



The Medial Prefrontal Cortex-Basolateral Amygdala Connection



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ABSTRACT

The two regions of interest in our study are the medial prefrontal cortex (mPFC) and the basolateral amygdala (BLA). We stimulated the mPFC which is responsible for complex behavior, decision making and logical reasoning. We recorded in the BLA which is responsible for autonomic responses, it is particularly known to act in emotional circumstances. A stereotaxic surgery was performed to acquire a signal with characteristics specific to the mPFC-BLA pathway. This surgery is new in our lab and therefore much of our time this summer has been concentrated on finding consistent methodology to acquire a successful and consistent signal in each attempt. The signal we are looking for has a unique feature of a negative peak at a latency of 25ms. To carry out these surgeries electrodes are created including the ground/reference electrode, stimulating/bipolar electrode and recording/monopolar electrode. Once the electrodes are created the experimenters may start their surgery. The rat is put under anesthesia using initially isoflurane liquid to relax the rat and then is injected with a mixture of ketamine anesthetics at the intraperitoneal site and is then prepared for surgery. An incision is made and the skull of the rat is cleaned to the point where Lambda and Bregma can be identified. Lambda and Bregma are reference points as to where to implant the electrodes. Once the electrodes are in place, they are capped with dental cement and the rat is left for five to seven days to recover. Histology was performed to verify the location of electrode implant. With the connection between the mPFC and BLA established we can begin LTP recordings to find control data. We then hope to assess how various types of stress impact this synapse. In conclusion, we established a consistent and successful methodology for a surgery that examines the synapse between the mPFC and BLA.

INTRODUCTION

- The Medial Prefrontal Cortex (mPFC) is involved in decision making, logical reasoning and other complex cognitive behaviors, we stimulated in this section of the brain.
- The Basolateral Amygdala (BLA) controls autonomic response and is associated with fear and emotion, we recorded in this section of the brain.
- The mPFC-BLA pathway does not show LTP but does show LTD.
- Acute stress promotes LTP in the mPFC-BLA pathway
- This is a new surgery in our lab so the original coordinates used in this surgery were based off of an article by Vouimba and Maroun (2011) and were then altered to ameliorate the signal we were finding.
- Histology was taken to verify location of implanted electrodes.

METHODS

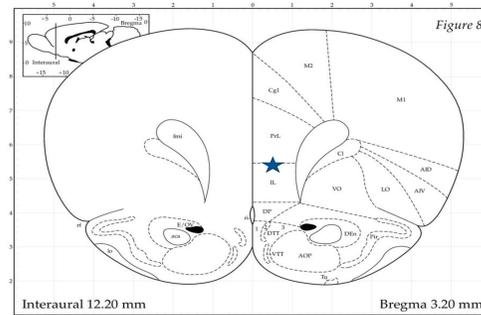


Figure 1: Medial Prefrontal Cortex; area being stimulated, star indicates where electrode was implanted.

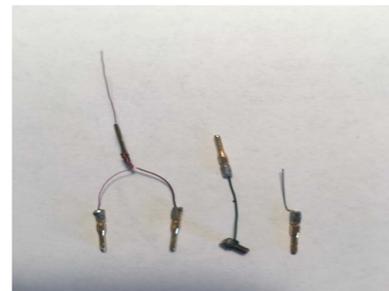


Figure 3: Electrodes used (from left to right): Stimulating (bipolar), Reference (ground) and Recording (monopolar)

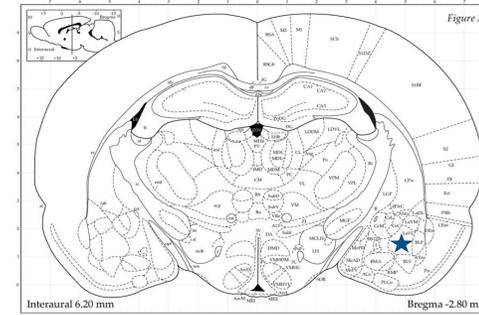


Figure 2: Basolateral Amygdala; recording from this area, star indicates where electrode was implanted.

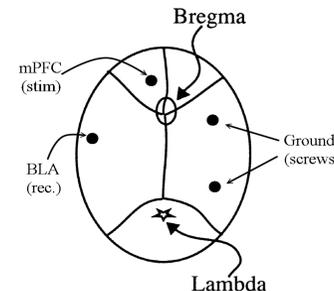


Figure 4: Skull of a rat with labeled landmarks, Bregma and Lambda and where the mPFC and BLA holes will be drilled

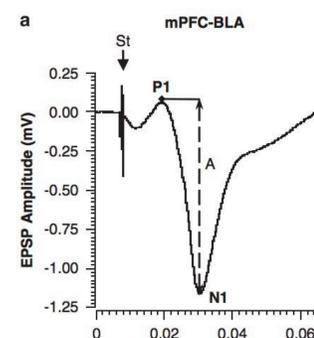


Figure 5: Signal expected to be seen based off of article by Maroun and Vouimba (2011)



Figure 6: First successful surgery on May 25th 2017, negative peak at a latency of 25ms

METHODS

- 30 day old, Sprague Dawley males rats are subjects
- Ground (reference) electrodes, stimulating (bipolar) and recording (monopolar) electrodes are created
- Stereotaxic surgery and electrode implantation takes place
- Rats are left to recover and LTP recordings are taken

FUTURE PLANS

- With the connection between the mPFC and BLA established, we can begin control testing to see if this synapse shows LTP
- Experiments on how stress affects LTP at this synapse
 - Neonatal (early life) stress: separation from mothers
 - PFC is still developing during early life
 - Constraint (adult) stress: place adult rat in confined space for period of time
 - Anxiety Drugs: do they mediate the effects of stress?

ACKNOWLEDGEMENTS

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