The influence of sex hormones on brain lateralisation

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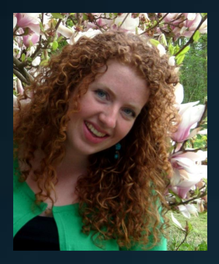
Sex hormones & brain lateralisation
- Research Program -



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Introduction

There is long standing debate to what extent variation in lateralisation between and within individuals is due to early or late exposure to sex hormones. The relation between sex hormone exposure and functional lateralisation will be investigated as follows:

1. Correlate existing data on prenatal hormone exposure with brain lateralisation in healthy children of 15 years
2. Analyze brain lateralisation in individuals with Gender Dysphoria (GD) before and after hormone treatment

Hypotheses

1. Prenatal testosterone masculinizes strength and direction of lateralisation[1]
2. Hormone treatment influences strength and direction of lateralisation towards the experienced gender in individuals with GD

Method

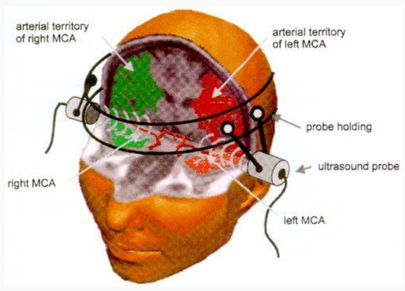
Prenatal hormones

Amniocentesis was performed within the 14th-19th week of pregnancy, the same period as brain lateralisation is assumed to be modulated by the influence of steroid hormones. The children born from these pregnancies are 15 years old now.

Subjects

fTCD

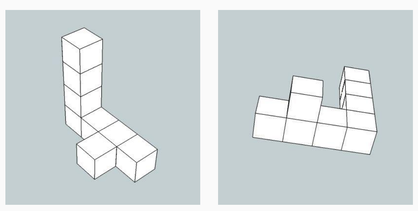
Brain lateralisation will be measured with functional Transcranial Doppler sonography. fTCD measures the difference between the left and right hemisphere in blood flow velocity in the Middle Cerebral Arteries during a cognitive task.



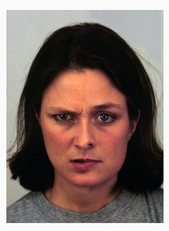
Tasks

Individual strength and direction of lateralisation will be assessed during 3 tasks:

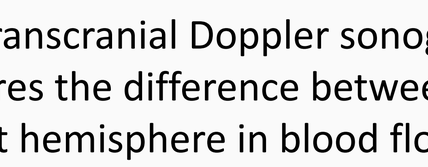
Mental rotation



Chimeric faces



Word generation



Additional data

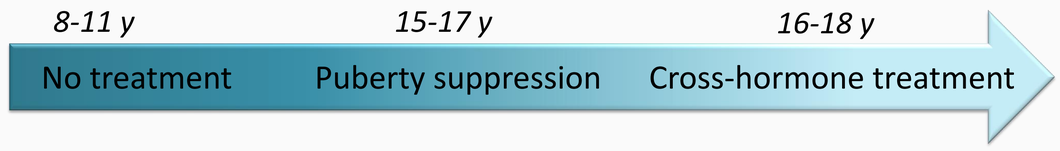
- Current hormone levels
- Handedness
- Aggression, Empathy
- Pubertal stage, Gender identity & Sexual orientation

Hormones later in life

Individuals with Gender Dysphoria experience a strong incongruence between their gender identity and natal sex. Many individuals with Gender Dysphoria undergo cross-sex hormone treatment to align their body with their gender identity.

Subject groups

Treatment in adolescence:



Treatment in adulthood:

Group comparisons

The organisational effect on lateralisation: 8-11y GD vs. 8-11y controls

The effect of puberty on lateralisation: 8-11y controls vs. 15-17y controls

The effect of cross-sex hormones on lateralisation in adolescents: (GD cross-sex – GD puberty suppression) vs. controls

The effect of cross-sex hormones on lateralisation in adults: (GD cross-sex – GD gonadal suppression) vs. controls

fMRI

Brain lateralisation will be measured with fMRI.

Tasks

Word generation, Mental rotation and Facial emotion recognition.

Additional data:

- Current hormone levels
- In some cases: Diffusion Tensor Imaging, Voxel-based morphometry or Resting state connectivity

Points for Discussion

1. Suggestions for essential measurements in the "Prenatal hormones study"?
2. How to analyze lateralisation in existing fMRI-data?

[1]*Previous study: Lust, J. M., Geuze, R. H., Van de Beek, C., Cohen-Kettenis, P. T., Groothuis, A. G. G., & Bouma, A. (2010). Sex specific effect of prenatal testosterone on language lateralization in children. Neuropsychologia, 48(2), 536–40.*
fTCD: Deppe, M., Ringelstein, E. B., & Knecht, S. (2004). The investigation of functional brain lateralization by transcranial Doppler sonography. NeuroImage, 21(3), 1124–46.