Epigenetics—where the environment meets the genetics of disease: Interpreting high-throughput DNA Methylation data

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Outline

1. Epigenetics Overview
2. Illumina 450K
3. Some Biology
4. Bringing it all together
5. Acknowledgements

Epigenetics: An Overview

- Epi-(GREEK:over,above) genetics
  - heritable changes in gene expression/phenotype
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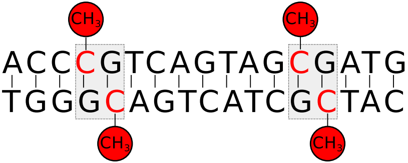
  1. Histone modifications (Acetylation and Methylation)
  2. **DNA Methylation**

A brief overview of DNA Methylation

- 5'methylation of cytosine
- typically at CpG dinucleotide



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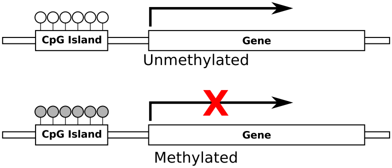

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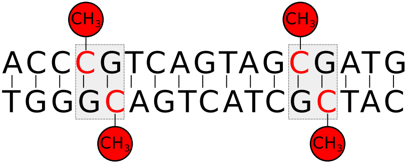

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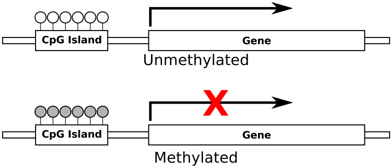

- Methylation is heritable - imprinting
- **BUT** is also dynamic: response to environment

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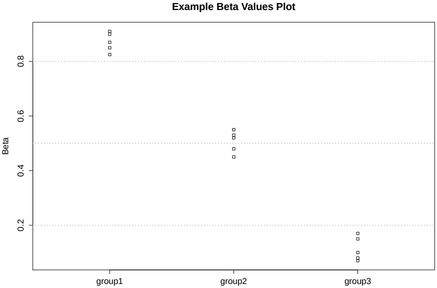
Beta Values

$$\beta = \frac{meth}{meth + unmeth + 100}$$

Values range between 0-1

- think of as percent methylation



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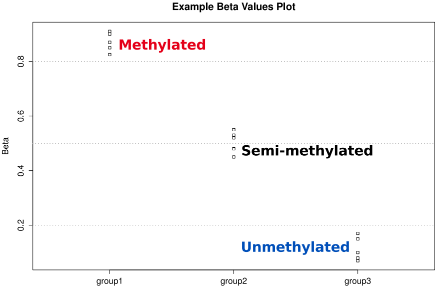

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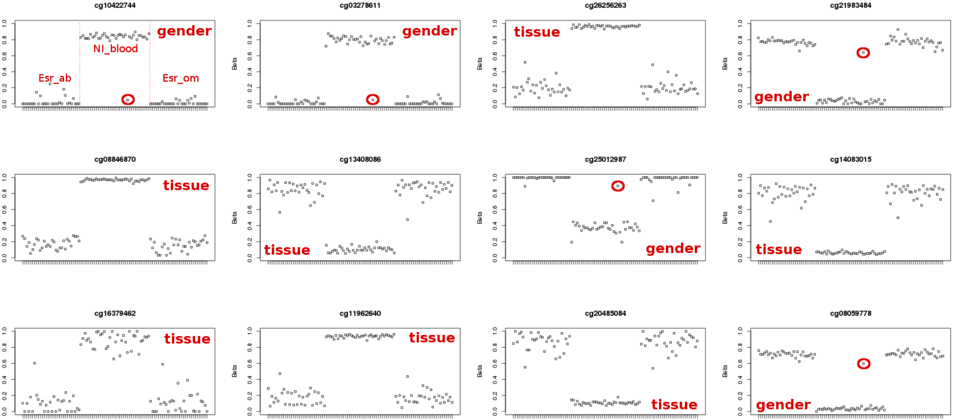
- Case/Control? Paired-samples? Numbers?

Example: Gender and Tissue specific markers



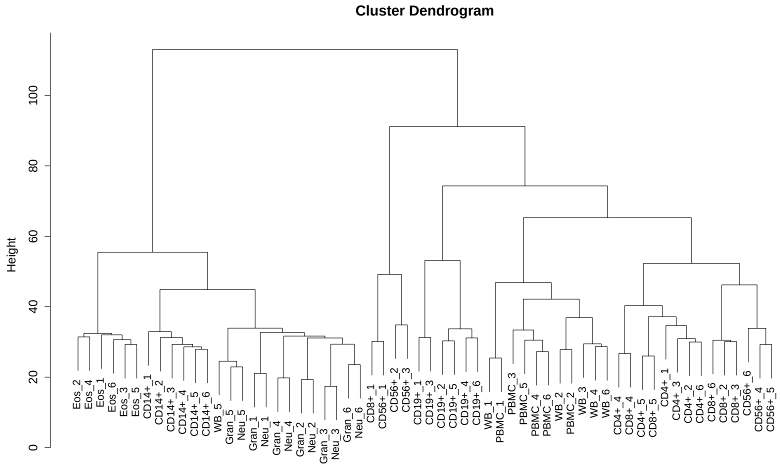
The Biology

Time for the interesting part...

The technology in action

Investigating Methyation Profiles in Blood Cells

Publicly available data set (6 'healthy' males) - cell sorted



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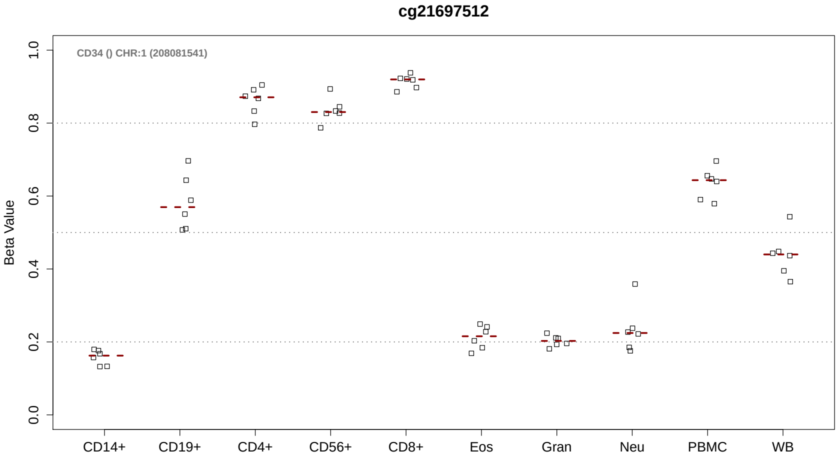

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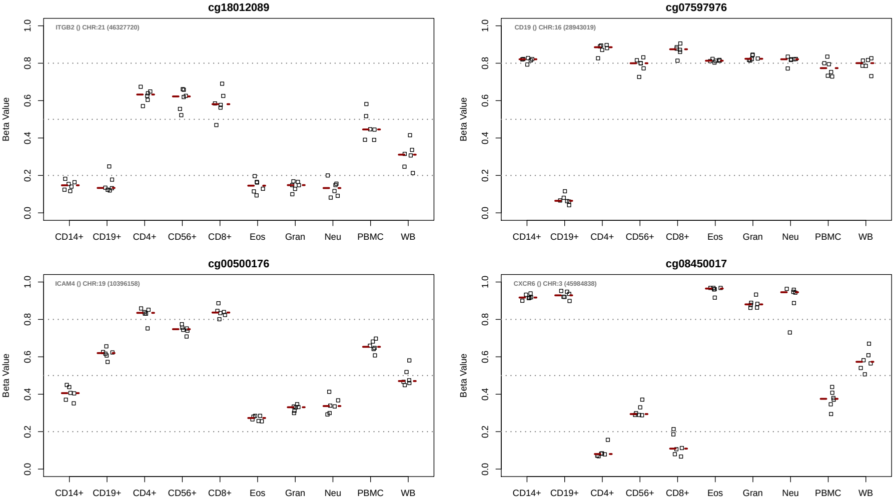

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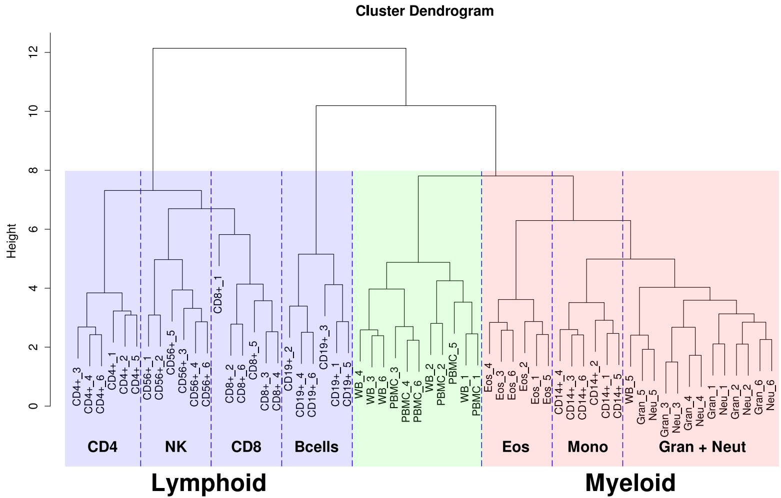

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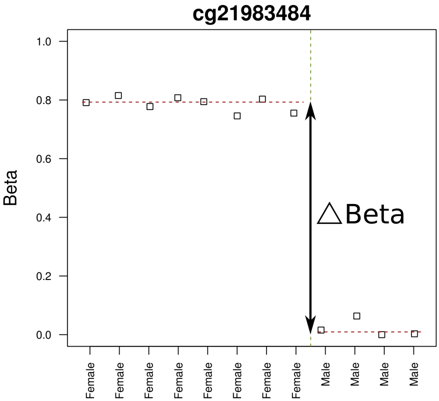

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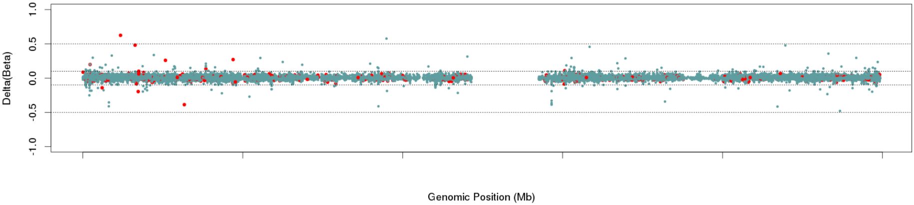

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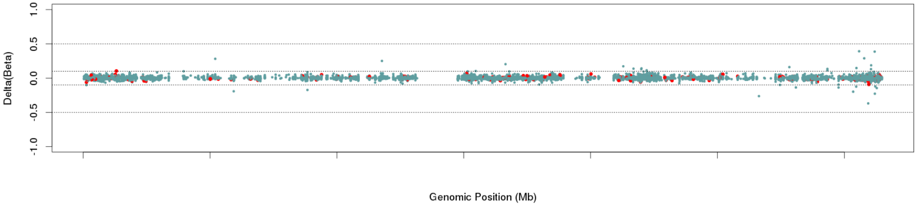

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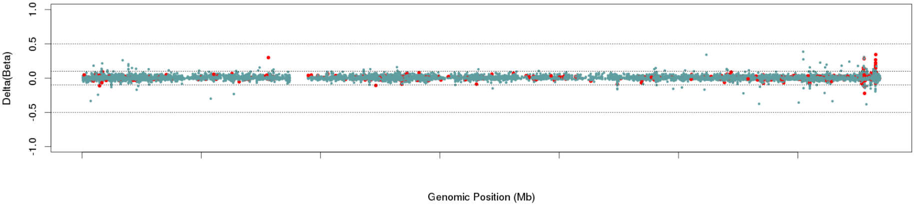

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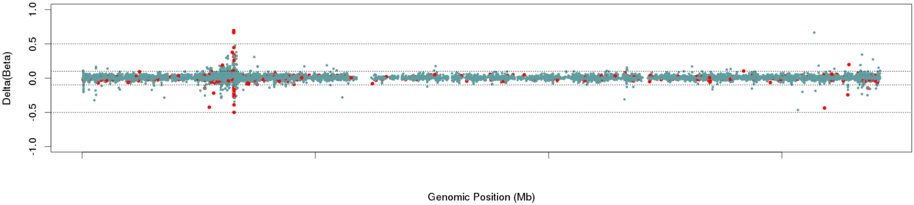

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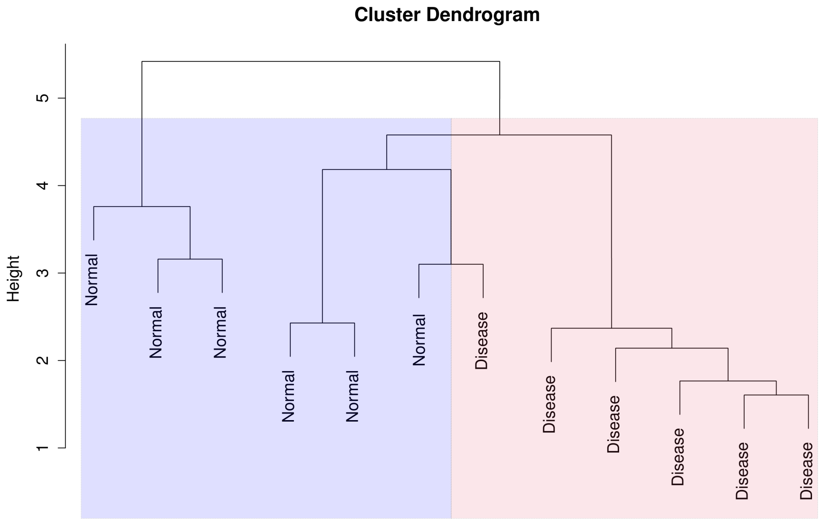
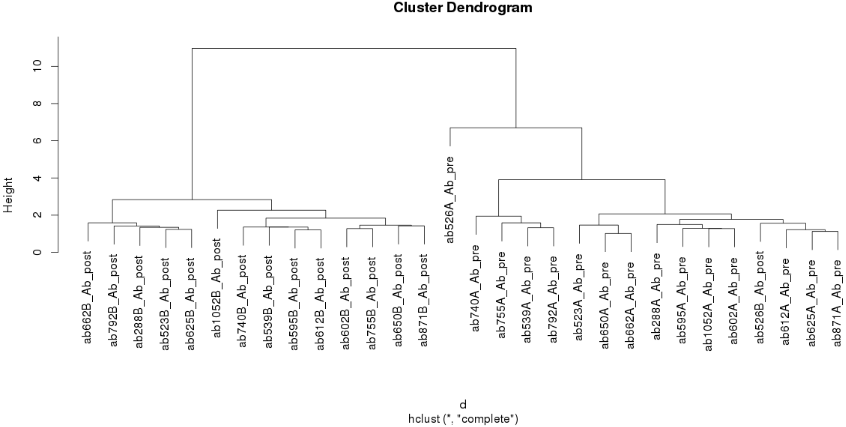


ESR/Wakefield Obesity Project

ESR/Wakefield Obesity Project:

-15 patients pre/post-op gastric bypass (female; abdominal fat tissue)



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- We have identified significant correlations between all layers of data
  - suggests strong biological relevance

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- Attention to study design will allow increased quality and application
  - i.e. multi-cell populations in tissue/whole blood
- Applying multiple layers of genomic data shows potential to increase our understanding of complex biological pathways/networks

Acknowledgements

ESR/Wakefield Obesity Project: Dr Donia Macartney-Coxson, Prof Richard Stubbs, Angela Jones, Daniel Kay

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Genomics Research Centre: Dr Heidi Sutherland, Michelle Hanna, Dr Bridget Maher, Dr David Eccles

Institutes: Institute of Environmental and Scientific Research, Wakefield Hospital, Griffith University, Victoria University of Wellington

All the patients for their consent to being part of the respective studies

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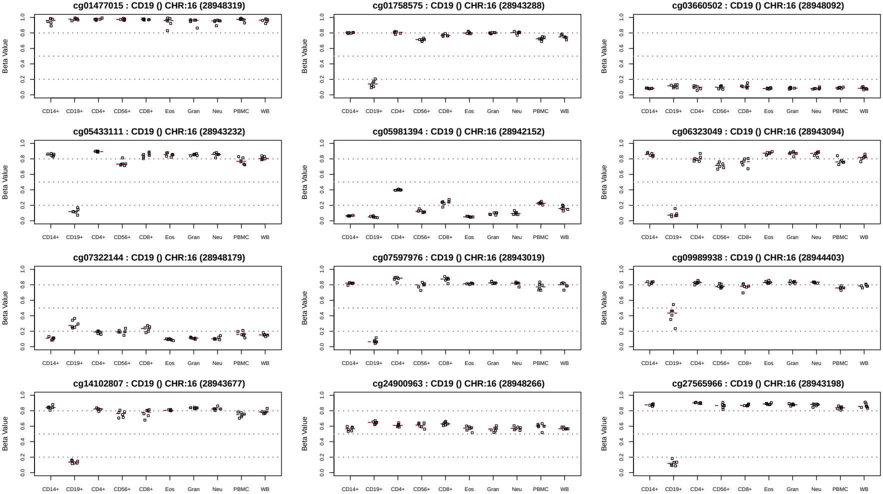
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