

PhD Opportunity

The potential of Artificial Intelligence to predict heart disease: exploring AI to link electrocardiographic and metabolic biomarkers in individuals at risk of heart disease

Supervisory team

This project is led by Dr Allain Bueno at the School of Sciences and the Environment. International collaborators from Spain and Brazil will also be involved in the research.

Director of Studies: Dr Allain Bueno

Supervisors: Dr Emma Edwards

Research Group: [Worcester Biomedical Research Group \(WBRG\)](#)

The PhD Opportunity

Ischaemic heart disease is the leading cause of mortality worldwide [1] and is increasingly prevalent in regions such as the USA and UK [2, 3]. The growing burden on public health systems is exacerbated by overlapping risk factors, including obesity, smoking, physical inactivity, hypertension, type II diabetes, and dyslipidaemia [4,5].

Diets low in omega-3 fatty acids are associated with an elevated risk of cardiovascular disease, while omega-3 rich diets offer protective benefits for the heart [6,7]. However, the precise mechanisms underlying this cardiovascular protection are not yet fully understood.

In the mid-1990s, researchers discovered that omega-3 reduce the electrical excitability of heart cells [8]. By the early 2000s, studies revealed that omega-3 consumption was positively correlated with a reduction in heart rate [9]. Despite these discoveries, their impact on overall cardiac function remained unclear until recently.

Our research group was the first to identify an inverse relationship between blood docosahexaenoic acid (DHA), a type of omega-3, and ventricular depolarization electrocardiographic (ECG) readouts in a population of healthy women [10]. Our findings offer a mechanistic explanation for the cardioprotective effects of omega-3 fatty acids by demonstrating that higher omega-3 levels improve the efficiency of the relationship between ventricular mass and its QRS voltage potential in healthy individuals.

The next step in our research is to explore these findings in larger population settings by integrating blood measurements, electrocardiographic markers, and artificial intelligence.

This project includes a pre-clinical component in which the PhD candidate will work directly with adults at risk of chronic metabolic diseases. The candidate will collect body composition data, electrocardiographic readings, and blood samples from consenting participants. Full training will be provided.

Applications are welcome from nutritionists, dietitians, clinical biochemists, or biomedical scientists, with excellent IT skills.

References

1. Wu P, Yu S, Wang J, Zou S, Yao DS, Xiaochen Y. Global burden, trends, and inequalities of ischemic heart disease among young adults from 1990 to 2019: a population-based study. *Front Cardiovasc Med.* 2023 Nov 24;10:1274663
2. Roth GA, Mensah GA, Johnson CO et al. GBD-NHLBI-JACC Global Burden of Cardiovascular Diseases Writing Group. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. *J Am Coll Cardiol.* 2020 Dec 22;76(25):2982-3021.
3. ONS: [Deaths registered in England and Wales - Office for National Statistics \(ons.gov.uk\)](https://www.ons.gov.uk)
4. Rocha, V. Z. & Libby, P. (2009) Obesity, inflammation, and atherosclerosis. *Nature Reviews Cardiology*, 6: 399–409.
5. Grundy, S. M. (2016) Metabolic syndrome update. *Trends in Cardiovascular Medicine*, 26: 364–373.
6. Kris-Etherton PM, Harris WS, Appel LJ; American Heart Association. Nutrition Committee. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. *Circulation.* 2002 Nov 19;106(21):2747-57.
7. Santos HO, May TL, Bueno AA. Eating more sardines instead of fish oil supplementation: Beyond omega-3 polyunsaturated fatty acids, a matrix of nutrients with cardiovascular benefits. *Front Nutr.* 2023 Apr 14;10:1107475
8. Kang JX, Xiao YF, Leaf A. Free, long-chain, polyunsaturated fatty acids reduce membrane electrical excitability in neonatal rat cardiac myocytes. *Proc Natl Acad Sci U S A.* 1995 Apr 25;92(9):3997-4001.
9. Mozaffarian D, Geelen A, Brouwer IA, Geleijnse JM, Zock PL, Katan MB. Effect of fish oil on heart rate in humans: a meta-analysis of randomized controlled trials. *Circulation.* 2005 Sep 27;112(13):1945-52
10. Casagrande BP, Sherrard G, Fowler MS, Estadella D, Bueno AA. Capillary Blood Docosahexaenoic Acid Levels Predict Electrocardiographic Markers in a Sample Population of Premenopausal Women. *J Clin Med.* 2024 Oct 7;13(19):5957

Additional costs

Given that this is a laboratory-based project, bench fees will apply to cover the procurement of materials essential to delivering the research objectives. This will include consumables for the handling and processing of blood samples.

Application Process

To begin the application process please go to:

<https://www.worc.ac.uk/research/research-degrees/applying-for-a-phd/>.

The Interview

All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Doctoral School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

Funding your PhD

For information about Doctoral Loans please visit: <https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx>.

During your PhD you can access the Research Conference Support Scheme to support the costs of presenting your research at an external conference.

Research at the University of Worcester

Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge, but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- [Human Health and Wellbeing](#)
- [Sustainable Futures](#)
- [Digital Innovation](#)
- [Culture, Identity and Social Exclusion](#)
- [Professional Education](#)

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

Research Degrees at Worcester

Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3rd for overall research student satisfaction nationally. Key to our success in this area is the Doctoral School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team.
- a Research Student Study Space with both PCs and laptop docking stations.
- a comprehensive Researcher Development Programme for students and their supervisors.
- a programme of student-led conferences and seminars.

Widening Participation

As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

For further information or an informal discussion on this project, please contact Dr Allain Bueno (a.bueno@worc.ac.uk)

