Focus on Faculty #32
Celia Greenwood

Dr. Celia Greenwood is a Professor in the Gerald Bronfman Department of Oncology as well as in the Department of Human Genetics and the Department of Epidemiology, Biostatistics and Occupational Health. She is a statistician whose research domain is development and application of statistical methodology for analysis of genetic and genomic data. Although originally from the west coast of Canada, she has a Bachelor's degree from McGill, enjoyed a postdoctoral fellowship in Human Genetics here, and in 2010, moved from Toronto to take a position as Senior Investigator at the Lady Davis Institute in the Cancer Axis with an appointment at McGill.

In 2007, she participated in an early genome-wide association study of colorectal cancer that identified a locus on chromosome 8q (Zanke et al. 2007 Nature Genetics). This work also led to two statistical papers on estimating significance thresholds – either in massively parallel problems or through a multi-stage validation process. In 2015, she co-led the statistics group of the UK10K study, where large scale DNA sequencing data on approximately 10,000 people were analyzed for association with multiple phenotypes (Walter et al., 2015, Nature). Similarly, this large collaborative project initiated theoretical developments on group association sets and estimation of genome-wide significance thresholds for such group association tests. Although she continues to be involved in methodological developments for analysis for DNA sequencing, more recently she has also started investigating approaches for the analysis of epigenetic data, as well as methods for high dimensional data reduction and association.

Statistical methodology work is highly collaborative, and Dr. Greenwood has many active and very rewarding collaborations with researchers working on a wide range of diseases and phenotypes. To highlight a few, Dr. J.B. Richards (Lady Davis Institute) is interested in the genetics of osteoporosis and diseases of aging, and they have collaborated on many projects exploring genetic contributions to complex traits. She has also a very active collaboration with Dr. M. Hudson (Lady Davis Institute) working on epigenetic contributions to systemic auto-immune

rheumatic diseases. In cancer, with Dr. P.N. Tonin, they have explored altered copy number profiles in ovarian cancer tumours, and looked at differential gene expression networks in several tumour types depending on TP53 mutation status; with Dr. W.D. Foulkes she has estimated cancer risks and ancestral ages for several mutations. She has also collaborated with at least 14 other members of the Gerald Bronfman Department of Oncology. Dr. Greenwood's lab manager Dr. K. Oros Klein merits a sincere recognition for helping to keep these many projects on track.

In addition, Dr. Greenwood is the Graduate Program Director of the new doctoral program "Quantitative Life Sciences" at McGill (currently operating in *ad hoc* mode), which was launched in 2017. This program seeks to attract students with strong quantitative backgrounds, and then provides a broad interdisciplinary training to acquaint the students with aspects of life sciences where quantitative research is essential. She is a co-Director of the Ludmer Centre for Neuroinformatics and Mental Health at McGill University; this Centre started in 2013 and focuses on integration of brain imaging, genetic, and epigenetic data to better understand mental health. She served on the Board of Directors of the International Genetic Epidemiology Society from 2015-2017 and will be President-Elect in 2018.

Outside work, she enjoys playing tennis in the summer months. She has sung in various choirs in BC, Toronto and Montreal over the years, sometimes as an alto and sometimes as a soprano.

We asked Dr. Greenwood to list a few of her articles whose work she is particularly proud or enjoyed the most. This is what she provided:

K Walter, J Min, J Huang, L Crooks, Y Memari, S McCarthy, JRB Perry, C Xu, M Futema, D Lawson, V Iotchkova, S Schiffels, A Hendricks, P Danecek, R Li, J Floyd, I Barroso, SE Humphries, ME Hurles, E Zeggini, JC Barrett, V Plagnol, JB Richards, **CM Greenwood**, N Timpson, R Durbin, N Soranzo (2015). The UK10K project: rare variants in health and disease. Nature 526(7571):82-90.

K Oros Klein, K Oualkacha, M-H Lafond, S Bhatnagar, PN Tonin, **CMT Greenwood**. (2016). Gene coexpression analyses differentiate networks associated with diverse cancers harbouring TP53 missense or null mutations. Frontiers in Statistical Genetics and Methodology, 7:137.

K McGregor, S Bernatsky, I Colmegna, M Hudson, T Pastinen, A Labbe, **CMT Greenwood** (2016). An evaluation of methods correcting for cell-type heterogeneity in DNA methylation studies. Genome Biology. 17:84.

Forest M, Iturria-Medina Y, Goldman JS, Kleinman CL, Lovato A, Oros Klein K, Evans A, Ciampi A, Labbe A, **Greenwood CMT**. (2017). Gene networks show associations with seed region connectivity. Human Brain Mapping, 38(6):3126-3140.