Analysis of longitudinal imaging data

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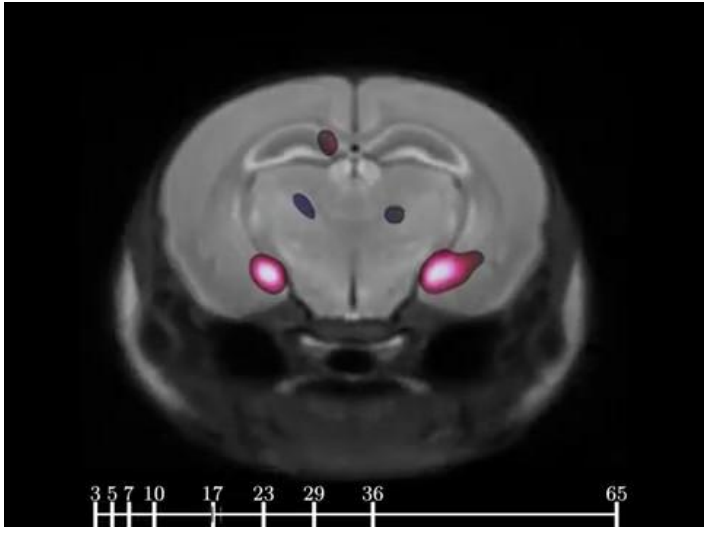
Why be interested in longitudinal data?

1. Can see time course changes of neuroanatomy
    a. When do differences emerge?
    b. How do they change?

Example: development of sex differences



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2. Possibility of predictive modelling

    a. If we know something about the brain at p3, what can that tell us about the brain at p65?

How is longitudinal data different from cross-sectional?

- Cross-sectional data: individual is measured/observed at one single time point (i.e. *ex vivo* MRI study)
- Longitudinal data: repeated measures/observations made at various timepoints for the same subject (i.e. *in vivo* MRI study)
- For longitudinal data:
  - Correlation between repeated measurements within the same individual
  - Data points from the same subject are not independent

How do we overcome these challenges?

1. Repeated measures ANOVA
    a. Repeated measures ANOVA works only for a completely balanced experiment
        i. I.e. no missing time points
2. Linear mixed effects models: more general/flexible
    a. Fixed effects
        i. Age, sex, treatment, etc
    b. Random effects
        i. A random effect for each mouse
            1. Baseline differences in the brain for each individual mouse