Female brain as a target of sex hormones

Introduction

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Does female brain mirror hormonal fluctuations? Hormones, including sex steroids, play a crucial role in reciprocal communication between brain and body. Behavior, cognitive functions, general well-being, body and mental health depend on the precise regulation of this interaction. In the introductory talk, I will focus on the neuroimaging and behavioral evidence showing the influence of fluctuating ovarian steroid levels on women's brain morphology and function.

No more stigma, it's science: Joint dynamics of menstrual cycle and brain structure

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Ovarian hormones are key modulators of neuroplasticity, with animal research offering robust evidence of endocrine regulation of brain morphology. Yet, we still require longitudinal human studies that investigate how subtle hormone fluctuations influence the brain. In our study, we utilized the menstrual cycle as a natural experimental set-up to model how endogenous ovarian hormone fluctuations influence hippocampal subfield volume and structural connectivity. Healthy female participants of reproductive age were invited for 6 time-points during their menstrual cycles to undergo 7-tesla ultra-high field magnetic resonance imaging and rigorous cycle monitoring. We will review our systematic protocol for accurate characterization of cycle changes as well as individual phenotyping of brain structure to identify hormone-associated neuroplasticity during the reproductive years. Given the scarcity of female data in basic and clinical neurosciences, we contribute to bridging this gap in knowledge by providing a rich and detailed new dataset which sheds light on the menstrual patterns of the female human brain.

Dynamic causal modelling of the menstrual cycle: predicting ovulation from brain connectivity

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Specific brain connectivity patterns characterize each phase of the menstrual cycle in healthy women, related to their endogenous hormonal milieu. Dynamic causal modelling and parametric empirical Bayes were performed in a triple model consisting of the default mode, salience and executive central networks during resting state. Effective connectivity within and between these three core networks will be detailed for menses (low progesterone and estradiol); pre-ovulatory phase (peak estradiol, low progesterone), and the mid-luteal phase (high progesterone and estradiol). Remarkably, the specific cycle phase in which a woman was in could be predicted by the connections that showed the strongest changes.

Progesterone antagonism beneficial for premenstrual dysphoric disorder

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Premenstrual dysphoric disorder (PMDD) is a psychiatric condition characterized by late luteal phase affective, cognitive, and physical symptoms, causing significant distress in about 3-5% of women of reproductive age. Progesterone is posited to be implicated in the symptomatology, thus we tested the efficacy of a selective progesterone modulator (SPRM) for PMDD. In a multicentre, double-blind, placebo-controlled clinical trial, we demonstrated that half of the women receiving the treatment improved completely, while the corresponding proportion of women receiving placebo was 21 per cent. Furthermore, SPRM treatment was associated with enhanced reactivity in the dorsal anterior cingulate cortex and dorsomedial prefrontal cortex during aggressive response to provocation stimuli, as assessed

by functional magnetic resonance imaging. The mechanism of action of the study drug provides insights into the potential molecular mechanisms underlying this psychiatric disorder and its treatment, suggesting a beneficial effect of progesterone receptor antagonism on top-down emotion regulation.

Investigating effects of oral contraceptives on women's intra and intersexual social behaviours and their neural correlates.
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Worldwide millions of women use oral contraceptives (OC). Evidence is accumulating that oral contraceptives may alter a range of socio-emotional processes. We were interested whether this holds also for (intrasexual) empathy and (inter) sexual approach and avoidance behaviour. Thus, we investigated women taking combined oral contraceptives (n = 37) and two groups of naturally cycling women (early follicular: n = 37, and periovulatory: n = 29) using the Tuebinger Empathy Test (TET) and an erotic approach avoidance task (AAT) during fMRI. Next to the results of the cross-sectional analysis, an outlook on a longitudinal comparison of women who stop taking OCs will be given.