



Making sense of big data to cure childhood cancers

The Computational Biology Program at CCI is using vast cloud computing resources to help make sense of big data and improve the lives of children with cancer.

The team has developed a purpose-built precision medicine data platform that brings together a range of analytical and statistical tools to enhance the treatment of children with high-risk cancers.

“The Luminesce Alliance has helped us establish the largest computational biology program for children with cancer in Australia, which has had a massive impact and is enabling precision medicine to move closer and closer to the clinic,” says A/Prof Mark Cowley, Lead of the Computational Biology Group at CCI.

Using supercomputers and custom-made tools and algorithms, the new digital platform is being used to help clinicians to better understand their patient’s disease and to individualise treatments. It also enables researchers to understand why some children develop cancer, why some don’t respond to their treatments, and to be able to identify new drug targets.

Turning data into insights

Huge datasets, including known genetic variations, drug responses and clinical information from thousands of patients, can be analysed and interpreted to provide recommendations for individual patients. This has the potential to provide more accurate diagnosis and treatment options.

Over about 24 hours, dozens of computers compare the normal genome of a patient, derived from analysing a blood sample, with that of the tumour from the patient, derived from a biopsy.

A/Prof Cowley says the process might identify millions of genetic changes in a patient and hundreds of thousands of genetic changes in a tumour, but there may be only one or two that predispose the child to a disease or point to a treatment.

“Cancer is cunning, it mutates the DNA in unusual ways and differently in each patient. There are thousands of these genetic changes where we still don’t understand what they do. Some of the clues to solving those puzzles are in developing better algorithms and tools to make predictions,” he says.

"Then there are a lot of genetic changes where we know exactly what they will do – and they are the ones that clinicians really want to know about."

Life-saving patient care

The team was asked to help with the case of a child who had a large tumour in their chest. Pathology results had not been able to provide doctors with the answers they needed to inform treatment.

Within six days, the scientists had identified a rare genetic change and were able to recommend a precise treatment – a specific drug that had recently been developed.

"This is a tangible example of discovering something which is rare, but where we were still able to interpret the sample, help make the diagnosis and get the patient on a life-saving drug," A/Prof Cowley says.

Making connections

The biggest users of the platform so far are clinicians of patients in the ZERO, the most comprehensive precision medicine program for children and young people with cancer in the world, led in partnership by CCI and the Kids Cancer Centre, Sydney Children's Hospital.

A/Prof Cowley says the work of the Luminesce Alliance team has been essential to the success and future expansion of ZERO.

The team has established collaborations across Australia and beyond, including working with world leaders in childhood cancer research in Toronto and Philadelphia.

"What we've been able to show is that precision medicine genomics has a real impact on patient care," adds A/Prof Cowley.

"The new frontier is how to get better clinical data and better outcome data, so that we can assess the benefit of precision medicine."

"We find ourselves in the precision-medicine revolution, where the idea is simply that we take more and more measurements from patients and translate that data into improved care: whether that's getting the right diagnosis, predicting if they're a good or high-risk prognosis, or finding the right treatment option for them. Data underpins all of these activities."

- A/Prof Cowley



A/Prof Mark Cowley
Head, Computational Biology Group
Children's Cancer Institute