# BRAIN PLASTICITY IN THE PERIPARTUM: A MULTI-METHOD LONGITUDINAL STUDY OF MOTHERS AND FATHERS

Guiomar, R.[1*], Pacheco, F.[1], Silva, A.[1], Fonseca, A.[1], Mateus, V.[2], Pereira, M.[1], Osório, A.[2], Ganho-Ávila, A.[1]

**Affiliations**: [1]University of Coimbra, Center for Research in Neuropsychology and Cognitive Behavioral Intervention, Faculty of Psychology and Educational Sciences, Portugal; [2] Social and Cognitive Neuroscience Lab, Developmental Disorders Graduate Program, Mackenzie Presbyterian University, Brazil; *contact: raquelguiomar18@gmail.com

## 1. BACKGROUD

The parental brain results from the interplay between environmental experiences and gene expression responsible for changes occurring in pregnancy and the postpartum period [1,2]. In particular, brain regions that are known to be involved in caregiving skills, and that combine the reward, salience, attentional and executive networks[3,4,5]. Previous studies are mainly cross-sectional, hampering the clear picture on the neurodevelopmental changes in first-time parents. Therefore, longitudinal studies that measure brain activity while at the same time behaviorally assessing changes in cognition and caregiving skills are deemed necessary.

## 2. OBJETIVES

Primary aim: To assess brain function changes (in verbal recall memory, inhibitory control, emotion regulation) associated with pregnancy and parenthood, as measured by fNIRS during behavioral tasks (paired-associates learning task, Stroop task, emotion regulation task, own vs other baby task) that recruit parental-brain networks, in first-time parents.

Secondary aims:

1. To explore the association between brain function changes over time and self-reported wellbeing in first-time parents.
2. To explore the association between brain function changes over time and self-regulatory emotional and cognitive-related processes (emotion regulation, ruminative thinking) in first-time parents.
3. To explore the association between brain function changes over time and the activation of the caregiving behavioral system (hyperactivation or deactivation strategies) in first-time parents.

## 3. METHODS

**Ethical considerations:** All procedures performed will be in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Procedure:** A convenience sample will be recruited. Each participant will complete 5 experimental sessions (3 prenatal and 2 postnatal). Prenatal sessions will have the following structure: 1) self-report questionnaires; 2) fNIRs montage, 3) computer-based behavioral tasks and fNIRS data collection. In postnatal sessions the own vs other-baby task will be added to the previous structure. A non-perinatal control group will be included to control for learning effects due to the tasks' repetition.

**Participants:** Participants will be assigned to 4 groups: i) first-time parents: men (group 1) and women (group 2) in the first trimester of pregnancy; ii) control: men (group 3) and women (group 4) non-parents matched (age and education) controls.

**Inclusion criteria:**

Singleton and primiparous pregnancy; currently in the first trimester of pregnancy; healthy pregnancy and healthy fetus/newborn; > 18 years old; european Portuguese speaking native; no current psychiatric condition; no medical conditions that could dysregulate neuroendocrine function; no current alcohol or recreational drug abuse .

Assessment timepoints: 10—12, 24—26, 30—32 weeks gestation; 3—4, 12—16 weeks postpartum Note. Controls will follow the same time-point intervals.

## 3. METHODS

**Measures:**

Brain function (fNIRS) and behavioral tasks:

| Target bilateral brain areas | Behavioral task |
|---|---|
| Frontal Inferior Opercularis | Stroop task |
| Frontal Superior Medial | Paired-associates learning task |
| Frontal Inferior Orbital | Emotion regulation task; own vs other-baby task |

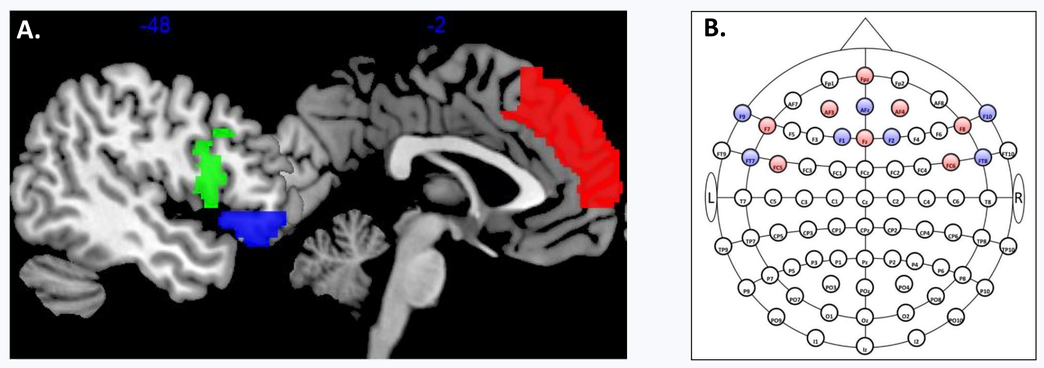


**Figure 1.** A. Representation of the target brain areas for fNIRS; numbers present the slice MNI coordinate. B. Representation of fNIRS montage: source (in red) and detectors (in blue) optodes in 10-10 EEG international system coordinates.

Self-reports assessing: depression, anxiety, fatigue, rumination, dificulties in emotion regulation, caregiving strategies; bonding.

**Analytic strategy:**

- Between group baseline differences (independent sample T tests)
- Confounds testing (regression analysis)
- Repeated-measures within-between ANOVA (4 groups x 5 moments); Post-hoc comparisons;
- Correlations with self-report questionnaires;

## 4. IMPACT

The P-Brain project has the potential to significantly expand our understanding of brain changes in the peripartum, through a minimally invasive procedure. The dissemination of the results will be achieved through the project's website, social media, and outreach activities that may include participation at local health fairs and networking among health specialists and community groups. The P-Brain project will impact society by leveraging knowledge about the neurobiological underpinnings of the distinctive parenthood experiences by men and women while supporting shared parenthood responsibilities.

## 5. REFERENCES

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