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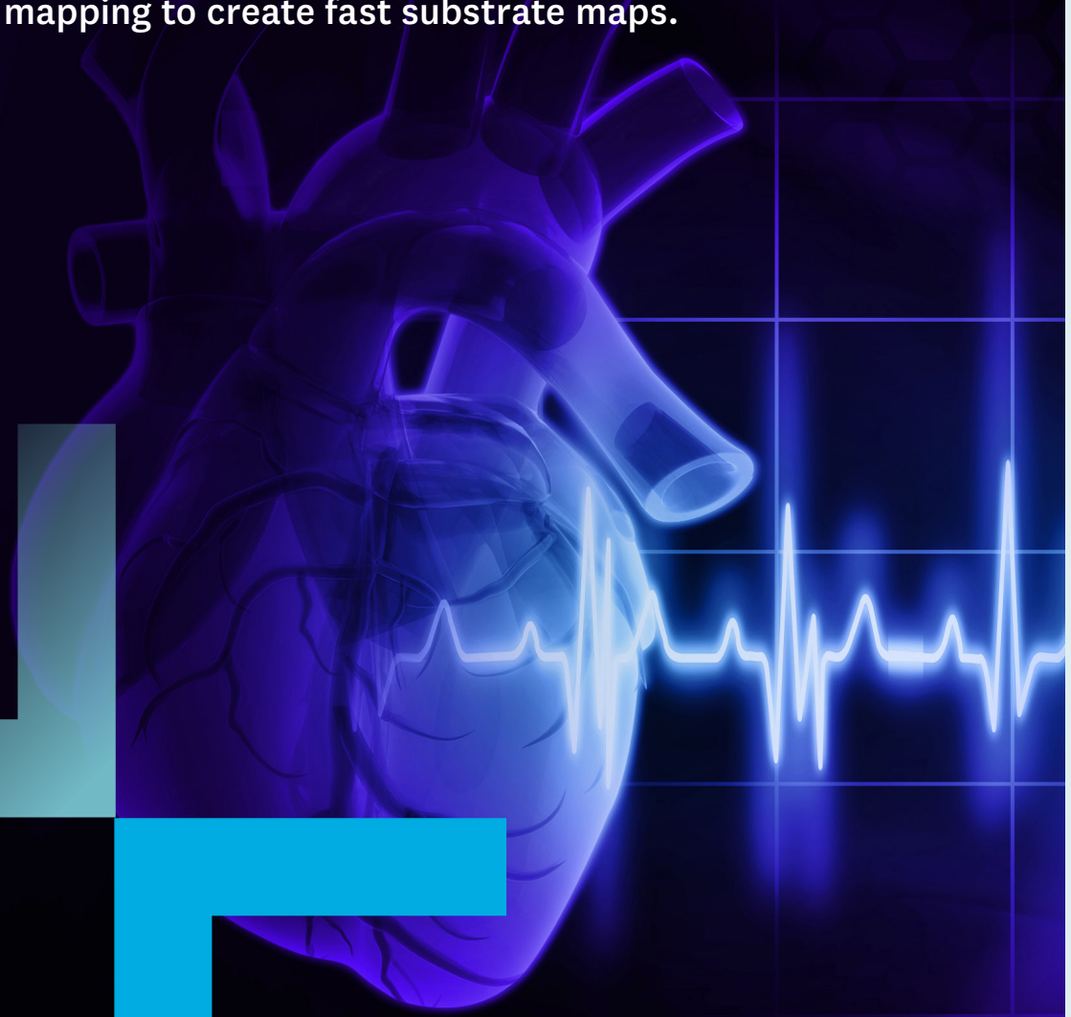
IDEAS TO LIFE RANGAHAUA KIA WHAI HUA

# Atrial fibrillation

## Real-time and robust mapping of heart activation

We present a novel catheter-agnostic software platform to identify ablation targets for atrial fibrillation (AF) using signal processing and 3D voltage mapping to create fast substrate maps.



## Background

The software platform, based on 10+ years of research at the Auckland Bioengineering Institute, was able to identify candidate sites for ablation consistently and robustly in a pre-trial study with the Royal Melbourne Hospital, representing a breakthrough in the field.

- AF causes a rapid irregular heart rate, increasing the risk of stroke and exacerbating heart failure.
- Anti-arrhythmic drugs are a common AF treatment as they reduce the frequency and duration of arrhythmia episodes. Approximately 50% of patients develop resistance to these drugs and there is just a 10-40% success rate in persistent AF.
- Persistent AF and permanent AF are known to be driven by fibrillatory activity in other distinct regions of both atrial chambers but attempts to identify ablation targets by electrical mapping and to isolate them have proved disappointing. Long-term success rates for this approach are low and no better than what is achieved with pulmonary vein isolation alone.
- The global market for AF was valued at $3.7 billion in 2017 and is expected to increase at a compound annual growth rate of 13.6% to reach a value of $7.8 billion by 2023. Growth of the market is driven by the increase in AF prevalence and the launch of premium-priced ablation catheters, diagnostic mapping catheters and left-atrium appendage closure devices primarily in Western countries.
- Previous alternative approaches to this problem have failed due to poor resolution and accuracy.

## Technology

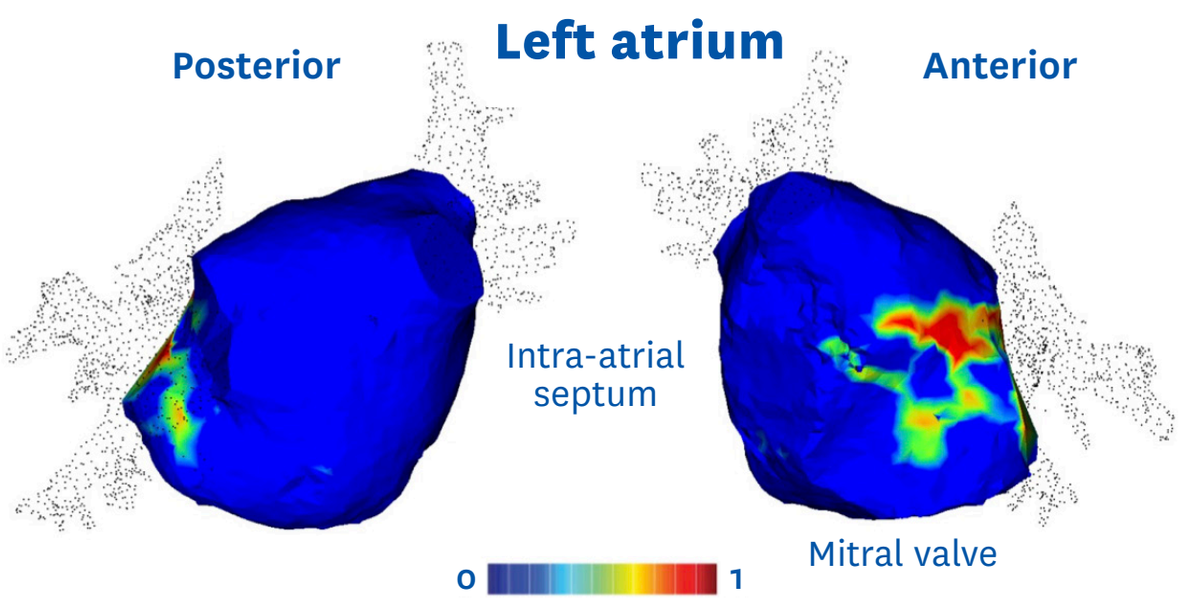
Our technology enables rapid 3D mapping and visualisation of electrical activity on the endocardial surface of a cardiac chamber using multi-electrode catheters in which some or all electrodes are not in contact with the heart wall.

It can be used for either global or region-of-interest mapping, ideally with a single purpose-designed basket catheter.

The approach uses an inverse mapping method that is fast, robust and will improve the performance of most current mapping systems.

We have developed novel time-averaged measures that enable regions with altered electrical properties to be identified from our mapping data. Because these local “fingerprints” of AF are stable over time, they can be assembled across the atrial surface with sequential intervals of regional mapping.

This combination of improved mapping and analysis methods is expected to result in reduced treatment times and reduced AF recurrence rates.



## Validation

- The inverse mapping approach has been carefully validated, an interactive demonstration module has been developed and novel catheter designs have been developed.
- The mapping methods were demonstrated successfully to Professor Jonathan Kalman and colleagues (Royal Melbourne Hospital) in a retrospective analysis of clinical data recorded by them in patients prior to pulmonary vein isolation for persistent and permanent AF.
- A further preliminary cardiac electrophysiology trial for 14 patients is ongoing.

## Patents & Publications

- We hold three patents covering the totality of the invention pipeline:
    - Heart Mapping System, US10,610,112, granted Apr 7, 2020.
    - Catheter, US17/609,069, filed May 7, 2020.
    - Heart Tissue Identification in the Context of Atrial Fibrillation, US63/336,265, filed Apr 28, 2022.
- Many scientific publications describing prior work in the field by our inventors are available through Google Scholar, Scopus etc. These represent over 200 papers and tens of thousands of citations.

## Science team

**Professor Bruce Smaill** is a foundation member of the Auckland Bioengineering Institute. He is interested in the muscular architecture of the heart and how this affects electrical function in normal and diseased hearts. His research with colleagues in Auckland has been influential in the field. It combines structural imaging, experimental studies and computer modelling.

**Associate Professor David Budgett** has a PhD in Electrical Engineering from Imperial College in London. David is part of the management team of the Auckland Bioengineering Institute, has major research grants in the field of implantable devices and maintains a special interest in commercialisation of the Institute's intellectual property.

**Professor Jonathan Kalman** is an internationally respected cardiologist and one of the leading heart rhythm experts in Australia. He is head of the Royal Melbourne Heart Rhythm department, which is internationally renowned for the high quality of clinical medicine and investigative research performed.

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## UniServices by the numbers

Total external research funding:
**$261.3M**
(35% increase over 2020)

**45**
companies started in the past five years

**$1.25BN**
Total market capitalisation of companies formed

**$73.5M**
Net asset value of the University of Auckland Inventors' Fund

**17,335** Covid-19 vaccinators trained by the Immunisation Advisory Centre in 2021

**1,700**
New Zealand teachers reskilled and upskilled through Tui Tuia | Learning Circle professional learning and development in 2021

**3,000**
clinical staff at 22 DHBs trained through teamwork-based acute care simulations designed by NetworkZ in the past five years

**14,391** times that child and youth mental health workers attended Whārauru e-modules, trainings and workshops in 2021

## UniServices

UniServices is a not-for-profit company of the University of Auckland that champions research and ideas with the power to change the world. From seeking out and bringing together partners in academic institutions, industry and government to build new knowledge and solutions through research; to whakatupu (nurturing) and commercialising the ideas and intellectual property that arise from the University of Auckland's great minds, we act as the kaihono (those who join and link people to people, and people to projects) firmly entrenched in the ecosystem that bridges the world of academia with business, government and our communities.

## University of Auckland

Waipapa Taumata Rau | The University of Auckland is New Zealand's largest and leading university. The name Waipapa Taumata Rau, gifted to the University by Ngāti Whātua Ōrākei, refers to the 'place of many peaks' – places to strive for, ascend to and succeed. We also rank in the top 10 globally for sustainable development impact. The University supports economic growth locally and nationally through innovation and entrepreneurship, creating quality jobs and high-value businesses, and producing graduates that contribute to our economy and society for the benefit of all.


### Contact

**Dr Pau Medrano**
Senior Investment Manager
**+64 27 406 29 44**
p.medrano@auckland.ac.nz



### UniServices

Level 10, 49 Symonds Street,
Private Bag 92019, Victoria Street West,
Auckland 1142, New Zealand
**+64 9 373 7522** **uniservices.co.nz**


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Waipapa Taumata Rau
NEW ZEALAND