Big data takes aim at a big human problem

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A James Cook University scientist is part of an international team that's used new 'big data' analysis to achieve a major advance in understanding neurological disorders such as Epilepsy, Alzheimer's and Parkinson's disease.

Dr. Ashley Waardenberg, a Theme Leader from JCU's Centre for Tropical Bioinformatics and Molecular Biology, said scientists from JCU, The Children's Medical Research Institute, Sydney, University of Southern Denmark and Bonn University (Germany) looked at how neurons in the brain communicated with each other.

"We studied the synapse—the communication hotspot between neurons—which is a place where neurological disorders and diseases can interfere with the brain's normal functions," said Dr. Waardenberg.

"We aimed to use new methods for mapping the protein pathways that neurons use to communicate with each other (neurotransmission) and tried to see if we could identify patterns of activity related to memory."

"A key part of the project that I led was to develop new computational methods to assess the very large amount of data that we collected. This led to the discovery of the major proteins responsible for the changes observed in the neurons," said Dr. Waardenberg.

He said the discoveries open up many new avenues for studying the protein pathways underlying neurotransmission and how they might be linked to neurological diseases and disorders.

Dr. Waardenberg said the breakthrough demonstrates how new computational methods are needed to develop insights from 'big data'.

He said the team of scientists is releasing the paper detailing the computational methods and the thousands of new proteins sites identified as a resource to the scientific community.

"We hope that this resource will help our future understanding of neuron signaling and memory. The discovery has very important implications for understanding the mechanisms of neurotransmission and

neurological disorders," he said.

Dr. Waardenberg is now aiming to establish these new methods at JCU and continue to develop new computational methods for tackling tropical diseases such as malaria.

More information: Kasper Engholm-Keller et al, The temporal profile of activity-dependent presynaptic phospho-signalling reveals long-lasting patterns of poststimulus regulation, *PLOS Biology* (2019). DOI: 10.1371/journal.pbio.3000170

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