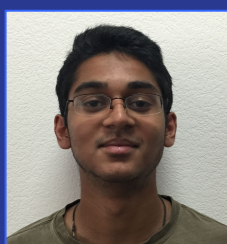
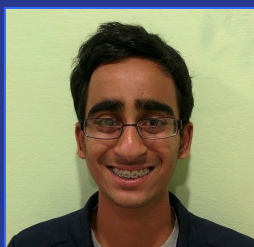


# Science Gurus

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## Cell Science Internship Annual Report 2015

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# Overview

Science Guru's Cell Science internship is an annual, seven week program held in the summer, during which selected applicants are exposed to topics ranging from biology to writing patents. The 2015 curriculum centered around cancer, covering all aspects from mechanisms of the disease to the drug discovery process and prospective treatments.

The daily agenda started with lectures featuring eminent guest speakers from various biotechnology companies and academic institutions throughout the Bay Area, including Genentech, Gilead, and Stanford to discuss their work. The lecturers presented advanced material excerpted from their own research, often years beyond the scope of high school curriculums, regarding the system of cancer and approaches to finding targeted therapies. It was therefore imperative that interns independently familiarized themselves with the selected topics to enhance their educational experience.

Although the lectures provided insight towards the biotechnology industry, the bulk of the program still lay in the participant's own work in the form of two major projects; the first of which was a research report on different types of cancer. Upon scouring databases for information on their selection, interns created and delivered oral presentations regarding all facets of their disease ranging from the biomechanics of the ailment to the current and possible future treatments.

The second and undoubtedly the more intriguing project required interns to work with partners to research a specific gene, the protein it codes for, its relation to the formation of cancer, and its role as potential or current targets for cancer drugs. It involved extensive use of bioinformatics tools and databases such as NCBI (National Center for Biotechnology Information), Ensembl, and Uniprot. Interns received instruction on how to use the databases through two exceptional Computational Biologists from Genentech, who volunteered their precious time to impart some of their vast knowledge to the students. Throughout the seven weeks, the interns worked tirelessly in pairs to gather as much research as possible on their assigned gene.

Upon finishing their research, interns wrote a detailed research paper and presented their findings orally in front of all participants and their parents. The seven week program concluded with dinner and an awards ceremony to commemorate the completion of the program, sending off the interns with their newfound knowledge about cancer and the drug discovery and development process.

# Participating Interns

Name

School

Aastha Parekh

American High School

Abhishek Mandalam

Moreau Catholic High School

Anisha Singh

American High School

Bhavya Malladi

American High School

Esha Kauravlla

Amador Valley High School

Jessica Pon

Monta Vista High School

Karthik Bharathala

Mission San Jose High School

Mariah Qura

Arroyo High School

Nidhi Bandrapalli

Burlingame High School

Nikita Pasumarthi

Cupertino High School

Rubi Caldeeron

Arroyo High School

Sreejay Pedapenki

Washington High School

Uma Ramaratnam

Archbishop Mitty High School

Vidya Pingali

American High School

# Curriculum



## Cell-Science Summer Internship Program

Date and Time: June 15 – July 31, 2013 Tuesday and Thursday, 5.30-8pm\*  
Location: 1531 Industrial Road, San Carlos, CA, 94070.

Day	Date	Instructor	Hours	Course Title	5.30-6.45pm Class	6.45-7.00pm Break	7.00-8.00pm Class
Tue	6/16/15	Jagath Reddy Junutula	2.5	Introduction to Cancer Biology	Meet and Greet; Goals of Internship/Assignment Overview		Cancer Basics and Phenotypes
Thu	6/18/15	Kiran Mukhyala/Suchit Jhunhunwala	2.5	Introduction to Bioinformatics	Introduction to Bioinformatics		Bioinformatics tools/applications
Tue	6/23/15	Jagath Reddy Junutula	2.5	Antibody Therapeutics	Bioinformatics tools/applications		Antibody Therapeutics
Thu	6/25/15	Pradeep Fernandes	2.5	Cell Signaling/Systems Biology	Bioinformatics tools/applications		Cell Signaling/Systems Biology
Sat	6/27/15	Bob Figari (1pm-4pm)		3 Workshop: " Effective Content Development & Delivery "			Workshop
Tue	6/30/15	Summer Interns	2.5	Cancer Group Presentations	Group1: Brain/Breast		Group2: Blood Cancers (Lymphoma/Leukemia/Myeloma)
Thu	7/2/15	Surya Sankuratri	2.5	Drug Development - Overview	Drug Development - Overview		Drug Development - Overview
Tue	7/7/15	Pablo Garcia	2.5	Small Molecule- Drug Discovery Kinases	Small Molecule- Drug Discovery Kinases		Group3: Pancreas/Kidney/Colon/Lung
Thu	7/9/15	Sanjeev Redkar/Sreedhara Alavattam	2.5	Small/Large Molecule Manufacturing &Formu	Small Molecule Manufacturing &Formulation		Large Molecule Manufacturing &Formulation
Tue	7/14/15	Zora Modrusan	2.5	Cancer Diagnostics-NextGen Sequencing	Cancer Diagnostics-NextGen Sequencing		Group4: Ovarian/Melanoma/Head&Neck/Liver
Thu	7/16/15	Ram Mandaiam	2.5	Cancer-Stem Cell Therapeutics			Cancer-Stem Cell Therapeutics
Tue	7/21/15	Surbhi Sama/Ganesh Kolumam	2.5	Cancer Therapeutics	Startup-101		Interplay Cancer and Inflammation
Thu	7/23/15	Sukhmani Padda/Heather Maecker	2.5	Overview to Clinical Trails/Cancer Immunoth	Overview to Clinical Trails		Cancer Immunotherapy
Sat	7/25/15	Aparna Gandhari/Raji Pingali (1pm-4pm)		3 Workshop: " Preparing Effective College Applications "			Workshop
Tue	7/28/15	Ravi Kiron/Sreedhara Alavattam	2.5	Business Development/Cancer-Nanoparticle	Business Development 101		Cancer-Nanoparticle Therapeutics
Thu	7/30/15	John Storella/Margaret Dillon	2.5	Overview to Patents-IP/Regulatory Filings	Overview to Patents-IP		Regulatory Filings
Sun	8/2/15	Final Project Presentations	5	Final Project Presentations (10am-3pm)	Final Project Presentations		Final Project Presentations

# Intern Presentations

## Group 1: Brain/Breast

Anisha (GBM/Brain Cancer), Nidhi (Breast Cancer)

## Group 2: Blood Cancers

Karthik (HL/NHL), Jessica (CML/CLL), Abhishek (AML/ALL),  
Aastha (MM)

## Group 3: Pancreas/Kidney/Colon/Lung

Mariah (Pancreatic Cancer), Nikita (Kidney Cancer), Rubi (Colon Cancer), Sreejay (Lung Cancer)

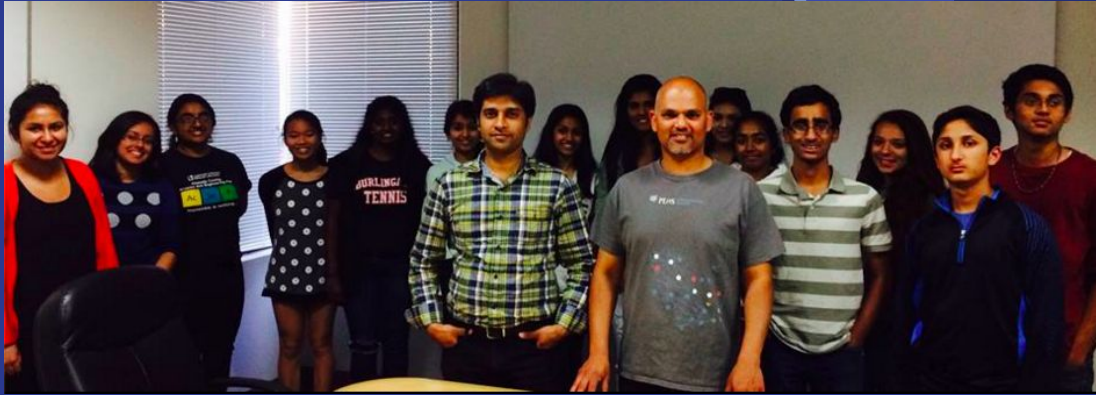
## Group 4: Ovarian/Melanoma/Head & Neck/Liver

Uma (Ovarian Cancer), Bhavya (Melanoma), Esha (Head & Neck Cancer), Vidya (Liver Cancer)



# Group Photos

Interns with  
Dr. Suchit  
Jhunjunwala  
and Kiran  
Mukhyala



Interns with  
Guest Speakers  
Pradeep  
Fernandes and  
Dr. Ram  
Mandalam

Interns at  
workshop for  
Preparing  
Effective College  
Applications with  
Guest Speakers  
Aparna Gandhari  
and Raji Pingali



Visit to  
Genentech R&D  
Lab and  
Manufacturing  
Pilot Plant with  
Genentech  
Host: Rao  
Goriparthi



Interns with  
Guest Speaker  
Bob Figari at  
the Workshop  
for Effective  
Content  
Development  
and Delivery

Interns with  
Guest Speaker  
Dr. Sukhmani  
Padda





# Final Report Abstracts



# Aastha Parekh and Esha Kauravila

## HER2 Gene

### HER2—A Cancerous Gene and the Revolution Behind it

Aastha Parekh-American High School, Fremont, CA, USA  
Esha Kauravilla-Amador Valley High School, Fremont, CA, USA

Cell-Science Summer Internship, Science Gurus,  
Fremont, CA, USA

#### Abstract

Cancer has been one of the leading causes of death amongst our society. Over the past century, scientists have been trying to obtain more knowledge on the various types of cancers and treatments to cure patients. As a result, scientists have been trying to target specific genes, which are responsible for causing certain types of cancer. These genes initiate cancer because of their mutations, altered sequences of the genome of an organism. Scientists have been trying to come up with targeted therapies, which aim to prevent these mutated genes from progressing the cancer. One of the most profound discoveries that changed the targeted therapy industry was the identification of HER2, a human epidermal growth factor. This gene has been found to play an important role in breast cancer. Since it has been found in a significant amount of people that have breast cancer, it was essential for scientists to create targeted therapies to pinpoint HER2.

# Abhishek Mandalam and Sreejay Pedapenki

## PD1 Gene

### PD1: Background and Future in Drug Development

Sreejay Pedapenki<sup>1,2</sup> and Abhishek Mandalam<sup>1,3</sup>

<sup>1</sup>Cell-Science Summer Internship, Science Gurus, Fremont, CA, USA, <sup>2</sup>Washington High School, 38442 Fremont Blvd, Fremont, CA 94536. <sup>3</sup>Moreau Catholic High School, 27171 Mission Blvd. Hayward, CA 94536.

#### Abstract

Programmed cell death protein 1, also known as PD-1 and CD279 (cluster of differentiation 279), is a protein that in humans is encoded by the *PDCD1* gene. PD-1 is a cell surface receptor that belongs to the immunoglobulin superfamily and is expressed on T cells and pro-B cells. PD-1 binds two ligands, PD-L1 and PD-L2.

PD-1, functioning as an immune checkpoint, plays an important role in down regulating the immune system by preventing the activation of T-cells, which in turn reduces autoimmunity and promotes self-tolerance. The inhibitory effect of PD-1 is accomplished through a dual mechanism of promoting apoptosis (programmed cell death) in antigen specific T-cells in lymph nodes while simultaneously reducing apoptosis in regulatory T cells (suppressor T cells). A new class of drugs that block PD-1, the PD-1 inhibitors, activate the immune system to attack tumors and are therefore used to treat cancer.

Throughout much of the activities of this gene we can determine the fact that of a majority of the patients using this gene were significantly help boost the immune system. The gene works by stopping the PD 1 receptor from attaching to a PDL1 ligand. The continuation of this pathway is used to promote cell death. This is good in malignant cells, but needs to be avoided in cells that are part of the immune system, such as T-cells. Many of the generic drugs in the PD 1 pathway use monoclonal antibodies, which are man made antibodies. These monoclonal antibodies are then used to lock the a pathway and the result is that the cell doesn't die. By studying this pathway, we can gain insight on how the cancer cells operate and how to better stop their metastasis. In addition, studying the drugs that target these pathways gives insights on what drugs can do to inhibit downstream cell signaling and other methods that cancers use to proliferate and thrive.

# Anisha Singh and Uma Ramaratnam

## EGFR Gene

1

### **EGFR: Epidermal Growth Factor Receptor**

**Anisha Singh<sup>1,2</sup> and Uma Ramaratnam<sup>1,3</sup>**

<sup>1</sup> Cell-Science Summer Internship, Science Gurus, Fremont, CA; <sup>2</sup> American High School, 36300 Fremont Blvd, Fremont, CA 94536; <sup>3</sup> Archbishop Mitty High School, 5000 Mitty Way, San Jose, CA 95129

#### **Abstract**

EGFR is a gene that codes for a cellular membrane receptor and is responsible for proper cell-proliferation, differentiation, and development in a majority of different cell types. However, mutations of EGFR have been found to lead to overexpression of the gene and, eventually leading to cancer. Mutations of EGFR occur throughout the gene, however, majority of the mutations occur at a region that codes for tyrosine kinase, which coordinates the phosphorylation of substrates in EGFR's pathways, such as the MAPK kinase pathway and ErbB pathway. EGFR plays the role of an oncogene in several of its cancers, but places greater emphasis and contribution in glioblastoma brain cancer and lung adenocarcinoma. EGFR is explored greatly in depth in regards to its domains between its orthologs, expression among normal and tumorous tissues, treatments and drugs, and methods of data collection and analysis.

# Bhavya Malladi and Vidya Pingali

## CD20 Gene

### **CD20: The marker gene and its role in cancer drugs**

Bhavya Malladi, Vidya Pingali

American High School, 36300 Fremont Blvd, Fremont CA 94536

Cell-Science Summer Internship, Science Gurus

#### **Abstract**

Cancer is a disease of the genome, and different forms of cancer have various mutations in the genetic sequence of our DNA that specifically cause the cancer. Many drugs are created to target these certain genes and the mutant proteins they code for, in order to eliminate the cancer cells from the body. Sometimes, however, it is more effective to target a gene or protein that does not necessarily cause cancer, but is expressed on the surface of many or all cancer cells. One such gene is CD20, which is known as a marker gene because it does not have a known cancer-causing function. After looking at the expression of CD20 in cancer cells versus normal cells and its mutation profile, we learned that CD20 is expressed on all B-lymphocytes, whether cancerous or not. Drugs such as Rituximab (Rituxan) and Ibritumomab (Zevalin) target these CD20 proteins on the cell surface in order to kill all B-cells, and allow cancer patients to regenerate new, healthier cells.



# Karthik Bharathala and Jessica Pon

## SMO Gene

### **SMO: Background and Future in Drug Development**

Karthik Bharathala<sup>1,2</sup> and Jessica Pon<sup>1,3</sup>

<sup>1</sup>Cell-Science Summer Internship, Science Gurus, Fremont, CA, USA, <sup>2</sup>Mission San Jose High School, 41717 Palm Ave, Fremont, CA 94539, <sup>3</sup>Monta Vista High School, 21840 McClellan Rd, Cupertino, CA 95014

### **Abstract**

SMO is a gene that aids in embryogenesis, but causes cancer when it is mutated later in life.

Although it is a rather new target in the field of cancer therapy, SMO and the hedgehog signaling pathway are opening up new door for drug developers. The data we have compiled in this report through the use of different databases gives an idea as to how and why this gene and its protein are so important. We have found that SMO plays a vital role in development through different species, and also takes other forms to perform different functions. By studying the pathway through which the gene performs its functions, we can learn more about how cancer grows and proliferates. In addition, studying the drugs that target these pathways gives insights on what drugs can do to inhibit downstream cell signaling and other methods that cancers use to proliferate and thrive.

# Rubi Caldeeron and Mariah Qura

## CD30 Gene

### **TNFRSF8/CD30 Targeted Therapies and an Insight to Antibody Drug Conjugates**

**Mariah Qura<sup>1,2</sup> and Rubi Calderon<sup>1,2</sup>**

<sup>1</sup>Cell-Science Research Summer Internship, Science Gurus, <sup>2</sup>Arroyo High School 15701 Lorenzo Ave, San Lorenzo, CA 94580

#### **Abstract**

For decades we have been at war with cancer. Luckily, over the course of the years we've developed better weapon to fight with. To this day, targeted therapies are the most efficient to tackling this disease. There are various targeted therapies approved and available for cancer patients now-in-days. Targeted therapies can aim to target either oncogenes, tumor suppressor genes, or tumor markers. We will be specifying on one particular tumor marker, CD30. CD30, also know as TNFRSF8 is part of the TNF receptor superfamily, and therefore highly expressed in Hodgkin's Lymphoma. So far, there is only one targeted therapy approved-- Brentuximab Vedotin, an antibody drug conjugate. Antibody drug conjugates are efficient because they have the ability to distinguish between healthy and diseased tissues.

# Nidhi Bandrapalli and Nikita Pasumarthi

## BCL-2 Gene

### **Bcl-2: B-cell CLL/Lymphoma 2**

**Nidhi Bandrapalli**<sup>1, 2</sup> and **Nikita Pasumarthi**<sup>1, 3</sup>

<sup>1</sup>Cell-Science Summer Internship, Science Gurus, Fremont, CA; <sup>2</sup>Burlingame High School, 1 Mangini Way, Burlingame CA 94010; <sup>3</sup>Cupertino High School, 10100 Finch Ave, Cupertino, CA 95014

#### **Abstract**

Bcl-2 was the first anti-death gene that was discovered in science. Since then, many other members of the Bcl 2 family have been found. The family includes, 8 pro-apoptotic proteins, 8 anti-apoptotic proteins and few other proteins. As will be discussed throughout this paper, the Bcl-2 family proteins are responsible for regulating all of the major types of cell death such as apoptosis, necrosis, and autophagy. The Bcl 2 family proteins aid in making sure our body cells function accordingly and are able to maintain a homeostatic balance within our bodies. Throughout this paper, the Bcl-2 gene and its relation to cancer will be discussed in greater depths.

#### **Introduction**


B-cell CLL/Lymphoma 2, more widely known as Bcl-2, is one of the main genes in the human body that is responsible for mediating cellular death. This gene falls under the Bcl-2 family which is comprised of 25 genes, both

protein. This overexpression of the protein is what causes certain types of Cancers to appear and thrive, this concept will be discussed later on in the article.

In terms of structure, the Bcl-2 gene is comprised of a hydrophobic helix surrounded by amphipathic helices. Hydrophobic means “water fearing” which is what protects the gene and its DNA, whereas amphipathic means both “water fearing and water loving”. The amphipathic aspect of Bcl-2’s figure gives Bcl-2 the ability to function in different areas and conditions in the body.

The Bcl-2 gene is located in the human DNA sequence on chromosome 18 at position 21.3 and has a total exon count of six. Exons are nucleotide sequences that are encoded by a gene that remain intact after the introns (non-coding sections of RNA) have been removed from the sequence.

Continually, as mentioned briefly above, Bcl-2 is one of the primary regulators of all major types of cell-death. These include Apoptosis (programmed cell death), Necrosis

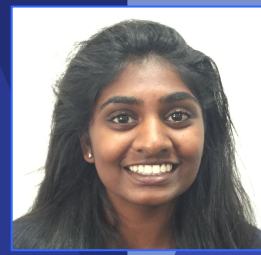


# Intern Reflections



# Nidhi Bandrapalli

Burlingame High School, Burlingame



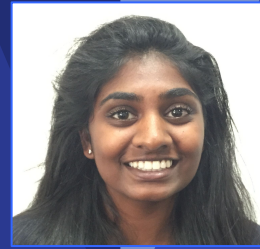
This past summer, I was given the opportunity to be apart of the intensive Cell Science Internship held by Science Gurus. It was a truly enlightening experience that kept me on my toes this whole summer!

When I first entered the program on June 16th, I was absolutely terrified because I did not know what to expect. We were told to watch an 8 hour video on Cancer Research and its nascency. At first I was apprehensive, but when I took the time to sit down and actually watch the video and jot down notes, I realized that not only was the video not as bad as I thought, but much of the content was very fascinating to me. This video is was what changed my perspective and made me eager and excited to be apart of this internship!

From there we had class two times a week for about three hours each day. At the beginning of our sessions we would have a small cancer research lesson by Kiran and Suchit who were valiantly and patiently helping/guiding the bunch of us create success final reports. After this hour lesson, we would usually then have two guest speakers who would talk about different aspects of the cancer research process. We would get new guest speakers every meeting. These topics the guests were speaking on ranged from the law aspect of bio company startups up to analyzing different cancers. All of these talks really opened my eyes and showed me how vast of a field Cancer Research actually is.

Our first "big" project for this internship was to research a specific cancer and then present our findings to the whole group. This project meant finding the different genes involved in the cancer, the different stages of the cancer, its symptoms, causes etc, treatment methods, targeted drugs, and even the pathways of the cancer. The cancer that I chose to research was Breast Cancer and I had a great time learning all about it. Through this one project I learned an incredible amount and was then able to create a great report and presentation. Furthermore, what was also awesome was learning all about the various cancers that the other interns researched.

(Nidhi Bandrapalli continued)

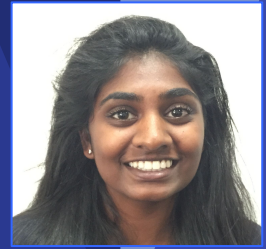


In terms of the homework for this internship, there was a lot of it. However, most of our homework would be to work on our projects, work with the different gene databases, or take notes on video seminars. I realized throughout the internship that the majority of our homework correlated with the next class' lesson and/or guest speaker talk, which I found to be very helpful. I would always be prepared for the talks because I had some background info on the topic that I had learned the night before. However, one suggestion to make the internship and homework a bit more appealing would be to possibly have a more "hands-on" class every now and then and possibly even a homework assignment that has the interns doing research away from the computer.

One great thing that I really enjoyed and found unique about this internship were the two Saturday workshops. One was on effective public speaking and project development and the other was on College and applications. I found these both to be very informative and I was able to take away some very great tips from both of these workshops. Also, the people who were leading these workshops were very nice, helpful, and encouraging as well.

During this internship, we were also given the opportunity to visit Genentech and tour its facilities. We saw the DNA sequencer, had lunch, saw how drugs are created, and toured one of their plants. It was definitely a one of a kind experience and I am so lucky to have gone on the field trip!

Lastly, our final project was an experience I won't forget. Simply because it took around 5 weeks to finish and I never knew I was capable of doing such research. Two interns were assigned to a gene and had to research every aspect of the said gene. For my project, I was teamed up with a fellow intern and we were given the gene Bcl 2 to research. We worked for many hours on this project, researching, looking at various gene databases, analyzing data, and all the above. It was a long and hard process, grueling even, but we were able to finish it and present our findings justly.



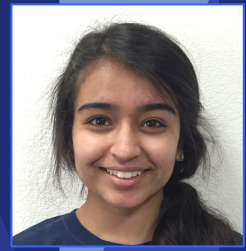
(Nidhi Bandrapalli continued)

Before I conclude, I just wanted to acknowledge Jagath. Jagath patiently guided each one of us through this program every step of the way, and made sure everything went accordingly. He took so much time out of his busy schedule to make sure we were all well accommodated and were all well acquainted with the topics being covered. Managing a bunch of teenagers over the summer must have been hard but Jagath did it effortlessly!

This internship truly pushed me to my limits and made me want to work harder. I was definitely surprised at all the work I did and everything that I accomplished through this internship. I am so happy with the outcome of this internship and I would strongly recommend it to anyone who is looking to go go into the research field.

# Aastha Parekh

American High School, Fremont



My experience during this cell-science internship was nothing short of memorable and worthwhile. Attending each week gave me more exposure and understanding of a potential career I may pursue in my life. From the guest speakers, lectures, presentations, workshops, and all the other experiences, this internship has opened up new doors in the science field.

From the first day on I knew that this internship would be no casual learning experience; but it would be a rigorous course for 1.5 months. Each week different speakers came in and talked to us about their profession and how their job works. While some were more difficult to understand than others, I still learned plenty of new information. This internship also introduced me to workshops, and I was able to enhance my speaking skills along with getting a deeper understanding of the college application process. Each intern's cancer presentation was unique and insightful, and although it is definitely difficult to become an expert after hearing one presentation, I did find out that some cancers were more interesting to study than others. The final presentation was easily the hardest work I have put into my internship, and I learned an immense amount of HER2 and how it functions. The homework assignments were time consuming, but were worth the time spent. Each video gave me insight in understanding a guest speaker, or basically simplified a lot of concepts which may have been hard to understand through solely a powerpoint or a speaker. The field trip was very eye opening because although we were aware of how these machines and laboratories functioned, but getting to see it in person and even having a few hands-on activities connects all the parts together. The environment was friendly, yet it was really clear that a lot of productive work went on which was crucial to the cancer industry and saving lives. It was never really clear as to how in depth and complex cancer and biotechnology really was, but this internship was very helpful in getting the surface information about that. There was not a time where I returned home after the 3 hours thinking that I didn't learn anything new. Each day was flooded with information, which always helped me understand cancer as a whole better. Another benefit of taking part in this was also that I met new people who shared similar interests as me and became friends with them.





(Aastha Parekh continued)

The main benefit of this internship was getting all of these opportunities for practically free. I was able to get insight from multiple people, all who were experts and professionals in the fields they worked in. Each speaker or member in this internship who has guided us was very thorough and helpful. Although it was busy and at times very confusing, I was still able to gain much about it. It peaked my interest even more in this field and I hope that I'll be able to carry on this knowledge further and become an expert in an area. The cell-science internship was one of the major highlights in the summer, and every hour that I've spent for it has been memorable and very helpful.

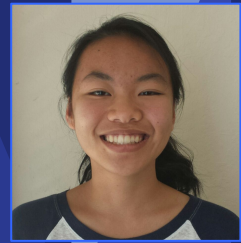


## Jessica Pon

Monta Vista High School, Cupertino

Going into this program, I honestly did not know what to expect. I had been told that there would be hands on activities to do, so I figured that meant lab work, and I was very excited. However, when Jagath told us we would be getting lectures every week, honestly I lost a bit of that initial enthusiasm. But, after the first few sessions, I was proved very wrong about this internship. Learning in depth about cancer, its paradigms, and the research that has been and continues to be done on the disease was extremely interesting, and over the entire course I feel as though I have expanded my horizons in terms knowing what possibilities are available to me in different fields.

The guest lectures were on a variety of different topics including bioinformatics, research, and drug development, and I must say that I felt very privileged to be able to learn from so many great people. However, my favorite lecture was definitely John Storella's because the topic was so fascinating. Rather than being about cancer research and drug development, he focused on the process that happens after everything has been done and approved. The patent process. This topic intrigued me because Mr. Storella's educational background is actually in both biology and in patent law. The lecture itself went into great detail about the process of getting a drug patented, and what the job of patent lawyers is in this process. As a whole, I learned that if I get a degree in a science and find myself hating lab work, I can always go into law and still work within the field of my original major, just in a different way.



(Jessica Pon continued)

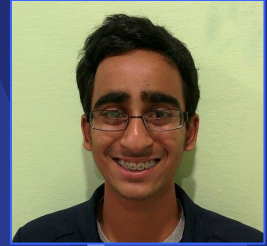
Another major activity from this internship that I thoroughly enjoyed was the visit to the Genentech campus in South San Francisco. During our tour, we got to visit the labs where they sequenced DNA, as well as the labs where they created the test batches for their drugs. The labs where they created the drugs were especially intriguing because we got to see what exactly happens when you develop a drug rather than just being told what happens in a lecture. Overall, the visit helped to reaffirm my will to study a field of science when I get to university.

The final most memorable thing for me from this internship was the culminating project and presentation at the end of our seven weeks. This project required us to take all the information we had learned in the past weeks, and create a presentation on an assigned gene that is related to cancer. It was basically a test to see how well we could navigate the different bioinformatics tools we had been introduced to, and use them to gather information to synthesize a research paper and presentation. While this was indeed a great challenge, I think this project helped me greatly improve in my research and data analysis abilities, which I know will be extremely useful to me in the future.

Overall, I thoroughly enjoyed my experience this past summer, and I am truly honored and thankful that I was given the opportunity to be a part of this amazing internship.

# Karthik Bharathala

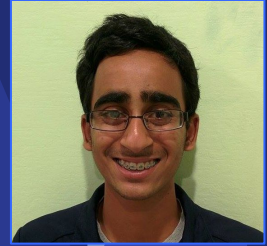
Mission San Jose High School, Fremont



When I opened my gmail one day and saw an email from Dr. Jagath Reddy that I got accepted into the Cell Science Internship program, I was ecstatic. I was waiting for this email for some time and it became a reality. I wanted to learn about cancer research because I was always curious about this "Emperor of Maladies", the incurable disease that has affected man and beast for centuries.

What I got out of the internship was much more than that. The program which was for seven weeks, was intense; 5 hours per week of lectures that were filled with plenty of information that was interesting and, at the same time, mind blowing. We had domain experts teaching a class of 20 students from the basics of cancer research, to how clinical trials are done and to the business aspects of drug discovery. Just so that we get more out of the program, we had workshops during the weekends which covered relevant topics like preparing effective college essays. To make it more participation based, we were asked to present papers on different types of cancers, how they occur and the fatality rates.

The lectures and video presentations that were done were at a level that can be easily understood by a high school student. This helped me learn the material easily and at the same time absorb most of the information. My parents were amazed that the guest speakers, well known in their fields, had taken time from their otherwise busy schedules to teach us about cancer and the genes responsible for its proliferation. We got to visit the Genentech lab to observe what scientists in pharmaceutical companies work on. Our final presentation was a group project, where you partner with another student and create a report and presentation on genes causing cancer.



(Karthik Bharathala continued)

My project was on the gene SMO: you get to know more of the history of that particular gene, its occurrence and how it causes cancer, and how it can, if at all, be cured. It was eye opening to see the groups present their work very knowledgeably and with confidence. The internship gave us an opportunity to shine before our parents and fellow students.

The grand finale was a banquet where your parents and family see you talk about cell works and what you learned in the process. I personally felt I learned more than what I expected to learn. I achieved my goal of understand more about cancer than before. But what I did not know I would learn was the way research needs to be done in the biomedical field, and getting up in front of people and talk about my work.

The 7 weeks flew by pretty fast, but the experience I gained during that period will stay with me for a very long time.



## Vidya Pingali

American High School, Fremont



The Cell-Science Internship this past summer really taught me about science as well as the scope of job opportunities in the field of biology. I thoroughly enjoyed the program. At first, the videos we were assigned to watch were tedious and mundane, but they greatly helped when we had guest lectures since the video topics were often linked to the lecture's topic. Before entering, I was not too interested in biology, although I knew I wanted to pursue something science related. The guest lectures, however, made me realize that there are so many different kinds of sciences that interest me. I found Pradeep Fernandes' talk on System Biology really interesting, where he talked about personalizing sequences for patients based on their internal systems. I really appreciated Jagath Uncle's dedication and passion towards us and the whole internship, as he was there every meeting, as well as collecting food for us every meeting. My favorite guest lecture was the one on intellectual property and patents. Since I have always been interested in law, I found it really stimulating that the speaker who had majored in biology and spent a few years working in a lab suddenly decided to go to law school. I realized that I want to pursue something like this: pursue a science career and then go to law school to earn a law degree. Then, hopefully, I can work with biotech companies as a patent lawyer, using my skills of both biology and law to assist me.

Unfortunately, I could not make it to Bob Figari's workshop, but I heard that it was very useful. I talked to him on the final day at Vara Indian Cuisine, and he advised me that I just need confidence while speaking and I should be fine. The college workshop by Aparna and my mom was useful as well as it answered many questions and doubts I had about entering college.

(Vidya Pingali continued)



The final project was definitely challenging, but my partner Bhavya and I learned a lot. We were very confused at first on how to start as we couldn't even find our gene CD20 on Google, but Kiran and Suchit guided us on how to proceed. I really appreciated all the tips and help they gave us, as well as guiding us with the steps on how to use each database to its full potential. Bhavya and I spent a lot of effort into the presentation as well as incorporating Bob Figari's tips. The report was a new process for us, but we had fun writing a proper scientific report.

The final event at Vara Indian Cuisine was really entertaining. I got to hear Ram Uncle's inspiring talk about choosing your career based on what you think you are capable of and following your dreams. In addition, I got to view all of my fellow interns' other talents as well as chat with many influential people in the biotech and bioinformatics field. Overall, the whole experience was a blast and I learned a lot about cancer, genes, drugs, and more that I had never known before.

Thank you for all your help and for providing with me a great summer experience.

## Nikita Pasumarthi

Cupertino High School, Cupertino



I signed up for this opportunity because I was interested in genetics and biology. This is something I wanted to do in the future and I did this internship to get a feel for that area of education. This internship has taught me about cancer on a cell level. I learnt many things that I didn't know. I learned how cancer is able to trick the body and slip through to become tumors. Every week we had guest speakers who have jobs in the cancer/science field. I learnt many things about the different jobs you could have in the science field. You don't just have to be a researcher, there are other ways to find ways to contribute to science. There were two really interesting projects we did in the during our internship. We researched a cancer first; we each had one cancer that we had to share with the class. In our other project, we went one step further and we researched genes that played different roles in cancer. One of my favorite thing we did was visit the company Genentech, where we saw different instruments used for DNA sequencing and cancer research. In addition to the science aspect of the internship, there was couple of workshops that helped us prepare for the future. One of the workshops we had was about tips to improve our public speaking. The instructor was really helpful and he gave us interesting tips to help our presentations. The second workshop was a college application presentation. The instructor went over different applications and how to decide which college was a good fit for us. Both workshops would help us towards the future. Overall this internship was really educational and a very interesting experience for me.

# Bhavya Malladi

American High School, Fremont



This past summer as an intern for the Cell-Science program, I learned a plethora of information about cancer, drug discovery, and drug development. I thoroughly enjoyed the various guest speakers, who talked to us about the different types of drug molecules, the ways in which they are manufactured, the legal issues that go along with them, and many other topics. I was especially interested in the lecture given by Mr. Mandalam, in which he talked to us about the stem-cell research that is being used for various applications such as testing drugs and improving cell therapy. I also learned a lot from the different video seminars about cancer and signaling pathways in cells, which reinforced the information we received from guest lectures.

We also had the opportunity to individually research on a specific type of cancer, mine being melanoma. It was fascinating to learn about the different forms of cancer and how they form from each of the students, who obviously put time and effort into thoroughly researching their topics. In research for my particular presentation, I learned why excessive UV radiation really is dangerous and how skin cancer can form from the most innocent of moles.

The internship also included two workshops that were not necessarily directly related to drug development and discovery, but were nevertheless essential information we needed to learn to succeed beyond the classroom. I personally enjoyed the workshop led by Bob Figari, in which we learned how to speak comfortably and clearly in front of an audience. The workshop was simultaneously fun and informative, which helped us learn and apply that knowledge to presenting our final projects. The workshop about the college application process was also extremely helpful, because it gave us insight on how to approach the essays and what we should or should not do.

(Bhavya Malladi continued)



One of my favorite parts of the internship was the field trip to Genentech, where we were able to take a tour of a pilot plant and view the ways in which different drugs were discovered, developed, and tested. I especially enjoyed the tour because of the interactive question-and-answer process that continued throughout.

Lastly, the most rewarding experience of this internship was the final project that we worked on throughout the seven weeks. I really appreciate the help we received from Kiran and Suchit, who took the time out of their busy schedules to come in and teach us about the different databases through which we could research our gene. My partner Vidya and I researched the gene CD20, and we learned so much about its role (or lack thereof) in cancer and its essential properties that are important in the discovery and development of drugs that can be useful for patients with lymphoma, for example. We also learned such information and more from other teams' presentations about their assigned gene.

Overall, this Cell-Science internship was an exciting learning experience for me, and I was able to gain a vast abundance of knowledge through research, guest lectures, individual projects, and field trips.



# Anisha Singh

American High School, Fremont



The Cell-Science Internship by Science Gurus made my summer of 2015 memorable. The internship dived in greater depth of what cancer actually is. Before this internship, whenever I heard the term "cancer," I would recall back to my high school biology class as cancer being uncontrolled cell growth; however, that is where my knowledge of cancer would stop. I never knew before how much weight the term "cancer" held and that it is associated with layers after layers after layers of hundreds of diseases working through millions of methods at billions of locations within the body. My fascination of the biotechnology world continues to grow as each project, video, and guest speaker of the internship continuously shows how scientists act like detectives in finding a cure to each aspect of the cancer. The internship gave me a greater respect for what research in different diseases truly consists of and how much depth is involved in not only finding a cure, but also producing the cure and putting it through clinical trials, regulations, and the market.

Being an intensive internship, there was no doubt that homework would be assigned throughout the 7-week course. The homework mostly consisted of watching videos by professional scientists and speakers and taking notes on each one. Although the interns would start by dreading each hour-long video, we would always be glad we were assigned them by the end of the assignment. Each video brought in new information and knowledge that we wouldn't have come in contact with if it weren't for this internship. Each homework assignment treated the interns as professionals and as college students, which makes us feel like we are greatly respected and treated as minors. I will cherish the information learned from the internship for the rest of my academic career and my life. 31

(Anisha Singh continued)



From the beginning to the end, there was one important person that made the internship even more enjoyable and an incredible experience; his name is Jagath. From the interns and I, we wanted to say thank you. Thank you for teaching us your wisdom in biotechnology and cancer research. Thank you for tolerating us when we were extremely quiet and would never participate in discussions or ask any questions. Thank you for spending extra hours at work from your personal time to review our papers and presentations to make us a better person and provide us with a brighter future, when instead you could be at home with your kids. Thank you for giving it your all when trying to get all 18 guest speakers. Thank you for dealing with 14 impulsive procrastinating hormonal teenagers and continue to do this every year. And finally, thank you for making us excited to come all the way to San Carlos twice a week and learn about what you do best and make us love what we are learning. The internship wouldn't have been the same without him.

# Esha Kauravila

Amador Valley High School, Pleasanton



My experience at Cell-science Internship has allowed me to gain a deeper knowledge in the field targeted drug therapies. Prior to the internship, I had a minimal understanding of the targeted drug therapy world and this experience allowed me to gain more insight in this field. I learned about the different tools used in drug research with the help of Kieran and Suchit and the internship gave me the opportunity of having a hands-on approach in using these tools. Some of the tools that I found to be very useful were the NCBI data base and Uniprot, which contain thousands of genes and the background behind them. In addition to learning about targeted drug therapies, I learned a lot of new facts about cancer that I had not learned about earlier in school. The videos Jagath assigned to watch were helpful in giving me a visual understanding on what exactly cancer is and how targeted drug therapies work. Also, the various guest speakers provided me with a vast amount of information about targeted drug therapies and the drug industry that I would not have received if not for the Cell-science Internship. The two guest speakers that stood out to me were Pradeep Fernandes and Bob Figari. Pradeep Fernandes introduced me to personalized targeted drug therapies, which was an interesting topic to me because it provides a specific therapy catered towards an individual in need of a treatment. Bob Figari gave me tips on giving a scientific presentation and it definitely helped improve my public speaking skills. Furthermore, the final project was the most important assignment throughout the internship because it incorporated all the different elements learned during the span of the internship. My partner and I got assigned to research HER2 and we spent countless amounts of hours working at various coffee shops trying to get the report finished and the presentation ready. It was a challenge, but in the end my partner and I completed the assignment and along the way we learned so much more about HER2 than we had initially. The presentation was nerve-racking, but it was nice to show our parents how much we learned from this internship. By the end of the presentation, I felt accomplished because I learned so much about targeted drug therapies and cancer throughout this internship. Overall, my experience during the Cell-science Internship was extremely enlightening and it broadened my view on cancer therapies.

# Mariah Qura

Arroyo High School, San Lorenzo



Starting this internship was very scary. I didn't know what to expect and I felt a little intimidated. I was excited to do cancer research because I've heard so much about cancer that I wanted to know more. I assumed that this internship was going to be more hands on, but it was more lecture base. It was not too bad because all the guest speakers were great! I enjoyed learning not only about cancer, but about drug development, stem cell research, and different genes in our body. Many people know that cancer is very complex, but during this internship, I understand a lot more why it is. Cancer doesn't only affect one gene, it may target a specific one more than others, but our many genes are so similar that cancer cells can also target those as well. Knowing this tells us why finding a cure for cancer is so much harder than we think it is. If we want to make a drug to target a specific area of our DNA we must also know all the isoforms that come along with that gene. What also interested me was learning about drug development. I did not know it takes 10-15 years to develop a drug. To me that is crazy! Scientists put in so much time to develop a drug and many times it does not get used for anything or it may not be approved. I do not think I will ever have the patience to wait that long to develop a drug. Although I am interested in cancer, this internship helped me identify where in the medical field I want to be in. Doing all research based things is not where I want to be and I now know that. I would strongly recommend this internship to anyone because it is a great experience and it opened my eyes to different occupations there are. Thank you for this wonderful opportunity!

# Rubi Caldeeron

Arroyo High School, San Lorenzo



My experience at the 2015 Cell-Science Research Internship was indispensable. When I went into the internship, I expected to learn only about cancer. Learning about cancer was enough to captivate my attention and trigger my desire to pursue the program, but the internship offered so much more. With the various guest speakers, we got to learn about the various jobs involved in the drug-research and development industry. The information they provided us with was excellent, because what better way to learn the about this industry, than from actual people who work in it. Their lectures gave us great insight on what their jobs consist of, making us question whether or not it's an area of study we're interested in. I think that even if you're not interested in the drug-research and development industry, you can still gain much from it. This internship really paved the path I will take towards my future career. Coming into the internship I was debating to either major in Biology, go into nursing, and/or go to medical school; coming out of the internship I concluded that I wanted to go into nursing and later possibly pursue medical school. I decided I'd rather go into nursing, and possibly got into medical school after Jagath lectured us about the various jobs you can get with degree in Biology. Nothing Jagath said was discouraging, it was great information that I'm thankful to have received because it facilitated my decision. Drug-research and development is extremely fascinating, but personally I'd rather interact with patients.





(Rubi Caldeeron continued)

The lectures weren't the only great source of information, but so were the workshops, presentations, and field trip. I can honestly say the the internship made me grow not only intellectually, but as a person. With the presentations I gained more confidence in my abilities, and acquired skills useful in everyday life. The fieldtrip encouraged me to study what I'm truly passionate about, just like those who work at Genentech. Both workshops were two great opportunities I'm grateful to have had access to. Bob Figari's workshop regarding public speaking gave me great pointers to use throughout the rest of my life; Ms. Gandhari's workshop offered great information as well, because college applications can be stressful.

Overall, you learn so much more from this internship than just cancer. It's an opportunity that offers indispensable skills, and applicable information.

# Sreejay Pedapenki

Washington High School, Fremont



In the cell science Internship I did many projects that helped me learn about cancer. These included activities like workshops, reports and lectures

In the workshops with Suchit and Kiran I learnt how to use the gene databases Ensemble and Uniprot. This was a very important part of the internship because knowing how to use databases was an important part of the final project. Not only did the databases give us information about genes we had to do reports on, but it helped us with the sequence alignment portion of the final report.

Throughout the internship I also wrote smaller reports on other topics like the hallmarks of cancer and targeted therapies. I wrote most of these reports by watching videos about the topic. Most of these videos were from Ted, or research institutions, so they were filled with data and important information. Another smaller report that I wrote was about a specific type of cancer; this let me learn about the basics of the older way of looking at cancer. Another larger report was the one on the 8 hour video, which showed the history of cancer and its treatments, as well as the emotional side of oncological research.

Everyday a guest lecturer would come to the internship and give a presentation on their field. These presentations were helpful because they showed me a professional perspective of the science we were learning. They would also explain how the science we were learning in class would be applied in their job. These guest lectures were very diverse and ranged from gene pathways to patent law. Bob Figari also came to us and spoke about public speaking and how to give an effective science presentation. Raji and Aparna also told us how to write our college letters which was useful and told us about the college application process.



(Sreejay Pedapenki continued)

One of the most important parts of the internship was the visit to Genentech. At Genentech I got to see how scientists applied the theoretical concepts to make a real life product. This included observing cell cultures and making the bacterial base. At the pilot plant I was able to see how companies like Genentech were able to produce massive amount of cell culture to use for their research.

The last project I did in the internship was the final presentation, where my partner I concentrated on one gene and wrote an analysis paper about it. Our gene was PD-2 and we wrote about its gene pathways and targeted therapies that were associated with it. While writing this report we learnt how to conduct research with the gene databases and how to properly write a scientific report.

# Honorary Guest Speakers and Presenters

- Jagath Reddy Junutula - Introduction to Cancer Biology and Antibody Therapeutics
- Kiran Mukhyala & Suchit Jhunhunwala - Introduction to Bioinformatics
- Pradeep Fernandes - Cell Signaling/Systems Biology
- Bob Figari - Effective Content Development and Delivery
- Surya Sankuratri - Drug Development
- Pablo Garcia - Small Molecule Drug Discovery Kinases
- Sanjeev Redkar & Sreedhara Alavattam - Small/Large Molecule Manufacturing & Formulation
- Zora Modrusan - Cancer Diagnostics-NextGen Sequencing
- Ram Mandalam - Cancer-Stem Cell Therapeutics
- Ganesh Kolumam - Interplay Between Cancer and Inflammation
- Sukhmani Padda & Heather Maecker - Overview to Clinical Trials/Cancer Immunotherapies
- Aparna Gandhari & Raji Pingali - Preparing Effective College Applications
- Ravi Kiron & Sreedhara Alavattam - Business Development/Cancer-Nanoparticle Therapeutics
- John Storella & Margaret Dillon - Overview to Patents-IP//Regulatory Filings

# Acknowledgements

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## Editors:

Anisha Singh  
Bhavya Malladi  
Vidya Pingali