THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

DISCIPLINE OF FOOD SCIENCE & HUMAN NUTRITION

HONOURS AND UNDERGRADUATE RESEARCH PROJECTS

2024

Undergraduate Research in Food Science & Human Nutrition

School of Environmental and Life Sciences

There are a number of strong research themes in the Discipline of Food Science & Human Nutrition in areas such as:

- Postharvest research
- Food Biochemistry
- Functional food ingredients
- Food Analysis

We encourage undergraduates to get involved in research throughout their degree. By doing so you will learn and develop skills in searching, selecting and retrieving information from scientific sources, skills in project management, experimental research skills as well as skills in presenting scientific information in a clear and concise manner, both orally and in writing. These will provide you with a strong foundation for your future career, whether it be in the industrial, commercial or academic sector.

There are three main ways to get involved in research:

a) ***Summer research project:*** Short paid undergraduate research projects over summer. Scholarships are advertised each year

b) ***SCIE3500:*** A 10-unit undergraduate course consisting of a research project under the supervision of an academic staff member. Assessment is based on a progress report, a research notebook, a final project report and an oral presentation. The course is open to third year students who have successfully completed at least 140 units and have a cumulative GPA of at least 5.0 and is offered in both semesters. Course outline link here.

c) ***Honours research project:*** A full-year research project after completion of the Bachelor of Food Science and Human Nutrition or another cognate degree. A minimum GPA of 5.0 is required for entry into honours. Program handbook link here.

This booklet contains a list of undergraduate research projects currently available in the discipline. Academics are listed in alphabetical order. In all cases you should discuss potential projects with prospective supervisors before trying to enrol or apply.

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Dr Taiwo Akanbi

Food Bioprocessing and waste valorisation

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There are growing health concerns over the use of chemically synthesised compounds in food and the food industry is now turning to natural ingredients. One of my research interests is investigating natural alternatives that can be used in food.

I am also interested in the recovery and utilisation of high-value compounds from food waste as this is consistent with the circular economy idea whereby food processing wastes are kept in use while also minimising negative environmental impacts and footprints.

Available research projects

Polyphenols as food preservatives: Polyphenols are a group of plant metabolites recognized for their health benefits, including anti-inflammatory, antimicrobial, and antioxidant effects. These properties make them suitable for use as natural preservatives of meat. Because polyphenols are soluble in either water, oil, or both, these affect their applications. This project will study how some commercially available polyphenols can be used to preserve minced meat and fish.

Composite antioxidants for stabilising omega-3 oils: Omega-3 fatty acids are the third most widely used dietary supplements after minerals and vitamins. They are also added to infant formulas because they help with visual function and neural development. However, they are highly oxidatively unstable, thus, the need for antioxidant addition. Interestingly, the most widely used antioxidants are chemically synthesized. In this project, a combination of natural antioxidants will be studied for their effectiveness in stabilising omega-3 oils.

Bioactive compounds from winery waste: Winemaking leads to the production of large quantities of wastes. These wastes are rich sources of phytochemicals such as anthocyanins, proanthocyanidins, and other polyphenols. Current methods of extracting these compounds involve the use of environmentally unfriendly chemicals. So, there is a need to develop new techniques. In this project, the effectiveness of adsorption resins for extracting phytochemicals from winery waste will be investigated.

Food-grade polysaccharides from seaweeds: Fucoidan is a polysaccharide commonly found in brown seaweeds and has many uses in the pharmaceutical and food industry. It has been successfully extracted from kelps and fucoid brown macroalgae in the Northern Hemisphere. The project is dictated by the need to find local sources of fucoidan, which could be used in the food industry. As a first step, we will use common algal species that are likely to contain fucoidan for extractions. The species will be sampled from different locations to see if there is spatial variability in fucoidan concentrations. Several extraction methods will be compared to maximise the possible yield.

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Dr Penta Pristijono

Horticulture Postharvest

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My research interests mainly to develop innovative horticulture postharvest technology for extending fruits and vegetables postharvest life.

Horticulture postharvest extension. Fruits and vegetables continue to respire and transpire after harvest. However, since the produce is removed from source of water, photosynthates (mainly sucrose and amino acids) and mineral, it is now dependent entirely on its own food reserves and moisture content. Therefore, losses respirable substrates and moisture are not made up and deterioration commences. Fruit and vegetables metabolically divided into two groups of climacteric and non-climacteric produce. The classification relates primarily to changes in respiration patterns and ethylene production during maturation, ripening and senescence. Climacteric produce experience a pronounced increase in respiration and ethylene production during ripening, while non-climacteric produce show no marked change in these characteristics during maturation. Methods for extending horticultural postharvest life by reducing metabolism rate, minimise exposure to postharvest pathogens and limit handling-related damage.

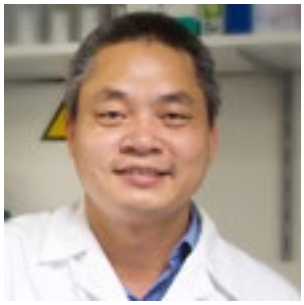
Research Projects

UV-C irradiation. UV-C irradiation has been reported to have beneficial effect on maintaining postharvest quality of horticultural produces. UV-C treatment offer considerable advantage over existing postharvest treatments, being low technology and chemical free for delaying fruit ripening and preventing produce deterioration in the supply chain. Project in this area will focus on the application of single UV-C treatment or combine with other postharvest technologies and different packaging materials to achieve optimum postharvest life extension for specific climacteric or non-climacteric produce, analyse fruits and vegetables quality using destructive and non-destructive methodology.

Amino acids. Proteogenic amino acids treatment offer considerable advantages as being water soluble solids that can stored and utilised in a commercial environment with minimal training. They also have GRAS (Generally Regarded As Safe) status which recognises their safety as food additives. The project in this area will focus on the use of proteogenic amino acids to inhibit the progression of key senescence characteristics of horticultural produce. This project also focuses on combination treatment with different temperatures and atmospheres, assess the fruits and vegetables postharvest life by assessing metabolic process focussing on respiration rate and ethylene production during storage.

Hydrogen sulphide (H_2S). H_2S has recently been identified as a biologically active gas that is linked to an increasing number of critical physiological processes in both plants and animals. H_2S has also been found to be active in postharvest metabolism, by inhibiting the development of a range of senescence characteristics including tissue browning and softening, chlorophyll degradation, cellular respiration and endogenous ethylene production in a range of produce. The project in this area will focus on the use of H_2S fumigation to inhibit the progression of key senescence characteristics of horticultural produce and to delay fruits ripening, assessment of fruits and vegetables quality using current postharvest quality assessment standard.

Essential oils. Plant essential oils (EOs) are mostly terpenoids derived from units of with further structural diversification achieved through the inclusion of heteroatom functional groups such as alcohols, aldehydes, ketones, esters, and ethers. EOs has been shown to be effective in controlling postharvest pathogens. This project will identify the main compounds of various EOs, application on different fruits either as a single treatment or combination with other postharvest treatments to achieve an ideal treatment against postharvest pathogens and maintains fruit quality, evaluate the fruit quality using subjective and objectives methods.



A/Prof Quan Vuong

Food Processing and Applications

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I am interested in exploring the benefits derived from a diversified array of natural products. My research focuses on compounds that possess potent antioxidant capacities and effective biological actions on human health. These compounds can be utilized in the pharmaceutical and nutraceutical industries. Additionally, I am interested in exploring the potential uses of Australian native flora as herbs or functional ingredients. Lastly, I am keen to address food processing waste by transforming it into valuable products.

Potential research projects:

Natural bioactive compounds (NBCs) as functional ingredients: NBCs, including volatile (aromatic compounds) and non-volatile compounds (phenolics, terpenes, and alkaloids), are diversified in various plant materials. NBCs have received increasing interests due to their potential as natural preservatives, functional and therapeutic agents. Cost-effective extraction and isolation of NBCs from the natural materials are critical for further applications. Therefore, this project aims to investigate the impact and establish optimal conditions for pre-treatment of plant materials, extraction, isolation and identification of NBCs and further apply these compounds as functional ingredients.

Development of health foods: Health foods containing specific components such as bioactive compounds, dietary fibre can provide health benefits beyond the basic nutrition. Development of food prototypes with functional ingredients can create new food products for various market demands. As health food components are susceptible to various processing, storage and distribution conditions, this project aims to identify the effects and establish the most suitable methods and prototypes for development of new food products for the designed market demands.

Potential uses of Australian native flora as herbs or functional ingredients: Australia is home to over 25,000 native floras. Many of these floras have been used as bush food and medicines for centuries by Aboriginal communities, however, less than 10% of Australia native floras have been studied for their bioactives and human health potential, and only few have been commercially used for producing bioactives and further applying in nutraceutical, cosmetic and health products. This project aims to investigate potential uses of Australian native floras as herbs or functional ingredients.

Valorisation of waste generated from the food industry: The large quantity of waste generated from agricultural and food production remains a great challenge and an opportunity for the food industry. As there are numerous risks associated with waste, billions of dollars are spent on the treatment of agricultural and food waste. Therefore, valorisation of food waste is essential to minimise the risks and add more value to the food industry. This project aims to examine potential use of food waste as food or functional ingredients for further applications.