BioPRIA NEWSLETTER

June 2019

From the Acting Director

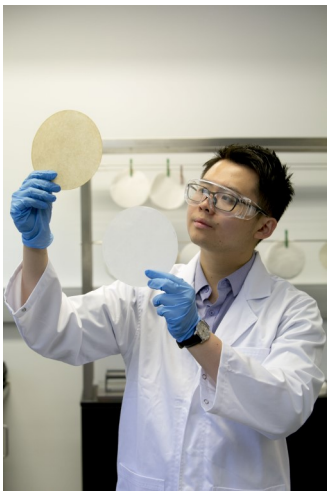
A/Prof Warren Batchelor

It seems hard to believe that Gil has nearly finished his sabbatical. The six months that I have been acting Director have flown past. I have really enjoyed working with everyone to further progress and develop the mission of BioPRIA over this time. During this time, we have held one review meeting from PALS and it has been impressive to see the continued advances of the projects and the strong engagement of our industry partners in the program. During the last six months, we have also had three PhD students complete their degrees and one submit his thesis.

I would like to especially thank everyone who have worked together to keep BioPRIA running: Joanne, Janette, Scot, Richie, Alysa, Rosi and Adele, and to thank all the research staff and students for their commitment to keeping the Institute running safely. I would especially like to acknowledge Alysa and Richie, who will be leaving us shortly as Alysa moves into a full time role outside Monash and Richie returns to Queensland. Richie was instrumental in developing the new Masters and the education design of the courses, while Alysa played a key role in the finances for both BAMI and PALS Hubs.

In closing, I would like to say welcome back Gil, we've missed you!

Research on Nanocellulose: Sustainable Packaging Materials of the Future



BioPRIA PhD student, Shaun Ang

The global consumer packaging industry is valued at approximately $500 billion USD according to recent estimates. So great is the drive in this modern day and time for renewable, sustainable and recyclable packaging materials with excellent strength and barrier properties, as in the case of nanocellulose.

My PhD project here at BioPRIA focuses on engineering these nanocellulose materials with remarkable performance which can rival that of fossil-fuel based plastics. I work closely with my industry partner, Australian Paper who provide guidance and support throughout this project. Australian Paper is Australia's only manufacturer of lightweight packaging, bag, sack and office printing papers. Our goal is to one day spur the widespread manufacture and adaptation of these nanocellulose based materials on an industrial scale for recyclable packaging applications.

A great emphasis is placed on the concept of sustainability and sustainable production throughout this PhD project. My work focuses on the production of nanocellulose from inexpensive, everyday commodity wood fibres as opposed using to more specialty, low-volume and unsustainable feedstocks. The production process of nanocellulose is often known to be very energy intensive which makes it unattractive from an industrial production standpoint. In my work, I have very recently published a paper on this topic addressing the issue of energy consumption for high strength applications. This paper highlights a way to produce very high strength nanocellulose sheets at lower energy. I have also investigated the production of nanocellulose from recycled wood fibres as a potential alternative to virgin wood fibres. I'm currently evaluating the recyclability of these high strength nanocellulose sheets with the goal of encouraging the use of these extraordinary recyclable materials over unrecyclable packaging plastics. Recently, I have also uncovered a way to produce high barrier nanocellulose films to serve as excellent packaging materials for food and coating applications.

This PhD has provided me an amazing platform to develop both strong technical skills and build life-long relationships with the people around me. I feel so blessed and humbled to be able to pursue this PhD and play a part in solving one of the most pressing issues of our time. It is my hope and dream that the production and application of these nanocellulose materials will one day be economically feasible, socially beneficial and most importantly, environmentally sustainable.

Further Reading:

Ang, S., Haritos, V. and Batchelor, W., 2019. Effect of refining and homogenization on nanocellulose fiber development, sheet strength and energy consumption. Cellulose, 26(8), pp.4767-4786. https://doi.org/10.1007/s10570-019-02400-5

Internship Abroad at Université de Sherbrooke (UdeS)

Prof Gil Garnier, Prof Jean-Michel Lavoie and Debjani Ghosh

PALS researcher, Debjani Ghosh had a four-month internship at the Laboratory of Biomass Technologies (LTB), in UdeS Canada as part of her PhD project. LTB was founded and directed by Prof Jean-Michel Lavoie, and it provided technological solutions for the recovery and utilisation of residual carbon process to many industrial partners (lumber, fuel, pulp and paper industries).

During her internship, Debjani worked on the development and optimisation of the processing parameters for isolation of hemicellulose as oligomeric sugars from different biomass. She undertook a wide range of task and activities including: learning and adopting the lignocellulose characterisation techniques. She also had an opportunity to visit a start-up company "Resolve Energy Inc", which aimed to transform lignocellulosic residue (bark, tree canopy, sawdust, woodchips) into second generation ethanol and pallets.

Debjani mentioned, "the internship was a worthwhile experience. It helped me to gain professional knowledge and make contacts with people who are leading in this field. Working here, I have improved my skills and awareness related to biofuels, biomass pre-treatment and valorisation. Having an access to the state-of-art analytical facility at LTB was definitely an advantage. A very big special thanks to my supervisors at LTB (Prof Jean-Michel Lavoie) and Monash University (Prof Gil Garnier and Prof Tony Patti) for this opportunity, and also new colleagues at UdeS who made my time so enjoyable at Canada."

Conferences Highlight

A/Prof Warren Batchelor and Shaun Ang at the International Conference on Nanotechnology for Renewable Materials in Japan

BioPRIA staff and researchers seized many opportunities to present at the international conferences to share their research and to network.

Eight BioPRIA researchers attended the *9th Biennial Australian Colloid and Interface Symposium* in February 2019 in Hobart, Tasmania, including **Dr Vikram Raghuwanshi** and **Dr Christine Browne**. This symposium provided the opportunity for them to share their findings in the field of colloid, surface and interface science. CI **Professor Gil Garnier** and BioPRIA researcher **Rodrigo Curvello** also attended the *American Chemical Society (ACS) National Meeting & Exposition*, 31 March – 4 April 2019 in Orlando, Florida. Rodrigo presented his work on nanocellulose hydrogels for blood typing diagnostics.

On May 5-8, the *2019 International Paper Physics Conference* was held in conjunction with TAPPI's PaperCon 2019 at Indianapolis, USA. CI **A/Prof Warren Batchelor** is part of the scientific committee. The conference covered a broad scope of physical properties of paper and paperboard materials, including the latest research of other materials produced from natural fibers (bio-composites and nanostructured materials). Recently, A/Prof Warren Batchelor also attended the *International Conference on Nanotechnology for Renewable Materials* in Chiba, Japan with BioPRIA researcher **Shaun Ang.** Many renowned scientists such as: Prof. Akira Isogai (University of Tokyo), A/Prof Emily Cranston (University of British Columbia) and Dr Heli Kangas (VTT Technical Research Centre of Finland) attended the conference and presented their work updating the audience on current activities of cellulose nanomaterials. A/Prof Warren Batchelor used this opportunity to present the work on energy efficient production of nanocellulose, while Shaun gave a presentation on refined and homogenized nanocellulose: fiber quality, energy and strength.

Professional Development Opportunities

Appita Young Professionals Network
YPN
Connect · Engage · Inspire

BioPRIA staff and researchers had the opportunity to join the webinars on 10th May and 14th June 2019, hosted by the **Appita Young Professionals Network**. The first webinar was delivered by **BioPRIA Educational Designer - Richard Young**, where he provided an overview of key "future work" ready reports and explored the key skills needed to succeed in a complex and evolving workplace. The second webinar was presented by **Matthew O'Connor - Technical Coordinator & Lab Manager at Norske Skog Albury**, where he gave an overview of applied data science in the pulp and paper industry with a focus on advanced analytics. These events can be used as a learning session to bridge the gap between theory and practice.

For more information about the upcoming webinars, please visit the Appita website.

2019 Three Minutes Thesis - Chemical Engineering Competition

The Department's Three Minute Thesis Competition was held on 6 June at Monash University, Clayton. It was an excellent day with seven outstanding presenters. BioPRIA and PALS researchers: **Marek Bialkower** and **Wriju Kargupta** participated the event and they had to present a compelling speech on their thesis topic to an intelligent but non-specialist audience in just three minutes.

Congratulations to the winner of the Department competition – Isaac Pincus who gave very confident and professional presentations. He will be competing in the Faculty 3MT competition. Congratulations to all competitors for delivering such high calibre presentation.

New equipment in BioPRIA

BioPRIA has just purchased a GEA pilot plant homogenizer Pony 2006. This homogenizer can operate up to 1500 bar, even with limited samples volumes and achieves the same results as bigger size machines. It offers significant improvements over our table-top homogenizer.

At BioPRIA, the homogenizer is used primarily as a mechanical treatment. The application of a high-pressure homogeniser allows the dispersion and homogenization of the cellulose fibres to the nanoscale.

Congratulations to our latest PhD successes

BioPRIA would like to congratulate our latest round of PhD graduates: **Thilina Gunawardhana, Aysu Onur** and **Llyza Mendoza**.

Thilina's thesis was entitled,"*Biorefinery Opportunities in Thermomechanical Pulping Mill*". He was supervised by A/Prof Warren Batchelor. Thilina is currently employed as a Research Engineer at Orora.

Aysu is a part of Chemicals and Plastics Manufacturing GRIP. The program enabled her to gain internship opportunity with 3M during her PhD candidature. Aysu's thesis was entitled, "*Engineering Cellulose Fibre Composites for Liquid Filtration*". She was supervised by A/Prof Warren Batchelor and Prof Gil Garnier. Aysu is currently joining a BASF Graduate Program.

Llyza completed her PhD under the supervision of Prof Gil Garnier and A/Prof Warren Batchelor. Her thesis was entitled "*Nanocellulose Gels: Concepts and Applications*". Llyza is currently working at Orora as a Research Engineer.

Study your Master of Bioproduct Manufacturing Engineering at Monash

COURSE DETAILS

Location: Clayton (Online)

Course code: E6007

Duration: 2 years part time

Enrolment: First intake July each year

The course comprises 48 points of core units structured into three parts:

MONASH University

MASTER OF BIOPRODUCT MANUFACTURING ENGINEERING

PART A: CORE (12 POINTS)

CHE5001- Advanced engineering data analysis

CHE5002 - Industrial Entrepreneurship

PART B: SPECIALIST UNITS (24 POINTS)

CHE5882 - Biomass and biorefineries

CHE5886 - Advanced biopolymers

CHE5887- Lean manufacturing

CHE5888 - Sustainability and innovation

BioPRIA

PART C: RESEARCH AND KNOWLEDGE

ENG5005 - Research methods

ENG5006 - Research practice

Enquiries to **Janette Anthony (janette.anthony@monash.edu)** for EOI and further enrolling information for the Master of Bioproduct Manufacturing Engineering, 2019 mid year intake closes July 1and 2020 1st Semester January 15,. Further into can also be found on **http://www.biopria.com.au/education/masters-program/**