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Developing new bioinformatics methods for single cell RNA-sequencing data.

Advances in single cell next generation sequencing methods have led to an explosion of new bioinformatics methods. Yet, many questions in biology remain unanswered. This project focuses on developing methods that ask new questions of single cell RNA-sequencing data so that we can learn more about biology through single cell techniques.

Understanding ageing through genome-wide gene expression datasets.

Ageing is a process that is characterized by heterogeneity in biological systems. Anecdotally, we know that how a person ages can differ dramatically from person to person. At the molecular level, the dysregulation of key signalling pathways and disruption to individual cell functions occur during ageing and give rise to symptoms we associate with ageing. This project aims to use gene expression datasets, many of them which are publicly-available, to add new knowledge into the genes and signalling processes that are involved during the ageing process. There is also scope to understand how ageing interventions, like senolytics or caloric restriction impact our transcriptomes and whether they can inspire us to identify new manipulations or anti-ageing therapeutics.

Separating signal from noise - benchmarking bioinformatics methods to identify biology from big data.

The promise of big data is to reveal compelling insights into medical biology. But a major challenge for realizing this goal is the intractable presence of noise. This project focuses on benchmarking different kinds of bioinformatics methods to understand the optimal ways to handle noise in the data to obtain concrete results in biology.

Please note: the field of bioinformatics, especially single cell RNA-sequencing techniques, moves very quickly. It is likely that at the time of commencing Honours, new projects have crystallized. For that reason, feel free to check in with our group to see what other ideas might be available for you to work on. We look forward to hearing from you!