

Cell Science Internship 2023

Editors: Kavya Desai and Sneha Varma



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Introduction

Science Gurus was founded in December 2009 by enthusiastic volunteers passionate about science and dedicated to supporting budding scientists. Science Gurus is a registered non-profit charitable organization, and it offers insights into a plethora of opportunities in research and development for students interested in pursuing a career in life sciences. Given the rapid growth of the life science industry across the globe, an understanding of nature and career opportunities may lead to educated decision-making. In addition, this organization's key objective is to attract young talent from engineering, technology, and natural sciences to address challenging scientific questions in human health and diseases. Science Gurus has been promoting charitable activities on supporting science education for deserving and needy students in the United States of America and in India by way of:

- Providing career growth mentoring to next-generation scientists
- Building Biotech/Pharma awareness among the youth
- Mentoring students to work on independent research projects
- Engaging the youth in STEM areas through hands-on teaching
- Recognizing and rewarding teachers to promote science education
- Sponsoring low-income students in obtaining science education in India
- Conducting drug discovery & development workshops in India
- Collaborating with academic institutions to build science curriculum in India

Organizing Committee



Program Coordinator:
Meenakshi Vengarai, PhD
Science Gurus



Program Director:
Jagath Reddy Junutula, PhD
Science Gurus



Program Co-Director:
Kushal Suryamohan, PhD
MedGenome



Program Co-Director:
Kiran Mukhyala, MS
Genentech



Program Instructor:
Anay Limaye, BS
MedGenome

Participating Interns

| | | |
|----------------------|--|---------------------|
| Adithi Kona | Dougherty Valley High School | San Ramon, CA |
| Aditya Kewalram | Lynbrook High School | San Jose, CA |
| Akhil Kalva | Chattahoochee High School | Johns Creek, GA |
| Danica Setna | San Ramon Valley High School | Danville, CA |
| Hitanshi Shah | Alpharetta High School | Alpharetta, GA |
| Jia Ruparel | Henry M. Gunn High School | Palo Alto, CA |
| Jireh Obena | Imagine International Academy of North Texas | McKinney, TX |
| Kavya Desai | Leland High School | San Jose, CA |
| Levi Woffinden | San Luis Obispo High School | San Luis Obispo, CA |
| Likhith Elisetty | Merrill F. West High School | Lathrop, CA |
| Manasi Vegesna | Hamilton High School | Chandler, AZ |
| Max Wang | Ridge High School | Basking Ridge, NJ |
| Mayukhi Katragadda | Dougherty Valley High School | San Ramon, CA |
| Nishanth Upadhyayula | Mission San Jose High School | Fremont, CA |
| Prisha Jain | Foothill High School | Pleasanton, CA |
| Ritu Doshi | Tesla STEM High School | Sammamish, WA |
| Sadhika Mulagari | Evergreen Valley High School | San Jose, CA |
| Sharanya Mantrala | Frisco High School | Frisco, TX |
| Shaurya Sinha | Dublin High School | Dublin, CA |
| Shriivanth Gunanidhi | Heritage High School | Antioch, CA |
| Sneha Varma | Canyon Crest Academy | San Diego, CA |
| Sriya Yenne | Monta Vista High School | Cupertino, CA |
| Srushti Batni | Monta Vista High School | Cupertino, CA |
| Suravi Bajaj | American High School | Fremont, CA |
| Tanmay Kapoor | Acton Boxborough Regional High School | Acton, MA |
| Tanvi Vuyyuru | Lightridge High School | Chantilly, VA |
| Tapan Sapre | Thomas Jefferson High School | Chantilly, VA |
| Trisha Ramineni | Quarry Lane High School | Dublin, CA |
| Vicky Zhou | Episcopal High School | Rego Park, NY |

Program Agenda

Week 1

Mon 6/5

6:00 - 7:00 PM

Meet and Greet + Goals of the Internship

Jagath Reddy Junutula,
Science Gurus

7:15 - 8:15 PM

Introduction to Cancer Biology and Cancer Basics

Jagath Reddy Junutula,
Science Gurus

Wed 6/7

6:00 - 7:00 PM

Bioinformatics Tools and Applications

Kiran Mukhyala, Genentech,
Anay Limaye, MedGenome

7:15 - 8:15 PM

Bioinformatics Tools and Applications

Kiran Mukhyala, Genentech,
Anay Limaye, MedGenome

Fri 6/9

6:00 - 7:00 PM

Drug Discovery and Development: Overview

Chakk Ramesha, Medhus
Bio LLC

7:15 - 8:15 PM

Drug Discovery and Development: Overview

Chakk Ramesha, Medhus
Bio LLC

Week 2

Mon 6/12

6:00 - 7:00 PM

Cancer Signaling

Jagath Reddy Junutula,
Science Gurus

7:15 - 8:15 PM

Systems Biology

Pradeep Fernandes,
Bugworks

Wed 6/14

6:00 - 7:00 PM

Gene Family Approach for Drug Discovery

Ajith Kamath, Pandorum
Technologies

7:15 - 8:15 PM

Bioinformatics Tools and Applications

Kushal Suryamohan,
MedGenome

Fri 6/16

6:00 - 7:00 PM

Bioinformatics Tools and Applications

Kiran Mukhyala, Genentech

7:15 - 8:15 PM

Large Molecule Drug Discovery

Jarret Adams, Anvila
Biologics

Week 3

Mon 6/19

6:00 - 7:00 PM
**Small Molecule Drug
Discovery**
Vasu Jamma, Aarvik
Therapeutics

7:15 - 8:15 PM
**Kinase Drugs and
Resistance**
Khyati Shah, Pfizer

Sat 6/24

8:00 - 11:00 AM
Student Presentations
Meenakshi Vengarai, Aarvik
Therapeutics (Host)

Wed 6/21

6:00 - 7:00 PM
**Bioinformatics Tools and
Applications**
Kushal Suryamohan,
MedGenome
Anay Limaye, MedGenome

7:15 - 8:15 PM
Student Presentations
Meenakshi Vengarai, Aarvik
Therapeutics (Host)

Sun 6/25

8:00 - 10:00 AM
Student Presentations
Meenakshi Vengarai, Aarvik
Therapeutics (Host)

10:00 AM - 12:00 PM
**Workshop: "Preparing
Effective College
Applications"**
Harpal Kochar, Success
Coach
Aparna Ganshari, Arroyo
High School

Fri 6/23

6:00 - 8:15 PM
Student Presentations
Meenakshi Vengarai, Aarvik
Therapeutics (Host)

Week 4

Mon 6/26

6:00 - 7:00 PM

**Small Molecule
Manufacturing and
Formulation**

Sanjeev Redkar, Apollomics

7:15 - 8:15 PM

**Small Molecule
Manufacturing and
Formulation**

Sreedhara Alavattam,
Genentech

Sun 7/2

9:00 AM - 1:00 PM

**Workshop: “Effective
Content Development and
Delivery”**

Bob Figari, InnerTrek

Wed 6/28

6:00 - 7:00 PM

**Internship Progress Check
and Q&A**

Jagath Reddy Junutula,
Science Gurus

7:15 - 8:15 PM

**Bioinformatics Tools and
Applications**

Anay Limaye, MedGenome
TAs

Fri 6/30

6:00 - 8:15 PM

**Interplay between Cancer
and Inflammation**

Ganesh Kolumam, Calico
Labs

7:15 - 8:15 PM

Stem Cell Therapeutics

Ram Mandalam, Citra
BioConsulting

Week 5

Mon 7/3

Holiday

Wed 7/5

6:00 - 7:00 PM
Biologic Analytics
Vish Katta, MS4CMC

Fri 7/7

6:00 - 7:00 PM
Clinical Trial Design and Execution
Will Reed, BeiGene

7:15 - 8:15 PM
Bioinformatics Tools and Applications
Anay Limaye, MedGenome
TAs

7:15 - 8:15 PM
Overview on Computer Aided Drug Designing (CADD)
Mutyala Rami Reddy, Rational Labs

Week 6

Mon 7/10

6:00 - 7:00 PM
Clinical Trial Operations
Sarah Hamirani, AbbVie

7:15 - 8:15 PM
Neuroscience and Behavior
Meenakshi Vengarai, Case
Western Reserve University

Wed 7/12

6:00 - 7:00 PM
Importance of Pharmacokinetics in Drug Development
Dhaval Shah, University of Buffalo

7:15 - 8:15 PM
Bioinformatics Applications
Anay Limaye, MedGenome
TAs

Fri 7/14

6:00 - 7:00 PM
The Story of Data for Pharma R&D
Santha Ramakrishnan, Bayer

7:15 - 8:15 PM
Business Development
Surya Sankuratri, Epok
Therapeutics

Week 7

Mon 7/17

6:00 - 7:00 PM
Career Q&A Session with
CSI-Intern Alumni

7:15 - 8:15 PM
GMP/FDA Compliance
Chitra Sharma, gCompliance

Wed 7/19

6:00 - 7:00 PM
Nanoparticle Therapeutics
Samir Mitragotri, Harvard
University

7:15 - 8:15 PM
Bioinformatics Tools and
Applications
Anay Limaye, MedGenome
TAs

Fri 7/21

6:00 - 7:00 PM
Biomarkers
Thamby Gomathynayagam,
Amgen

7:15 - 8:15 PM
Overview of
Neurobiological Diseases
Suresh Poda, Encoded
Therapeutics

Week 8

Mon 7/24

6:00 - 7:00 PM
Patent Overview
John Storella, Storella &
Witt, LLP

7:15 - 8:15 PM
Bioinformatics Tools and
Applications
Anay Limaye, MedGenome
TAs

Thu 7/27, Fri 7/28

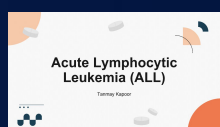
4:00 - 8:15 PM
Final Project Presentations

Sun 7/30

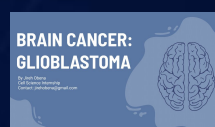
6:00 - 9:00 PM
Science Gurus Annual
Event and Certificate
Presentation

Human Disease Presentations

The Human Disease Presentation is the first of two projects during the Cell Science Internship. Each intern was assigned a disease to research, ranging from viral diseases to neurodegenerative diseases to cancers. They were tasked with studying the disease and producing a paper, including information about genetic changes, key cell signaling pathways, biological mechanisms, diagnostic procedures, symptoms, treatments, current research, and other relevant information. They later presented their research. Below are the 2023 Human Disease Presentations.



Acute Lymphocytic Leukemia
Tanmay Kapoor



Brain Cancer (GBM)
Jireh Obena



Acute Myeloid Leukemia
Shriivanth Gunanidhi



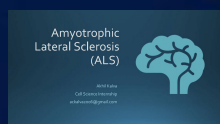
Colon Cancer
Shaurya Sinha



Alzheimer's Disease
Jia Ruparel



Coronary Artery Disease
Tapan Sapre



Amyotrophic Lateral Sclerosis
Akhil Kalva



COVID-19
Likhith Elisetty



Asthma
Sadhika Mulagari



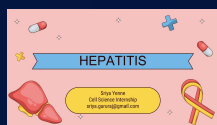
Epilepsy
Prisha Jain



Bone Cancer
Vicky Zhou



Gastric Cancer
Trisha Ramineni



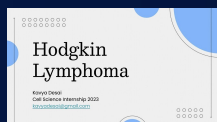
Hepatitis

Sriya Yenne



Pancreatic Cancer

Sharanya Mantrala



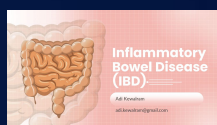
Hodgkin Lymphoma

Kavya Desai



Parkinson's Disease

Shaurya Sinha



Inflammatory Bowel Disease

Aditya Kewalram



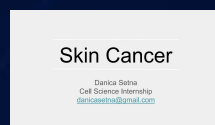
Psoriasis

Levi Woffinden



Kidney Cancer

Sneha Varma



Skin Cancer

Danica Setna



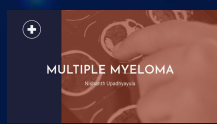
Monkeypox

Hitanshi Shah



Small Cell Lung Cancer

Adithi Kona



Multiple Myeloma

Nishanth Upadhyayula



Thyroid Cancer

Manasi Vegesna



Non-Small Cell Lung Cancer

Ritu Doshi



Triple-Negative Breast Cancer

Tanvi Vuyyuru



Ovarian Cancer

Suravi Bajaj



Type 2 Diabetes

Mayukhi Katragadda

Final Projects

The Final Project of the Science Gurus' Cell Science Internship is a collaborative endeavor that allows interns to apply all their knowledge of bioinformatics tools. Throughout the course of the internship, interns receive training with how to use and analyze data from various biotechnology databases including cBioportal, the National Center for Biotechnology Information (NCBI), Uniprot, and Xena Browser. In this project, they are tasked with using the databases to research an assigned gene or gene group, and then producing a formal research paper with their findings. They later presented their work to the rest of the interns. The Final Projects of the 2023 Cell Science Internship are listed in the following pages.

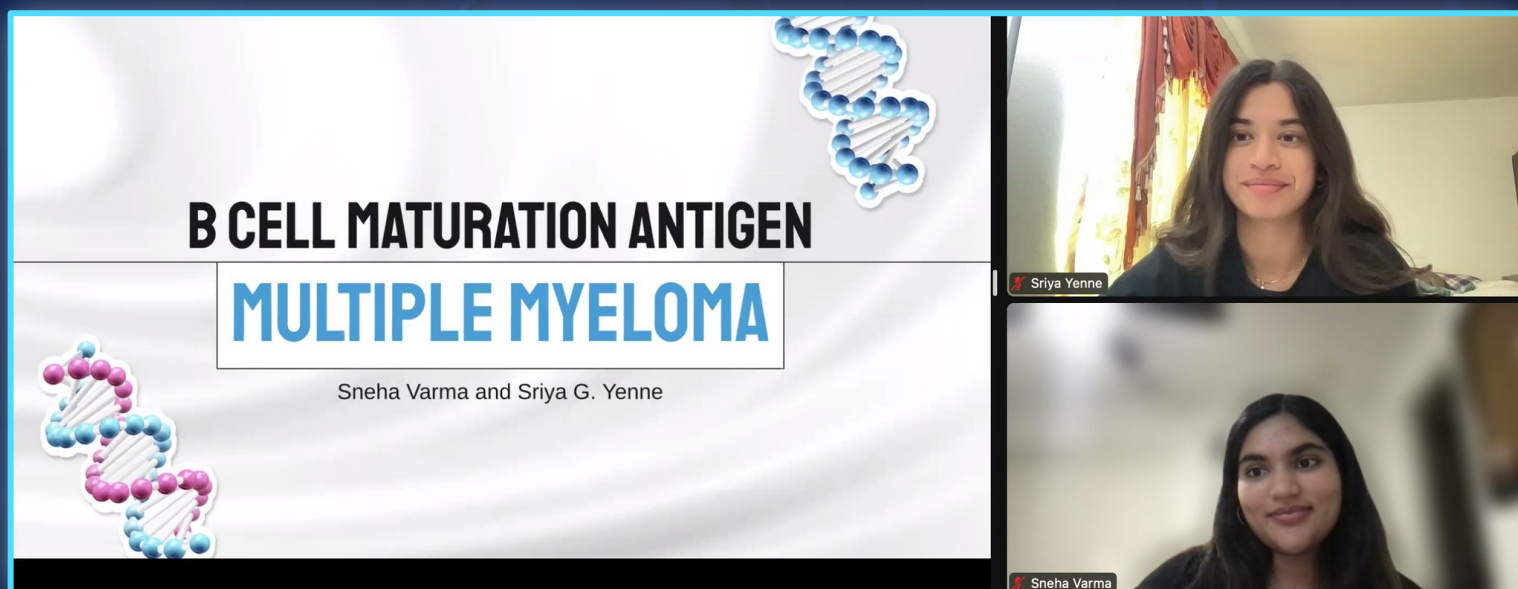
BCMA/Tecvayl - B Cell Maturation Antigen/Multiple Myeloma

Sriya G. Yenne¹, Sneha Varma²

¹ Monta Vista High School, ² Canyon Crest Academy

Abstract

The TNFRSF17 gene encodes the B cell maturation antigen (BCMA), a receptor crucial for B cell development and autoimmune response. BCMA is highly expressed on myeloma cells, making it an attractive target for multiple myeloma therapies. Teclistamab-cqyv (Tecvayli) is a promising bispecific antibody that targets BCMA and CD3 receptors on T cells, activating them to attack myeloma cells. Teclistamab shows efficacy in treating relapsed and refractory multiple myeloma patients, with response rates ranging from 60-90% in clinical trials. The drug's mechanism involves activating T cells to target BCMA-expressing cancer cells. Teclistamab also affects immune cell levels and cytokine production in multiple myeloma patients. Overall BCMA-targeted therapies, including Teclistamab, offer hope for patients with relapsed refractory multiple myeloma. The trial for the immunotherapy drug teclistamab (Tecvayli) showed promising results in people with multiple myeloma who did not respond to at least three previous treatments. Nearly two-thirds of participants had a partial response, and almost 40% achieved complete remission of their cancer. The median time without cancer worsening was around 11 months, and responses lasted for a median of 18 months.



B CELL MATURATION ANTIGEN MULTIPLE MYELOMA

Sneha Varma and Sriya G. Yenne

Sriya Yenne

Sneha Varma

BTK - Brukinsa

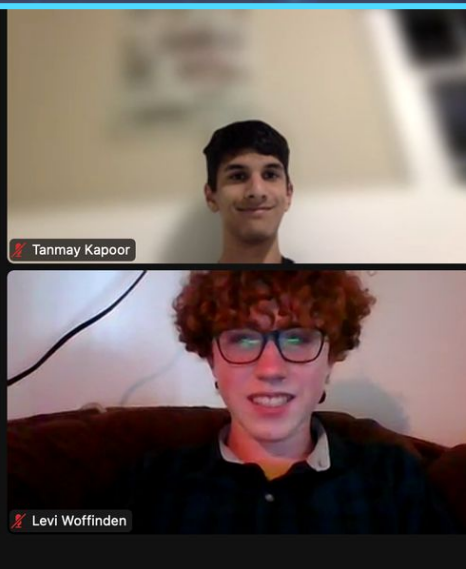
Tanmay Kapoor¹, Levi Woffinden²

¹ Acton Boxborough Regional High School, ² San Luis Obispo High School

Abstract

Bruton's Tyrosine Kinase (BTK), is a protein involved in many immune system cells, is needed for immune cell development and proliferation, and is important in the B-cell receptor signaling pathway. Mutations in BTK are involved in, but are not often the cause of, many lymphocytic illnesses, such as chronic lymphocytic leukemia (CLL), small lymphocytic lymphoma (SLL), Waldenström's macroglobulinemia (WM), mantle cell lymphoma (MCL), and marginal zone lymphoma (MZL). X-Linked Agammaglobulinemia is an illness that is caused entirely by BTK mutations, but affects the body differently than lymphomas, and is therefore treated differently. BTK mutations are treated with inhibitors, such as Ibrutinib, Zanubrutinib, and Pirtobrutinib, in the previously mentioned lymphocytic illnesses. Treatment has improved over the years, being adapted to still work against resistances to inhibitors that are developed by the BTK protein.

BTK - BRUKINSA



CD19/CAR-T Cell Therapies

Prisha Jain¹, Trisha Ramineni²

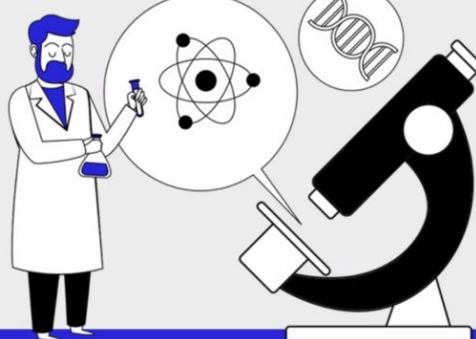
¹ Foothill High School, ² Quarry Lane High School

Abstract

The present study experimentally investigated the CD19 protein used in CAR-T therapies through various bioinformatic techniques. CAR-T therapies are used as cancer immunotherapy treatments and they specifically work to treat leukemia, Lymphoma, and multiple myelomas. CAR-T cells, or Chimeric antigen receptor T cells are cells that are genetically changed and have receptors so they can bind to cancer cells. This is especially important in cancer treatment because cancer cells sometimes have antigens that the body does not recognize, leading to the immune system not sending T cells to fight the malignant cells. Within the CAR-T therapy model comes an integral protein known as CD19 which is found in humans and mice. To better understand CD19, genetic sequences and protein structures were compared within the two organisms.

CD19/CAR-T Cell Therapies

Prisha Jain & Trisha Ramineni



Sharanya Ma...

Sharanya Mantrala



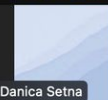
Jagath Reddy Junutula



Trisha Ramineni



hitanshi shah



Danica Setna



Prisha Jain

Role of CD20 and Ocrelizumab in Multiple Sclerosis

Jireh Obena¹, Sadhika Mulagari²

¹ Imagine International Academy of North Texas, ² Evergreen Valley High School

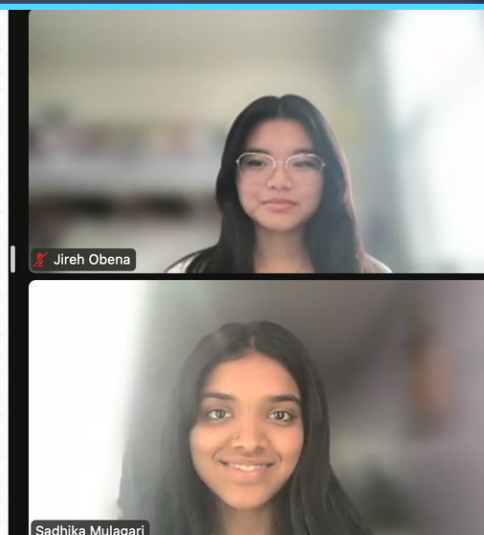
Abstract

CD20 is a protein primarily expressed on the surface of B-lymphocytes, and it is used as a target in several medical therapies, particularly in the treatment of B-cell related disorders. Several monoclonal antibodies that bind to CD20 have been developed, and this paper will focus on ocrelizumab, a monoclonal antibody used in the treatment of multiple sclerosis. Ocrelizumab selectively depletes CD20 B-cells, which are believed to play a role in the inflammation and damage to the central nervous system seen in multiple sclerosis. This report will investigate the role of CD20 in multiple sclerosis using several bioinformatics tools and analysis of protein sequence, structure, and expression. The function and efficacy of ocrelizumab in the targeting of CD20 in multiple sclerosis will then be evaluated using the results and data collected from the bioinformatic tools.

Role of CD20 and Ocrelizumab in Multiple Sclerosis

By Jireh Obena and Sadhika Mulagari

Imagine International Academy of North Texas, Evergreen Valley High School



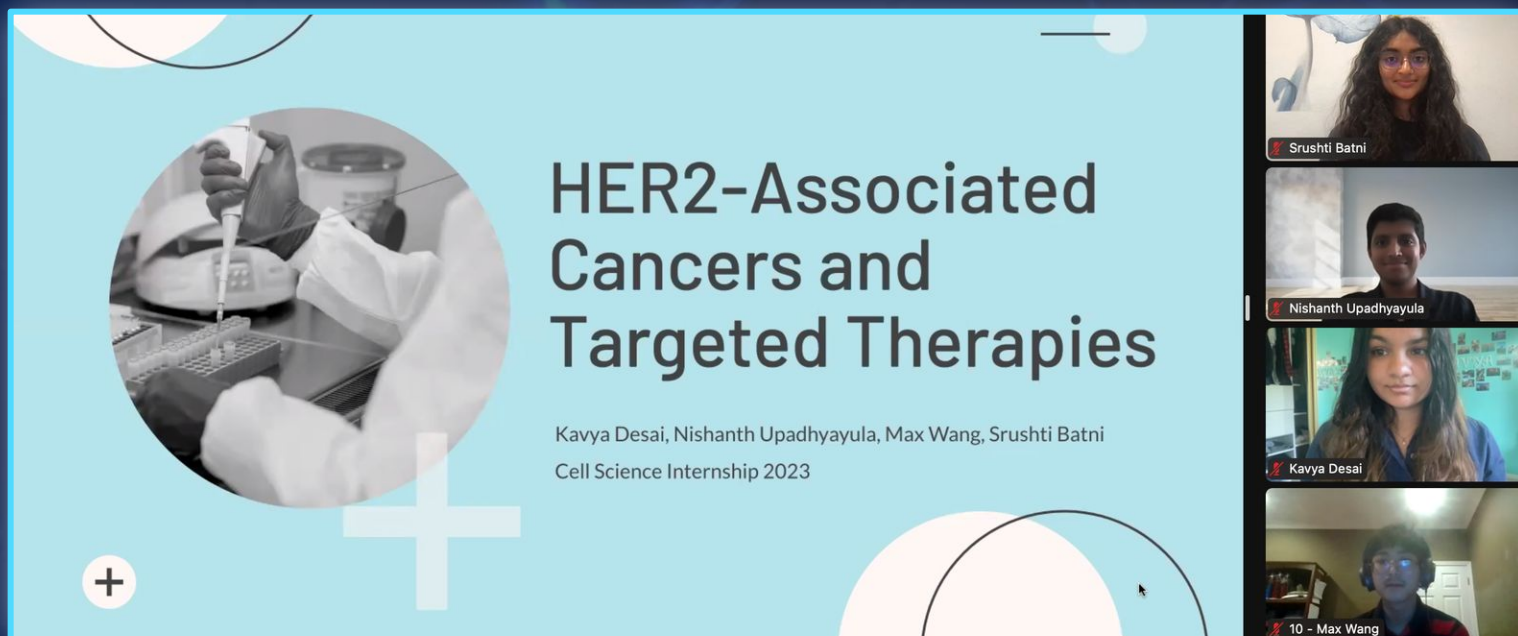
Review and Analysis of HER Family: HER2-Associated Cancers and Targeted Therapies

Kavya Desai¹, Nishanth Upadhyayula², Max Wang³, Srushti Batni⁴

¹ Leland High School, ² Mission San José High School, ³ Basking Ridge High School, ⁴ Monta Vista High School

Abstract

HER2, a member of the HER family of receptor tyrosine kinases, plays a critical role in regulating cellular processes. Dysregulation of HER2 signaling is implicated in various cancers, including breast, gastric, ovarian, and prostate cancer. HER2 overexpression leads to hyperactive signaling through key pathways, promoting cancer cell growth, survival, and metastasis. Because of its prevalence in a variety of cancer types and its key role in cancer cell proliferation, HER2 has been a popular target for therapeutic drugs. The purpose of this review paper is to summarize and analyze existing literature related to HER2 and the HER family while concurrently using several bioinformatics tools to analyze data from previous studies in order to gain a comprehensive understanding of HER2's role in cancer and its correlations to the rest of the members in the HER family.



HER2-Associated Cancers and Targeted Therapies

Kavya Desai, Nishanth Upadhyayula, Max Wang, Srushti Batni
Cell Science Internship 2023

Srushti Batni

Nishanth Upadhyayula

Kavya Desai

10 - Max Wang



IL6 Receptor: Tocilizumab and NMOSD

Aditya Kewalram¹, Akhil Kalva²

¹ Lynbrook High School, ² Chattahoochee High School

Abstract

N/A

NMOSD/IL6R /Tocilizumab

By: Adi Kewalram and Akhil Kalva

Adi Kewalram

Akhil Kalva

Tofacitinib Targeted Therapy on the JAK Signaling Pathway

Suravi Bajaj¹, Ritu Doshi²

¹ American High School, ² Tesla STEM High School

Abstract

Tofacitinib, a Janus kinase (JAK) inhibitor, has emerged as a promising targeted therapy for various immune-mediated disorders, including rheumatoid arthritis, psoriasis, and ulcerative colitis. This article provides an in-depth analysis of the JAK signaling pathway and its role in the context of tofacitinib-focused drug therapy for rheumatoid arthritis. It also assesses the effectiveness of tofacitinib in reducing RA and its effects on cancer risk in patients with severe RA symptoms.

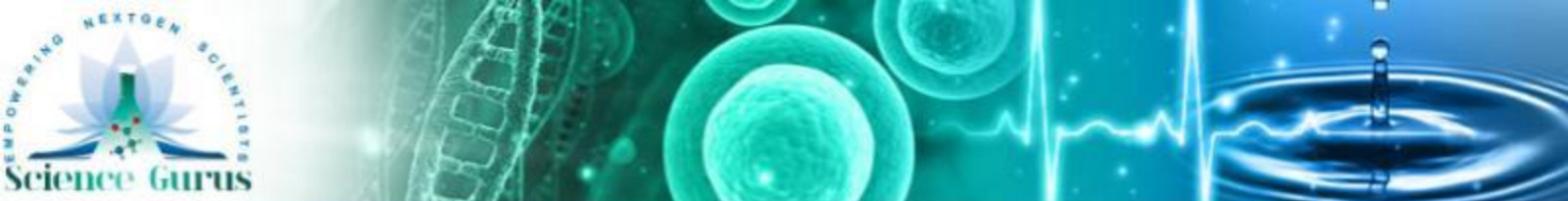


TOFACITINIB
Janus Kinase
signaling pathway

By Suravi Bajaj & Ritu Doshi

Suravi Bajaj

Ritu Doshi



MAPK Pathway BRAf Inhibitors

Vicki Zhou¹, Adithi Kona²

¹ American High School, ² Tesla STEM High School

Abstract

N/A

MAPK pathway BRAf inhibitors

Vicky and Adithi



Investigating the Effects of Zeposia on Multiple Sclerosis and Ulcerative Colitis through Analysis of the Sphingosine 1-Phosphate Receptor

Likhith Elisetty¹, Tapan Sapre²

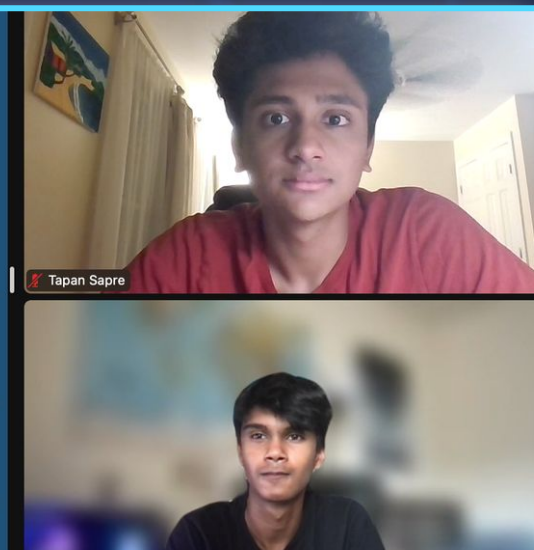
¹ Merrill F West High School, ² Thomas Jefferson High School for Science and Technology

Abstract

With the rise of multiple sclerosis and ulcerative colitis in the modern world, it is crucial to investigate various treatment options and the mechanisms by which they operate. Zeposia (Ozanimod) is a drug that targets the sphingosine 1-phosphate receptor and is used to treat relapsing forms of multiple sclerosis. The sphingosine 1-phosphate receptor is a G protein-coupled receptor that functions in many biological processes including cell growth and lymphocyte trafficking. This receptor is found in immune cells including macrophages, mast cells, eosinophils, etc., but is also highly expressed in endothelial cells. This receptor is the target of Zeposia in treating multiple sclerosis, in which Zeposia inhibits the signaling of S1PR1, which stops lymphocytes from entering the Central Nervous System (CNS) and harming the myelin sheaths, which is how multiple sclerosis affect the bodies. Beta interferon drugs are the most common treatment option for relapsing forms of multiple sclerosis. These drugs suppress the immune response by reducing inflammation in the sites of myelin sheath and neurons. In comparison to Zeposia, beta interferon drugs prove to be less effective in the short term, but are shown to be effective in the long term at reducing relapse rate. Additionally, the symptoms of beta interferon drugs are less severe than Zeposia.

Zeposia, Sphingosine 1-Phosphate Receptor, Multiple Sclerosis

Likhith Elisetty
Tapan Sapre




The Role of TNF-alpha in Inflammatory Progression

Mayukhi Katragadda¹, Manasi Vegesna²

¹ Dougherty Valley High School, ² Hamilton High School

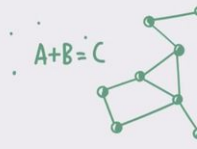
Abstract

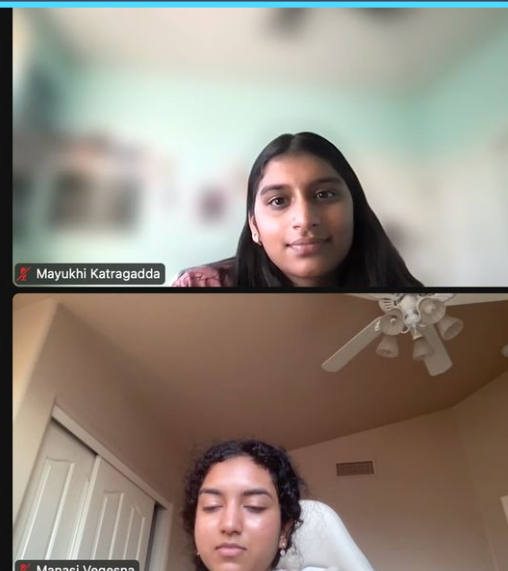
Tumor necrosis factor receptor (TNFR) and tumor necrosis factor alpha (TNF- α) are pivotal components of the immune system, playing critical roles in various physiological and pathological processes. TNFR is a class of cell surface receptors that bind to the proinflammatory cytokine TNF- α , which is primarily produced by immune cells. This review provides a comprehensive examination of TNFR and TNF- α , shedding light on their molecular structure, signaling pathways, biological functions, and their involvement in several diseases. Understanding the intricate interplay between TNFR and TNF- α is crucial for the development of targeted therapies for numerous inflammatory and autoimmune disorders.



TNF alpha/ TNFR-Humira

By: Mayukhi Katragadda and Manasi Vegesna
Dougherty Valley High School and Hamilton High School
Science Gurus Cell Science Internship
July 28, 2023





TP53: An Overview of the Guardian of the Genome

Danic Setna¹, Hitanshi Shah²

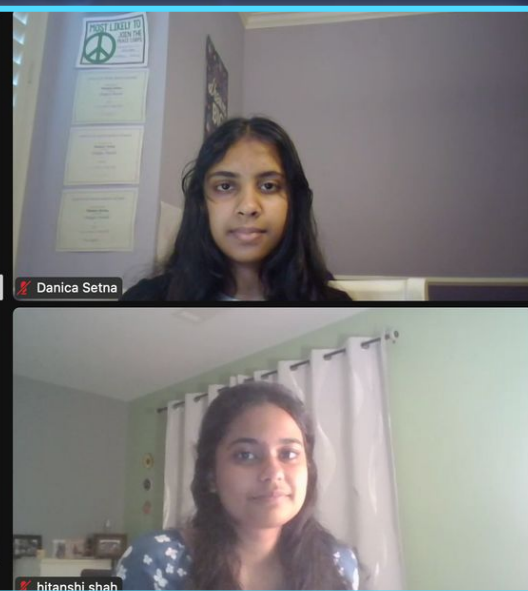
¹ San Ramon Valley High School, ² Alhambra High School

Abstract

Tumor Protein 53 (TP53) codes for the protein P53 to help monitor and regulate cell division while also protecting the human genome from oncogenic manifestations. It is infamous in the cancer research and oncology industries for its inability to be 'druggable' and is also one of the root causes for virtually all cancers. In somatic cells, P53 is located in the cell nucleus and acts as a transcription factor that exerts regulatory functions during cell division. More Specifically, P53 is primarily activated and expressed in the G1 checkpoint during interphase in the cell cycle, preventing tumors from arising before cell division is even complete; however, cells exponentially proliferate when this protein is mutated. When inactivated, P53 harbor oncogenic characteristics in lieu of the original tumor suppressing qualities, leading to fatal diseases such as Uterine Cancer and Li-Fraumeni Syndrome, to name a few.

TP53

Danica Setna and Hitanshi Shah



A Comprehensive Study of Trop-2 Trodelvy

Shriivanth Gunanidhi¹, Shaurya Sinha²

¹Heritage High School, ²Dublin High School

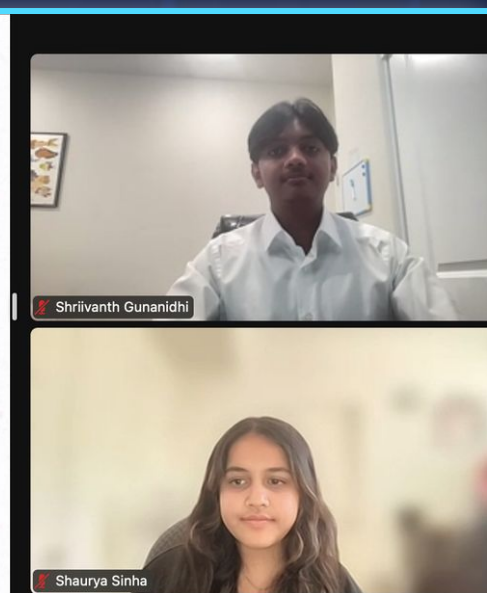
Abstract

Trop-2 Trodelvy is a revolutionary therapeutic breakthrough for cancer treatment that has recently been approved. Trop2-Trodelvy is a targeted therapy that has recently become a promising treatment option for many solid tumors. Trop-2 is a cell-surface glycoprotein that is highly overexpressed in many types of tumors with the smallest amount of expression in normal tissues. Trop-2's overexpression has been and is still under investigation as a target for therapeutics. Trodelvy, which targets the Trop-2 protein, is an antibody-drug conjugate which offers a novel approach to cancer therapy. Trodelvy, also known as sacituzumab govitecan, is a prescription medicine used to treat adults with breast cancer with different types such as estrogen and progesterone hormone receptor (HR) negative, and human epidermal growth receptor 2 (HER2)-negative, also known as triple-negative breast cancer, and and that has spread to other parts of the body (metastatic). Trodelvy is also used for treatment for patients with metastatic triple-negative breast cancer (mTNBC) who have previously received two or more treatments, one of them regarding the metastatic disease. Regardless of Trop-2 being overexpressed in many other types of cancer, it is the most prevalent in breast cancer.

Trop2- Trodelvy

By Shriivanth Gunanidhi & Shaurya Sinha
Cell Science Internship 2023

Emails: gshriivanth@gmail.com & cherry.sinha17@gmail.com



Role of VEGF and Avastin in Glioblastoma Multiforme

Jia Ruparel¹, Sharanya Mantrala²

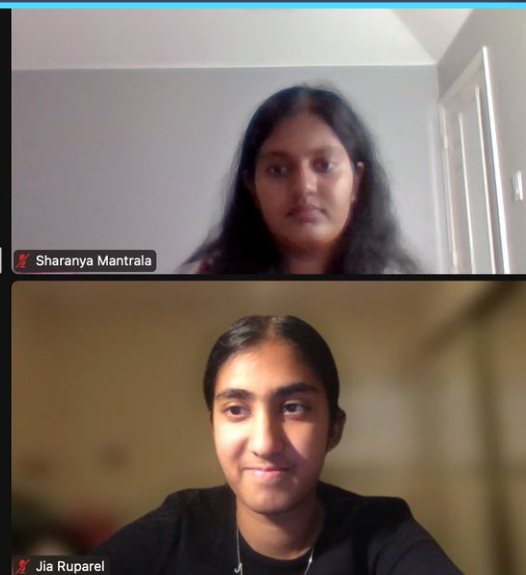
¹ Frisco High School, ² Henry M Gunn High School

Abstract

Cancer stem-like cells, which have been described as tumor-initiating cells or tumor-propagating cells, play a crucial role in our fundamental understanding of glioblastoma multiforme (GBM) and its recurrence. Glioblastoma is a lethal cancer, characterized by florid vascularization and aberrantly elevated vascular endothelial growth factor (VEGF). VEGF promotes tumorigenesis and angiogenesis of human GBM stem-like cells. However, whether and how VEGF contributes to GBSCs proliferation remains largely uncertain. In this report, there is a discussion about the VEGF and VEGF-A genes, as well as the VEGFR receptor and how they lead to the development of GBM. These studies suggest that suppressing VEGFR2-dependent GBSC proliferation is a potentially therapeutic strategy in GBM.

VEGF/VEGFR Avastin – Glioblastoma

Sharanya Mantrala and Jia Ruparel
Science Gurus
Frisco High School and Henry M Gunn High School



Intern Reflections

The following are reflections submitted by the 2023 interns about their personal experience during the 2023 Cell Science Internship.

“I am very glad that I signed up for the Cell Science Internship. I have learned so much about bioinformatics, drug discovery, cancer research, and more through this internship that I don’t think I could have learned with the same motivation and precision on my own. Each session was informative in its own way that either expanded on my previous knowledge or taught me something I never thought to learn about. I am grateful for the many professionals that took the time out of their lives to come and speak to us about different topics they were passionate about. The homework assignments were rigorous and time-consuming but I learned a lot about different specific tools and people who specialized in cancer. If not for the assignments, I would not have the variety of broad and specific knowledge I have now. This knowledge can also help me learn more about these tools and research in the future. The bioinformatics final project also took a lot of work but it was very interesting working the bioinformatics tools and having to analyze clinical trial data. Finding all the information for my gene/protein and the targeted drugs was difficult but it taught me a lot about research as well as the biology of my gene and in general. Overall, this internship proved to be an informative experience that made me more knowledgeable about the STEM fields I may potentially want to study. Thank you to everyone at Science Gurus, the bioinformatics teachers, and the professionals from each session for enabling me to learn about fields I am interested in and making this internship invaluable.”

– Danica Setna



“I am so grateful to have discovered the Cell Science Internship as I have learned an incredible amount in just 8 weeks. We were provided with such a valuable opportunity to meet many experts from various backgrounds, and I truly learned so much from them. Each session was interesting, and I was introduced to various fields and paths in biology that I could take. Through the guest speaker sessions and projects, I have discovered a newfound interest in both drug development and neurobiology. Regarding the work required in the internship, each assignment was valuable and packed with information, and they were important in solidifying my understanding of concepts such as cancer. During the bioinformatics project, I was able to gain experience working with several databases, and I learned to analyze diseases and treatments on a whole other level by using bioinformatic tools to study the genes and proteins involved. My partner and I are even planning to continue to work on our article and get it published later. Overall, this internship has been a valuable and worthwhile experience for me. The project presentations have strengthened my presentation and delivery skills, and I will utilize the bioinformatics tools I’ve learned in the future. Thank you so much to Dr. Jagath for providing this learning platform, I greatly appreciate the time and effort he and many others have put into this internship.”

– Jireh Obena



“The Cell Science Internship overall was incredibly helpful. Going into the internship, I knew that I was interested in pursuing biology, but the internship expanded my understanding of the various careers that are possible. The session that I found the most useful was the meeting with the four Cell Science alumni where we got to hear about their experiences in college. Since many of us are going to start the college application process soon, it was very reassuring to know the different paths that are open to us and the steps that we can take to pursue different goals. It was also nice to know that we can change our path if we discover something we are more passionate about. As for the lectures themselves, I appreciated the wide variety of professionals in the industry. The lecture I found most interesting was the one given by John Storella about Intellectual Property and Patent Law; I loved seeing how biology can intersect with other disciplines in ways I had not realized before. I gained many valuable connections through this internship. I would highly recommend this internship to others who are interested in biology or drug development.”

– Kavya Desai



“The Science Gurus Cell Science Internship gave me an opportunity to connect with professionals and learn about important topics within the field biotechnology, such as drug discovery, cancer therapies, bioinformatics, etc. I got a better understanding of the biotech field thanks to hearing about these professionals’ perspectives and experiences, and it’s given me a clearer idea of what I’d like to pursue in the future. The assignments, though time-taking, were extremely valuable since they not only introduced me to various tools, ideas, and concepts within the biomedical sciences, but they helped give me a new perspective which will undoubtedly aid me on my journey as a budding scientist. Finally, through the final research project, I learned how to use several bioinformatics tools to analyze clinical data, something that I previously found a complex and challenging task, and I felt a great sense of accomplishment from completing a paper and presenting it to my peers. All in all, this internship has equipped me with the tools I’ll need in order to become a cancer researcher in the future, and I’m grateful to everyone who made this opportunity possible.”

– Nishanth Upadhyayula



“The Cell Science Internship was a fantastic way to learn about the field of biologics and pharmaceutical drug discovery. I think that hearing from experts directly making impacts in the field was a very effective way to learn about the past, current, and future technologies and innovations that have impacted the world of personalized medicine and drug development. The expanse network of professionals brought in was also insightful in that it gave us a glance at all the different important roles and components that go into running and manufacturing a successful drug and its surrounding regulations. I especially liked the career Q&A session with the previous interns, as it felt relieving to see people who had gone through the same experiences as us in good company positions. The various job profiles and experiences they held also helped emphasize that there are so many possibilities in the healthcare field apart from being a doctor or pharmacist. I hope that with my new knowledge and connections, I am able to take this information and these experiences with me as I choose a career field for myself.”

– Ritu Doshi



“The Cell Science Internship gave me an unique opportunity to listen in on engaging lectures and work on projects using bioinformatics analysis tools. I got a better understanding of the biotechnology field and I was able to use the stuff I learned here in other projects that I am working on. I found the assignments to be useful because the videos always helped me to understand the topic more. As an aspiring doctor, this internship allowed me to get a different perspective to biology and think about a different possible career option. With the disease project, I was able to get a deeper understanding of a common disease and understand the biology behind it. With the final project, I was able to go in depth on a certain protein/gene and learn so much about analyzing data and I am planning to expand on it and publish it with my partner. All in all, this internship was very useful for my future and is something I would recommend to others!”

– Sadhika Mulagari



“The Cell Science Internship opened many new doors in biology that I didn’t know about, and helped me expand my knowledge on biotechnology and research that is highly relevant in cancer research today. I really enjoyed my time during all of the sessions as various speakers shared their knowledge on topics that I want to learn more about in the future. It was interesting to hear the perspectives of former interns and how they approached science research in college and in their jobs, and how their goals and decisions changed with time. Before the internship, I had little to no knowledge about cancer drug development and various bioinformatics tools for analyzing data. However, the final project taught me not only how to use these tools, but also how to conduct research as well as do a formal presentation. I was able to improve my presentation, research, and collaborative skills through the individual and final projects. The weekly assignments were extremely interesting, and I enjoyed reading articles on cancer and learning about scientists that embarked on unique journeys no matter the challenges they faced. Overall, I am very grateful for the opportunities that this internship provided, and I definitely recommend it to any aspiring scientists!”

– Sharanya Mantrala



“The Science Gurus Cell Science Internship has given me a clearer idea of what I want to pursue in the future. It let me work with many bioinformatic tools and taught me about drug discovery in-depth. I would not have learned this with a normal biotechnology school curriculum. The assignments were extremely helpful in fully understanding the small concepts that made up the foundation of the projects we did in the internship. These tools and concepts are definitely something I’ll carry with myself in the future. It gave me the opportunity to connect with many professionals in multiple fields who were passionate about teaching. Although just 8 weeks, it was equipped with imperative information that I had not known about before which helped me with the project about cancer and our final research project as well. The projects were a lot of work but pushed me out of my comfort zone and motivated me to learn further. As I was at the near end of the internship, I was filled with a sense of accomplishment, positive growth mindset, and excitement about my future. Overall, this internship has been an invaluable experience for me and gave me a sneak peek of what I’ll be doing in the near future.”

– Shaurya Sinha



“I thought this internship was very valuable and I learned so much about the field at a very fast pace. I felt that the final project was really important because it was very independent and we got the chance to explore the different databases ourselves. Some of my favorite sessions were the communications extra Sunday class we had, the patent law/intellectual property lecture, the Q and A with past Science Gurus interns, Dr. Meenakshi’s bees lecture, and the Wednesday sessions with bioinformatics TAs. The TAs did a really great job trying to help us understand what we were looking at in different databases and the different pages that would help us out in research the most. Overall, I enjoyed the pace of the program. I felt that the videos for homework were a great introduction and fun to watch. I also liked the disease project a lot, and I appreciated the way that we got to choose which disease we wanted to study. I am grateful that I got to be a part of this program because we got to learn so much content that would never be discussed at school. It allowed me to make informed career choices as a rising senior by narrowing down my major and seeing what parts of biotechnology I love or dislike. It was insightful to hear from so many guest speakers and learn so much from manufacturing to the law side of the biotech world. I also liked how we developed our communication skills through the presentations we did. I would recommend this program to anyone who wants an introduction to biotechnology or to see what specific field in biotechnology they are most interested in. Thank you to everyone at Science Gurus!

– Sneha Varma



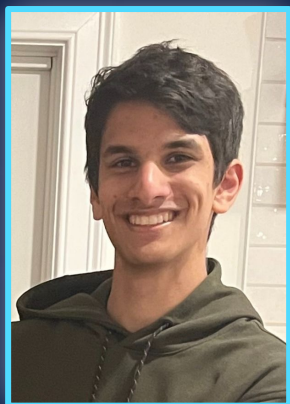
“The Cell-Science Summer Internship was a great way to learn and gain more exposure to biotechnology and drug discovery careers. Listening to guest lectures from expert leaders in the industry gave me valuable insight into the extensive and lengthy drug development process. Furthermore, completing the assignments gave me a better understanding of cancer and allowed me to build off the knowledge I gained from AP Biology. This internship has also sparked an interest in me to do research on cancer in the future. Before this summer, I did not have any knowledge of bioinformatics. However, conducting the research project on immunology and receiving guidance on using various bioinformatics tools has equipped me with valuable skills I can use in the future. Furthermore, I also found the Q&A session with the alums very helpful. Hearing about each alum's journey made me realize that the skills I learned from this internship apply to various fields. I am grateful to have learned so much new information in 8 weeks. Thank you to Dr. Jagath and everyone who made this internship possible.”

– Suravi Bajaj



“I feel lucky that I discovered and signed up for the Cell Science Internship. The variety of guest speakers gave interesting presentations that piqued my interests in fields of biotechnology that I didn’t even know existed. One of my favorite presentations was Mrs. Meenakshi’s presentation on the function of neurons. While I had studied neurons in the past, she described aspects of neurology that gave me clear understanding and insight into the field. I also really enjoyed the projects. My favorite one was definitely the Human Diseases project. I got deep insight into the disease ALL (Acute Lymphocytic Leukemia) that I would never have explored otherwise. Altogether, I am grateful to Mr. Jagath for organizing all of this and further fueling my interest in biology. Additionally I want to thank Anay and Aadhavan for helping me greatly during the final project and guiding me towards the best steps.”

– Tanmay Kapoor



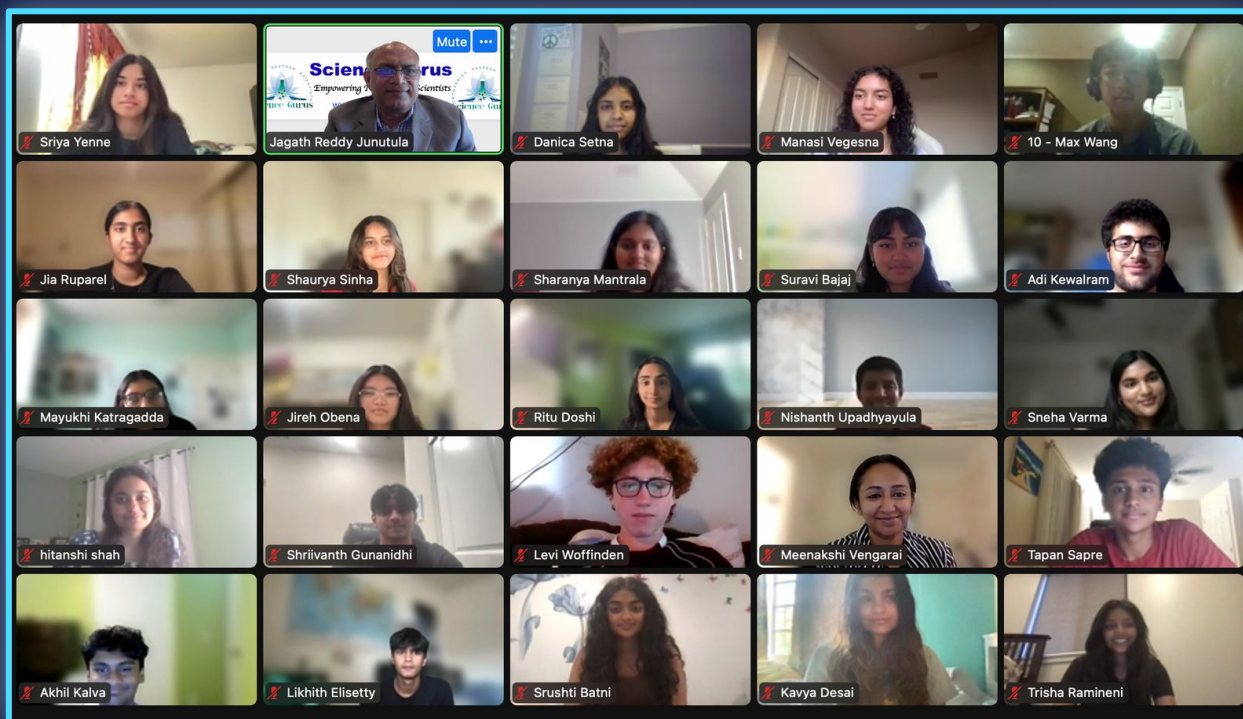
“I had a pretty good experience overall. I really enjoyed the lectures, but the homework was not very accessible to me, since I kept having internet problems. I also couldn’t connect to YouTube which was definitely a pain. Overall, though, it was a very pleasant and educational experience. I’m going to recommend it to a sophomore I met at neuroscience seminar.”

– Vicky Zhou

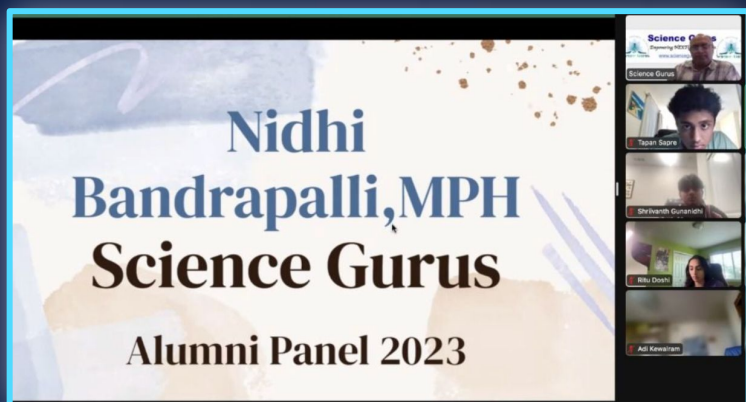


Photo Gallery

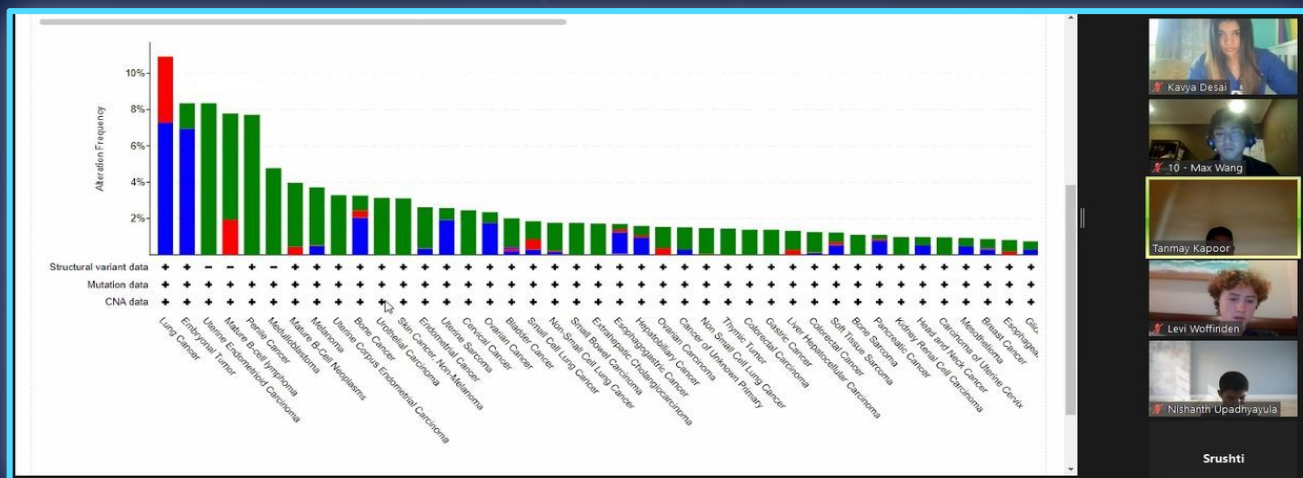
First Day Group Photos!



CSI Alumni Panel

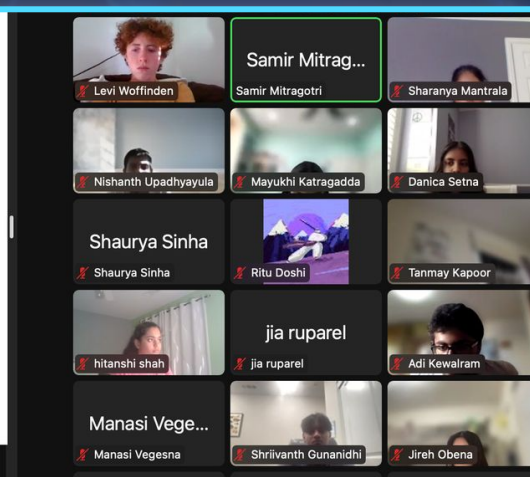


Bioinformatics Workshops and Guest Lectures



Lessons Learned

- Be curious
- Be bold. Dream big
- Find great mentors
- Don't be afraid of failures
- Surround yourself with great people
- Be persistent. Success comes in small incremental steps
- Be humble



Acknowledgements

This program would not have been possible without the time and effort of Dr. Jagath Reddy Junutula and Dr. Meenakshi Vengarai, who organized this incredible internship. We would also like to thank the program instructors, Anay Limaye, Kiran Mukhyala, and Kushal Suryamohan, who provided guidance to the interns and enabled them to use various bioinformatics tools. In addition, we would like to thank each and every one of the speakers and presenters who took time out of their busy schedules to share their knowledge and advice with the interns. Through the joint efforts of these amazing people, the 2023 Science Gurus Cell Science Interns were provided the valuable opportunity to make meaningful connections with a variety of professionals in the biotechnology industry.