

Thursday, 16 November 2023

MAKING MEDICINE WITH ARTIFICIAL INTELLIGENCE

HMRI's cutting-edge research to combat debilitating, incurable illnesses

Artificial Intelligence (AI) is supporting Hunter Medical Research Institute (HMRI) with important exploration into new therapies for Inflammatory Bowel Disease (IBD) and Ulcerative Colitis, made possible by a \$98,700 grant from Newcastle Permanent Charitable Foundation.

Both complex, lifelong conditions, Crohn's disease and Ulcerative Colitis (IBD) impact people of all ages, leading to a life of invasive procedures, long-term immune suppressant medications, and major alterations to quality of life.

Dr Gerard Kaiko, of HMRI and the University of Newcastle, said treatments targeting the disease beyond suppressing inflammation could be key to helping patients receive completely different and better outcomes.

"My group has been researching intestinal stem cells and three-dimensional organoids in the gut, as well as the collection of millions of microbes in the gut, known as the microbiome. The microbiome is intimately linked to health and is a part of normal human biology, but when it gets out of balance it can contribute to many diseases, including IBD.

"The microbiome and intestinal stem cells are two key components that I believe are major drivers of IBD but are not targeted by current therapies, which simply suppress the patients' immune system."

Identifying therapies from the gut microbiome is a complex undertaking with huge amounts of data, which is why Dr Kaiko and his team are applying AI to this research.

"We are using neural networks, which is the category of AI model that forms the basis of ChatGPT and image recognition software to identify patterns in huge datasets so we can identify new therapies," said Dr Kaiko.

"AI can recognise patterns in enormous amounts of data that humans could never attempt, and previous computational models could not handle.

Each of us have more than 20 trillion cells. If we took the DNA that makes up our genes from all of those cells and laid it out in a linear fashion, it could wrap around the earth 2.5 million times, or reach to the sun and back 300 times and the microbiome in our guts contain at least 100 times more genes.

All human beings are 99.9 percent identical in their genetic makeup, and it's the 0.1 percent differences that hold important clues about the causes of diseases. This is the needle in the genetic haystack that AI can help us locate.

"Not only can our AI model help us find the needle – it can tell us the needle's trajectory through the haystack which helps us understand how the diseases formed, and the pathways we need to use to treat it.

Media release

“We are currently doing this with IBD but the system we have developed has potential application to many other diseases as well.”

Newcastle Permanent Charitable Foundation Executive Officer, Carly Bush, said it is inspiring to see groundbreaking research on such devastating illnesses.

“With approximately 100,000 people in Australia currently living with Inflammatory Bowel Disease, the research into new treatments is extremely pertinent,” Ms Bush said.

“IBD is so much more than just an upset stomach. This debilitating illness can truly upend a person’s life and can be fatal.

“More broadly, some form of gut disease impacts about 1 in 5 Australians now, yet gut diseases have historically received less support and attention than they are probably due. This needs to change.

“There is also a need for more Australian development of new technologies, including with AI. The system HMRI has developed in this project is a shining example of ways to grow biotechnology with future healthcare and it’s happening right here in the Newcastle and Hunter regions.

“Gerard and his team are using the technology of today to complement this important research in finding appropriate treatments that will empower people living with these conditions to live full lives.

“We are proud, long-standing supporters of HMRI and are honoured to support Gerard and his research.”

Dr Kaiko said the funding received from Newcastle Permanent Charitable Foundation has helped conduct studies that are moving the needle.

“We have already defined a potential 'microbiome therapy' and are undertaking work on turning this treatment into a viable therapy that could be taken as an oral pill,” Dr Kaiko said.

“This is an important step in drug development, which is also helping us to widen our search for other therapies in the human microbiome.

“We are now beginning to work with Industry partners in Melbourne and Japan to address how we can expand this work in the drug development process towards clinical trials.”

HMRI is a partnership between the University of Newcastle, Hunter New England Health and the community.

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About Newcastle Permanent Charitable Foundation

Newcastle Permanent Charitable Foundation provides more than \$1 million in grants each year to charitable projects aimed at improving the health and social wellbeing of vulnerable people in regional New South Wales. Since its establishment in 2003, the Foundation has provided more than \$26 million to some 550 community initiatives.