



Differentiating Organoids for Brain Integration

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By now, 2-dimensional tissue culturing *in vitro* is widely developed and used for research. Although useful, a major criticism of 2D cultures is that they cannot represent completely how a 3D system- cells interacting through layers- would respond, posing a problem since human tissues are 3D environments.

This summer, my project was to focus on growing human stem cells into 3D structures called organoids; characterize, analyze, and transplant them into the brains of living rats; and evaluate their survival and integration within the brain after a time. Techniques implemented include differentiating cells so they exhibit characteristics of the human cortex, animal surgeries to transplant cortical organoids into visual cortex, tissue sectioning, immunohistochemistry, and data analysis. The goals of this project were: to generate *in vitro* tissues with characteristics of human cortex, especially cortical layer-specific neurons; and to assess organoid survival and integration with the host animal brain.

I learned all the techniques needed to take on this project. Specifically, I learned how to maintain stem cells *in vitro* using standard cell culture techniques, differentiate them into cortical tissue using different growth factor protocols, section thin slices of brain tissue using a cryotome, stain tissue sections with different antibodies to search for specific characteristics, and image these stains. Additionally, I learned the surgery techniques used for the transplantation into rats and was able to act as an assistant during them.

Participating in this research gave me the link between what I learn in classes and what I hear about how they are applied. We are taught their applications but it made a difference for me to actually be using the techniques I learn about. The PURM experience gave me a greater understanding of the scientific background behind the techniques, solidifying the information I learned in the classroom. Whereas before this experience, I felt lost when talking about research ideas, I now have many ideas about new projects and questions I want to answer. I therefore plan on continuing my research experience with Dr. Chen in the future.