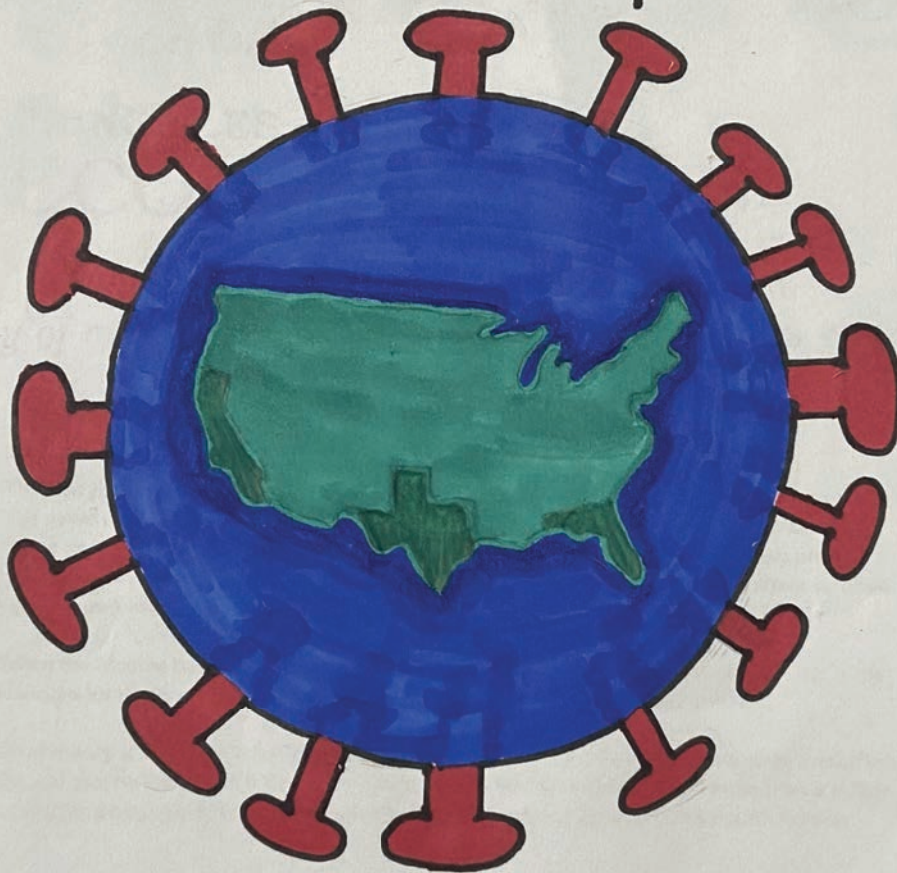


# CELL SCIENCE

*Internship*



# 2020

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# Introduction

The Cell-Science Internship is an eight week program, intended to educate next generation scientists about rational drug design and discovery in the biotechnology field and beyond. Students learn about topics from bioinformatics to cancer therapeutics to drug development from expert guest lecturers from Pharmaceutical and Biotech companies. While learning, students also have the task of completing assignments and oral /project reports involving their new bioinformatics knowledge, centered around different diseases and targeted therapeutics.

Science Gurus was founded in 2009 by enthusiastic volunteers passionate about science and supporting budding scientists, especially South Asians in the US and in India. Science Gurus is a registered non-profit charitable organization, offering insight into a plethora of research and development opportunities.

# Interns

Aayusha Dakwala

Abinayaa Murugu

Amy Stanley

Ananya Garg

Anokhi Shah

Arjun Shivkumar

Brandon Chang

Harshitha Pandian

Jasmine Pannu

Meha Goyal

Neha Gondra

Riya Chaudhari

Saahil Nayudu

Sachi Bopardikar

Sanika Mhatre

Shreya Nagunuri

Shreyas Balaji

Sonali Carumbaya

Srinitya Sriram

Suhaas Mandala

Trisha Jaishankar

Varsha Thalladi

Veda Goskonda



# Guest Speakers

Aparna Gandhari

Bob Figari

Chakk Ramesha

Chitra Sharma

Eric Stawiski

Ganesh Kolumam

Gavin Choy

Heather Maecker

Jagath Reddy Junutula

John Storella

Khyati Shah

Kiran Mukhyala

Kushal Suryamohan

Pradeep Fernandes

Raji Pingali

Ram Mandalam

Ravi Srinivasan

Sanjeev Redkar

Shailesh Raichura

Sinnathambi Gomathinayagam

Sreedhara Alavattam

Sujata Mudumba

Surya Sankuratri

Viswanatham Katta

Vasu Jamma

William Reed

# Topics Covered

Bioinformatics

Tools/Applications

Biologics of Targeted  
Therapies

Business Development

Cancer Biology

Cancer Biomarkers

Cancer Immunotherapy

Cancer Signaling

Clinical Trial Design &  
Execution

Content Development and  
Delivery

Drug Discovery and  
Development

GMP/FDA Compliance

Interplay Between Cancer  
and Inflammation

Kinase Drugs & Resistance

Nanoparticle Therapeutics

Patents

Pharmacokinetics in Drug  
Development

Regulatory Affairs

Small Molecule Drug  
Discovery, Manufacturing,  
& Formulation

Stem cell Therapeutics

Systems Biology

# Cancer Presentations

At the start of the internship, interns got to research on different types of cancers and give a presentation. Listed below are all the types of cancers that were presented:

Head and Neck Cancer

Chronic Lymphocytic  
Leukemia

Hodgkin Lymphoma

Non-Hodgkin Lymphoma

Lung Cancer

Kidney Cancer

Pancreatic Cancer

Thyroid Cancer

Acute Lymphoblastic  
Leukemia

Multiple Myeloma

Brain Cancer

Colon Cancer

Triple Negative Breast Cancer

Chronic Myeloid Leukemia

Endometrial Cancer

Bone Cancer

Prostate Cancer

Cervical Cancer

Melanoma

T- Cell Lymphoma

Gastric Cancer

Liver Cancer

Ovarian cancer

Acute Myeloid Leukemia

# Photos with Guest Speakers



Aparna Gandhari



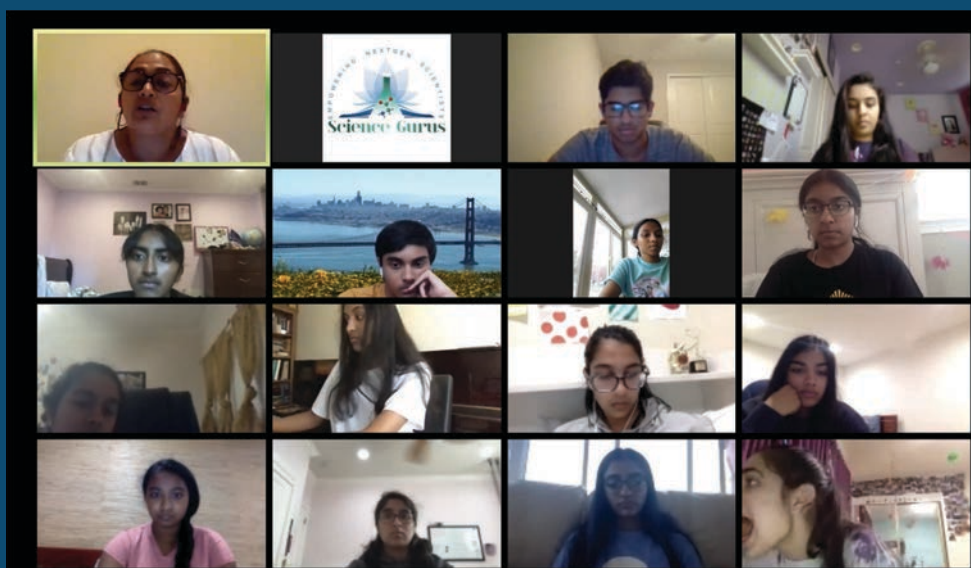
Bob Figari



# Photos with Guest Speakers



Chakk Ramesha



Chitra Sharma

# Photos with Guest Speakers



Eric Stawiski



Gavin Choy



# Photos with Guest Speakers

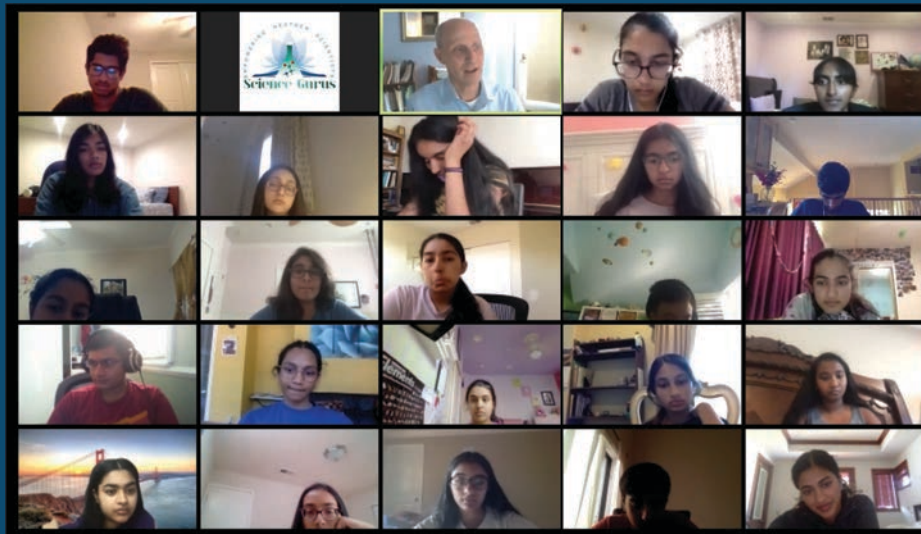


Heather Maecker

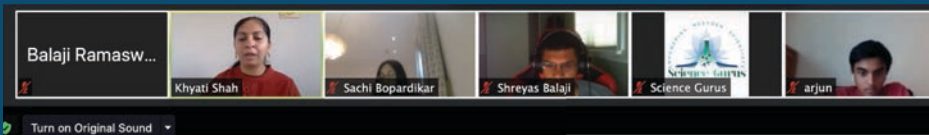


Jagath Reddy  
Junutula

# Photos with Guest Speakers

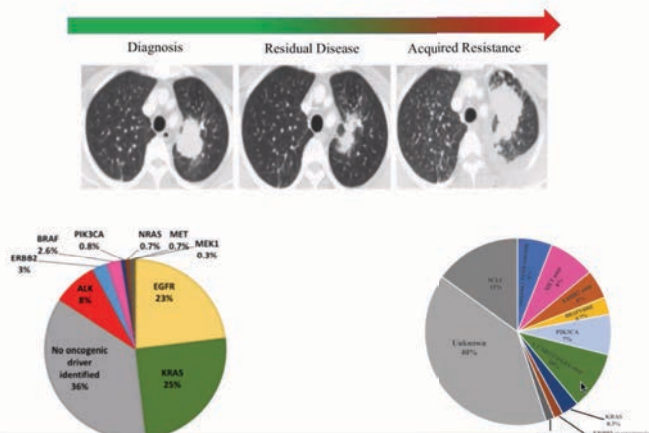


John Storella



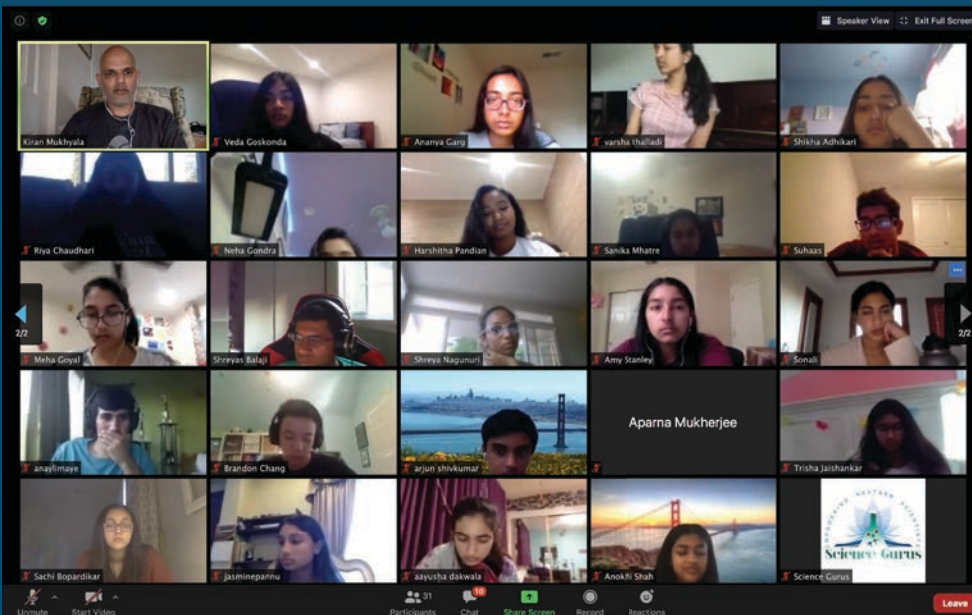
Khyati Shah

Can we cure cancer?

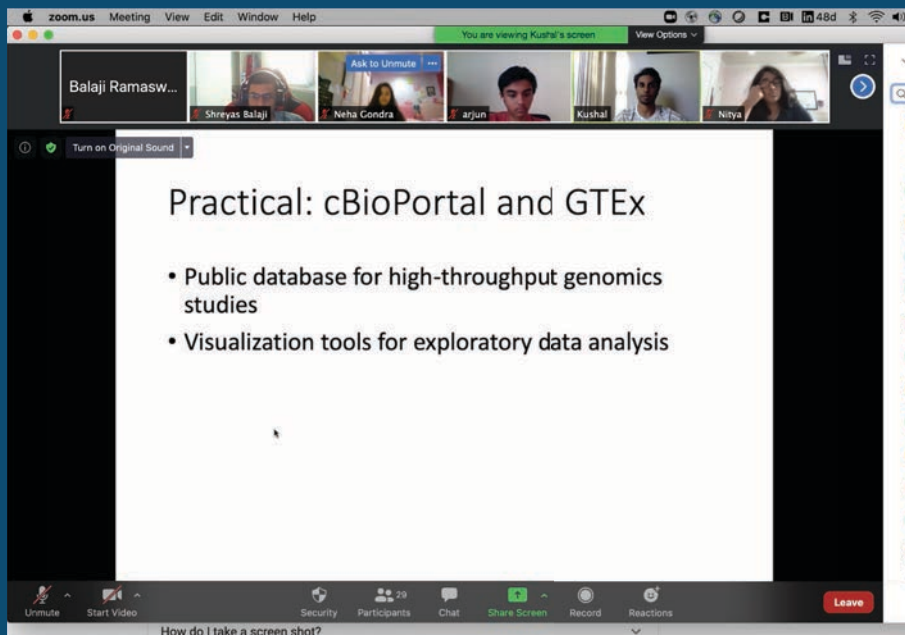




# Photos with Guest Speakers



Kiran Mukhyala



Kushal  
Suryamohan

# Photos with Guest Speakers



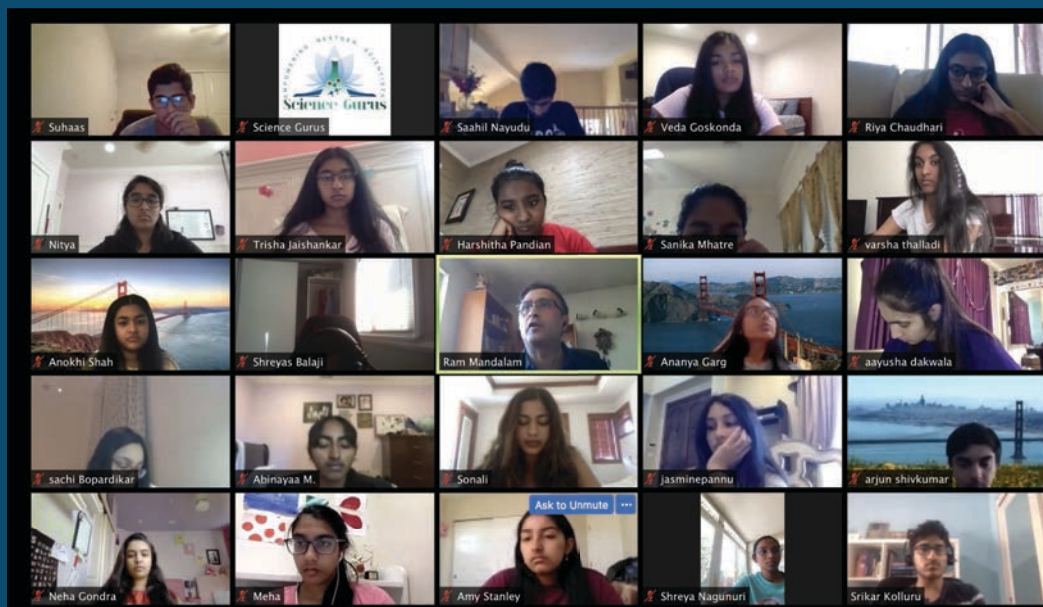
Pradeep  
Fernandes



Raji Pingali



# Photos with Guest Speakers

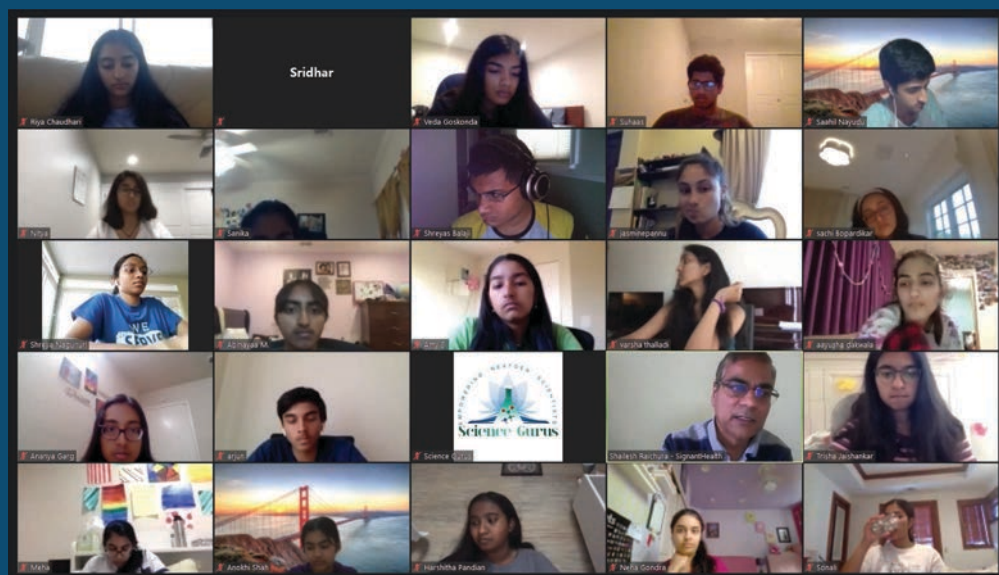


Ram  
Mandalam



Sanjeev Redkar

# Photos with Guest Speakers



Shailesh  
Raichura



Sinnathambi  
Gomathinayagam



# Photos with Guest Speakers



Sreedhara Alavattam

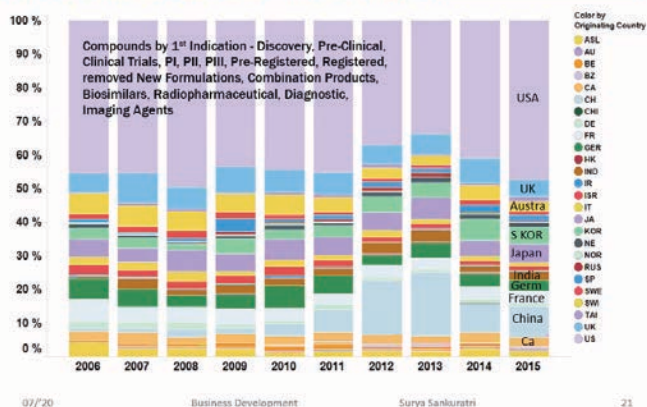


Sujata Mudumba

# Photos with Guest Speakers

Surya Sankuratri

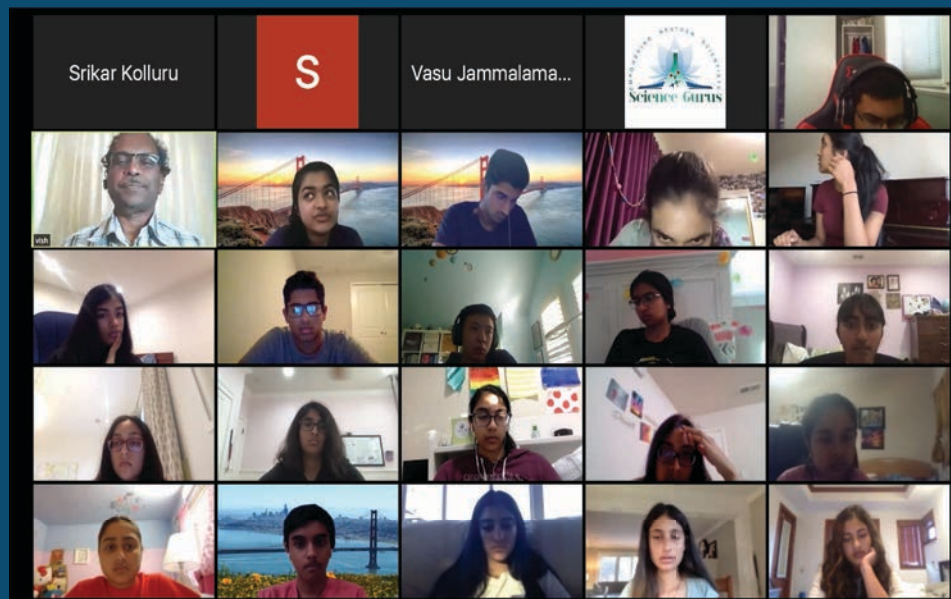
## Origin of Novel candidates for the disease areas of interest to a Pharma Company



Viswanatham Katta



# Photos with Guest Speakers



Vasu Jamma



Network with Intern Alumni

# Intern Projects

## Report of Cluster of Differentiation 79 & Polivy

Aayusha Dakwala<sup>1,3</sup> & Varsha Thalladi<sup>2,3</sup>

Aragon High School<sup>2</sup>, Leland High School<sup>1</sup>, and Science Gurus: Cell-Science Internship<sup>3</sup>  
July 25, 2020

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### Abstract

Cluster of Differentiation 79, better known as CD79, has alpha and beta heterodimers CD79a and CD79b which are a part of the B-Cell receptor (BCR) complex that works to activate B-cells. In cancer, CD79a, an oncogene, encourages proliferative signaling and metastasis, while CD79b, a different oncogene, helps the tumor evade apoptosis. Both CD79a and CD79b oncogenes are mutated significantly in DLBCL (Diffuse Large B-Cell Lymphoma), making them suitable targets for finding a treatment. Polivy is currently the *only* FDA-approved targeted therapy for the CD79b gene.



# Intern Projects

## Epidermal Growth Factor Receptor and its Oncogenic Qualities

Abinayaa Murugupandiyan<sup>1,3</sup> and Srinitya Sriram<sup>2,3</sup>

<sup>1</sup>American High School, <sup>2</sup>Dougherty Valley High School, <sup>3</sup>Science Gurus: Cell Science

Internship 2020

July 24, 2020

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### Abstract

Epidermal Growth Factor Receptor (EGFR) is one of the most widely studied growth receptors and is expressed in nearly all adult human tissues (although some exceptions include hematopoietic cells). This paper covers an introduction to EGFR (primary functions, structure, major signaling pathways EGFR is a part of, etc.), EGFR's relevance to cancer (how EGFR expression varies in normal tissues versus cancer tissues, EGFR's prevalence in specific cancers, specific mutations that occur in EGFR that support tumorigenesis, etc.), the methods that were used to obtain the data presented in the paper (individual bioinformatics tools that were used), as well as therapies (mainly targeted therapies) currently used and those being researched (currently in clinical trials) in order to address mutations in EGFR. The findings presented suggest that EGFR plays a key role in a majority of human cancers — due to its contribution to pathways involving cell proliferation and prevention of apoptosis — and is a viable target in the search for new treatments.

# Intern Projects

## **Implication of BRAF and its effect on the MAP Kinase Pathway**

Trisha Jaishankar <sup>1,3</sup> and Amy Stanley <sup>2,3</sup>

Amador Valley High School <sup>1</sup>, Milpitas High School <sup>2</sup>, and Cell-Science Internship <sup>3</sup>

July 26th, 2020

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### **Abstract**

The MAP (Mitogen Activated Protein) Kinase pathway also known as the Ras-Raf-MEK-ERK pathway is a chain of proteins in the cell that communicates a signal from a receptor on the surface of the cell to the DNA in the nucleus of the cell. MAP Kinase pathways relay, amplify and integrate signals from a diverse range of stimuli and elicit an appropriate physiological response including cellular proliferation, differentiation, development, inflammatory responses and apoptosis in cells. The BRAF gene, which encodes for the b-raf protein, is an oncogene that activates the MAP Kinase Pathway. When BRAF is mutated it can lead to uncontrolled cell growth and eventually cancer. Mutations in BRAF are frequently identified in cancers such as melanoma, non-Hodgkin lymphoma, colon cancer, thyroid carcinoma, etc. Some BRAF kinase inhibitors are used to treat cancer. This report will focus on the intertwined effects of the BRAF gene and the MAP Kinase pathway.



# Intern Projects

## Bruton's Tyrosine Kinase

**Veda Goskonda & Anokhi Shah**

Homestead High School, Monta Vista High School

Cell-Science Internship 2020, Science Gurus

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### Abstract

Bruton's tyrosine kinase (BTK) is a non-receptor kinase that plays a key role in oncogenic signaling that is important in many B cell malignancies to the proliferation and survival of leukemic and lymphoma cells. It is a member of the nonreceptor tyrosine kinase part of the Tec kinase family. BTK plays a role in the maturation of B cells in the bone marrow and activation of mast cells via the IgE receptor. When mutated, BTK is constantly activated, signaling B cells to proliferate and crowd out cells. Inhibitors of Bruton's tyrosine kinase (IBTK) have shown excellent anti-tumor efficacy. As a result, BTK inhibition as an anti-cancer treatment is being studied and tested in clinical trials. Targeted drugs such as Ibrutinib, Acalabrutinib, and Zanubrutinib are IBTKs used to inhibit BTK. In this article, we discuss the role of BTK in several cancers as well as cancer therapies.

# Intern Projects

## **A Comprehensive Study of ACE2 & its Function as a Receptor for Sars-Cov-2**

**Arjun Shivkumar<sup>1,3</sup>, Mountain View High School<sup>1</sup>**

**Suhaas Mandala<sup>2,3</sup>, Steinbrenner High School<sup>2</sup>**

**2020 Science Gurus Cell-Science Internship<sup>3</sup>**



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### **Abstract**

This paper will provide a comprehensive review of the Angiotensin Converting Enzyme 2(ACE2) gene. We will discuss the structure of ACE2, the signaling pathways involved, the various isoforms of ACE2, and the domains on the ACE2 protein. Further, we describe in detail the function of ACE2 on the molecular level. Using several different bioinformatics tools such as uniprot, the BLAST alignment tool, the GTEX browser, and the RCSB database, we will compare the expression of ACE2 across various different tissues, homologs, and orthologs in order to determine the importance of the conservation of ACE2 over evolutionary time. Finally, we will explain how Sars-Cov-2 is able to use ACE2 to manipulate and enter a target cell, and exaggerate the immune response. We will provide an overview of drugs that are currently in clinical trials to treat Sars-Cov-2, and hypothesize possible treatments that could have potential in creating a much needed therapeutic.



# Intern Projects

## **Isocitrate dehydrogenase-1 (IDH1) & Tibsovo     Brandon Chang**

### **Abstract**

Official symbol: IDH1

Full name: isocitrate dehydrogenase (NADP(+)) 1

Location: 2q34

Isocitrate dehydrogenase 1 and 2 (IDH1) are key enzymes that function at a crossroads of cellular metabolism, epigenetic regulation, redox states, and DNA repair. Mutations in the genes encoding for these enzymes occur in various types of malignancies, including >80% of low-grade gliomas and secondary glioblastomas [1–3], ~60% of chondrosarcomas

# Intern Projects

## A Comprehensive Study of Fibroblast Growth Factor Receptor 2 and Pemazyre

Jasmine Pannu<sup>1,3</sup> and Meha Goyal<sup>2,3</sup>

<sup>1</sup>Evergreen Valley College, <sup>2</sup>The Harker School, and <sup>3</sup>Science Gurus Cell-Science Internship

July 26, 2020

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### Abstract

This paper will provide a comprehensive review of the Fibroblast Growth Factor Receptor 2 (FGFR2) gene including its structure, primary signaling pathways, isoforms, functions, and targeted therapy, while specifically focusing on Pemazyre (Pemigatinib). FGFR2 plays a key role in a multitude of bodily functions, but the gene can oftentimes get mutated and become involved in diseases such as Breast Cancer, Cholangiocarcinoma, and Crouzon Syndrome. The gene is found to be involved in four main signaling pathways, stemming from a single two way split after the cell reception of FGFR2. There are three main categories of targeted therapies aimed at reducing the effects of a mutated FGFR2 gene, the most common of which is a Tyrosine Kinase inhibitor, and the prime example explored is Pemazyre. This drug (in the form of an oral tablet) targets FGFR2 genes and prevents the proliferation of cancerous tumors in the body.



# Intern Projects

## The Significance of the BCR-ABL Mutation and Gleevec Drug Response in CML

Neha Gondra<sup>1,3</sup>, Sanika Mhatre<sup>2,3</sup>

Mission San Jose High School<sup>1</sup>, Harmony School of Innovation - Katy<sup>2</sup>, Science Gurus: Cell-Science Internship<sup>3</sup>

25 July 2020

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### ABSTRACT

BCR-ABL is a fusion gene coding for an unregulated tyrosine kinase enzyme. The fusion gene, also called the Philadelphia chromosome, is the result of a translocation mutation of chromosomes 9 and 22. The BCR-ABL gene mutation is present in the myeloid bone marrow cells of chronic myeloid leukemia (CML) patients, disrupting the JAK-STAT and PI3K signaling pathways and leading to the evasion of apoptosis, uncontrolled cell proliferation, and disruption of immunologic function. For CML, the target is the unique protein called the BCR-ABL tyrosine kinase enzyme. Drugs that target the BCR-ABL tyrosine kinase enzyme are called tyrosine kinase inhibitors or TKIs. These types of drugs can prevent the BCR-ABL enzyme from working, which causes the CML cells to die quickly. There are several drugs that treat CML including but not limited to Imatinib, Dasatinib, Nilotinib, Bosutinib, and Ponatinib. These drugs have specific effects on CML cells. Thus, they are considered targeted therapies. Imatinib (Gleevec) was the first drug to specifically target the BCR-ABL tyrosine kinase protein, and because of this, it's known as a first-generation tyrosine kinase inhibitor. Almost all CML patients respond to treatment with Imatinib, and most of these responses seem to last for many years.

# Intern Projects

## CD19, Blincyto and CAR-T therapy

By: Saahil Nayudu and Shreyas Balaji

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### Abstract

B-cell Acute Lymphoblastic Leukemia (B-ALL) is a major issue in both children and adults. B-ALL is the leading cause of cancer related death in children, while in adults, B-ALL accounts for ~75% of all ALL cases. Current therapies for B-ALL most frequently involve long term chemotherapy, but despite the initial effectiveness of this treatment in causing remission, there is a high rate of relapse and a possibility of refraction. Additionally, chemotherapy can cause many side effects, including lower white blood cell counts, resulting in a weaker immune system. As a result of the impact of B-ALL and the shortcomings of chemotherapy, a more effective treatment is needed. CD19 is an antigen expressed on B-cells and is mutated in cancerous B-cells. In a nutshell, CD19 makes it easier for the body to exhibit a larger immune response. This paper describes 2 treatments targeting the CD19 gene, Blincyto and CAR-T therapy, including the mechanism of action, effectiveness, history, and other relevant information about these treatments.



# Intern Projects

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## A Study of Trop2 and Its Significance to Cancers

Sachi Bopardikar - Notre Dame Belmont High School

Riya Chaudhari - Wilcox High School

Science Gurus Cell Science Internship

July 25, 2020

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### Abstract

Trop2 is a cell-surface glycoprotein reported to be overexpressed in various types of tumors with minimal expression in normal tissues. Specifically, Trop2 has been found to be overexpressed in various types of solid tumors, especially carcinomas. The carcinomas with high Trop2 expression include late stage epithelial, ovarian, colorectal, pancreatic, gastric, squamous cell carcinoma of the oral cavity, and adenocarcinomas. Due to increased expression of Trop2 in cancer cells, the protein has been and is currently under investigation as a target for therapeutics. Trodelvy is an example of therapeutic with Trop2 as a target. Trodelvy is a prescription medicine used to treat adults with breast cancer that is: estrogen and progesterone hormone receptor (HR) negative, human epidermal growth factor receptor 2 (HER2)-negative (also called triple negative breast cancer), and that has spread to other parts of the body (metastatic). Trodelvy is indicated for the treatment of adult patients with metastatic triple-negative breast cancer (mTNBC) who have received at least two prior therapies for metastatic disease. This indication is approved under accelerated approval based on tumor response rate and duration of response.

# Intern Projects

## The Function and Oncological Significance of PD-L1 and its Antibodies

Ananya Garg<sup>1,3</sup> and Shreya Nagunuri<sup>2,3</sup>

American High School<sup>1</sup>, Granite Bay High School<sup>2</sup>, Science Gurus Cell Science Internship<sup>3</sup>

July 25, 2020

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### Abstract

The PD-L1 protein, also known as programmed death-ligand 1 is a protein encoded in the CD274 gene. Specifically, PD-L1 belongs to the immunoglobulin superfamily of proteins, and it is a transmembrane protein that allows nutrients across the cell membrane. PD-L1 works in close connection with T cells (thymus cells) and B cells (bone marrow- or bursa-derived cells). PD-L1 binds to the PD-L receptor on T-cells to regulate and sometimes inhibit (in the case of cancer) the activated T cells, B cells, and myeloid cells. Once their activation is inhibited by PD-L1, the T-cells are unable to fight foreign substances in the body like infections, diseases, and cancers, thus allowing cancerous tumors to grow without check. Elevated levels of PD-L1 have been found in a variety of cancers, including melanoma, non-small cell lung cancer (NSCLC), Hodgkin's lymphoma, bladder cancer, renal cell carcinoma (RCC), head and neck squamous cell carcinoma (HNSCC), breast cancer, Merkel cell carcinoma, hepatocellular carcinoma (HCC) and gastric cancer (GC). Among other information, this study also examines the protein sequence of PD-L1, alignments of the sequence, the structure, functional domains, gene expression, copy number, and mutation profiles.



# Intern Projects

## Report of BCL2 and BCL2 Inhibitors

Sonali Carumbaya<sup>1,3</sup> and Harshitha Pandian<sup>2,3</sup>

<sup>1</sup>Amador Valley High School, <sup>2</sup>Monta Vista High School, and <sup>3</sup>Science Gurus: Cell-Science Internship

July 26th, 2020

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### Abstract

This research paper will explore the BCL2 gene and the BCL2 inhibitors and its effect on cancer. The BCL2 protein family is a key part of apoptosis regulation, with both anti-apoptotic and pro-apoptotic proteins. The BCL2 protein is anti-apoptotic because it binds to inhibit Bax/Bak, which induce signaling pathways that are necessary for mitochondrial degradation and, ultimately, cell death. BCL2 protein also regulates mitochondrial membrane permeability which can regulate cell death. Therefore, when there is an overexpression of BCL2 there is an increase in cell survival. When damaged cells are able to thrive because this protein blocks the necessary signaling for apoptosis, cancer can grow.

# Reflections



## Aayusha Dakwala

This past summer I participated in the Cell Science Internship led by Dr. Junutula. I wanted to participate in order to expand my knowledge in the field of biology. Through this internship we talked about various topics. We were introduced to Biotechnology, the genetic manipulation of microorganisms for the production of antibodies, hormones, etc. We received an overview of drug discovery and its development process. Along with talks about cancer, its signalling and pathways, therapies and immunotherapy. We showed our understanding through two projects. The cancer project: where we were assigned a type of cancer to research and present our findings to our peers, and the final project where we were paired up and assigned a gene to research and present. Both these projects alone gave us an in depth knowledge of our respective topic. Along with the projects given to us to complete outside of the session times, during the session we had many presentations given by guest speakers. Every speaker had their own specialty and gave us an overview of what they did and research they have done or are doing. Each speaker had a different aspect of biology to teach us and show us various career paths. A guest speaker that I would like to highlight is Mr. John Storella. Mr. John Storella is a patent lawyer and gave a presentation on patent filing. Of all the guest speaker presentations we had, Mr. Storella's stood out the most to me. His presentation highlighted a career path where I could still have a background in biology but also be a lawyer. This stood out to me because I myself was conflicted on a career path as I was interested in both law and biology. This presentation opened up a new career path that I could take that I did not previously know about. Overall, this internship helped in clarifying what path I would like to take in the future. It also furthered my knowledge in a constantly growing field.



# Reflections



**Abinayaa Murugu**

I participated in the Cell Science Internship as an incoming junior. I was very unaware of the variety of careers possible in the fields of biotechnology, and I was new to the topic of drug development. Learning about the long, arduous process that new compounds go through before they are prescribed to patients gave me a new appreciation for the hard work that goes into each drug. We were also able to apply these principles to cancer drugs, which have to target a very complex disease. I loved listening to the knowledgeable and experienced guest speakers speak about their field and respective topics, but one talk that stood out to me a lot was a presentation on pharmacogenomics by Dr. Khyati Shah. The idea that drugs, even if they work, have to be improved to reach their maximum therapeutic potential with different people while becoming more and more efficient resonated with me, and I was able to appreciate the drive to improve products past the “acceptable” stage. Using each patient’s genomics, one of my favorite biology topics, to change drugs is fascinating to me. Overall, through this internship, I gained a new appreciation for research and became more informed about the different opportunities available for people interested in biology like me.

# Reflections



Amy Stanley

Over the course of the 7 weeks of the Cell-Science Internship, I was exposed to a myriad of fascinating topics, guest lectures, and thought-provoking assignments related to cancer, drug discovery, bioinformatics, various biotechnology fields, and the list goes on. One of my favorite guest lectures was from Ravi Srinivasan who spoke about the application of Biotechnology in the Entrepreneurial world, which really broadened my view of possible career choices. Mr. Srinivasan's background and accomplishments in life were so inspiring, I even thought about changing my career path to Entrepreneurship & Business as I realized the great need in this field and the powerful impact that can be made! Moreover, after finishing the Internship, I am proud to say that I could not have spent my summer break doing anything better! The inspiration and knowledge I received from the program is my driving force for pursuing Biomedical Engineering in college, today. Thank you Science Gurus, Jagath Uncle, and all the guest speakers who made this Internship possible!



# Reflections



**Ananya Garg**

The Cell-Science Internship was a very engaging and experience in which I learned so much about cancer drug discovery and drug development. Not only was I introduced to different bioinformatics tools like CBioPortal, UniProt, and the UCSF Xena Browser, but I also got to hear firsthand experiences from experts in the field. I learned about the different phases of the drug development and discovery process through compelling and engaging guest speaker sessions. One of my favorite guest speaker sessions was that of Ms.

Chitra Sharma (Founder and President of gCompliance, Inc.) who spoke on "Drug Development to Commercialization - the FDA roadmap." Through weekly lectures and assignments, it was very interesting to see how cancer worked at the molecular level and to learn about different gene signaling pathways and how they were activated. I learned important skills for the future, such as how patents work with scientific discoveries. Overall, this internship was an amazing opportunity to learn college-level information and skills all over the course of one summer.

# Reflections

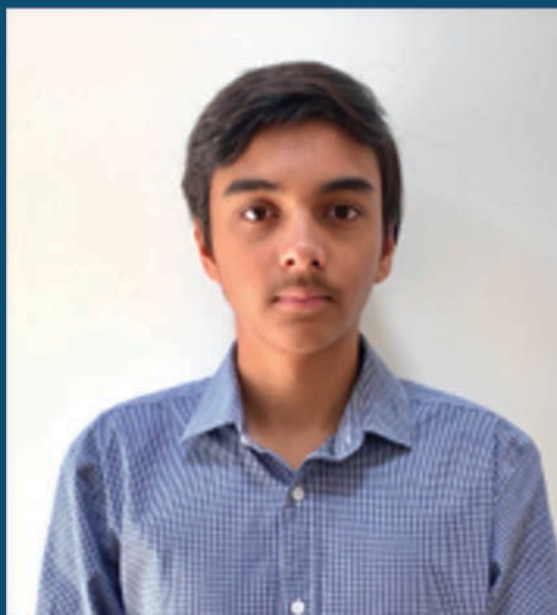


**Anokhi Shah**

The Cell-Science Internship has been an unforgettable experience that has changed how I view the whole of biology and medicine. It was fascinating to listen to and engage with multiple guest speakers who outlined their real-life experience and told us about new developments and opportunities in their respective fields. Both of these speakers, I have learned so much about biological topics such as cancer, genomics and medicine over the course of the 7 weeks of the internship, in addition to other important areas of focus like drug discovery, patent creation, and public speaking. Today I have a much better understanding of how real-world biological companies and science work, which certainly affected my career choices. The cancer readings and lectures outside of the guest speakers have also helped to improve my awareness of an field that is so important to all of us and is the foundation of treatment and focused therapies. To me, the seven-week bioinformatics project and final presentation have been an eye opener. I never realized that there were so many online databases and services that could be used to perform a comprehensive study of the cancer-related genes and proteins. Given a subject, through bioinformatics I was able to collect data and arrive at significant conclusions. I grew as a scientist and presenter during this internship, made important contacts with speakers and other interns and learned about myself. I expect to major in computational biology and hope to enter the cycle of drug creation, or build tools and therapies for future treatments. I want to thank Jagath Uncle and the whole Science Gurus organization for giving me this amazing opportunity.



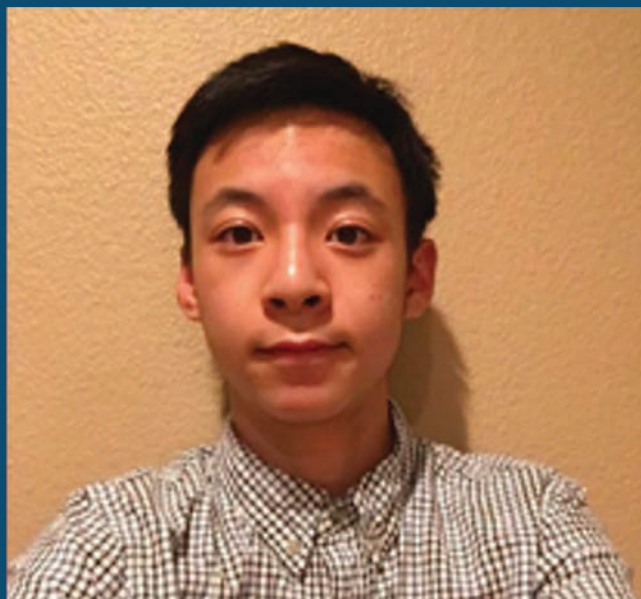
# Reflections



## Arjun Shivkumar

The 2020 Cell-Science Internship was truly an amazing and enriching experience for me. I got the chance to learn about so many interesting topics that I never had much exposure to in the past. The vast and comprehensive selection of articles and youtube videos allowed me to gain a fundamental understanding of the underlying mechanisms of cancer, including its ability to metastasize and develop new blood vessels to support the tumor's growth. I was also able to learn about what various therapeutics currently exist for combating cancer, such as antibodies, CAR T-cell therapy, and other immunotherapies. Along with cancer, I also learned a lot about the field of bioinformatics and what types of tools are used in the industry to analyze cellular pathways in the body. I got to apply these learnings in the form of a final project, where I studied the ACE2 gene and its relationship with SARS-Cov-2. Additionally, the many guest speakers were able to share their experience and expertise in their fields through intriguing presentations about various topics. One guest speaker in particular that stood out to me was Dr. Sanjeev Redkar, who discussed the advantages of small and large molecule drugs, as well as a broad overview of how organic chemists put together drugs using lab techniques. Overall, this internship provided me with an extensive knowledge of cancer, bioinformatics, and drug discovery that I would not have gained anywhere else. I am extremely grateful for the opportunity to participate in it, and would 100% recommend it to anyone interested in Biology!

# Reflections



## Brandon Chang

The summer of 2020 was a transformative one, and this was all thanks to the Cell Science Internship. Bioinformatics was a topic I had not much exposure with, but after it was introduced to me through Mr. Junutula's and other guest speakers' presentations, I can proudly say that I have found a new passion for it. Multiple segments of detailed explanations about controlled drug release, targeted cell therapy, gene editing, and genome engineering actually sparked an interest in me that bioinformatics was an extremely helpful and prevalent tool in our society. One of the main presenters during this summer that I really appreciated was Mr. Anay. During my final project, which was meant for two people in a pair, I was actually left without one. Mr. Anay assisted me greatly with a lot of work about the alignment of isoforms, mutations, protein codes, and prevalence in the human body. I had never known UniProt or CBioportal existed, but I realized what great resources they were after Mr. Anay taught the entire internship how to properly manage the system. I could compare gene sequences and align them amongst different species, such as mice and monkeys, or develop a contrast among a multitude of isoforms in *homo sapiens*. I enjoyed this internship, and it inspired me to pursue a path of bioinformatics.



# Reflections



Harshitha Pandian

# Reflections



## Jasmine Pannu

This summer I took the opportunity to participate in an internship that I did not know much about. Prior to this experience with Science Gurus, I simply knew that topics such as cancer immunotherapy, biotechnological advancements, drug development, targeted therapeutics, and more would be covered in the 2020 Cell-Science Internship. However, I was unaware that so many professionals in various fields would all play integral roles in relaying all this new information and knowledge into each class. Each expert brought their own working experiences and teaching styles to the table, allowing interns like myself to grasp multiple aspects of a single field. Additionally, the rigorous homework assignments kept each student on their feet and ensured that no one was struggling to comprehend the topics covered each week respectively. One speaker that stood out to me was Heather Maecker, who went into great depth explaining how the human body is able to harness its immune system to fight the growth of cancer. Discussing the Major Histocompatibility Complex and T-cell responses were key to understanding cancer immunotherapy and treatment, including CAR-T therapy and certain antibodies which modulate T-cell coreceptors. Another speaker whose presentation proved to be extremely useful was John Storella. He detailed very practical aspects of the biotechnical field, from approving drugs and inventions to patenting them. Working as a patent lawyer for 30 years, Storella demonstrates the combination of two seemingly different fields. His work allowed all the interns to see the importance of patenting a biological or technological advancement so that the inventor's intellectual property is protected. Along with these two speakers, many more individuals contributed to the wonderful CSI experience, and I am grateful to have learned from each and every one of them.



# Reflections



## Meha Goyal

This past summer, I participated in the Cell Science Internship. As someone interested in technology and biology, it was exciting to explore how data analysis could be used to analyze mutated genes and develop effective therapies. Interns were also introduced to many professional speakers who dived deep into each of their subjects, so I was able to get a valuable, in-depth look into the drug-development process, causes of cancer, patenting process, and more. Finally, I had the valuable opportunity to conduct research of my own with a partner, and we specialized in the FGFR2 gene and Pemazyre drug.

Overall, this experience expanded and solidified my interest in bioinformatics, and provided valuable insight into a bioinformatics career.

# Reflections



**Neha Gondra**

The 2020 Cell Science Internship was an amazing and insightful experience for me. I was able to learn in great depth about the mechanisms of cancer, immunotherapy, and the history of cancer discovery and drug development. In addition, the plethora of guest speakers spanning the various fields in the pharmaceutical industry provided me with great insight into potential careers in this industry and the diversity of jobs available within it. From law and finance to research and entrepreneurship, this 7 week intensive internship showed me how important the industry is to the healthcare field. One guest speaker, Ms. Khyati Shah, spoke about her experiences as a senior scientist at Pfizer, detailing about the drug discovery and development process. I also learned about bioinformatics and was able to actually try using these tools, providing me with valuable hands-on experience that I will never forget. I was able to form friendships with other interns who were as passionate about the topics in this internship as I was. As a student who is interested in the healthcare field, a valuable learning experience as this has proven wonders in solidifying my career goals and striving to make an positive impact on the lives of others through research and care.



# Reflections



**Riya Chaudhari**

This internship provided me with the amazing opportunity of getting to know the cancer genomics and bioinformatics fields in a short span of time. I was especially interested in Mr. Kiran Mukhyala's presentations because it allowed us to get hands-on experience in working with the tools and resources that are used to compute bioinformatics for the various genes and molecular entities that are found in cancer.

These programs were very helpful for my final project because I knew I could rely on them for credible information on the gene and drug that I was assigned. I also liked that we were given projects and assignments to complete either on our own or with a partner because it gave us more exposure on how the field works, specifically how to conduct research and compile it into papers and essays that can then be read by our peers and others. Another aspect of this internship that I liked was the constant effort that went into it.

I really appreciated the fact that we were always given insightful answers to our questions and help was always there in case we needed it for assignments and projects. This internship will also help guide me in the future as I choose my major for college and start deciding on a career.

# Reflections



Saahil Nayudu

# Reflections



## Sachi Bopardikar

Overall, I loved my experience with Science Gurus through the Cell Science internship. The knowledge and experience

I gained from the internship were invaluable. I do not have many family members in the biotechnology and medical fields, so I had very little insight into future careers for myself. The internship organized an array of guest speakers, all of which were experts on slightly a different topic within the biological field. The speakers were thoughtfully organized

so the broader and easier to understand talks were given in the first few weeks of the internship, while the more complicated talks were given later on. One of my favorite speakers was Gavin Choy MD, MBA, the Executive Vice President and COO of Apollomics. He was the second to last speaker and gave a talk focused on pharmacokinetics. He spoke about different forms of drug delivery, how a drug is absorbed and distributed around the body, bioavailability,

and much more. I especially liked this speaker's delivery style because he explained a complicated topic in a clear manner which was easy to understand. This was the only talk centered around pharmacokinetics, so I was grateful to be exposed to the topic. Throughout the various guest speakers, personal assignments, and overall program, I was able to gain an in-depth understanding of the entire drug discovery and development process, even learning about the financial aspects of it. I learned about a multitude of cancers down to the signaling pathway which cause them. I developed a skill for utilizing bioinformatics tools and conducted my own research using them. I learned so much in the 7 weeks and am thankful to have participated.



# Reflections



**Sanika Mhatre**

The 2020 Cell-Science Internship has been extremely helpful in unveiling the countless job opportunities and careers in the health industry besides the more commonly known physician pathway. By the end of the program, I learned about the intricacies of all that pharma has to offer, which was presented so well by the various guest speakers, each of whom had their own specialty and contributions in pharma and cancer research. One of the speakers I was inspired by, Dr. Ravi Srinivasan, has founded a few biotech companies across the country. He presented his entrepreneurial journey, after which many of us got that motivation to follow the entrepreneurial path. Beyond that, he presented some of his groundbreaking innovations that hold plenty of future promise, such as his and his team's attempt to currently manufacture oral therapeutics. As of now, many biologic drugs are not very patient-friendly since they are administered through IV. The I2O company that Dr. Srinivasan mentioned is attempting to combat this with a new class of materials called ionic liquids that are both orally delivered and are a cheaper option to traditional biologics, as the expense of developing biologic drugs has long been a major issue among the pharma community. I was simply astounded by all that I learned, not only from Dr. Srinivasan, but from all the professionals that we were introduced to, as each of them had their own unique input to drug delivery/ development and cancer research that I highly doubt I would have had exposure to elsewhere.

# Reflections



## Shreya Nagunuri

The Cell Science Internship was one of the most memorable internships that I have ever done. One thing in particular that set it apart from any other internship was the story that it told when it came to cancer. It started off with the biology and the science behind why cancer occurs and just learning about the basics but over the course of the internship, this sphere of discussion broadened to discuss patents and therapies and even more. This provided me with holistic view of the medical field and how other fields intersect with it, which often forgotten. Every speaker that spoke to us filled in a piece of a puzzle to reveal a beautiful picture in the end and while every speaker was amazing and enlightened the group, Mr. John Storella, in particular, provided me with an invaluable insight on the drug-making process from a legal perspective. In addition, Mrs. Aparna Ghandari was also a great speaker to listen to since as a junior the entire college application system can be confusing, but she explained it in a way that made sense to me and Mr. Kiran Mukyala taught me so much about bioinformatics and assisted me when writing my reports. Overall, when I look back at my high school journey, CSI will be something that I look up favorable as it was what fully emerged me into the medical field but it also solidified my decision to work to become a doctor and it also taught so much that I wouldn't have learned otherwise.

# Reflections



**Shreyas Balaji**

My favorite part of the Cell Science Internship was the fact that we were able to learn more about how the biological and cell science fields interacted with other professions. For example, in this internship, we were able to learn about and explore the interactions of biology and law, manufacturing, and business. Prior to this internship, I was mostly interested in a biological field, and while I still am, I am also more aware of how exactly this field interacts with other ones. One of the talks that I enjoyed the most was the one by Mr. John Storella, MS, JD on how patent law interfaces with biology and biotechnology. We spent the class time learning how to properly read patents, and looked at many patents of important discoveries and technologies relating to biology. This experience was incredibly interesting not only because I was able to learn about patent law and law in general, but also because I did not expect how interconnected the biological field was with other disciplines. To conclude, this talk, along with many other talks at the 2020 Cell Science Internship not only educated me on cancer, cell science and biology, but also showed me how these topics interacted with other fields, which was a very enlightening experience and gave me an opportunity to explore other related fields as a career in my future.



# Reflections



**Sonali Carumbaya**

The cell science internship was really interesting to be a part of. I loved listening to lectures from such accomplished scientists. I learned so much about different career options that will allow me to contribute to the science community. I learned that there are so many unique paths I can take that engage my interest in research biology. One of the highlights of the internship was co-writing a research paper on the BCL2 gene and BCL2 inhibitors. In preparation, I had to read so many papers, analyze so many studies, and look at so many data banks. I also had to utilize various bioinformatics tools including Uniprot, cBioPortal, RCSB Protein data bank, and the UCSC Xena Browser. It was particularly difficult because I hadn't been exposed to a lot of bioanalytics prior to the internship, but I learned a lot from different scientists and interns. The report required a lot of work and really extensive research, but I am very proud of how it turned out. I am really interested in molecular biology (it is an interest I want to pursue in the future), so I really valued this internship. I got so much exposure to different research and studies.

# Reflections



**Srinitya Sriram**

The cell science internship was one of the most helpful and engaging academic activities I have participated in. It not only taught me about the biological side of cancer research, but also the hundreds of other career choices I could pursue in the field of medicine. For example, one of the guest lectures was on patent filing, and I hadn't even known that a patent lawyer was a job a person could do before this program. I especially enjoyed the guest lecture on cancer immunotherapy (conducted by Dr. Heather Maecker). Previously, I was not really interested in pursuing any form of research, but after this talk I think cancer immunotherapy is something I might really enjoy studying further. It was fascinating to be able to understand not only how cancer works on a molecular level, but also how researchers have found ways to use the body's own immune system to treat cancer patients. Dr. Maecker was able to make this topic both interesting and fun, and it was lectures such as this one that made me happy I participated in the Cell Science Internship. Lastly, I thoroughly enjoyed being able to interact with other students who have the same interest in the medical field as I do. The final project gave me a chance to collaborate with another intern and understand the teamwork behind cancer research. Overall, I'm really grateful that I was given the opportunity to take part in such an amazing program. It was truly a wonderful experience, and I would recommend it to any student interested in pursuing medicine.

# Reflections



## Suhaas Mandala

The Cell Science Internship program was an amazing academic experience. During the COVID-19 pandemic it was hard to find an academic summer program, and I am glad I was able to find the cell science program. Since this program is typically done at a physical location in San Francisco, one could say that I am lucky that it was held online as I reside in Florida. It was eye-opening to listen to over 20 guest speakers from major pharma companies cover complex concepts in cancer biology, drug discovery and genetics. One guest speaker whose lectures I found very interesting and useful is Mr. Kiran Mukhyala. Mr. Mukhyala taught us how to use various bioinformatics tools such as UNIPROT, Ensembl, Gtex, Cbioportal, etc. I ended up using these bioinformatics tools for my final project, and I now have a general understanding on how to use these tools for learning about mutations, structures, homologs, gene sequencing and so on. Learning about how to use these tools will help me in the future, therefore, I am thankful for being a part of this program and to all the guest speakers including Mr. Mukhyala for taking their time to teach in this internship. Because of this program I have learned various topics, such as cancer cell growth and bioinformatics, which I would never learn in my high school classes. I am grateful for the exposure to these topics in the medicine field as I plan to become a doctor in the future, and the lessons I learned from this class will be useful for years to come.



# Reflections



## Trisha Jaishankar

Before taking part in the Cell-Science internship at Science Gurus, I had a vague idea of the vastness of the biology field. As a rising senior interested in pursuing medicine and eventually oncology, I was unsure as to what I wanted to major in. Under the mentorship of Dr. Junutula, this internship experience exposed me to several fascinating fields of biology including bioinformatics and biotechnology. Exploring various bioinformatics tools and being able to use them to find data for the BRAF gene and its influence on cancer was a highlight of my experience. In the 7 weeks of the internship, I learned so much about the cancer drug discovery and development pathway from knowledgeable guest speakers and also learned life skills such as public speaking from Mr. Figari. One notable guest speaker that truly inspired me was Mrs. Heather Maecker who spoke about Cancer Immunotherapy. She explained the adaptive immune system and the role of antigens, antibodies, t-cells, and b-cells in protecting our body from tumors and diseases like cancer. This was very interesting because I learned so much about what our bodies naturally do to protect us from mutant/foreign invaders and how immunotherapy is a rapidly developing treatment option that serves to use our own immune system to fight diseases like cancer. All in all, I would like to thank Science Gurus for hosting this internship as I was able to get a clarity of what I want to pursue in the future. This was a great experience and I'm extremely thankful I was a part of it.

# Reflections



**Varsha Thalladi**

The Science Gurus Cell Science Internship was one of the most engaging and informative academic experiences I was able to partake in throughout high school. I enjoyed how interactive this internship was although it was online: for example, during Dr. John Storella's patent presentation, he had us read and comprehend patents; and during Dr. Shailesh Raichura's presentation on clinical trials included a Kahoot game to keep us on our toes. All of the topics covered throughout the summer were extremely informative and interesting, and all of the speakers were highly knowledgeable and able to answer any question us students had. Every single session exceeded my expectations (of course, I had certain preferences and topics that I enjoyed learning about even more -- i.e. clinical trials (Dr. Raichura) and regulatory affairs (Dr. Sujata Mudumba)), but all the speakers definitely helped in augmenting my experience. It was also really helpful that there were personable aspects in the internship: speakers not only taught us about scientific topics, but also gave personal tips on how to public speak and how to write better reports. Overall, the exposure to numerous biology fields and careers solidified my passion for the sciences, and gave me a better sense of direction to figure out in which way I can contribute to the ever-changing field of drug development.

# Reflections



## Veda Goskonda

I am super happy that I applied for this summer internship. This summer was one of the best academic opportunities I have received. While applying, I was skeptical that the amount of education we would receive would be less since it was virtual, but I was surprised by the amount of knowledge I gained from the internship being online. The lectures we received taught me about the variety in the science field. Every speaker was very knowledgeable and passionate about their subject and their lectures helped me figure out what part of the science field I'm interested in. The presentations by the other interns helped me learn about different cancers and researching my own cancer topic helped me learn more about different therapies and treatments for cancers other than chemotherapy. The gene research project was also very helpful; it helped me practice using the bioinformatic tools. One of the important points of this internship were the skills that could not be learned in a classroom setting. I was taught the importance of networking and maintaining relationships with my peers and colleagues. Also, sessions on college applications and public speaking were really beneficial for preparing us for our future. Being Class of 2021, it was tough for the rising seniors to get help with their college applications. College counselor Mrs. Aparna Gandhari helped us by talking to us about essays and answering any questions we had about applications. Before her presentation, I was very confused on how applications were going to work, but her presentations helped me prepare.



# Acknowledgments

This internship would not have been possible without the time and effort of Dr. Jagath Reddy Junutula, who organized this incredible internship.

We would also 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 tips with us.

Mr. Kiran Mukhyala was another extremely helpful and guiding figure through the internship, giving us the tools and information we needed to complete the bioinformatics portions of the projects. Mr. Anay Limaye patiently gave useful advice and insight on our projects often, and was ready to help at any given time.

We are eternally grateful to the Science Gurus Organization for giving us the opportunity to participate in the Cell-Science Internship; though online, this experience was invaluable, and we will remember the lessons shared with us in our future endeavors.

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