

Human intracortical structure differs between sexes and is modulated by the menstrual cycle

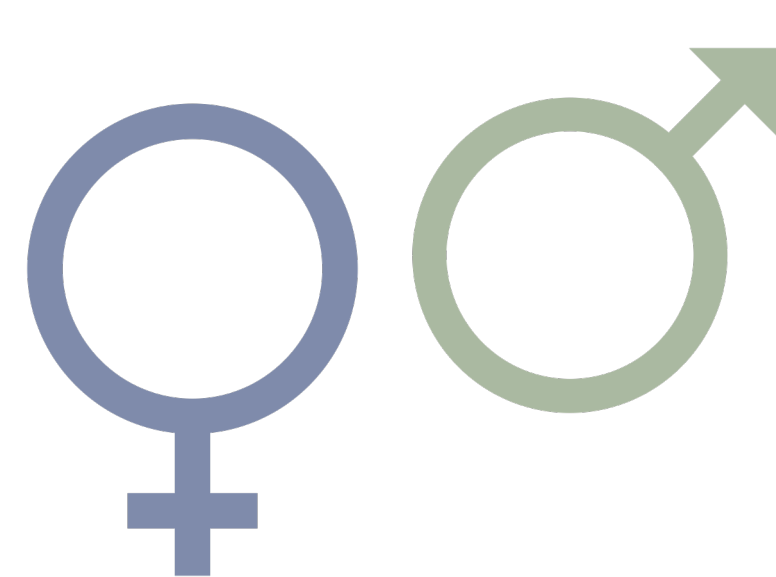
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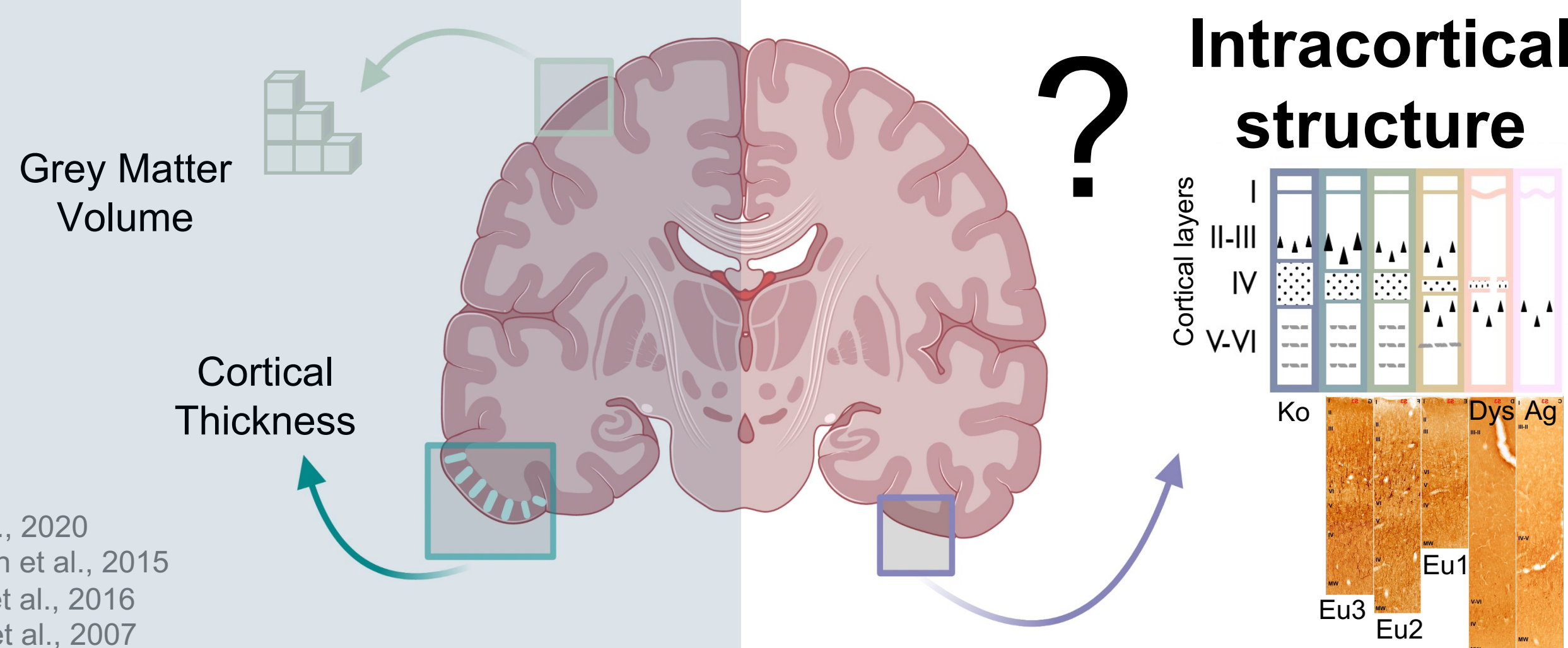
Introduction

Sex differences

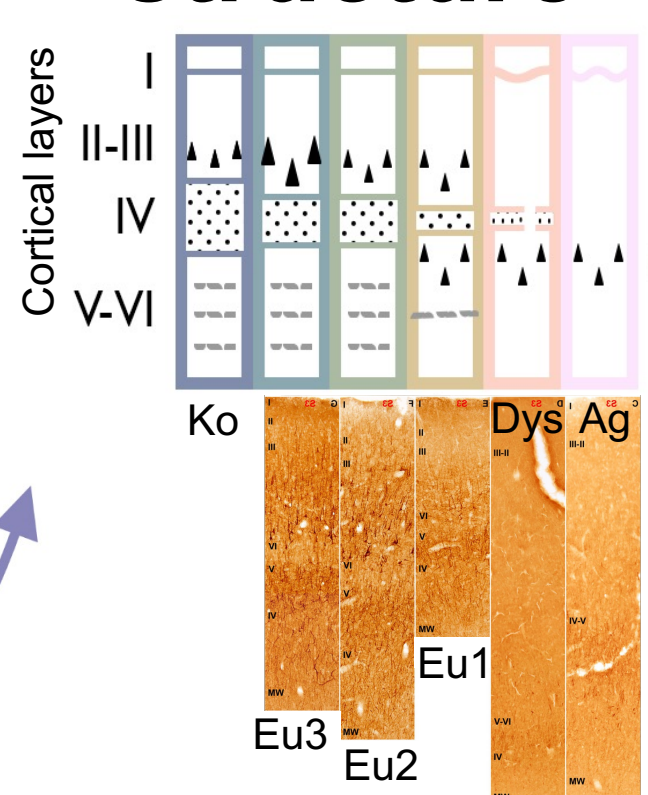
Sex hormones induce long-term structural changes in male and female brains.



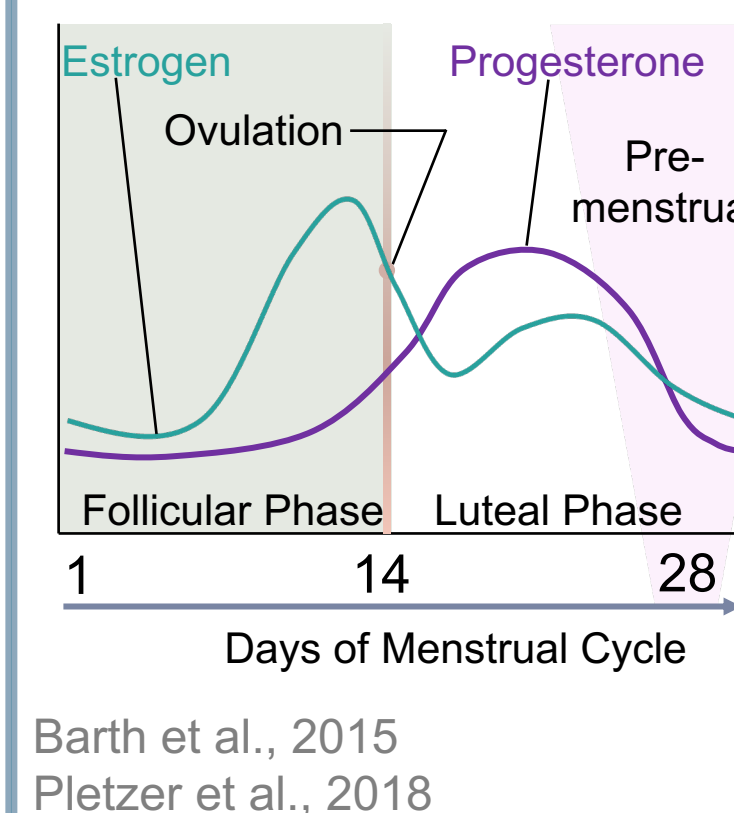
Barth et al., 2015
Gegenhuber et al., 2022
Herting et al., 2015



Intracortical structure



Menstrual cycle fluctuations

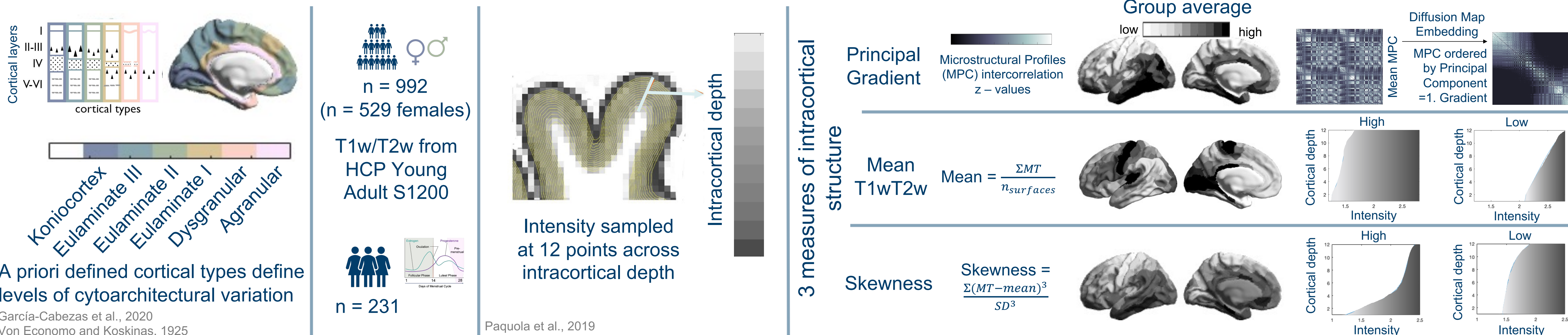


Sex hormones induce short-term structural changes in female brains during the menstrual cycle.

Barth et al., 2015
Pletzer et al., 2018

Methods

We use T1w/T2w (MRI) as a proxy for intracortical structure, to assess how sex hormones may induce microstructural plasticity on the short- and long-term. We will assess this in reference to cortical types, that reflect levels of cytoarchitectural variations within intracortical structure.

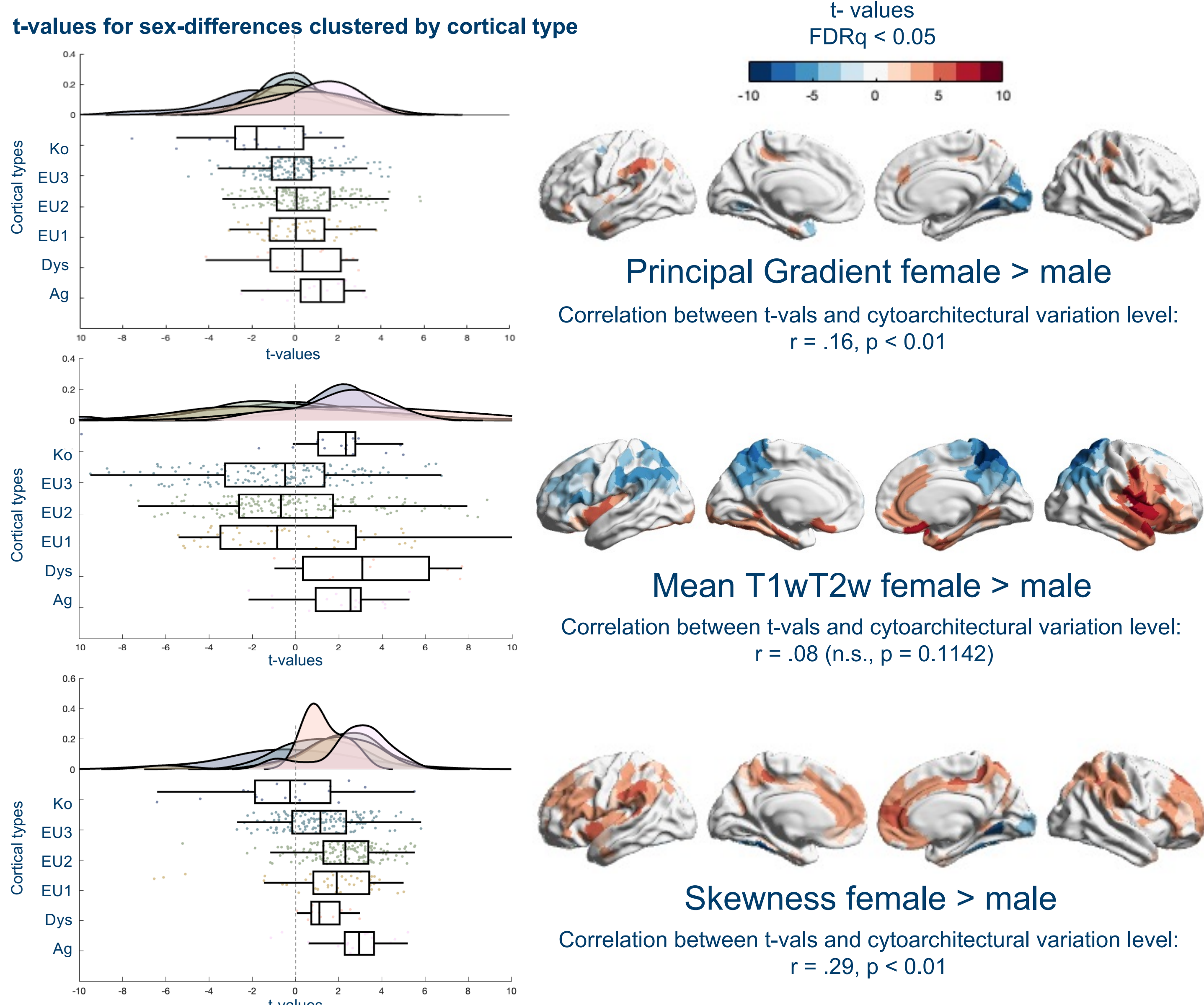


Results

Sex differences

The intracortical structure of male and female brains differs.

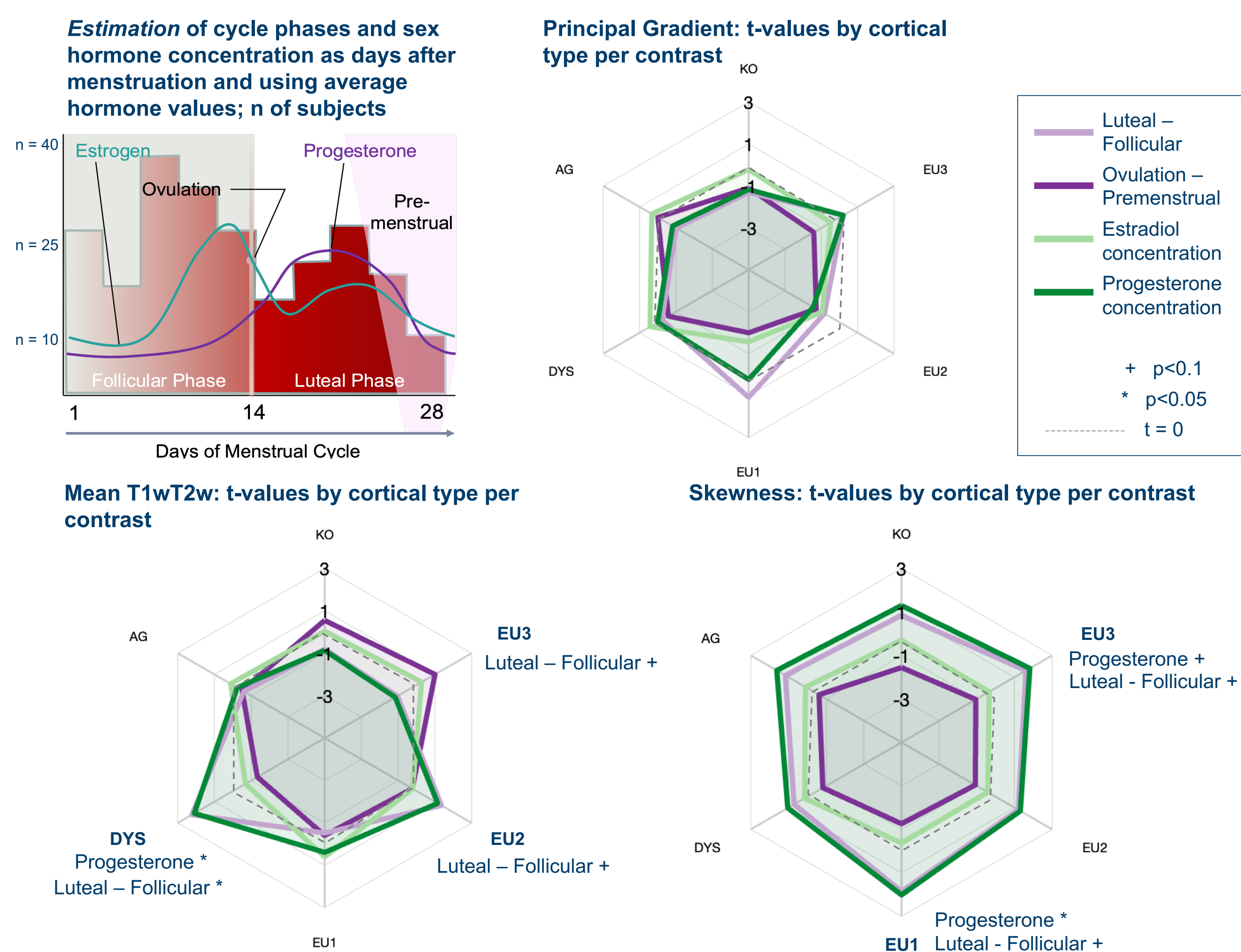
These differences correlate with cytoarchitectural variation levels in the cortex.



Menstrual cycle fluctuations

The intracortical structure changes during the female menstrual cycle.

These effects are observed (in trends) in response to in-cycle progesterone concentration levels, and differ between follicular and luteal phases.



Discussion & Outlook

Sex differences

- We observed the biggest sex differences in intracortical structure in koniocortical and agranular areas, generally thought to represent primary sensory and higher-order processes
- We will follow-up our analysis with transcriptomic analyses (Liu et al., 2020) and with analysis of post-mortem derived histological samples (e.g. BigBrain, Amunts et al., 2013), to further understand the relevance of cytoarchitectural variation in sex differences.

Future directions

While the field moves towards considering and explaining sex hormones as a shaping factor for female brains, few studies focus on interactions between male brain structure and male sex hormones. This lacuna needs to be targeted for a complete, systematic picture of brain areas sensitive to sex hormone modulation.

Menstrual cycle fluctuations

- The menstrual cycle effects didn't survive FDR correction. For more precise measures, we will follow-up the analysis with a 7T longitudinal dataset (6 timepoints, hormonal measures, n=27).
- Note that while sex hormones modulate brain structure within hours to days (Patel et al., 2013, Arevalo et al., 2010), sex hormones also influence fluids (Teasdale et al., 1988). We tried to ameliorate these effects by controlling for CSF.