = 0.998-0.999), limit of detection (0.27-0.54 mg/L), limit of quantification (0.91-1.80 mg/L) and precision (%RSD = 0.04-0.58). The validated method was used for quantification of the compounds in the crude extract and will thus provide the platform for the quality control and quality assurance of Moringa products in the market.

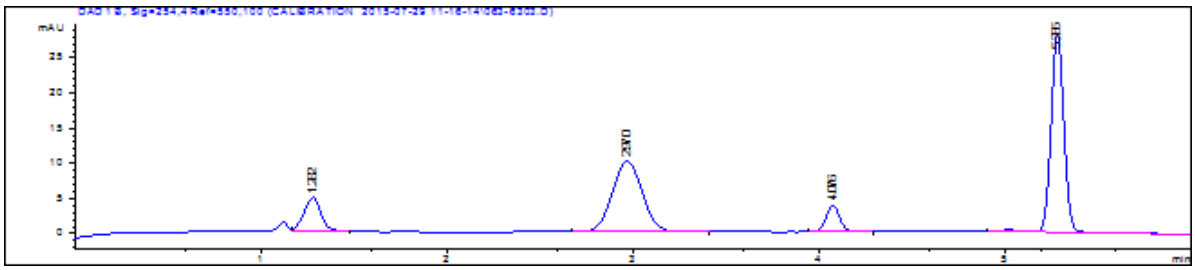

Figure 1: Chromatogram for the separation of the compounds using HPLC-DAD
Column: XTerra C18, 4.6 x 100mm, 3.5 µm. The mobile phase (A) Water with 0.1% formic acid, (B) Acetonitrile , a gradient elution mode was used, commencing at 0 min 65% (A), 1 min 70% (A), 2 min 65% (A), 3 min 45% (A), 4 min 55% (A), 6 min 55% (A). Flow rate: 1mL/min.trile +0.1% Acetic acid: 0.1% Acetic acid in water

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Plenary Lecture #11

DISCOVERY OF BIOACTIVE NATURAL PRODUCTS

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The focus of all the research in our group is the discovery of structurally novel natural products that can act as cell biology tools to study human disease or as lead compounds for the development of therapeutic agents to treat human disease. Most of our efforts over the years have centered on marine natural products, but we also explore terrestrial plants and microorganisms as sources of new bioactive natural products. Recently we have been interested in finding inhibitors of Human Pancreatic Amylase (HPA) as potential treatments for diabetes and obesity, and inhibitors of human cathepsin K (CatK), a cysteine protease highly expressed in bone resorbing osteoclasts and a well characterized pharmaceutical target for the treatment of osteoporosis. These efforts have resulted in the discovery of the HPA inhibitory glycoside montbretin A from plants in the genus Crocosmia, the HPA inhibitory peptide helianthamide from the Caribbean sea anemone Stichodactyla helianthus, and the cathepsin K inhibitor lichostatinal from cultures of a terrestrial actinomycete obtained from a BC lichen. Protein xray crystallography played an important role in the characterization of all three families of drug target inhibitors. The lecture will describe the isolation, structure elucidation, synthesis, and biological activities of these highly potent enzyme inhibitors.

Plenary Lecture #12

ISOLATION OF SECONDARY METABOLITES FROM DICOMA ANOMALA SUBSP.GERRARDII

Vusi W Masilela, Gerda Fouche and Carol A Summers

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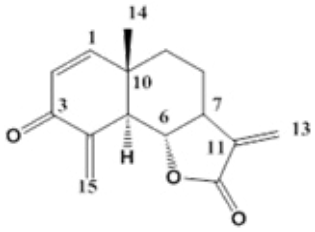
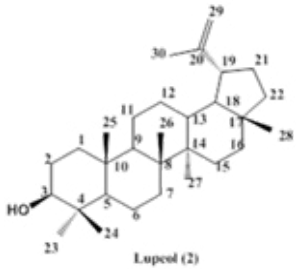
South Africa has a long history of using plants as part of traditional medicine and the maintenance of good health. Dicoma anomala subsp.gerrardii is one of the medicinal plants that are reported to be traditionally used for treating various diseases in human and animals worldwide such as circulation, blood disorders and tuberculosis / cough.

This study focused on the isolation, characterization and biological activities of secondary metabolites of Dicoma anomala subsp.gerrardii. Compounds from the ethyl acetate extract of the plant material were isolated using the standard phytochemical analysis techniques. Structural elucidation of the compounds was performed using Nuclear Magnetic Resonance spectroscopy (NMR). Two pure compounds, dehydrobrachylaenolide and lupeol, and a semi pure triterpenoid were isolated. The compounds were tested for biological activity against herpes simplex virus type 1 (HSV-1) and the cytotoxicity was tested against Vero cells. Only the semi pure triterpenoids showed good activity against herpes simplex virus 1 (HSV-1) with about 90% cytopathic effect (CPE) inhibition at 100 µg/ml. Lupeol did not show significant activity against HSV-1. Lupeol and the semi pure triterpenoids were tested against Vero cells and found to be nontoxic. Dehydrobrachylaenolide was not tested because the sample precipitated in the solvent used in these analyses.



Dehydrobrachylaenolide (1)



Lupeol (2)

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Short Paper #13

A TERMITICIDE DISCOVERED BY ACCIDENT, THE FREQUENT ROUTE TO NOVEL FINDINGS

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An undergraduate student researcher, while counting Formosan Subterranean Termite hindgut symbiotic protozoans noticed something strange about termites treated with 2-Phospho-Inositol, their antennae were damaged, appearing shorter and "burnt". She stated the most important 2 words in science: "That's Funny"!! A grad student looked in the microscope and with the undergraduate set up a set of dose-response experiments and found that within 9 days, at a minimal toxic dose, the antennae completely degraded to stubs. The termites have no eyes, and exist in a chemosensorium using receptors in their antennae to communicate and explore, therefore they stopped all activity and eventually perished. Searching the web for researchers who may have had inositol with phosphates on other hydroxyls (was the 2-phosphate a stereospecific requirement?), we found no-one who has synthesized such a set of compounds. Looking at the bottle of 2-phospho-inositol, we noticed that it was sold in a certain unusual salt form, and another undergraduate found 3-phosphoglycerol as the same salt form. When we tested this compound, the termites lost their antennae!! Therefore the salt form was the culprit termiticide. We ordered the salt compound neat, and it caused the same results, however it was noxious, and not useful as an insecticide. The second undergraduate made just the phosphate salt, without the sugar, and it caused the same result. We have submitted a patent disclosure on this new termiticide and are preparing a paper for publication. The route to discovery is sometimes tortuous!!

ABSTRACTS OF POSTER PRESENTATIONS

Poster #1

THE AMINO ACID PROFILE OF THE LEAVES OF JAMAICAN VARIETIES OF CASSAVA (MANIHOT ESCULENTA)

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As a staple crop across Latin America, the Caribbean, Asia and Sub-Saharan Africa, the cassava plant (Manihot esculenta) is a goldmine with several applications in the human food, animal feed and chemical industries. Not only is the root a valuable starch source, but the leaves have an unexpectedly high crude protein content of 14-40% (dry weight basis)1. It is postulated that leaves from some Jamaican varieties of cassava may provide a valuable source of plant protein with a wholesome amino acid (AA) profile comparable to traditional protein sources such as eggs, cheese and milk2. Analysis will be performed on two Jamaican cassava varieties- Rockwood and Manson. Crude proteins will be extracted from dried cassava leaves and its protein content analyzed by Lowry's colorimetric method. The protein extracts will be purified and separated by chromatography (column and/or thin-layer) into polypeptide and amino acid fractions. Preliminary investigation by thin-layer chromatography will characterise the AA present in cassava leaf samples and reversed-phase HPLC will be employed to identify and quantify the amino acids present in the cassava leaf samples.

Such research may lead to the identification of a Jamaican cassava variety with a rich AA profile and an evaluation of applications of the cassava leaf in food processing, animal feed and human diet supplementation.

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Poster #2

THE VARIATIONS OF ESSENTIAL OILS OBTAINED FROM THE PIMENTA DIOICA

Cressana Williams-Massey, Roy Porter

Department of Chemistry, The University of the West Indies, Mona

There are twenty-one known species of the Pimenta plants. Of this, five are found in Jamaica: Pimenta dioica, Pimenta racemosa, Pimenta jamaicensis, Pimenta richardii and Pimenta obscura. The seasonal variations in the composition of the essential oils obtained from P. dioica growing at different locations were examined using by GC and GC-MS. The data indicates that there were variations in the compositions with location and season. These results provide useful information on when best to harvest P. dioica oil.

Poster #3

RARE EARTH METAL ORGANIC FRAMEWORKS FROM 2-NITROTEREPHTHALATE: POTENTIAL APPLICATIONS IN GAS STORAGE AND SENSING.

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Metal Organic Frameworks (MOFs) are a new class of porous coordination polymers (CPs) with well-defined topologies that continue to intrigue scientists not only because of their appealing structural architectures, but also because of their potential applications in gas storage and separation, magnetism, catalysis and biomedicine. The synthesis of MOFs using rare earth metal ions is still relatively under explored due to the unpredictable way in which rare earth ions may form a series of complexes. Significant research needs to be carried out in order to establish suitable trends that can lead to the construction of desired rare earth frameworks which combine the properties of MOFs with the unique catalytic, magnetic and light emitting properties of rare earth metal ions. Indeed, our group has been actively involved in the design and synthesis of such rare earth MOFs.5

Herein we report the synthesis and characterization of seven novel rare earth coordination polymers and MOFs using the nitro-substituted benzenedicarboxylate ligand, 2-nitroterephthalic acid (NTA); [Nd(NTA)(HNTA)(OH2)2].5H2O (1), [Nd(NTA)2(OH2)].6H2O (2), [Ln2(NTA)3(OH2)2].H2O [Ln = Sm (3), Eu (4), Tb (5), Er (6)), La2(NTA)3(OH2)6 (7). The complexes were made by hydrothermal synthesis and slow evaporation at room temperature. They have been characterized by X-ray crystallography, elemental analyses, infrared spectroscopy and thermogravimetric analysis (TGA). This report documents only the second known example of rare earth coordinated networks with the NTA ligand.

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Poster #4

A FORMAL SYNTHESIS OF PRENOSTODIONE

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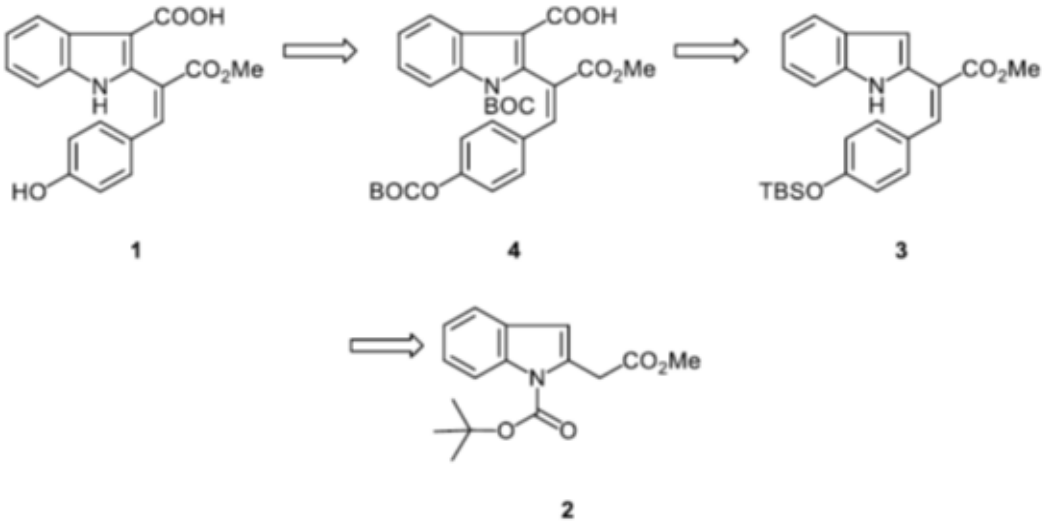
The total synthesis of prenostodione (1), a novel UV-absorbing natural pigment isolated from cyanobacteria by Ploutno and Carmeli,1 eluded researchers 2-3 for many years with only one reported synthesis found in the literature to date.4 We herein present a formal synthesis of prenostodione (1) achieved in ten steps with an overall 5% yield. The sequence commenced with the stepwise construction of tert-butyl 2-(2-methoxy-2-oxoethyl)-1H-indole-1- carboxylate (2), from commercially available materials, followed by core assembly of (E)-methyl 3-(4-((tert-butyldimethylsilyl)oxy)phenyl)-2-(1H-indol-2-yl)acrylate (3) utilizing a lithium diispropylamide-initiated Macor condensation.5-6 Subsequent and sequential formylation, BOC-protection and Pinnick oxidation7 generated di-BOC acid 4 which, upon deprotection, afforded prenostodione (1).



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Poster #5

POTENTIAL FOR USE OF MORINGA OLEIFERA EXTRACTS IN OXIDATIVE STRESS CONDITIONS

Racquel Wright*, Ken Lee, Hyacinth I Hyacinth, Jacqueline M. Hibbert, Marvin E. G. Reid, Andrew Wheatley and Helen Asemota

Moringa oleifera, also known as “Marenga” in Jamaica and the “Miracle Tree”, is celebrated for its medicinal benefits, however there is little scientific evidence to support these claims. A study was conducted to determine the veracity of these claims by testing the antioxidant capacity of the plant as oxidative stress is implicated as a factor in the progression of many illnesses. Oxidative stress is the result of an imbalance between reactive oxidative species (ROS) and antioxidant components in the body. ROS can potentially damage the cells in the body, destabilizing the cell integrity by reacting with cellular components. Generally the body is able to restore balance however in a state of ill-health this does not occur and the body remains under stress. These will lead to further injury at cellular and potentially chronic damage to organ systems.

In the study, leaf biomaterials from Moringa plants in Jamaica were extracted using different solvents. Analyses of crude extract from Moringa showed the presence of phenols, flavonoids, saponins, anthraquinones, tannins, terpenoids and alkaloids.. Many of these phytochemicals are known to possess antioxidant properties. A crude ethanol extract from Moringa leaves was further purified using hexane, chloroform, butanol and water which produced extracts E, E1, E2, E3 and E5 respectively. The antioxidant activities of these fractions and the crude ethanol extract were tested using 2, 2-Diphenyl-1-picrylhydrazyl (DPPH) assay. Antioxidative capacity was assessed using the calculated DPPH reduction percentages and IC50 (the amount of antioxidant needed to reduce 50% of DPPH) values.

The following extracts; E1, E2, E, E5 and E3 had IC50 values of 4477µg/mL, 1604µg/mL, 832.8µg/mL, 516.9µg/mL and 172.6µg/ml respectively. Inverse correlations were found between IC50 values and antioxidant activity. Polarities of the extracting solvents generally determined the extent of antioxidant capacity with the extract from solvents with lower polarities that is hexane and chloroform, having lower antioxidant capacities. Extracts E3 and E5 (prepared with polar extracts) had values which correlated to greater antioxidant capacity; they were also comparable to those seen in vitamin C (257.3µg/mL). Due to the increased antioxdant activity found in polar extracts from Moringa leaves, Moringa leaves may have clinical applications in conditions where an oxidative stress state has been implicated.

Poster #6

EVALUATING THE QUALITY OF RAW COW’S MILK IN JAMAICA

Sonal Gupte and Ian Thompson

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The research project is seeking to improve the capacity of dairy farmers in Jamaica to produce raw cow’s milk to international standards by adopting good manufacturing practices and sanitation protocols. This intervention is required to achieve reduced bacterial count so that the quality and shelf life of the raw milk are enhanced. This project is being viewed as a necessary step towards revitalising the dairy industry in Jamaica. The milk will be tested for its organoleptic (appearance, taste and smell), , physical and chemical characteristics (e.g, acidity and pH) and its microbiological quality (standard plate count, coliform count and methylene blue reduction test). The results obtained will be used to assess the possible causes of poor milk quality and to develop intervention strategies (remedial measures) designed to improve the quality of raw milk and to minimise the risk of spoilage.

Keywords: Raw milk, Sanitation, GMP, Coliform, SPC

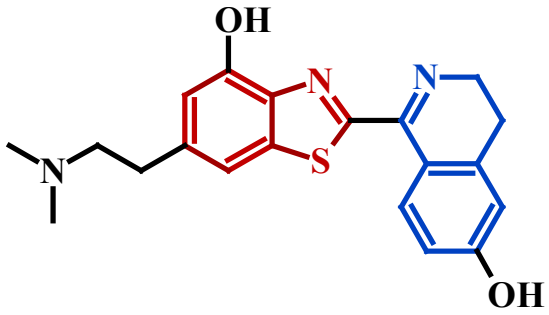
Poster #7

SYNTHESIS OF AN ANALOGUE OF VIOLATINCTAMINE

Alexa O. Redway, Nadale K. Downer-Riley and Yvette Jackson*

Department of Chemistry, The University of the West Indies, Mona, Kingston 7, Jamaica, W.I.

Marine organisms provide a plethora of natural products with medicinal properties. Violatinctamine (1) is one such natural product that was isolated from the tunicate Cystodytes cf. Violatinctus.1 It possesses both the benzothiazole and dihydroisoquinoline units that are found in many drugs and bioactive natural products alike. The biological significance of these two potentially active sub-units has fuelled research towards the synthesis of violatinctamine. conditions where an oxidative stress state has been implicated.



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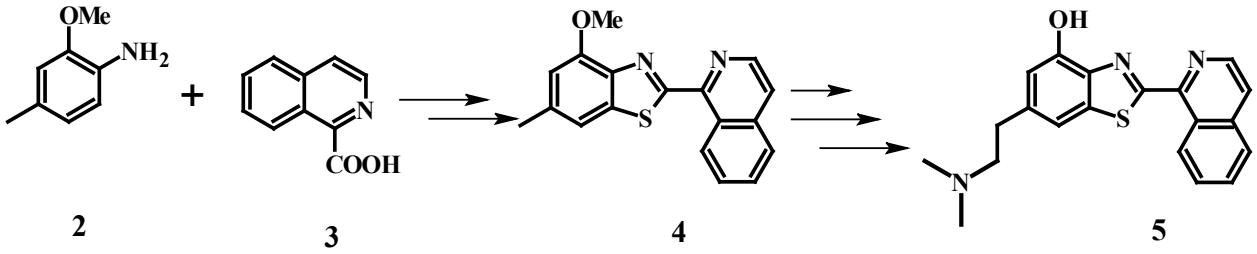
Presented here are the approaches undertaken toward the synthesis of violatinctamine analogue 5. A key precursor, compound 4, was obtained in 47% yield over three steps from compounds 2 and 3. The methyl group of benzothiazole 4 was subsequently manipulated towards obtaining the violatinctamine analogue.



2 **3** **4** **5**

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Poster #8

MODIOLIDE A AND OTHER SECONDARY METABOLITES PRODUCED BY PARACONIOTHYRIUM CYCLOTHYRIOIDES, A POTENTIAL SOURCE OF ANTIBACTERIAL AND ANTIFUNGAL AGENTS

Oneiro Cherrington, Garren Nelson, Denton Fearon and Paul Reese

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Microorganisms, including fungi, increasingly have been a source of natural products, aimed at addressing medicinal and pharmaceutical issues. This is due to the biological activities that these compounds exhibit. This work was undertaken to study the production and chemistry of natural products from the fungus Paraconiothyrium cyclothyrioides. In this investigation the fungus was grown on different solid-based as well as liquid-based media. The known polyketide Modiolide A was isolated, along with a previously unreported structurally related compound, provisionally named Modiolide C.1 Modiolide A is reported to exhibit antibacterial and antifungal activity against Micrococcus luteus (MIC value 16.7 µg/mL) and Neurospora crassa (MIC value 33.3 µg/mL) respectively.1

Reference:

M. Tsuda,† T. Mugishima,† K. Komatsu,† T. Sone,‡ M. Tanaka,‡ Y. Mikami,§ and J. Kobayashi*†, J. Nat. Prod. 2003, 66, 412-415

Poster #9

ISOLATION, CHARACTERIZATION, AND INVESTIGATION OF THE BIOACTIVITY AND INSECTICIDAL PROPERTIES OF COMPOUNDS AND EXTRACTS FROM MARINE ORGANISMS

Doleasha Davis and Winklet Gallimore

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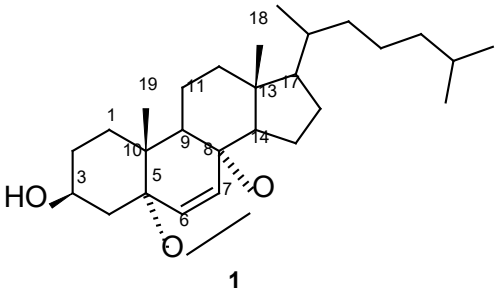
Marine organisms such as gorgonians, ascidians and sponges, have been shown to produce a number of interesting metabolites of pharmacological and agricultural importance.

In the current investigation, specimens of H. melanodocia were collected in the shallow waters from the Port Royal coast, Jamaica. Extraction was effected using solvents of varying polarity and purification of components was effected using sephadex LH-20 and repeated silica column chromatography. 5 , 8 -epidioxycholesta-6-en-3 -ol (1) was obtained from the non-polar fractions and has low cytotoxity towards prostate, colon and breast cancer cell lines and when tested against 5 selected fungi, 4 selected gram (+ve) and 7 selected gram (-ve) bacteria, showed very low inhibition. Other minor sterols have been indicated from the non-polar fractions as well. Additionally, compounds containing the cerebroside core (2) with varying levels of oxidation were identified in the polar extracts. Cerebrosides have been known to exhibit moderate antifungal activity against Mortierella remanniana and cytotoxicity towards P388 murine leukemia cells.4It is the aim of this study to test extracts and compounds for their anti-insecticidal properties, in the hope of unearthing novel and interesting compounds that will be of great economic significance in the pharmaceutical industry, as well as the agricultural sector in Jamaica.



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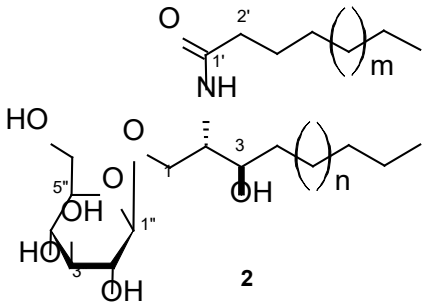

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Poster #10

GLYCEMIC INDEX OF FRUITS COMMONLY CONSUMED IN JAMAICA

Ryan D. Francis, Perceval S. Bahado-Singh, Ann Marie Smith, Andrew O. Wheatley, and Helen N. Asemota

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Fruits should form an essential part of every diet for their complex carbohydrates, dietary fiber and micronutrients. Diabetic patients are reluctant in consuming fruits because they are sweet and they believe that sweetness is directly correlated to increase blood sugar. The present study investigated the glycemic index (GI) of commonly available and consumed fruits in Jamaica.

Poster #11

CHARACTERISATION OF THE BIOACTIVE COMPOUNDS FOUND IN JAMAICAN PLANT MALLONTONIA GNAPHALODES

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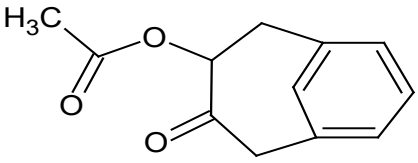
Mallontonia gnaphalodes is a broad leathery green leaf shrub found on the coastal regions of the Caribbean. While work has been done on the extract to evaluate its bioactivity; there has been a limited amount of work done on the isolation of the compounds responsible for the various bioactive properties exhibited by this shrub.

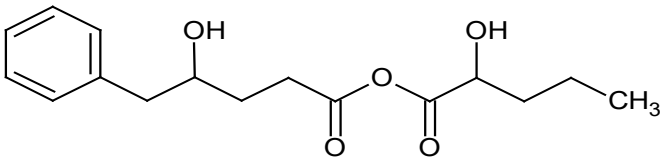
The aim of the research is to isolate, purify and characterize the compounds in Mallontonia gnaphalodes responsible for its antibacterial and insecticidal properties. The research will also look at the feasibility of formulating an organic insecticide from the compounds.

The sample was collected by hand on the coastline of Yow Rest Stop, Rio Beuno, Trelawny Jamaica, cleaned and oven dried for four days. The sample was extracted with dichloromethane: methanol (1:1) over a period of three days. A portion of the extract (9.98 g) was subjected to vacuum liquid chromatography using a silica stationary phase to effect the separation of the compounds. Thin layer chromatography was then used as the basis for the combination of different fractions from the column. Further column chromatography was done on the fractions to yield two novel compounds (Martinone and Mallontodiol). A combination of 1D (C13, H1 and DEPT) and 2D (COSY, HMBC and HSQC) experimental techniques were used in the elucidation of both compounds.

Mallontodiol showed moderate bioactivity towards four bacterial strains; Streptococcus pyogene, Enterococcus faecalis (29212), Klebsilla pneumoniae (1706), Escherichoa coli (25922).



Martinone



Mallontodiol

Poster #12

IMMOBILIZED FUNGAL CELLS AS AGENTS FOR THE GENERATION OF TERPENOID ANALOGUES

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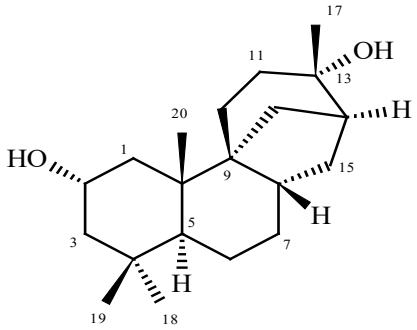
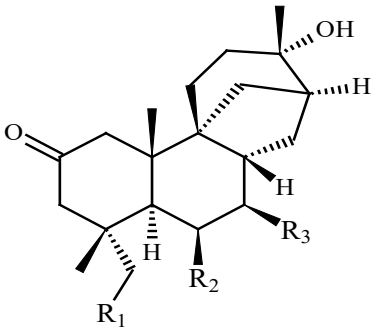
The use of alginate-immobilized filamentous fungal cells for biotransformation gives yields which parallel those obtained by the traditional free cell fermentation method. The immobilized cells allow for an efficient workup with little or no natural product formation, thus making purification much easier when compared to its free cell counterpart.1 The technique has been successfully applied to the bioconversion of steroidal substrates,1,2 and is herein applied to the terpenoid substrate, stemodinone (1).

Stemodinone is derived from the cytotoxic and mildly antiviral diterpenoid stemodin (2), isolated from the local plant Stemodia maritima. The utilization of Actinomucor elegans, Curvularia lunata, Mucor circinelloides and Rhizopus stolonifer has yielded the 6,13(S)-dihydroxystemodan-2-one (3), while 7,13(S)-dihydroxystemodan-2-one (4) and 13(S),18-dihydroxystemodan-2-one (5) were generated from fermentations with Mucor plumbeus and Beauveria bassiana respectively.



2



1. $R_1 = H, R_2 = H, R_3 = H$

3. $R_1 = H, R_2 = OH, R_3 = H$

4. $R_1 = H, R_2 = H, R_3 = OH$

5. $R_1 = OH, R_2 = H, R_3 = H$

Reference:

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2. Peart, P.; Reynolds, W.; Reese, P., Journal of Molecular Catalysis B: Enzymatic, 2013, 95, 70-81

Poster #13

ISOLATION AND CHARATERIZATION OF POTENTIAL BIOACTIVE METABOLITES FROM DIFFERENT PARTS OF BIXA ORELLANNA L. (ANNATTO) PLANT

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Bixa orellana L,(annatto) is a member of the Bixaceae family. Bixa orellana L, (annatto) is a tropical plant cultivated for use as a food colouring agent and in traditional medicine. The focus of this study is isolate and characterize components from in different parts (leaves, stems and seeds) of the plant. The extracts and the isolates will be subjected to antioxidant evaluation using 2,2-diphenyl-1- picrylhydrazyl (DPPH) radical scavenging activity and iron (III) oxide reducing power. They will also be evaluated for antimicrobial activities against gram negative and gram positive organism) as well as toxicity assay using both the brine shrimp lethality test and the acute and sub-acute animal model test

Poster #14

AUTHENTICATION OF THE ENDEMIC PIPER AMALAGO VAR. NIGRINODUM (BLACK JOINTER) GROWN IN JAMAICA VIA NOVEL HPLC & HPTLC CHEMICAL FINGERPRINTING METHODS

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A novel high performance liquid chromatography (HPLC) and a novel high performance thin layer chromatography (HPTLC) method were developed for the characterization of extracts from Piper amalago var. nigrinodum variety, a plant endemic to the island of Jamaica. The novel (HPTLC) method provided a chemical fingerprint of this Piper species as well as a quick screening methodology for authentication purposes. DPPH anti-oxidant bioassay was conducted and the solvent extract of the Piper nigrinodum yielded 87.6% antioxidant activity at 50 µg/mL concentration.

Elemental analysis showed that the piper species was replete with several essential elements required for proper human health. The solvent extraction of the milled Piper amalago var. nigrinodum commonly known as black jointer gave an oleoresin yield of 15.87 w/v%. Traditionally black joiner is consumed as a herbal tea by Jamaicans. This research study has confirmed that the black jointer herbal tea is a rich source of antioxidants, with essential elements and hence a potential nutraceutical for the health and wellness industries.

Poster #15

THE PREVALENCE OF USE OF NATURAL PRODUCTS AMONG PROSTATE CANCER PATIENTS IN JAMAICA: A CROSS-SECTIONAL STUDY

Sasha-Gay Wright, Helen N. Asemota, and William D. Aiken

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Prostate cancer is the most frequently diagnosed cancer in Jamaica and the leading cause of cancer-related deaths among men. Many men seem to favour the use of natural products along with or instead of prescribed treatments for the different stages of prostate cancer. As standard treatments for prostate cancer can be expensive and may have undesirable side-effects, the use of natural products may become increasingly attractive to patients.

Primary study objective: To determine the prevalence and types of natural products used among prostate cancer patients in Jamaica and whether use predated the diagnosis of prostate cancer.

Poster #16

MECHANISTIC INVESTIGATION OF HYDROLYTIC DECOMPOSITIONS OF ROUSSIN'S BLACK AND ROUSSIN'S RED SALTS IN AQUEOUS ACIDIC AND BASIC SOLUTIONS.

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Two iron-sulfur-nitrosyl cluster complexes, Roussin's black salt (RBS), NH4[Fe4S3(NO)7] and Roussin's red salt (RRS), Na2[Fe2S2(NO)4] were synthesized following published procedure and characterized by spectrophotometric measurements. Both complexes are soluble in water, photochemically active and have the ability to release nitric oxide, NO, which is a very important biochemical messenger. We are interested in investigating the mechanisms of NO release from both RBS and RRS complexes in order to evaluate these complexes as potential pharmaceutical products. Here we are reporting the results of kinetic studies of degradation of RBS in acidic and basic media and the electrochemical behavior of both complexes. The mechanisms of these reactions will be discussed in light of kinetic data such as second order rate constants, equilibrium constants, and activation parameters.

Reference:
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2. Sanina, N.A.; Chuev, I. I.; Aldoshin, S. M.; Ovanesyan, N. S.; Strelets, V.V.; Geletii, Y.V. Russ. Chem. Bull. 2000, 49, 444-451.
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Poster #17

BIOTRANSFORMATION STUDIES OF BEAUVERIA BASSIANA WITH DITERPENE SUBSTRATES

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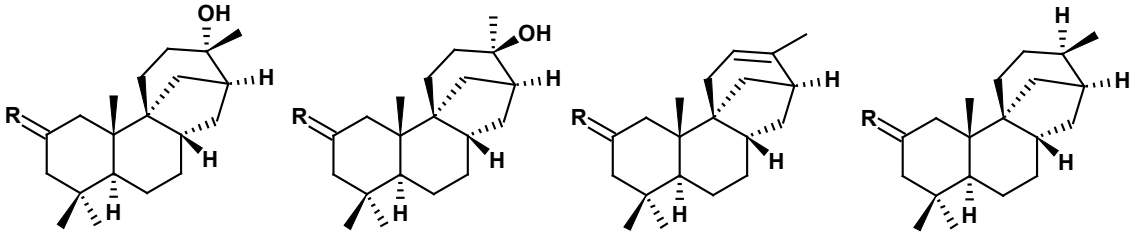
Beauveria bassiana ATCC 7159 (B. sulfurescens or Sporotrichum sulfurescens) has demonstrated its potential as a microbial oxidant, and also gained popularity as the fungus responsible for the muscardine disease in insects. Biocatalytic reactions of B. bassiana include hydroxylation of a host of organic compounds. Other reported reactions are sulfoxidation, epoxidation, ester hydrolysis, Baeyer-Villiger oxidation, glucosidation and O- and N-dealkylation.1-3

Stemodane analogues were synthesized from the mild cytotoxic and antiviral diterpene stemodin. This attractive starting material is isolated in high amounts from the plant Stemodia maritima. The diterpenoids 1-16 were incubated with B. bassiana, and purification of the extracts obtained from the fermentations yielded a number of novel products.4- 6

Several relatively simple models of the cytochrome P450 enzyme for B. bassiana have been reported.1 However, with the information obtained from the biotransformation studies carried out on the terpenes 1-16, as well as similar studies, a more advanced model of the active site of the P450 enzyme can be generated.7 The model, once produced, will provide more applications to the field of biotransformation.



1. R = αOH, βH
2. R = O
3. R = αH, βOH
4. R = H_2

5. R = αOH, βH
6. R = O
7. R = αH, βOH
8. R = H_2

9. R = αOH, βH
10. R = O
11. R = αH, βOH
12. R = H_2

13. R = αOH, βH
14. R = O
15. R = αH, βOH
16. R = H_2

Reference:
1. G.J. Grogan and H.L. Holland, J. Mol. Catal. B: Enzym., 2000, 9, 1-32.
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Poster #18

AN EVALUATION OF THE FUNCTIONAL PROPERTIES OF ACETYLATED CASSAVA (MANIHOT ESCULENTA) STARCH

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Cassava (Manihot esculenta) is one of the most widely grown tubers in the world and is a principal staple crop in Africa, Asia, Latin America and the Caribbean. The root is rich in starch (20-30%, on a wet weight basis) and the extracted starch may be modified using different methodologies, by using physical, chemical or enzymatic techniques.1 In this research project, chemical modification of the starch (by acylation) is to be undertaken.

The acylation technique involves the treatment of the cassava starch with acetic anhydride to substitute the hydroxyl groups on the starch molecule with an Acyl group. This type of chemical modification changes the functional properties of the native starch to modified characteristics which find wide application in industry. The properties which are impacted by acylation are viscosity (the starch solutions gets more fluid), solubility, swelling factor (ability of the modified starch granules to absorb more water before bursting/ deformation), hardness (i.e. firmness of gels), cohesiveness, adhesiveness and translucency and initial gelatinization temperature (i.e. gels at a lower temperature).

The chemical modification (acylation) technique is performed by mixing acetic anhydride with the native starch while controlling the pH with the periodic addition of NaOH and HCl.3 It is known that different native starches have different functional properties, and that the properties of starch may also vary within the same crop across varieties. It is postulated that the acylation of native starch from different cassava varieties will lead to unique functional properties of the modified starches produced which may then be classified and characterized to determine their industrial application. This postulation is supported by experiments done on yam varieties.

Keywords: Cassava, Acylation, modified starch properties

Reference:

1 Okunlola, A.; Akingbala, O. Characterization and evaluation of acid-modified starch of Dioscorea oppositifolia (Chinese yam) as a binder in chloroquine phos phate tablets. Braz. J. Pharm. Sci., [Online] 2013, 49(4), 699-708.

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3 Ayucitra, A. Preparation and Characterization of Acetylated Corn Starches. Int. J. Chem. Eng. Appl., [Online] 2012, 3(3), 156-159

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Poster #19

ION SPECIFIC EFFECTS IN SURFACE CHARGING AND ELECTROKINETICS OF SILICA NANOPARTICLES

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Specific ion adsorption and lyotropic behaviour (decrease in hydration with increased crystallographic radius) was observed to follow the Hofmeister series: Li+ < Na+ < K+ < Rb+ < Cs+) for colloidal silica present in alkali-chloride solutions. Potentiometric titrations were conducted to investigate the effects of specific ion adsorption on surface charge development. The negative surface charge previously present on the silica surface ~ pH 10.0, became increasingly negative in accordance with the Hofmeister trend for 0.01 M and 0.1 M alkali-chloride solutions. This indicated that specific ion adsorption was indeed occurring at the silica/water interface, more so that it also influenced surface charge development. Zeta ( ) potential was measured to investigate if specific ion adsorption influenced – potential similarly as it did surface charge. This expected Hofmeister trend in – potential was not strictly observed; however a novel trend was observed, whereby colloidal solutions which had undergone the titration process possessed more negative – potential than its respective untitrated solution at the same pH (~10.0). The absolute premise for this occurrence has not been fully established, however a plausible reason for the difference correlates to structural modification of the silica surface; future work will have to be done to approve/disprove the latter assumption.

Keywords: chaotrope, colloidal silica, electric double layer, Hofmeister series, kosmotrope, specific ion effects, surface charge.

Poster #20

THE NUTRIENT AND ANTI – NUTRIENT COMPONENTS OF THE JAMAICAN BREADFRUIT (ARTOCARPUS ALTILIS)

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Breadfruit is said to be the food of the future. However, the presence of anti-nutrients in the breadfruit affects the availability of the nutrients present. This research is intended to uncover the nutritional and anti-nutritional factors in the Jamaican breadfruit (Artocarpus altilis) flour. Processing methods for the production of flour and its use in snack foods will also be explored. Both quantitative and qualitative methods of analyses will be employed.

It is expected that increased demand for the crop will stimulate its cultivation, benefitting farmers economically, and by extension, the country. can be generated.7 The model, once produced, will provide more applications to the field of biotransformation.

Keywords: Breadfruit, Artocarpus altilis, Nutrients, Anti – nutrients

Poster #21

INVESTIGATION OF SOURCES OF ATMOSPHERIC AEROSOL AT SELECT URBAN AND SUB-URBAN AREAS IN JAMAICA

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According to the World Health Organization (WHO), seven million premature deaths can be attributed to ambient air pollution annually. Numerous studies have demonstrated that short term exposure to particulate matter (PM*) is associated with adverse health effects especially aerosol particles that are smaller than 2.5 μm in diameter (PM2.5). Whereas most developed countries have investigated and reported on the elemental analysis of PM 2.5 , Jamaica has only a few published reports on PM10 and total suspended particulate matter (TSP) (Davis et al., 1997; NEPA, 2012) and the ambient concentration and composition of PM2.5 is still largely unreported.

In this study, aerosol particles smaller than 2.5 μm in diameter (PM2.5) will be collected for 24 h periods at five sites (urban and sub urban) across Jamaica between January 2016 and January 2018. Samples will be collected using Environmental Dusttrak aerosol monitors model EDTDX high volume air sampler and Staplex TFIA Filter paper and analysed for their elemental composition PM10 and PM2.5 using Energy Dispersive X-ray Fluorescence (EDXRF) techniques. Back trajectory analysis will be used to ascertain the possible source of atmospheric aerosols in these areas. The results will be assessed for the validity and accuracy using the IBM SPSS package and compared with the current maximum acceptable annual means specified in the European Commission's and the US Environmental Protection Agency's environmental quality standards for ambient air.

Results from this study will contribute significantly towards the development of more targeted air pollution regulations and policies in Jamaica and will provide data necessary for further research on its pollution-related health effects.

Poster #22

CHIRAL RUTHENIUM(II) AMINOPHOSPHINE COMPLEXES: SYNTHESIS, CHARACTERIZATION AND APPLICATIONS TO ASYMMETRIC HYDROGENATION AND TRANSFER HYDROGENATION REACTIONS

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2 Kamal Pharmachem Inc, 100 College Street, Banting Institute, Toronto, Ontario M5G IL5, Canada
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Chiral aminophosphines are privileged ancillary ligands with increasing interest in asymmetric catalysis. They have unique structural and electronic properties and have the ability to exploit transition metal complexes for very useful catalytic transformations which are of importance to organic chemists. Aminophosphines have a hard (amine) centre and a soft (phosphine) centre that can ligate and stabilize the metal both in a high and low oxidation state.

Our research focuses on five transition metal: Ruthenium(II), Palladium(II), Copper(I), Rhodium(I) and Iridium(I); for this paper, however, we will be looking on Ru(II) complexes prepared from four aminophosphine ligands: (Rc)-1-((Sp)-2-diphenylphosphino)ferrocenylethylamine (Rc,Sp-PPFNH2) L-1, (Sc)-1-((Rp)-2-diphenylphosphino)ferrocenylethylamine (Sc,Rp-PPFNH2) L-2, (R)-8-(diphenylphosphino)-1,2,3,4-tetrahydronaphthalen-1-amine (R-THNANH2) L-3 and (S) -8-(diphenylphosphino)-1,2,3,4-tetrahydronaphthalen-1-amine (S-THNANH2) L-4 (Figure 1). These complexes were characterized by 1H, 13C and 31P NMR spectroscopy, CHN, IR spectroscopy and polarimetry. Their application to asymmetric hydrogenation and transfer hydrogenation will also be discussed.

Results from this study will contribute significantly towards the development of more targeted air pollution regulations and policies in Jamaica and will provide data necessary for further research on its pollution-related health effects.

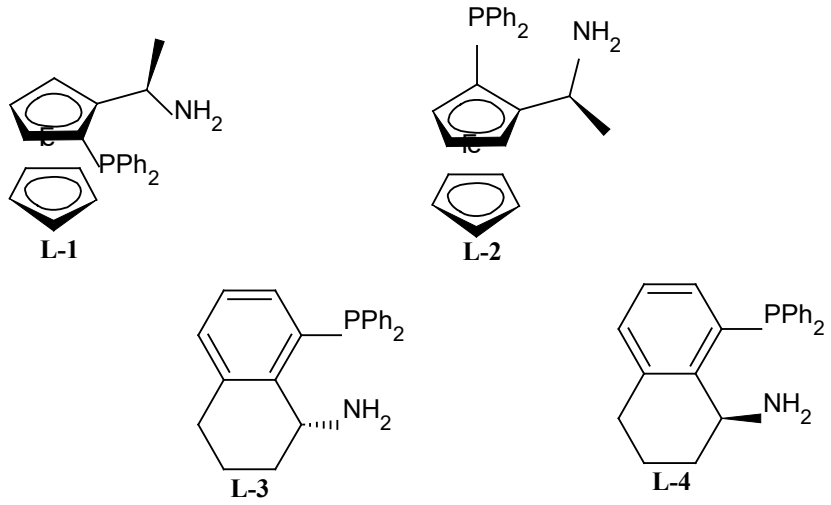

Figure 1

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