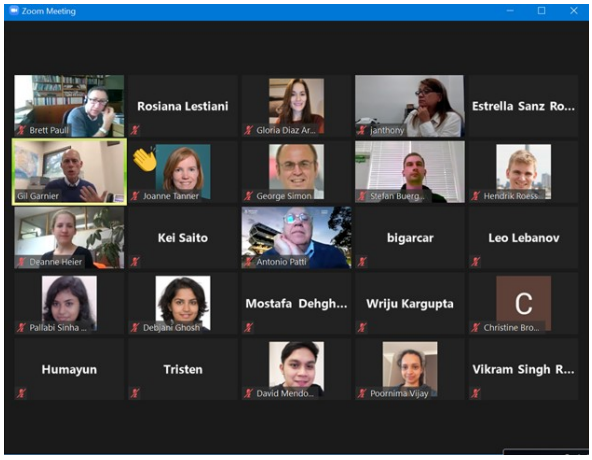
BioPRIA NEWSLETTER

November 2020

2020: A Year in Review



The COVID-19 pandemic has completely changed our daily routines but our researchers continue to work in rostered A and B teams and are progressed well.

In the second half of this year and due to COVID-19 we converted PALs Quarterly Review presentation to virtual meeting which include monthly presentations by students and Postdocs. This has been valuable for us and has enabled the students to remain connected with Industry partners and Chief Investigators who have welcomed this change.

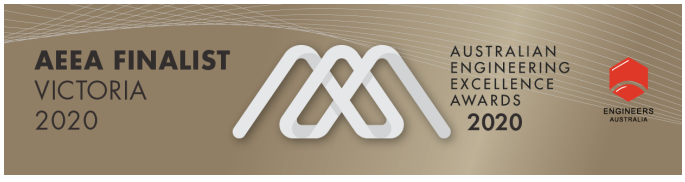
In 2020, BioPRIA has published around 25 journal papers. A paper in the field of mini-organs was recently accepted at Advanced Science, which was included as a high impact journal of 15.890.

Two students completed their PhDs and one of them has been offered a position at the Loesser Group at Monash University.

In terms of teaching the Master of Bioproduct Manufacturing Engineering course, the first cohort of students has successfully completed their studies, and we congratulate all of them. We are certain they will apply the knowledge gained from this degree, be successful into their workplace or whatever pathway they choose in their future.

Two students, Ruth and Maisha have also joined the Appita Young Professional Mentoring Program. This program has built new relationship with the industry and helped our students with their personal and professional growth.

Recent Award and Recognition



BioPRIA's blood diagnostics research group led by Dr Clare Manderson made it through to being a finalist at the Australian Engineering Excellence Awards 2020 for their laser incubation technology. Nominated by the faculty to represent Engineering at Monash University, we were up against significant engineering projects like smart buildings and level crossing removal projects. Our technology, although small by comparison, will have a huge impact on the lives of blood transfusion recipients and pregnant women. Laser incubation technology for blood group antibody screening reduces the time it takes to detect potentially fatal antibodies by 95%, which will allow blood transfusions to happen faster.

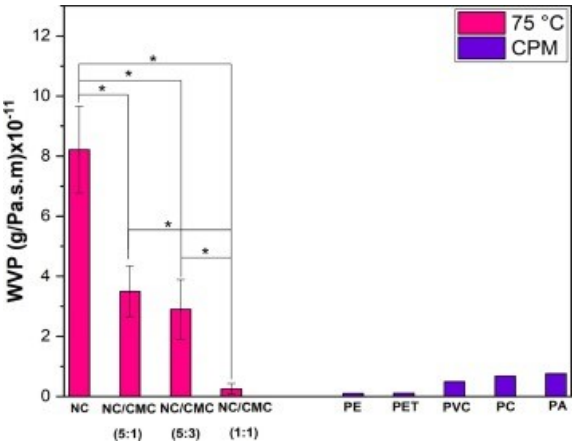
In recognition of this study, Dr Clare Manderson has also received the 2020 Dean's Award for Excellence in Research.

Latest PALS Research Publications

1. An Energy Efficiency Production of High Moisture Barrier Nanocellulose/carboxymethyl cellulose films via spray-deposition technique

Nanocellulose films are considered as a prospective alternative to non-sustainable packaging materials. However, their higher embodied energy and limited moisture barrier properties are regarded as a huge constraint regarding their commercialization.

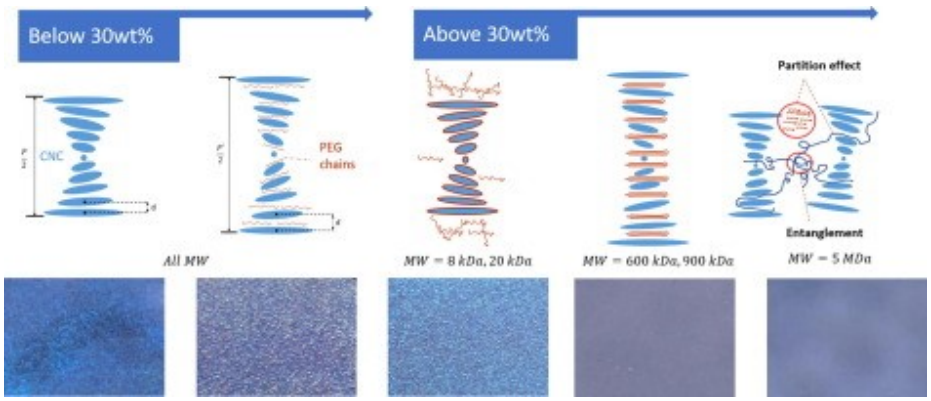
In our latest study published in Carbohydrate Polymers, nanocellulose based composite films with relatively low environmental impact and improved barrier performance were produced via spray deposition, with the addition of carboxymethyl cellulose (CMC). The paper demonstrated that a 50:50 mix of Nanocellulose and CMC reduces the water vapour permeability to a significant extent (comparable with conventional packaging), while increasing transparency and quadrupling strain at break to 34%. The CMC addition has also improved the heat resistivity of the Nanocellulose and the composite films could be produced with significantly reduced drying time. From the energy consumption perspective, the Nanocellulose/CMC films had an overall environmental impact due to their ease of recyclability.



Further reading: Nadeem, H., Naseri, M., Shanmugam, K., Deghani, M., Browne, C., Miri, S., Garnier, G. and Batchelor, W. 2020. **An Energy Efficient Production of High Moisture Barrier Nanocellulose/carboxymethyl cellulose films via spray-deposition technique**. Carbohyd Polym 250: 116911. https://doi.org/10.1016/j.carbpol.2020.116911

2. Modulating transparency and colour of cellulose nanocrystal composite films by varying polymer molecular weight

Cellulose nanocrystals (CNC) can produce photonic composite films that selectively reflect light based on their periodic cholesteric structure. The study demonstrated that modulating the photonic properties of CNC composite film can be achieved by changing the concentration of the polyethylene glycol (PEG) and its molecular weight. Depending on the molecular weight, the composite films were able to reflect light from the UV region (242 nm) across the visible spectrum to the near-infrared region (832 nm). Different trends in variation of the reflected light based on the molecular weight was found with increasing PEG concentration. This was explained by weak depletion interactions occurring between CNC and PEG, which was reduced with increasing PEG molecular weight. The reported findings assist in the future design and synthesis of CNC and polymer composite films where the polymeric component can manipulate the final optical properties, whilst produce improved mechanical properties.



Further reading: Lin, M., Raghuwanshi, V. S., Browne, C., Simon, G. P., Garnier, G. (2020). **Modulating transparency and colour of cellulose nanocrystal composite films by varying polymer molecular weight**. Journal of Colloid and Interface Science 584. p. 216-224. https://doi.org/10.1016/j.jcis.2020.09.123

PhD Scholarship Opportunity ARC Hub for PALS

In the past weeks, we have begun to review the applications and have started the interview with the prospective PhD candidates. The applications are still open for the 11 projects that relates to the functional materials and high value sustainable biomass-based products. Help us spread the word about this opportunity among your colleagues and friends.

Further information on the projects and how to apply are available here.

Student's Reflection

Michael Hertaeg

In August, I submitted my thesis entitled 'Interfacial Flows in Drying Blood Drops and Paper-Based Diagnostics'. This was exactly three and a half years since I began my PhD journey and represents my greatest accomplishment thus far.

I started my PhD as a fresh Monash graduate from a Bachelors in Mechanical Engineering degree. Although this prepared me for the fluid mechanics and physical analysis that formed the main component of my research, the interdisciplinary nature of the environment at BioPria and my project meant that there was a lot more to learn. In particular, I had no experience with working with complex fluids like blood or any biological system. Whilst this was a significant challenge for me, I found that my physical sciences background gave me a useful perspective from which to analyse biological phenomena.

The original title of my PhD project was 'Inkjet Printing for High-Throughput Blood Typing' which was designed as an application heavy, experimental research task to optimise this method of blood typing. However, shortly after commencing I found significant gaps in literature regarding the fundamental processes involved. I am grateful that my project had enough flexibility to allow its focus to shift onto more fundamental goals which were more in line with my interests. To support this, I sought out additional collaboration with external academics and I was fortunate enough to be invited for a three month secondment at the University of Cambridge. I am grateful to all members of BioPria, particularly my main supervisor Gil Garnier for guiding me through my journey. I have learnt more than I thought was possible in such a short period of time and grown far beyond the mechanical engineer I was 3.5 years ago.

Meet the Researchers - Connor & Liam

This month, we have the incredible opportunity to spotlight two ex-students, Connor Lowndes and Liam Methven, who both did a double degree in Chemical Engineering, Chemistry and Applied Mathematics; and graduated in 2020. Connor and Liam are now based at BioPRIA but working for Varden Process, one of the industry partners that has a research base here, working hand in hand with Prof Gil Garnier and A/Prof Warren Batchelor.

Liam is working on thermoforming bagasse and in particular working on how thermoforming of cellulose can alter the properties of the paper to make it suitable for applications in FMCG packaging. He said "it is great to be at the forefront of packaging innovation, but still be within Monash and able to access some of the people here for collaboration."

Connor runs the test programme that Varden and BioPRIA do jointly using the full gamut of equipment on hand here and said "we use the Scanning Electronic Microscope to understand the structure within the paper and then we can tweak the thermoformer accordingly and dial in the best performing parameters."

Varden has just completed its latest range of samples destined for a European FMCG brand, and research is continuing to grow with a joint BioPRIA-Varden ARC fund team of six more researchers expected to start next year.

Visit Varden for further information.

Mark your Calendar!

The next PALS Review Meeting is scheduled for 26th November 2020 at 1-2.30pm. Our speakers, Debjani Ghosh and Dr Vikram Raghuwanshi will give updates on their research projects. Everyone is welcome to attend.