Efficiency of Neuronal cells with 3D Agarose Cultures

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Abstract

New technology is revolutionizing drug discovery and improving drug viability in medical research. This study explores whether 3D cultures, specifically using agarose as a matrix, can improve the viability of neuronal cultures in drug discovery, compared to 2D cultures. Using SH-SY5Y neuroblastoma cells, a cell line that is commonly employed in neurological research, we developed a 3D culture system where cells are grown in agarose-filled tubes. This setup aims to mimic the natural, three-dimensional environment of neuronal tissues. To assess the structure and viability of these cultures, we aim to embed the grown cells in wax, in order for precise sectioning and detailed microscopic examination. This model promises to be a valuable tool in the study of neurodegenerative diseases where a more accurate representation of brain tissues is crucial.

Introduction

- We employed a three-dimensional culture system with agarose-filled wells to grow SH-SY5Y neuroblastoma cells, to mimic their natural environment.
- Agarose was used in two ways: regular placement and scraped on the bottom. The agarose was scraped to determine if cells adhere better to a rough or a smooth surface.
- By embedding the cells in wax, we aim to demonstrate that 3D culture models can improve drug discovery processes.
- This approach provides a more accurate model of brain tissues.

Methods

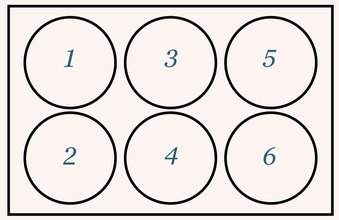

Figure 1: Overview of six wells with varying treatments. Wells 1-2: 1% Agarose. Wells 3-4: 1% Agarose with a scraped bottom. Wells 5-6: No agarose, control.

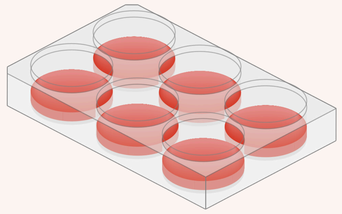

Figure 2: Six wells with medium visualization.

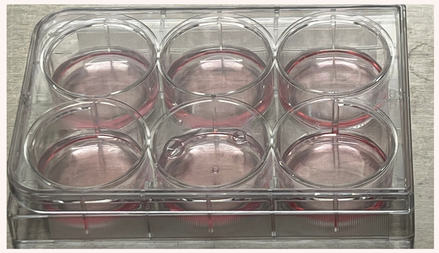

Figure 3: Six wells with medium and agarose - cell treatment.

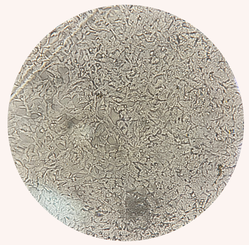

Figure 4: Cells under the microscope.

Results

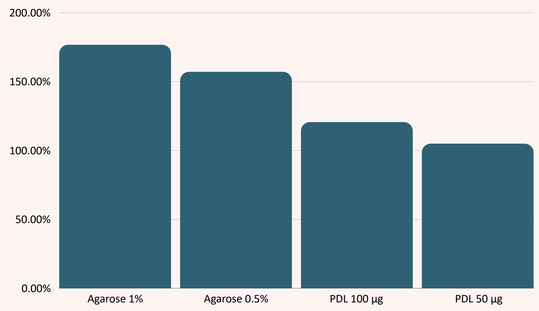

Figure 5: Cell increase compared to control (%). We compared the cell increase in both agarose and poly-D-lysine (PDL) to determine which one had a higher increase of cells.

- Cell growth was compared using agarose or poly-d-lysine treated wells.
- We determined that cell growth was better when agarose was used as a matrix vs PDL.

Conclusion

- Successfully grew 3D cultures of SH-SY5Y cells in agarose, creating a pivotal model compared to the traditional 2D cultures.
- Initial assessments indicate that 3D cultured cells exhibit improved cell viability, which is critical for accurate drug testing and discovery.
- We plan to embed our 3D cultures in wax and section them (Figure 6). This will enable us to identify both cell bodies/axons and dendrites of the neurons in their 3D state so that we can accurately count them and determine phenotypes.

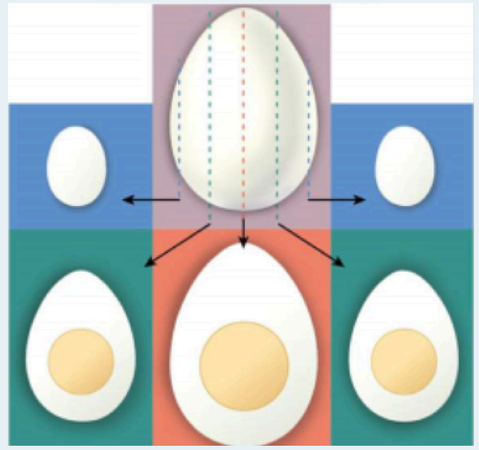

Figure 6: Sectioning solid objects. Reference: The McGraw-Hill companies, inc.

- Future research will focus on measuring the differences in drug response between cells grown in 2D versus 3D environments to showcase the benefits of this culture system in drug discovery.

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