UCSF HIGH SCHOOL INTERN PROGRAM

PAST PROJECTS

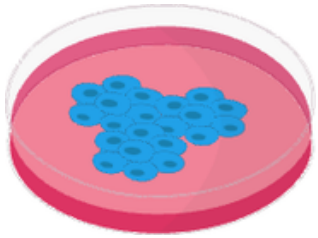
Does Age Create More Noise in the Brain?

Filler words and filler sounds are common, it is rare to encounter someone who does not perform them. Previous research shows that birds may use filler sounds when they are singing, similar to how humans do when we speak. We think that the brain uses filler words and filler sounds as a type of correction mechanism, and the use of filler words and filler sounds changes with age.

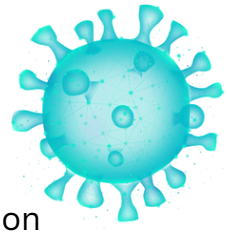
Our hypothesis was that young adult Zebra finches make more mistakes while singing than adult Zebra finches. For the study, we recorded Zebra finches of different ages singing inside acoustic chambers for several days.

Comparative Analysis of Gene-Targeting Strategies for iPSC Line Generation

Induced pluripotent stem cells (iPSCs) are pluripotent stem cells generated directly from somatic cells, capable of differentiating into various tissue types. iPSCs were first generated by Shinya Yamanaka and Kazutoshi Takahashi at Kyoto University, Japan in 2006. **We aim to compare and use two gene-targeting strategies to generate iPSC lines carrying various fluorescent reporter proteins for studying gut development.**



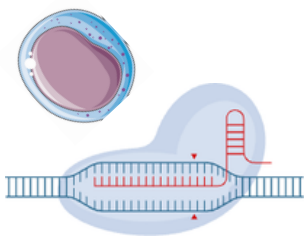
Understanding Central Nervous System (CNS) Autoimmunity Potentially Induced By SARS-CoV-2



SARS-CoV-2 is known to affect the human's central nervous system (CNS). Previous studies on neurological symptoms demonstrated in COVID-19 patients, such as "brain fog" and mental health disorders, suggested that uncontrolled immune responses pre- and post-SARS-CoV-2 exposure were associated with severe health outcomes. As the cause of these symptoms remains unknown, **our group aims to understand the mechanism by which SARS-CoV-2 infection leads to severe neurological disorders in patients through CNS autoimmunity.**

CRISPR Efficiency in NK-92 Cells

Immunotherapy, where the immune system is harnessed to fight cancer, has shown some clinical successes. However, its success is not universal; responses vary from patient to patient. A better understanding of the immune system is needed to improve outcomes. CRISPR-Cas9 is a revolutionary tool used for genetic editing. Its simplicity and speed has made knocking out genes a much easier approach to understanding the molecular mechanisms of the immune system. **The goal of our study was to optimize CRISPR editing conditions for NK-92s, an immune cell line.**



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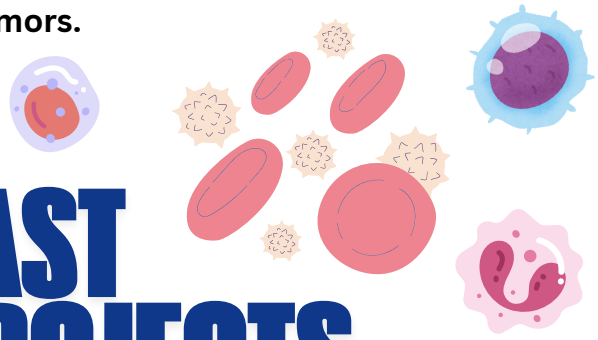
Effects of Prenatal THC Exposure on Human Cortical Cell Diversity

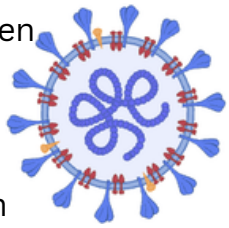
Cannabis use during pregnancy is on the rise and has been associated with increased risk of neurodevelopmental disorders in children. Despite these concerns, the molecular effects on the developing brain remain unclear. To study these impacts, we treated iPSC-derived cortical organoids from three cell lines (H1, 1323-4, WTC-11) with THC at differentiation week 10 for three days. We assessed changes in protein expression using known markers. Our preliminary data suggest that CBD exposure alters cortical cell composition, particularly affecting neural progenitor and neuronal subtypes. **Our findings highlight the need for further investigation into how cannabis compounds influence human brain development at the molecular level.**

Expression of Immune Evasion Genes in Breast Cancer

Normal cells progressively alter their biological capabilities as they develop into cancerous cells which allows them to survive, proliferate and spread. The six hallmarks of cancer include self-sufficiency in growth signals, insensitivity to anti-growth signals, tissue invasion and metastasis, limitless replicative potential, sustained angiogenesis or development of new blood vessels, and immune evasion. **Our research focuses on the hallmark of immune evasion which is associated with the advanced development of breast tumors.**



ZIKVs Effect on Proliferation of Astrocytes In The Developing Brain



Zika virus (ZIKV) is a significant risk to fetal brain development, often leading to birth defects such as microcephaly. ZIKV disrupts cortical development by inducing neuroinflammation and altering neural cell populations. My project aims to examine how ZIKV affects the abundance of astrocytes and neurons in the developing brain. **These findings may contribute to a better understanding of ZIKV and support the development of future scientific research or preventive strategies.**

The Effects of Immunosuppressants on Human Bronchial Epithelial Cell Line

Every year 2,000 people get lung transplants. It is important for transplant recipients to take immunosuppressants to prevent lung transplant rejection. Here we expose airway epithelial cells (16HBEs) to common immunosuppressants and measure cell stress levels, and proliferation, which helps inform how to better dose immunosuppressants for patients.