**UNDERGRADUATE SUMMER VACATION SCHOLARSHIP AWARDS – FINAL SUMMARY REPORT FORM 2020/21**

***NB: This whole report will be posted on the Society’s website therefore authors should NOT include sensitive material or data that they do not want disclosed at this time.***

**Name of student:**

Olivia Mosley

**Name of supervisor(s):**

Darren Roddy

**Project Title: (no more than 220 characters)**

Virtual dissection of the fornix and stria terminalis in young adolescents with psychotic experiences

**Project aims: (no more than 700 words)**

This study aims to investigate any magnetic resonance structural differences of the fornix and stria terminalis in young adolescents with psychotic experiences (PE’s)

Hypothesis tested included

1. Young adolescents with PE’s have fornix microstructural differences compared to controls

2. Young adolescents with PE’s have stria terminalis microstructural differences compared to controls

3. Fornix and stria terminalis differences are correlated with indices of early childhood trauma.

**Project Outcomes and Experience Gained by the Student (no more than 700 words)**

**Differences in fornix and stria terminalis diffusion metrics were found in young adolescents with PEs.**

**The student was trained in cutting edge MRI techniques, neuroanatomy, hypothesis generation, data analysis, manuscript preparation and presentation skills. Specifically, Olivia gained experience in the following techniques:**

**Freesurfer/ExploreDTI software.** Olivia learntfor pre-processing diffusion techniques of MRI images such as Gibbs ring correction, signal drift correction, image stabilisation etc. The theory and physics behind these techniques and their application are transferrable across all MRI modalities and beyond. This allows Olivia to understand both the limitations and uses of MRI.

**ExploreDTI for tractography.** Olivia gained experience with the use of Boolean operators. These concepts are transferrable across all research domains and analyses. Also, immersion within the 3D ExploreDTI environment provides a sound basis for learning complex neuroanatomy and cortical relationships.

**Neuroanatomy.** Olivia learnt the complex neuroanatomy surrounding the hippocampus, amygdala, fornix, stria terminalis and other limbic structures.

**Microsoft Excel.** Olivia gained experience with the transferable skills of data input, data sequencing, simple calculations, data checking, data presentation etc on Microsoft Excel.

**SPSS.** Olivia learnt statistical analysis on SPSS, including analysis of covariance, multiple comparison corrections such as Bonferroni corrections and false discovery rate, partial correlation analysis, logistical regression analysis.Concepts such as group testing, variances in relationships, predictors and correcting for confounders were also explored. SPSS familiarity and sound statistical knowledge are the basis for any academic/clinical career and industry.

**Microsoft word.** Olivia used Microsoft word for writing up her dissertation/report for local meetings as well as the anatomy society meeting. Transferable skills to any career.

**Endnote.** Olivia gained proficiency in Endnote for appropriate and consistent referencing. Transferable skills to any academic career.

**Microsoft PowerPoint.** Olivia gained experience with using Powerpoint for poster generation and presentation of results to faculty. Transferable skills to any career.

**Please state which Society Winter or Summer Meeting the student is intending to present his/her poster at:**

Winter 2021

**Proposed Poster Submission Details (within 12 months of the completion of the project) for an AS Winter/ Summer Meeting – (no more than 300 words)**

The fornix and stria terminalis are aligned yet discrete limbic bilateral white matter bundles that connect the hippocampus and amygdala to the both the hypothalamus and septal forebrain areas. Dissection studies have shown that fibres traversing this structure follow discrete paths depending on what subsections of the hippocampal formation or amygdala they originate from. Until now there has been insufficient spatial resolution to allow differentiation between the hippocampal fornix and amygdalar stria terminalis. As both the hippocampus and amygdala have been implicated in psychosis, we investigated virtually dissecting out these structures from diffusion MR imaging in a cohort of young adolescents with psychotic experiences (PEs) and controls.

We performed High Angular Resolution Diffusion Imaging in 61 directions in 25 young adolescents with PEs and age matched control subjects using 3T MRI and used Constrained Spherical Deconvolution to reconstruct whole brain tracts. We found that the fornix and stria terminalis could be reliably reconstructed across subjects with a bespoke protocol using the hippocampal and amygdalar nuclei to extract apart the fornix and stria terminalis respectively from the original conjoined tract. We also subdivided out the pre (septal) and post (hypothalamic) commissural components of the fornical and stria. The number and volume of tracts in each component of the column was calculated as well as standard diffusion metrics such as mean fractional anisotropy, apparent diffusion coefficient, axial diffusivity and radial diffusivity.

Although no volume differences were found between PE and control groups, distinct diffusion metric differences between the groups was found for both the fornix and stria terminalis.

Due to the discrete nature of the connectivity of these tracts, this novel technique showing differences in hippocampal and amygdalar output tracts in young adolescents with PEs may prove useful as a potential biomarker for the condition.

**Brief Resume of your Project’s outcomes**: **(no more than 200-250 words)**.

*The title of your project and a brief 200-250 word description of the proposed/completed project. The description should include sufficient detail to be of general interest to a broad readership including scientists and non-specialists. Please also try to include 1-2 graphical images (minimum 75dpi). NB: Authors should NOT include sensitive material or data that they do not want disclosed at this time.*

Although the hippocampus and amygdala have been linked to psychotic experiences (PEs), their output tracts, the fornix and stria terminalis, are poorly understudied in individuals with PEs. Using magnetic resonance imaging data from the Adolescent Brain Development study at the Royal College of Surgeons in Ireland, this project aimed to understand the relationship between these tracts, PEs and neuropsychological measures in a cohort of 50 young adolescents (25 PEs, 25 controls). Using an anatomically validated model of fornix and stria medullaris generation, these tracts were reconstructed, and diffusion metrics extracted. Group differences between PEs and controls were explored using appropriate statistical techniques. Differences in specific diffusion metrics of both tracts were found along specific parts of the tracts, suggesting that hippocampal and amygdalar outflow may be impacted in young adolescents with PEs. This project applied sound anatomical principles to the analysis of magnetic resonance psychiatric data. This project has furthered our understanding of the functional anatomy of the fornix and stria terminalis and the influence of the microstructural anatomy on psychological symptoms.

**Other comments: (no more than 300 words)**

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| **Data Protection/GDPR**: I consent to the data included in this submission being collected, processed and stored by the Anatomical Society. Answer YES or NO in the Box below |
| YES |
| **Graphical Images**: If you include graphical images you must obtain consent from people appearing in any photos and confirm that you have consent. A consent statement from you must accompany each report if relevant. A short narrative should accompany the image. Answer N/A not applicable, YES or NO in the box below |
| N/A |
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| N/A |

*Signature of student......* *Date 29/09/2021*

*Signature of supervisor………………* *Date 29/09/2021*

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