Curtin University

Food Science and Technology

MSc and Honours Projects 2020

Food Science and Technology MSc and Honours projects 2020

Allocation of Projects

Students should review the list of available MSc Projects in this Booklet and meet with potential supervisors to discuss the projects on offer, in order to choose their project preferences. Contact details for all Curtin supervisors are provided to assist you in this process. All students are requested to provide **three project preferences (in order) from different supervisors to the Course Coordinator by 8.00 AM Monday 3 August 2020 the very latest.** You need to provide your project preferences and other details in the table on page 2, preferred option is by email. Project allocations will be confirmed as soon after that, after eligibility can be confirmed. Please provide an email address through which you can be contacted.

Allocation of projects will take into account a number of factors, including student merit, student preferences and interests, as well as allocation of students across available supervisors and workload of supervisors. Select your project preferences carefully, keep an open mind and consult as widely as possible.

Please note that **late submissions and/or incomplete submissions will result in the student being allocated to remaining projects after everyone else has been allocated, irrespectively of the listed preferences.**

If you have any questions about this process, please contact me (email is the most effective option).

Dr Ranil Coorey

Course Coordinator Food Sciences and Technology

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MSc Project Preferences

To be submitted by email to Dr Ranil Coorey (r.coorey@curtin.edu.au) by
8.00 AM on Monday 3 August 2020.

Please ensure that projects from 3 different primary Curtin supervisors are listed.

You can provide the information by using this form, or type ALL information into an email.

Student ID :	**Name :**
Contact Email Address:	**Contact Phone Number:**

Preference	Project Title	Curtin Supervisor
1		
2		
3		
4		

MSc Supervisors – 2019

A/ Prof Stuart Johnson

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MSc and Honours Projects

Hello!! I completed my PhD Food Science in the UK, after which I have had a varied career in food science; spanning industry, Government and academic positions.
My current research focuses on grains suitable for sustainable agriculture, in particular lupin and sorghum as (a) novel human foods for chronic disease risk reduction, (b) sources of nutraceuticals and (b) sources of novel biomaterials.

1. **Development of prototype vegan foods using a novel lupin gelling protein** (several projects)
We have recently filed a patent application (Al-Ali and Johnson, 2019) for an innovative method to, for the first time, induce gelling properties using ultrasound in protein isolated for the seeds of the legume lupin. This new functionally now gives lupin protein great potential for texturizing a wide range of high protein vegan food analogues, such as dairy and meat analogues and pasta to meet the growing demand for vegan foods. In this project you will select a target product and using "one-factor at a time" development approach aim to identify a formulation and processing method to produce a vegan, non-GM, gluten-free and soy-free analogue that has quality attributes similar to the conventional product. The findings of your project may result in a patent application, a publication and formulation and process optimisation in collaboration with the food industry.

Al-Ali, H.A., Johnson, S.K. (2019) Australian provisional patent application No. 2019901521. High Protein Food Ingredient. Curtin University. Retrieved from http://pericles.ipaustralia.gov.au/ols/auspat/applicationDetails.do?applicationNo=2019901521

2. **The role di-tyrosine in elasticity of non-gluten plant proteins** (several projects)
A key attribute of the success of any plant protein ingredient is its technological functionality that is its ability to form structures within the food matrix to provide the mechanical or sensorial experience expected by consumers. Only a few plant proteins such as the glutenins and gliadins in possess molecular structures providing the viscoelastic gluten properties in dough required for a product such as leavened bread. This gluten network is a visco-elastic protein matrix that contains covalent cross-linkages between glutenin and gliadin proteins. The responsible cross-links have generally been considered as di-sulphide bonds, however another cross-link, di-tyrosine may play a role in gluten visco-elasticity Peña et al. (2006). In addition di-tyrosine bonds may play a role in the viscoelastic properties of proteins of some other gluten-free extensible plant proteins such those from marama bean and carob bean germ (Amonsou, et al. 2012). We have developed a liquid chromatography-mass spectrometry (LC-MS) method for

the accurate, precise and sensitive quantitation of di-tyrosine in plant proteins and doughs (Nguyen et al. 2017)

This project will involve:

1. Preparation of protein isolates from marama beans and carob bean germ and standard wheat
2. Formation of doughs from the protein isolates
3. Measurement of the extensibility of these doughs using a texture analyser
4. Measurement of the rheology of these doughs using a small deformation rheometer
5. Determination of the di-try content of the protein isolate and the doughs using LC-MS method
6. Determination of the primary and quaternary structures of the protein isolates using non-reducing and reducing sodium dodecyl sulphate – polyacrylamide gel electrophoresis
7. Determination of the predominant secondary structure of the protein isolates and doughs using Fourier transform infrared spectroscopy.
8. Comparison of the properties of the three proteins

Findings of this research will give us a fundamental understanding of structure, including the potential role of di-tyrosine in the viscoelastic proteins in marama bean and carob bean germ protein. This understanding may assist in development strategies to induce viscoelasticity in other plant proteins which currently do not have this important functionality.

Amonsou, E. O., Taylor, J. R., Emmambux, M. N., Duodu, K. G., & Minnaar, A. (2012). Highly viscous dough-forming properties of marama protein. *Food Chemistry*, *134*, 1519-1526.

Nguyen, D. D., Johnson, S. K. & Clarke, M. W. (2017). Identification and quantification of dityrosine in grain proteins by isotope dilution liquid chromatography-tandem mass spectrometry. *Food Analytical Methods,* 10, 3321-3328.

Pena, E., Bernardo, A., Soler, C., & Jouve, N. (2006). Do tyrosine crosslinks contribute to the formation of the gluten network in common wheat (*Triticum aestivum* L.) dough? *Journal of Cereal Science*, *44*, 144-153.

Dr Rewati Raman Bhattarai

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Background

My research interests comprise the areas of grain science, nutrition and health. My recent research projects involved elucidating the role of plant food structure in macro-nutrients digestion and fermentation kinetics. In particular, I investigated how plant cell walls and macronutrients interacts in whole food and during processing and digestion. Carbohydrate and health encompassing resistant starch, dietary fibres, digestion and fermentation are of my special interests. I have developed methods to obtain high dietary fibres and resistant starch enriched milled fractions in cereals and legumes. I have used *in vitro* food digestion/fermentation models that mimic the human and animal digestive system to study food nutritional properties. My research area also include ingredient functionality and sensory quality in various cereal products. My previous projects focussed on understanding on wheat quality requirements for various end products such Asian noodles, bread, and their textural and sensory assessments.

Research and Honours projects

1. **Investigations on pulsed light technology to improve plant protein functionality (several projects)**

The plant protein functionality area is of high research demand nationally and internationally. We have a lot of Stakeholders willing to invest and capture the global market of high consumer demand plant proteins. Alternative plant-proteins for food and nutraceutical are now urgently required to due to consumer demand and concerns for ethical and sustainable practices, waste minimisation, food security and healthy lifestyle. Our team at Curtin has successfully established collaborative research on functionality of lupin proteins. This project will investigate the potential of a novel, green technology, known as pulsed light, to beneficially modify plant protein functionality in cereals/legumes. The innovation is expected to provide a nutritionally and functionally high quality protein to feed global population as well as increase production and value of Australian grains.

2. **Innovations in sorghum grain functionality**

Several projects will be conducted to investigate sorghum grain functionality:

1. Identification of Australian sorghum varieties with superior popping ability

Popping is a traditional and economical method adopted to improve nutritional quality of grains. Studies to assess the popping ability of sorghum have been completed, but most of these have evaluated sorghums adapted and produced in Asia or the USA. To the best of our knowledge, no reports are available on the ability of sorghum genotypes grown in Australia for their popping ability. Furthermore, it is well known that the

environment can influence grain quality and possibly popping characteristics. Therefore, it is important to assess the relative effect of genotype and environment on popping characteristics.

2. Effect of black sorghum fractions on in vitro starch and protein digestibility

Consumer interests towards healthy, gluten free diet has increased the use of sorghum for human nutrition. Sorghum grains are abundant in health-promoting compounds such as bioactive compounds and polyphenols. In recent years, pigmented plant cultivars have gained major attention due to association between polyphenols and reduced starch digestion. However, limited research has evaluated the effect of polyphenols from sorghum on starch and protein digestion. This study aims to investigate the effect of polyphenols from different fractions of Australian black sorghum on in vitro starch and protein digestion and unravel the associated mechanisms. The study is expected to provide more evidence on using black sorghum for the development of healthier functional foods.

3. The role of di-tyrosine cross linking in wheat protein elasticity

The gluten network in wheat flour is an elastic protein matrix that contains covalent linkages between glutenin and gliadin proteins. There is very scarce information available on the contribution of di-tyrosine cross linking on visco-elastic properties of gluten.

This project will evaluate a range of wheat classes varying in their protein contents and quantify the di-tyrosine levels. It involves isolation of proteins from wheat classes, preparation of protein dough and measurement of textural and rheological properties. The di-tyrosine content will be quantified using liquid chromatography-mass spectrometry (LC-MS) developed by (Nguyen et al. 2017). The correlation will be carried out to investigate the relationship between di-tyrosine content and visco-elastic properties.

Note: This project will run in line with A/Prof Stuart Johnson's di-tyrosine projects and aims to unravel how di-tyrosine level correlates to extensibility of wheat.

Nguyen, D. D., Johnson, S. K. & Clarke, M. W. (2017). Identification and quantification of dityrosine in grain proteins by isotope dilution liquid chromatography-tandem mass spectrometry. *Food Analytical Methods,* 10, 3321-3328.

Dr Ranil Coorey

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Background

My research interests are mainly in the area of food safety, both chemical and microbiological and food product innovation. My research includes the AMPC Red Meat Safety, Chicken processing and safety and the determination of composition and applications for Australian bush foods. My chicken processing and safety research program is a collaboration between the industry and several African countries, which is funded by the AAUN. I also have industry funded projects on value addition to Australian truffles and fruit. Another Department of Primary Industries and Regional Development sponsored project for students on brewery by-product utilisation. Some of my other work includes value addition to food industry by-products, such as applications for Australian banana peel and second grade banana. My work also includes the development of food ingredients from chia and quinoa. The product innovation research includes gaining an understanding of raw material interaction and performance during processing plus the development of commercially acceptable products. All of my publications based on student projects related these research can be accessed through Curtin's library. One of my objectives is to publish student research with them.

Masters and Honours Project

Food Safety research projects

These projects are industry and research organisation collaborations. You will be working in a team and will have a PhD student of mine as a mentor.

1. Comparative study between some Australian red meat processors in food safety practises and legislation

Industry partner: AMPC

The study will look and the legislation and practises in the red meat processing industry between different large and medium scale Australian processors.

2. The identification of the prevalent microbial flora within the West Australian red meat processing facilities

Industry partner: An Australian red meat processor (due to confidentiality the exact name of the facility cannot be released to the public)

The project will isolate and identify the typical microbial flora within the chicken processing chain in Western Australia and determine their antibiotic resistant characteristics

3. Identify microorganisms isolated from retail chicken products in Western Australia

Industry partner: An Australian poultry processor (due to confidentiality the exact name of the facility cannot be released to the public)

The project will identify already isolated organisms from retail chicken products and determine their heat and antibiotic resistance characteristics

4. Determination of stress hormone levels in meat products (this project may have some external funding available)
Industry partner: AMPC

The project will validate a developed process in identifying stress hormones and other chemical compounds in animal muscles after slaughter. Some of these compounds may have safety implications to the consumer

Australian Bush Food applications

The Bush Food projects are in collaboration with my Australian Indigenous Bush Food Industry. You will have the opportunity to work with a Community Elder. The two projects under this area are priority. You will be working in a team and will have a PhD student of mine as a mentor.

1. Identifying the chemical composition and safety of selected Australian bush foods
Industry partner: Swan Valley and Eastern Regions Inc (this project may have some funding)

There are three separate projects available under this topic. The aim of the projects will be to determine the chemical profile of some selected Australian native bush food. The project will specifically look for known plant chemicals hazards

2. Determination of the nutritional composition of selected Australian bush foods
Industry partner: Swan Valley and Eastern Regions Inc (this project may have some funding)

There are three separate projects available under this topic. The aim of the projects will be to determine the nutritional profile of some selected Australian native bush food. The project will specifically look for known plant based nutritional and bioactive compounds

I also accept student ideas and interest that fall within my research program. Students are welcome to come and talk to me about their interest when deciding on the projects.

Food by-product utilisation

The projects in this area are in collaboration with the industry. You will be working in a team and will have a PhD student of mine as a mentor.

1. Optimisation of the extraction of different pigments from banana peel for food application
Industry partner: Sweeter Banana cooperative

This project has potential patents and industrial confidentiality around it. Due to which details can't be publicised. If you are interested in further information me contact me

2. Determination of the composition of spent grain from the brewing industry and their extraction.

This project is funded for a student project by the Department of Primary Industries and Regional Development and the Industry. The project is to determine the nutritional composition of the spent grain that can be extracted for food applications. It would be beneficial if you can develop a functional food product incorporating one of the extracted components. This is a priority project.

All of my publications based on student projects related these research can be accessed through Curtin's library. One of my objectives is to publish student research with them.

Dr Janet Howieson

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Master and Honours Project

Please note all listed projects are part of existing externally funded industry research projects.

1. Sustainable packaging liners for the seafood industry
   - Identify sustainable (ie compostible/recyclable or re-useable) liners to replace current single use plastic products.
   - Trial new liners when compared to traditional options for a selected seafood species, using temperature, microbiological, quality and economic indicators.
   - Undertake a preliminary assessment using traditional sustainability metrics.

(Please note that this project can be undertaken by more than one student as each student may focus on one seafood species)

2. Understanding new product opportunities from freeze dried abalone shuckings (building on previous work).
   - Assess nutritional and compositional attributes of freeze dried abalone shuckings from different commercial species
   - Assess for certain specific antioxidant and other therapeutic activity.
   - Investigate enzyme hydrolysis techniques to potentially change product functionality.
   - Develop new product outcomes based on identified attributes.

3. Developing new products from seafood processing offcuts
   - Participate in and extend an existing project to develop and assess a fish jerky product.
   - Participate in and extend an existing project to develop and assess a fried fish skin snack.

(Please note that this project can be undertaken by more than one student as each student may focus on one seafood product).

4. Extraction and functionality of chitin from prawn processing heads/shells.
   - To develop a method to extract chitin from prawn processing green and cooked heads and shells.
   - To test the extracted chitin for quality and functional attributes.
   - Develop new product outcomes based on identified attributes.