Allen Brain Atlas

Hands-on session by Boudewijn Lelieveldt and Linda Dib

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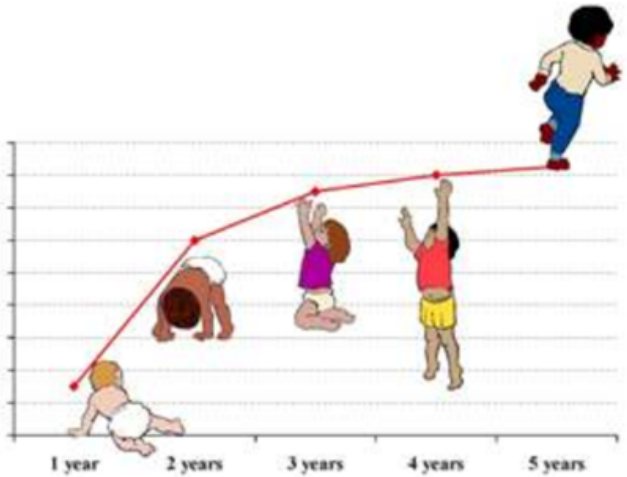
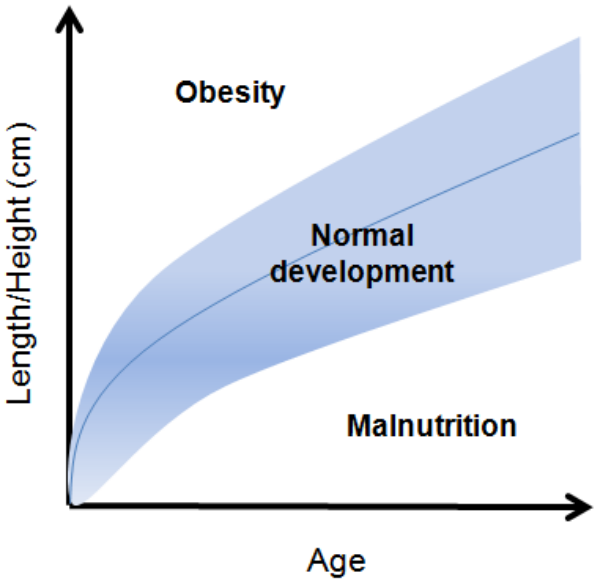
Human Brain Project

What is the norm?

What is normal and abnormal weight and height development?



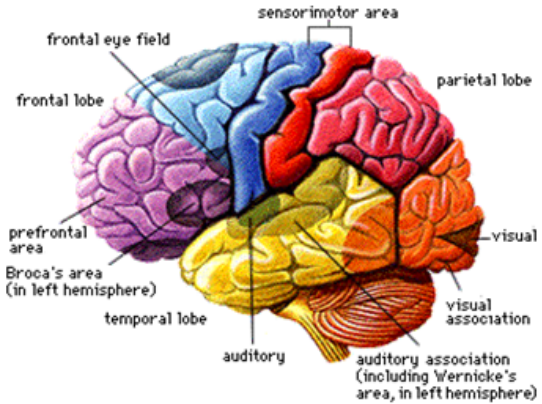
WHO child growth standards



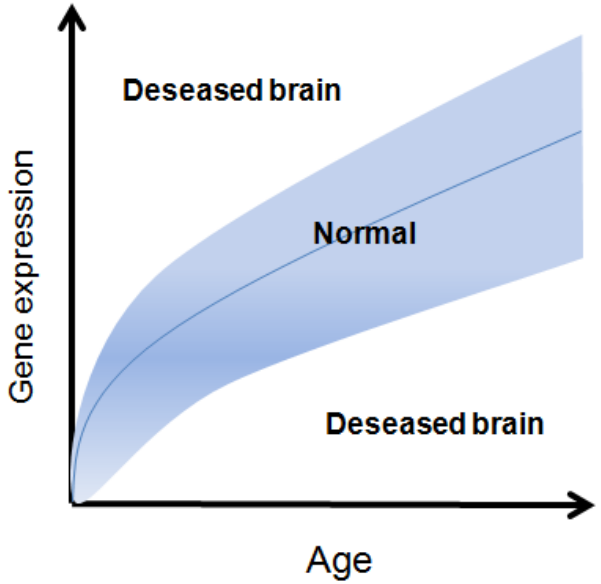
Adapted from WHO

What is the norm?

What is normal and abnormal brain development?



HBP/Allen brain genes expression standards



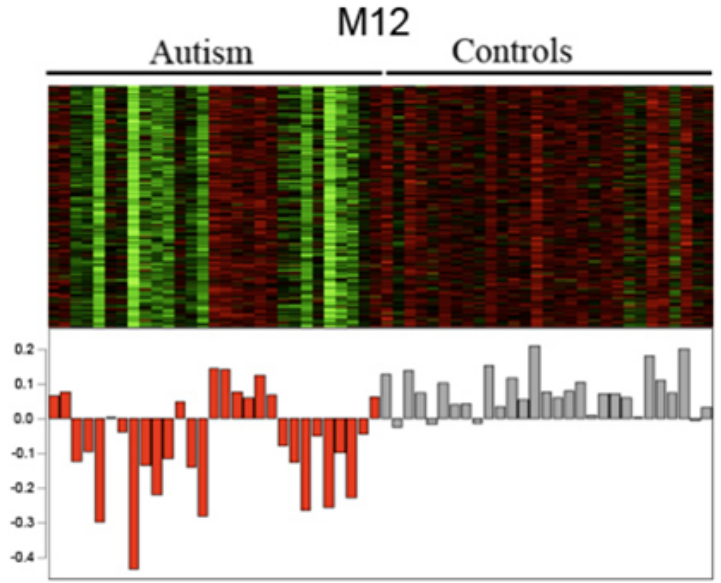
Adapted from WHO

A clinical example

Genes, Brain and Autism

- 444 genes differently expressed in autism brain
- Mostly located in frontal and temporal cortices

What about Schizophrenia, Alzheimer's Disease and other brain disorders?

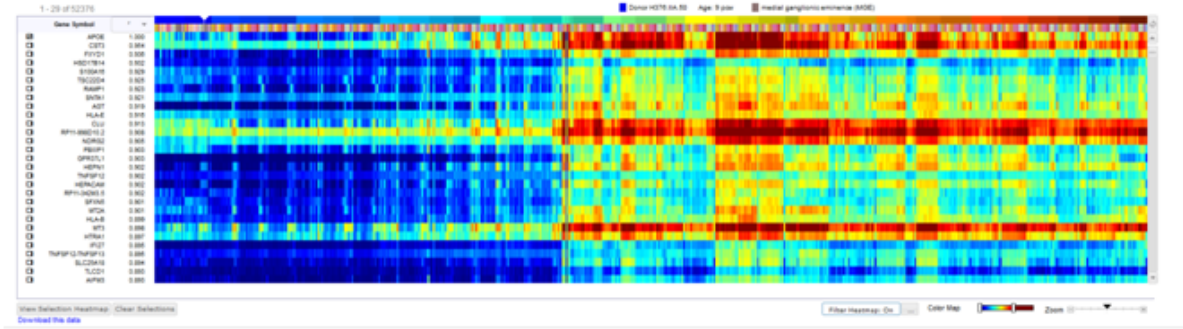


Voineagu et al. Nature 2011

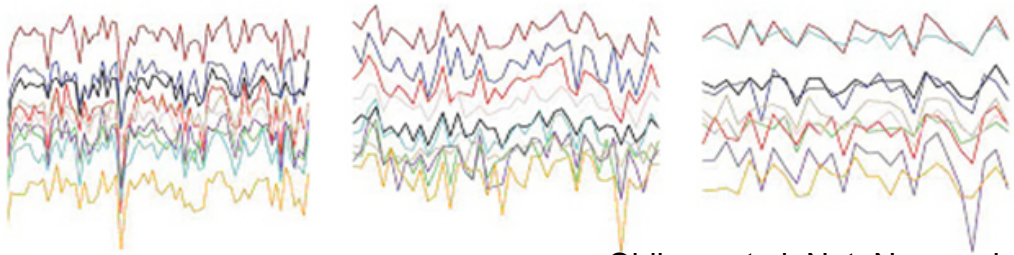
Hypotheses

We know that:

Single genes are not working alone!



Genes turn on and off together!



Oldham et al, Nat. Neurosci. 2008

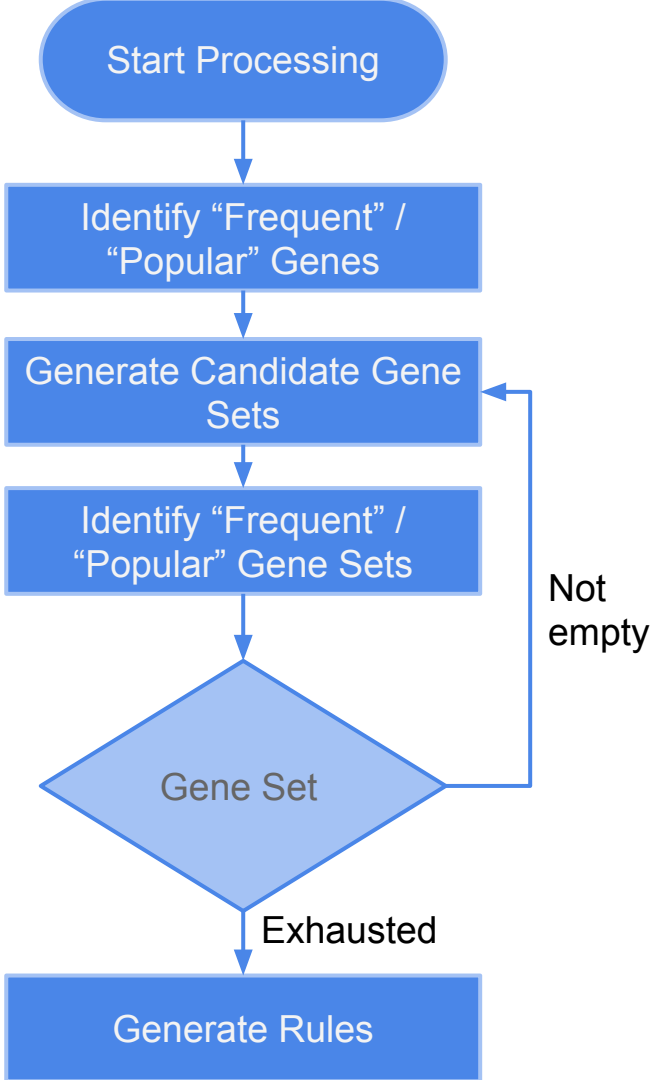
Working hypotheses

- Normal trajectories of multiple gene expressions in specific areas of the brain are stable for healthy people
- Correlations between gene expressions change in time

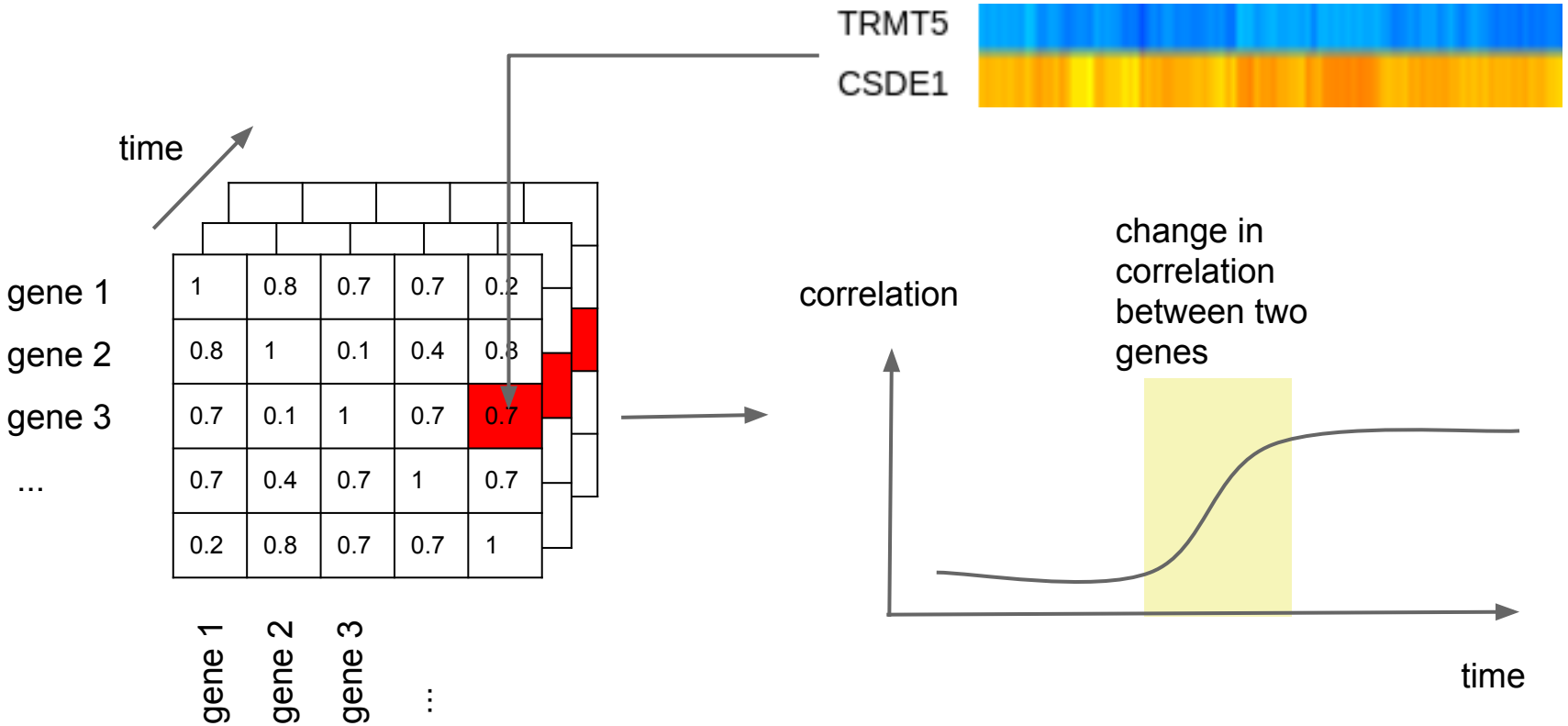
Methods

- Tracking of pairwise correlations of gene expressions throughout the lifespan → correlation matrix through time

- Data mining for frequent itemsets (Apriori) to identify gene dependencies with more than a pair of genes

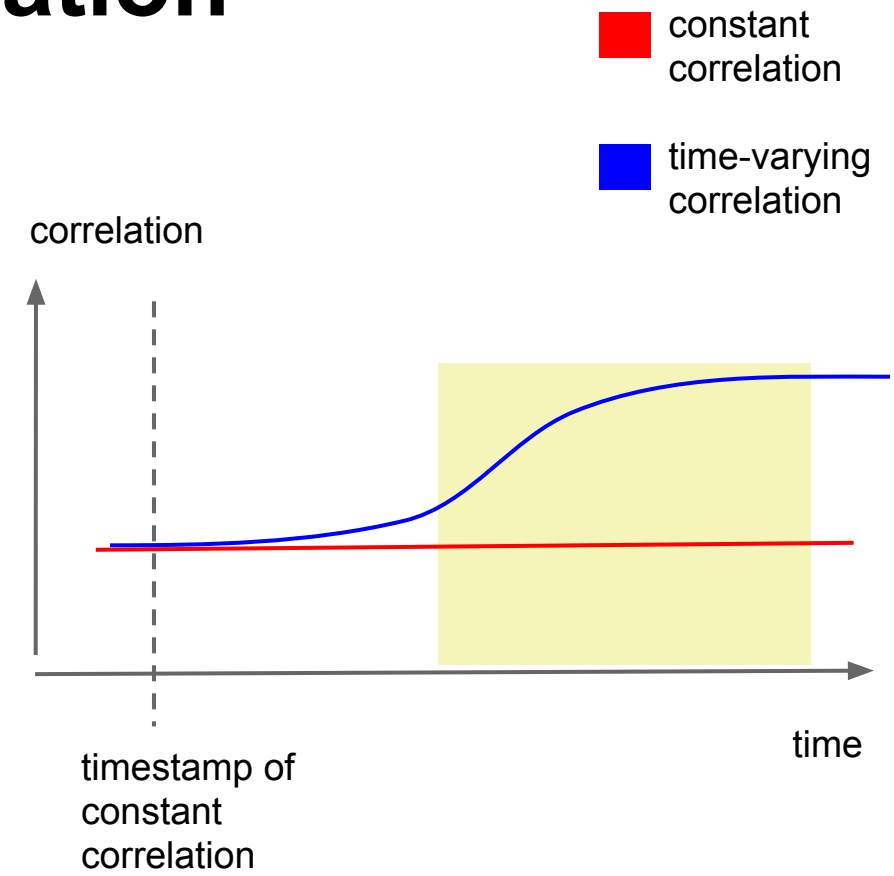


Expected results



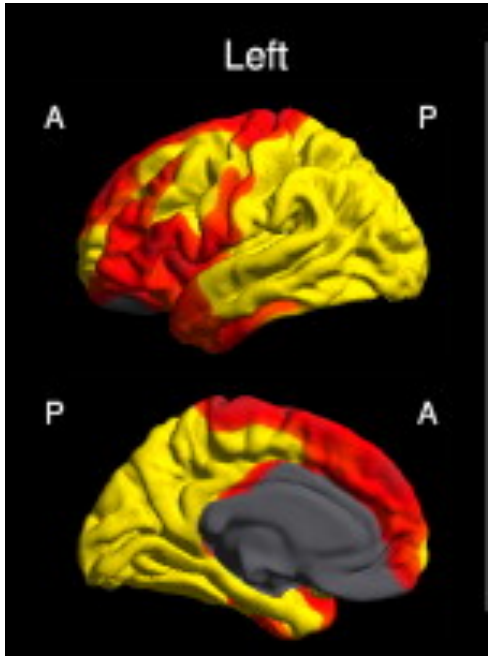
Changes in correlation

- Might happen due to old age and not disease
- Disprove previous studies that assume static correlations



Area-specific correlation

- Calculate the correlation for specific areas of the brain
- Use gene pair correlations as biomarkers in a disease progression model
- 20,000 x 20,000 biomarkers → need to reduce complexity



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correlation between two genes

Conclusions

- Can compute correlation profile across age
- Ability to distinguish disease from normal ageing
- Can also be used in future studies for finding disease onset