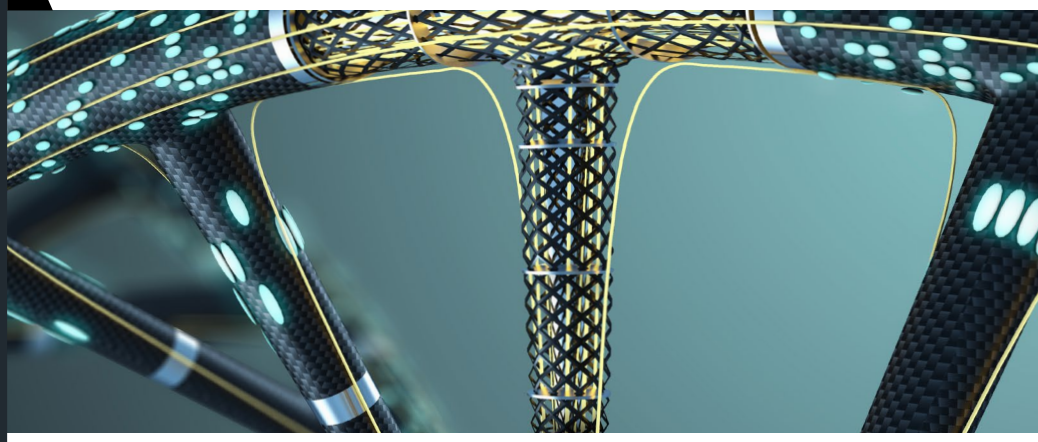
AN NREN CASE STUDY BY BCNET

LAYING THE GROUNDWORK FOR GENETIC HEALTH



USING HEALTH DATA SAFELY

Commonly available and low-cost DNA sequencing has created a proliferation of diverse applications for these data that can identify criminal perpetrators, validate herbal supplements, and conserve wildlife. Consumer DNA services can even report on one's presumed ancestry and genetic health risks. But there's a new use for DNA sequencing on the horizon: personalized treatment plans. By analyzing the genome, personal traits, and treatment history of the many patients who receive health care services, we are starting to identify which treatments work best for which individuals with particular genes or inherited disorders. This will ultimately allow us to create highly tailored treatment plans for Alzheimer's, cystic fibrosis, certain cancers, and other illnesses.

However, there are challenges with managing, sharing, and processing large-scale human genomic data. Extensive computing resources are required to analyze the data – a demanding task considering the size of a single individual's stored data is around 3TB (over 4,500 CDs' worth). Another significant challenge in genomic research is privacy – or rather, concern over its loss. Genomic data is typically stored securely at the many different hospitals, academic centres, and health institutions where it is collected, but cross-institutional collaboration is crucial for researchers to create meaningful sample sizes and accurate inferences.

To meet these challenges, researchers in British Columbia worked with their counterparts in Ontario and Quebec to launch the CanDIG project. Funded by the Canada Foundation for Innovation (CFI), this collaborative initiative relies heavily on Canada's National Research and Education Network (NREN) to ensure that researchers can effectively access and share critical genomics data sets across the country.

GENOMICS RESEARCH PLATFORM

CanDIG is focussed on building a genomics research software platform – a distributed, standardized, and anonymous way to study genetic data for both clinical and research applications. The NREN, which consists of CANARIE and its 12 provincial and territorial partners, provides the tools and ultra high-speed network that CanDIG leverages to distribute massive genomics data-sets among researchers within Canada and to share this data with researchers around the world.

CanDIG is currently working with a small number of lead hospitals and research facilities. It works by

WHAT IS THE NREN?

The National Research and Education Network (NREN) is an essential collective of infrastructure, tools and people that bolsters Canadian leadership in research, education, and innovation. CANARIE and its twelve provincial and territorial partners form Canada's NREN. We connect Canada's researchers, educators, and innovators to each other and to data, technology, and colleagues around the world.

safely maintaining the patient profile, health history, and DNA data for each individual at the site where it was collected, while allowing researchers to search distributed databases – without releasing any related personal data. This allows researchers to study national-scale genomic datasets while respecting provincial jurisdictions of health data and privacy.

LEVERAGING CANADA'S NREN

To support this project within the NREN, BCNET provides connectivity for CanDIG sites in BC, while ORION does this in Ontario, and RISQ in Quebec. CANARIE provides interprovincial connectivity and international connectivity to enable national and international collaboration.

The network, which operates at speeds up to 100 Gigabits per second, is thousands of times faster than today's consumer-grade networks. For example, 3TB of genomic data would only take four minutes to transfer over the NREN (as opposed to 27 days using a standard Internet connection).

CUSTOMIZED CURES

The result of the significant collaborations that support the CanDIG project is a foundation for highly personalized clinical applications, which not only identify the best treatment plans for individuals but also find effective remedies for rare genetic diseases. The project also enables a much more complete way to answer research questions surrounding the health and development of DNA- and RNA-based diseases and associated risks.

Once CanDIG has been proven in initial trials, the goal is to roll it out to academic, research, and health institutions across the country, providing scientists with a much richer dataset for genetic research. The NREN, which connects almost 715 Canadian universities, hospitals, and research labs, is the infrastructure that will support this wide-reaching health community.

INTERNATIONAL ALLIANCE

CanDIG is a prime example of Canadian scientific leadership. Last year, it was selected by the Global Alliance for Genomics and Health (GA4GH) to help create international genomic standards. The alliance targets projects that push the boundaries of genomic data exchange and have real-world impact; in this case, the outcome will be to develop international standards for the exchange of human genomic data. An example of Canadian leadership in genomics research, CanDIG is paving the way for a global impact on customized treatments.

For more information, visit:

BC.NET