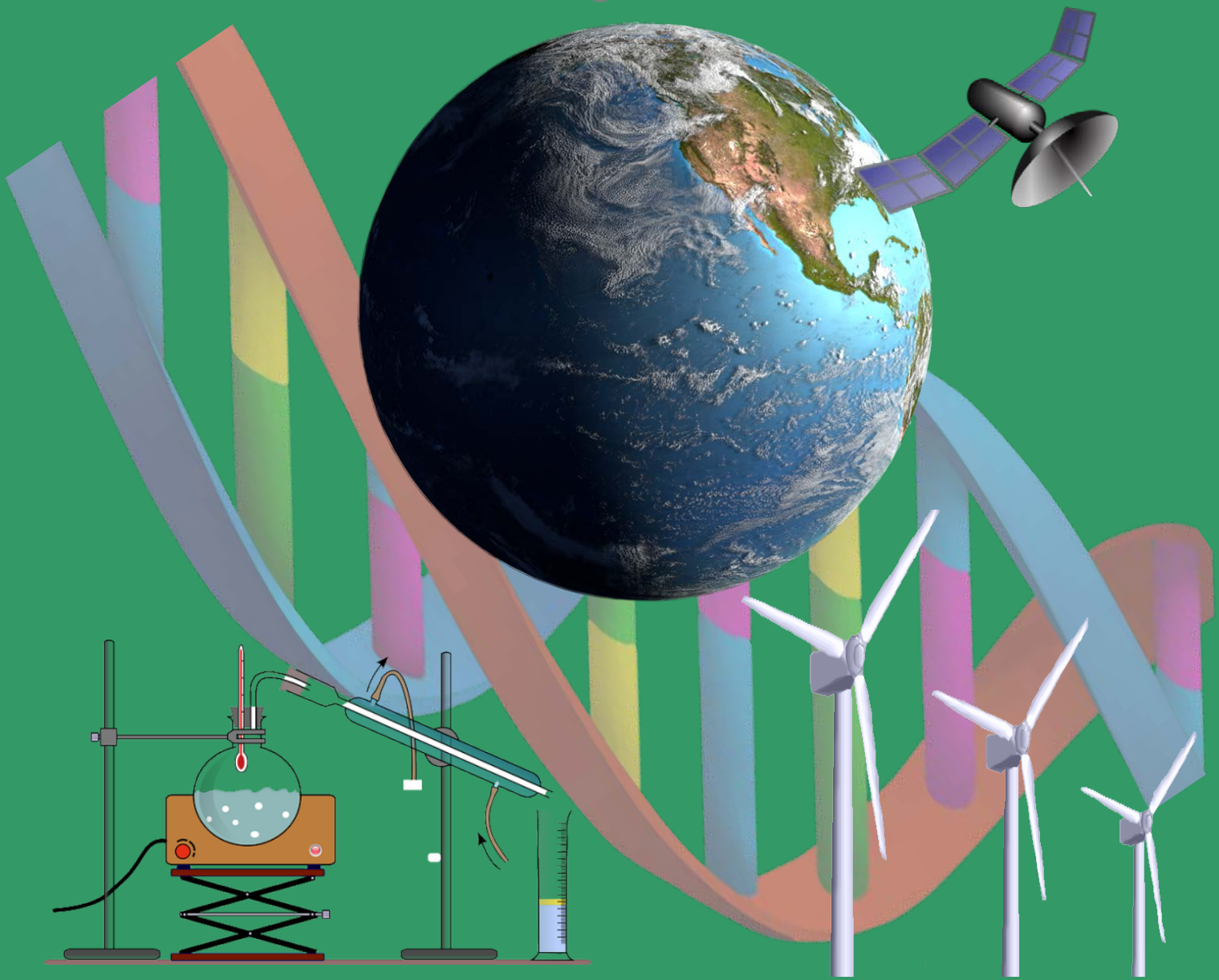
Science Symposium

"Where Creativity Meets Innovation"



ABSTRACT BOOK - 2017

Organized by
NBT Science Symposium Committee
(A Service Project of Agraj Seva Kendra)

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NBT SCIENCE SYMPOSIUM 2017

NBT
Science Symposium
Executive Committee

Gangadhara Rao
Vakkalagadda

Surendar Reddy Revuri

Sudharani Kanakanala

Govinda Rajan
CEO-Agraj Seva Kendra

Learn and explore the possibilities in STEM!

SPECIAL THANKS TO OUR SPONSORS

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- NY Life, Kris Padmanabhan

"The important thing is not to stop questioning. Curiosity has its own reason for existence. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery each day."

- Albert Einstein

Message

Gangadhara Rao Vakkalagadda

Dear Young Scientists and Friends,

I am honored to welcome all of you to the 2nd NBT Science Symposium, held here at the North Brunswick High School on the 7th of May, 2017. I would like to extend my sincere and warmest welcome to all of you. We held the 1st NBT Science Symposium last year for students from Grade 4th to 12th and I am proud to say that it was a great success, made so by the enthusiasm, commitment, support and dedication of all the participants, parents, sponsors, speakers, judges and volunteers. Each and every student that participated was a winner in science, whether or not their team won any award. It is extremely motivating and rewarding to see such an overwhelming response by young scientists this year again, and I am humbled to provide them a venue to explore and pursue their interests in science.

As promised last year, we evaluated our strategy to include children from lower grades and hence, this year, we have invited children from Grades 3rd to 12th to display their talents and research. This has encouraged a number of 3rd graders to participate.

Science and technology is all around us! Latest smartphones, apps, self-driving cars, breakthroughs in cancer therapy, and rocket science are just a few exciting examples. The last couple of decades have seen a tremendous revolution in science and the world is engulfed with ideas and innovations that are unprecedented! I would like to see North Brunswick School District students excel in various areas of science and technology and set standards for innovations of the future.

I want to acknowledge the efforts of the Executive Members of the NBT Science Symposium Committee, the Advisory Board and the numerous volunteers who helped make this event possible. I also want to recognize the continued partnership of NBT Science Symposium Committee (A service project of Agraj Seva Kendra), with the North Brunswick Board of Education and the North Brunswick Department of Parks, Recreation and Community Services, which makes this event unique and successful.

I wish every student a great success today and always! To repeat what I said in my address last year, “I hope you can reflect on this Science Symposium with a positive and inspiring sentiment later in your life!”

Thank you,

Gangadhara Rao Vakkalagadda
Chairperson, NBT Science Symposium Committee

Messages

Govinda Rajan

Dear Brothers & Sisters,

On behalf of Agraj Seva Kendra and NBT Science Symposium Committee (a service project of Agraj Seva Kendra), I welcome you all to the NBT Science Symposium 2017. This year marks first anniversary of the formation of NBT Science Symposium Committee. Our mission is:

- To provide an opportunity for students of North Brunswick Township School District to apply creativity and critical thought to the solution of science, technology, engineering, arts and mathematics (STEAM) problems beyond the confines of the classroom.
- To recognize the students for their talent.
- To enhance and improve competences in youth outcomes and academic and social skill development.
- To provide volunteering opportunities, making North Brunswick a livable community.

I wish good luck to all the participating teams. I extend my gratitude to all generous sponsors, volunteers, judges, speakers and distinguished guests. I congratulate Gangadhara Rao Vakkalagadda and his team for their tireless efforts in bringing out this wonderful event.

Thank you all for coming in large numbers and encouraging these budding scientists.

Sincerely
Govinda Rajan
CEO, Agraj Seva Kendra

Dr. Brian Zychowski

Dear Community Members,

Albert Einstein once said," I believe in intuition and inspiration. Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." The ***North Brunswick Township Science Symposium*** is an inventive environment that inspires students to be imaginative and creative. Students are being exposed to this rigorous challenge of creating science projects that they must present and defend. This educational endeavor captures the essence of Einstein's belief.

On behalf of the North Brunswick Township Board of Education, I would like to thank the NBT Science Symposium Committee for facilitating the ***North Brunswick Township Science Symposium***. I look forward to discussing the many projects with the student inventors. There will be educational excitement permeating throughout the high school that can only be produced by creative minds demonstrating scientific application.

It is with great pride and admiration that I express to all students and families best wishes for a successful program. I am confident that our students will continue to excel while meeting the highest standard of innovative learning.

Sincerely,

Brian Zychowski Ed.D.
Superintendent of Schools
North Brunswick Township Public Schools

March 30, 2017

Dear Gangadhara Rao and NBT Science Symposium Executive Committee,

I am pleased to know that the second annual NBT Science Symposium (Science Fair) will be held at North Brunswick Township High School on Sunday May 7, 2017. On behalf of the *Rotary Club of Plainsboro-North & South Brunswick* I extend our greetings to 'NBT Science Symposium Committee' on this occasion.

Your objective to encourage students in the North Brunswick School district by way of providing them a platform to showcase their expertise in the area of STEM and recognize their talent is a noble initiative indeed. It gives me immense pleasure to learn that you having an overwhelming response from the children from grades 3-12.

We at the *Rotary Club of Plainsboro-North & South Brunswick* share your passion of community service with a selfless attitude. As you know, Rotary is in the service of humanity and communities all over the world.

Recently we have completed several projects such as - Donation of food items to local township food pantries; Support to the annual "Ganesh Visarjan" event; Shoe Drive for "Soles4Souls"; and Volunteering at the STOP HUNGER NOW campaign.

On the international front, some projects we have supported are "Jaipur Limb" in India, "Homes for Hope" in Nepal and a project to provide books to Cape Town Schools in South Africa.

We wish the symposium and your organization success in this and future projects.

Sincerely,

Satish Vamburkar

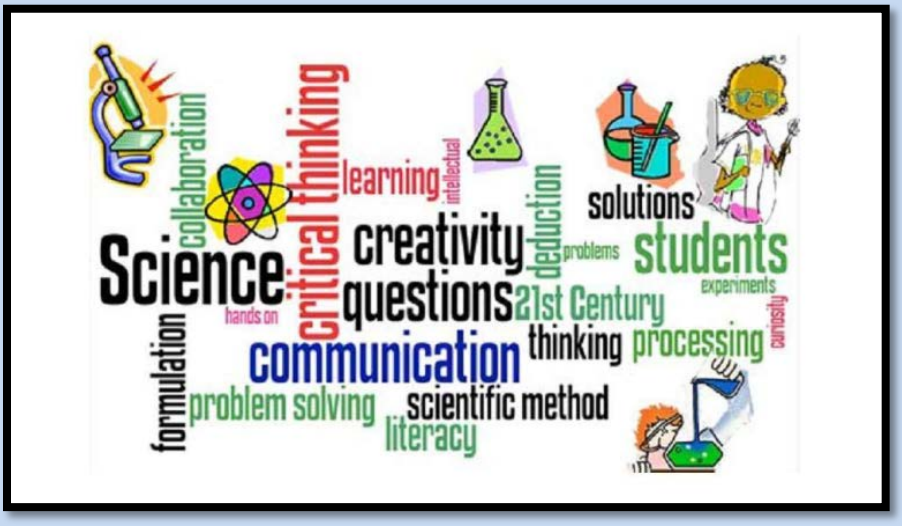
(Satish Vamburkar)
President
Rotary Club of Plainsboro-North and South Brunswick

Rotary Club of Plainsboro-North and South Brunswick
P.O. Box. 171, Kendall Park, New Jersey 08824
www.plainsbororotary.org http://rotaryfest.org/

NBT SCIENCE SYMPOSIUM 2017

Program Schedule

Time	Activity
9 AM to 10 AM	Participants to pick up the registration packages and setup displays
10 AM	Judging Sessions begin Room 1 Judges • Angela Swercheck • Stacie Oliveri • Madhusudan Reddy Room 2 Judges • Madhav Vasanthvada • Michael Kestlinger • Randy Dockens Room 3 Judges • Ed Szemis • Naresh Chintalacheruvu • Liliana Falzon Room 4 Judges • Vijay Reddy • Luci O'Reilly • Daniel Bachalis
1 PM	Welcome address by Gangadhara Rao Vakkalagdda Address by Dr. Brian Zychowski Address by Coleen Keefe Symposium Speaker Aditya Pandyaram Symposium Speaker Josh Baker Symposium Speaker Varun Garla
2 PM	Awards Distribution Vote of Thanks



NBT SCIENCE SYMPOSIUM 2017

Room 1 (Room # 420)

Team #	Team Name	Judging Time
153	Team Khanna	10.00 AM
152	Shine Science	10.10 AM
150	Electrifying Electrons	10.20 AM
149	Energy Producer	10.30 AM
146	Four Musketeers	10.40 AM
143	The Scientist Explorers	10.50 AM
142	Harry Porter Nerds	11.00 AM
141	Go Green	11.10 AM
138	AG Einsteins	11.20 AM
134	The Mathemagicians	11.30 AM
132	Junior Volcanologists	11.40 AM
131	LP3 Lightsabers	11.50 AM
129	Team Green	12.00 NOON

Room 2 (Room # 423)

Team #	Team Name	Judging Time
124	Team Electro	10.00 AM
122	Newtonians	10.10 AM
121	Wacky Wizards	10.20 AM
120	Whiz Kids	10.30 AM
119	Power Sources Team	10.40 AM
116	Melaphaine	10.50 AM
114	Electrons	11.00 AM
113	Team Tree	11.10 AM
110	The Einstein Minions	11.20 AM
108	Horizon Communication	11.30 AM
104	The Science Stars	11.40 AM
101	On Fire	11.50 AM

Room 3 (Room # 424)

Team #	Team Name	Judging Time
154	R.A.I.S	10.00 AM
148	Fab Labs	10.10 AM
147	SUL Labs	10.20 AM
144	MasterMinds	10.30 AM
139	Brains of Steel	10.40 AM
136	Brunswick Bros	10.50 AM
135	The Survivalists	11.00 AM
133	Hydro Girls	11.10 AM
130	The Hover Boys	11.20 AM
128	Team Emoji	11.30 AM
125	Blue Tide	11.40 AM
123	The Scanner Girls	11.50 AM
118	Simple Solutions	12.00 NOON
117	139 baker street	12.10 PM

Room 4 (Faculty Room)

Team #	Team Name	Judging Time
115	Visionary	10.00 AM
112	Ecofy Scientists	10.10 AM
107	Space Bunnies	10.20 AM
106	πr^2	10.30 AM
103	Golden Gals	10.40 AM
102	The Scientists of Tomorrow	10.50 AM
151	Team Rome	11.00 AM
145	Team Rocket	11.10 AM
140	The Unpredictables	11.20 AM
137	Double A Minders	11.30 AM
127	EPIX	11.40 AM
109	Nefarious Wizards 2.0	11.50 AM
105	INOV8 Tech	12.00 NOON

Abstracts

Elementary School Projects

Team: **On Fire (101)**
Title: DIY Lava Lamp
Participants: Penelope Jones and Brianna Ketrow

Objectives/Goals: Our goal is to make a working lava lamp from household items.

Methods/Materials: The materials we used were water, vegetable oil, a water bottle, food coloring and Alka-Seltzer tablets. We started by adding vegetable oil to ¾ of the bottle. Then, we added water to fill the rest of the bottle. Next, we put food coloring. We had to make sure we only put one color per lava lamp. We also had to make sure we only put 10 drops of food coloring. Last, we broke the Alka-Seltzer tablets into 4ths and put one in and watched our creation go! But, when the bubbles completely settle you have to put another tablet in.

Results: There was a bubbly, colorful, and successful creation.

Conclusions/Discussion: Based on the steps we did the creation was awesome. We spent lots of time having fun watching the bubbles form and go all around the bottle.

Summary: This project is a great idea if you're bored and you want something that you can do at home.

Team: **The Science Stars (104)**
Title: Potato Powered Prototypes
Participants: Devin Sanghvi, Milav Shah and Anish Vuthaluru

Objectives/Goals: Lights go out? Head to your kitchen and grab a potato! Our objective is to run battery powered electronics by potatoes. We are powering stuff with potatoes to show that batteries are not the only things you can power stuff with. Today we are going to power a clock, a calculator and a light bulb with potatoes and discuss the science behind it.

Methods/Materials: You need

- Potatoes
- Copper element like wire/a penny
- Galvanized nails
- Alligator clip assemblies
- Battery powered electronics (clock, calculator ...etc.)

To power something with potatoes:

1. Remove the batteries from the electronic
2. Insert one nail and one short piece of copper wire into each potato.
3. Use the alligator clips to connect the potatoes with battery powered item.
4. Check connections and……..BOOM!

Results: We powered all the prototypes successfully with potatoes.

Science behind Potato Battery: A potato battery is an electrochemical cell. An electrochemical cell is a cell where chemical energy is switched to electric energy by a spontaneous electron transfer. In the case of a potato, the zinc in the nail reacts to the copper wire. This is called Chemical to Electric Energy. The copper wire is the positive battery terminal (+) and the galvanized nail (zinc) is the negative terminal (-). For it to work, the 3 alligator clips have to connect the copper in potato 1 and the nail in potato 2, the nail in potato 1 and the negative battery terminal, and the copper in potato 2 and the negative terminal.

Conclusions/Discussion: Potatoes work as batteries. Lemons, oranges and limes also work. We are making this because it's a clean energy source. Potato batteries are more environmentally friendly. They are also biodegradable.

Team: **Horizon Communication (108)**
Title: Past, Present, and Future Communication
Participants: Brian Lin, Faith Lin and Karthik Parambath

Objectives/Goals: This study is to learn about ways people have communicated throughout the history and through the future.

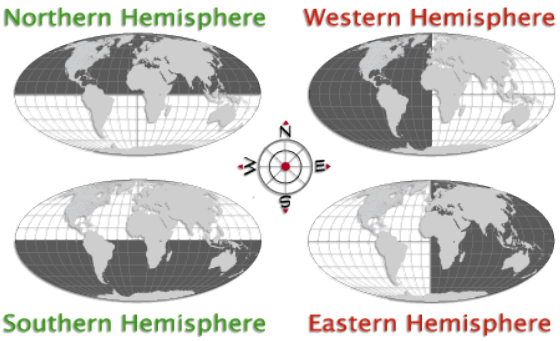
Methods: Horizon Communication will research different types of communication that existed, currently exist and we will hypothesize (predict) what will exist in the future. We will show photographs of these devices as well as provide descriptions. In addition, we will create three models for each time period. We will create a working telegraph, a wired phone system, and a model of how communication will occur in the future.

Results: All forms of technological communication need some kind of connection along with a power source.

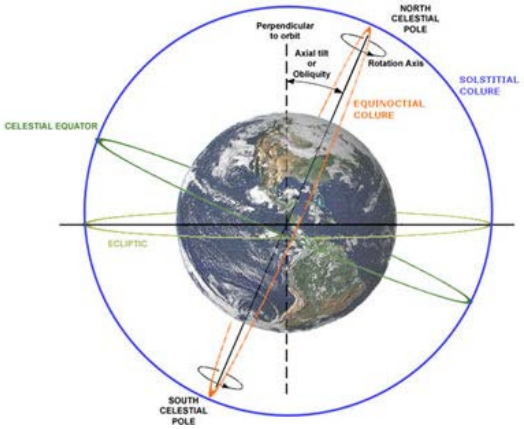
Conclusions/Discussion: Before 1753, communication did not need electricity. Before that time, people used optical (with eye) telegraphy, carrier pigeon, or pony express. After the use of electricity all modern communication required electricity to send and receive messages. This includes phones controlled by an operator, phones using a land-wire to cordless phones, computers, and cell phones. In an effort to predict what communication would be made available in the future, we concluded that communication devices can be inserted into the brain. It was determined that this could help people who have communication impairments such as individuals with Autism Spectrum Disorder, Speech, Language, or Hearing Disorders, and Multiple Sclerosis.

Team: **The Einstein Minions (110)**
Title: How and Why seasons Change
Participants: Anish Bokka, Atharv Rege and Mohit Pradhan

Summary: During the year, the seasons change depending on the amount of sunlight reaching the Earth as it revolves around the Sun.The seasons are caused as the Earth, tilted on its axis, travels in a loop around the Sun each year. Summer happens in the hemisphere tilted towards the Sun, and winter happens in the hemisphere tilted away from the Sun. As the Earth travels around the Sun, the hemisphere that is tilted towards or away from the Sun changes.



The hemisphere that is tilted towards the Sun is warmer because sunlight travels more directly to the Earth's surface so less gets scattered in the atmosphere. That means that when it is summer in the Northern Hemisphere, it is winter in the Southern Hemisphere. The hemisphere tilted towards the Sun has longer days and shorter nights. That's why days are longer during the summer than during the winter.
In general, the further away from the equator you travel, the cooler summer and winter temperatures become. At the equator there are no seasons because each day the Sun strikes at about the same angle. Every day of the year the equator receives about 12 hours of sunlight. The poles remain cool because they are never tilted in a direct path of sunlight. Much light is scattered by the atmosphere before reaching the Earth's surface at the poles. During midwinter, when a pole is tilted away from the Sun, there is no daylight at all. The sun never rises! However, during the summer, a pole receives sunlight all the time and there is no night.



Team: **Team Tree (113)**
Title: All About Trees
Participants: Kylie Mikita, Peyton Mikita, and Ashley Kouras

Objectives/Goals: Our goal is to let others into the world of trees to learn all about them. We hope you get to learn what you would like.

Methods/Materials: We chose to split up the project into 3 parts: 1 part for each of us. Ashley is going to talk about how to tell different types of trees apart, Peyton is going to talk about how you can tell how old a tree is, and Kylie is going to talk about what tree rings mean and what we can learn from them. We will each talk about our part by ourselves, but will answer questions together.

Conclusions/Discussion:: Through our research, we have found these things:
1) How to tell how old a tree is
2) What tree rings mean and what we can learn from them AND…
3) How to tell different types of trees apart

Summary: We have explained all about trees- How to tell how old a tree is, how to tell trees apart from one another, what tree rings mean and what we can learn from them.

Team: **Team Electrons (114)**
Title: Electric Circuits – Hearing Aids
Participants: Sibi Thiagarajan, Varun Ramanathan and Lukesh Mohindra

Objectives/Goals: This research was aimed at understanding what is current, how an electric circuit is formed and what are the necessary components to have a functional circuit. In order to make it useful for everyday life, we extended the circuit to perform an amplification function of sound to help the hearing impaired people.

Methods/Materials: Since the concept of electric current can be felt only in an electric circuit, the method we used, is to design a circuit that will have an indication of electric current, accomplishing a task, a practical and a useful one. Here in this circuit the sound waves are converted to electric signals using a microphone, amplified with the help of an Integrated circuit (IC) operational amplifier and then transferred to a speaker or headphone which transforms the electric current into sound signals, louder than before helping the hearing impaired to hear well.

Results: The results of our project helped us to learn that electric circuits are intriguing and since sound waves are part of the electromagnetic spectrum, electricity can be used interchangeably with sound waves to accomplish a practical and a useful purpose, in our case, a super hearing aid.

Conclusions/Discussion: Our project reiterates that electric current is a fascinating concept and can be used in various technical projects to accomplish something practical for everyday life. We further want to point out that the electric current, to be from a renewable energy source to keep the environment clean like in our project we have used rechargeable batteries for power source.

Summary: Our project affirms that electric circuits are inevitable part of everyday living which can be harnessed for many useful applications.

Team: **Melaphaine (116)**
Title: The Hologram Illusion
Participants: Melanie Romero, Stephanie Tom, Raine Sherman

Objective/Goals: The goal is to project an image with strong light onto a clear surface creating the illusion of a hologram.

Methods/Materials: The project we made is formally called a hologram pyramid. To make this you'll need: scissors, a CD case, graph paper, thin clear tape, a stanley knife, a ruler and an electronic device. First, take the ruler and draw a trapezoid on the graph paper, the trapezoid should have a width of 6 centimeters and length of 4 centimeters. Next, take your CD case and trace that trapezoid 4 times onto the plastic, and cut them out with your stanley knife (be careful not to crack the plastic). Then, tape the trapezoid together to make a pyramid shape. Last, pull up a hologram video and place the pyramid onto the middle of the video. Make sure no lights are on so you can see the image clearly on the pyramid, and turn your device's light all the way up. The images appear because the light in the hologram video reflects off each side of the pyramid.

Results: All of this causes the effect of a 3D image(hologram).

Conclusions/Discussion: In the end we discovered a different way to use a reflection. It's different because most reflections are in a mirror, water, etc. When we stand a clear object in the middle of light, that makes the reflections also stand up, making it look like a 3D image. The impact of the pyramid shape really causes the look of the 3D hologram. This happens because it has 4 sides, all showing a part of the image. That's why we called it The Hologram Illusion.

Summary: This project shows one way to create a 3D image with bright lights onto a clear surface.

"If you can dream it, you can do it."
- Walt Disney

Team: **Power Sources (119)**
Title: Lemon Battery
Participants: Ayse Pelin Ozturk and Hannah Gobena

Objectives/Goals: This project is aimed to find out how citrus juice works and to make electricity out of fruit.

Methods/Materials: The materials are 8 lemons, 8 pennies (or copper wire), 8 galvanized nails, alligator clips and a flashlight. 1. We rolled the lemon to make more juice. 2. We added 1 penny and 1 zinc nail to each lemon. Make sure they are not touching in the lemon. 3. We clipped each ends of the alligator clips to each penny and nail. 4. We clipped the last ends of the alligator clips to the copper wire in the flashlight and the other one to a zinc pole in the flashlight.

Results: The flashlight lit up as soon as we attached the alligator clips to the copper and the zinc poles in the flashlight.

Conclusions/Discussion: The zinc nail is an active metal, which reacts with the citrus juice in the fruit. The active ingredient in the fruit is positively charged ions. The copper makes the process of the flow. A transfer of electrons takes place between the zinc nail and the citrus juice from the fruit. The nails act as poles for the battery, one positive and one negative. Electrons travel from the positive pole to the negative pole via the alligator clips, generating enough electricity to the flashlight. Even though the flashlight lit up, with regular batteries the flashlight was super bright and with the lemon battery we made, the flashlight did not light up as bright. We found out that this can also work with an LED light.

Summary: This project attempts to determine if real fruit that has citrus juice in it can light up a low voltage light.

Team: **Whiz Kidz (120)**
Title: The Heart - Our Lifeline and an Incredible Machine
Participants: Aarav Yadav, Rohan Bhatia and Sahil Choudhari

Abstract: Our heart is very special, we are alive just because of the heart pumping blood to the body. It is shocking to know that heart disease kills more people than cancer, AIDS, and car accidents combined in the United States. This leads us to believe that the rate of deaths can be reduced by educating and bringing awareness. Most of us have heard about common heart diseases but are not aware that like all the other illnesses, our heart send us the signs of something being wrong too, but often due to lack of knowledge people don't understand those signals. The goal of this project is to understand the heart's structure, its functioning, its diseases and the cures. It aims to make us understand the signals that our heart is trying to give us. Alertness can help the incredible and vital organ function uninterruptedly throughout our life. Our project also highlights on successful treatment options available and recent innovations made in the field of Cardiovascular health. In this project, we are going to build and present a working model of a human heart that explains its functioning in depth and explains how it looks and works when healthy and otherwise. We will also demonstrate the CPR and home remedies that one could use before help arrives to the best of our ability.

Team: **Wacky Wizards (121)**
Title: Fun With Dry Ice
Participants: Naina Choudhari and Yash Choudhari

Objective/Goals: Our goal is to show people what Dry Ice is and how it can be used in the real world. In addition to having fun, we also learnt a lot of fun facts using this one simple ingredient.

Abstract: Dry Ice is carbon dioxide that has been frozen below -78°C in order to form a solid. We used Dry Ice in many different experiments out of which some worked great and few were just very messy. We made an air conditioner using an old bucket, some Dry Ice, a fan, PVC pipe and Duct tape. We also had a lot of fun making home-made delicious ice cream. This ice cream had a special fizz in it. A few other things we made were dry ice bubbles and a dry ice geyser. We also tried inflating a balloon using dry ice and it worked! We made really cool snake scales, heard screeching noises, and even frosted the outside of a glass. Instead of melting into a liquid, dry ice evaporates into a gas. Because of this feature it becomes very useful in normal, day to day life.

> "If you do not express your own original ideas, if you do not listen to your own being, you will have betrayed yourself."
>
> - Rollo May

Team: **Newtonians (122)**
Title: Newton's Laws of Motion
Participants: Nirek Shah, Sachit Arora and Anay Choudhari

Objectives/Goals: Objective of this project is to understand Newtons laws of motion and put them to test to see how they work in real life. We will deal with each law in its sequence.

Methods/Materials: We will perform the below experiments to prove Newtons each law of motion.

1st Law – Law of Inertia - We will build a car with a dummy sitting on it. When the car is in motion & stops suddenly, the dummy falls off the car. Then we put a seat belt on the dummy and this time when the car stops suddenly the dummy stays put.

2nd Law – Law of Motion- We will have 2 shopping carts of equal weights, one will be left empty and second will be filled with some mass. When equal amounts of force is applied to each of these shopping carts, they will accelerate differently based on their total weight.

3rd Law – Every Action has an equal and opposite reaction – We will build a balloon car to prove this law. This car (made from a plastic bottle) will be attached to a balloon. When the balloon filled with air is released, it pushes the car in the opposite direction of the escaping air.

Conclusions/Discussion: Newton's First Law of motion states that an object with no net force acting on it remains at rest or moves with constant velocity in a straight line.

Newton's Second Law of motion states that the acceleration of an object is directly proportional to the net force on the object and inversely proportional to the mass of the object.

Newton's Third Law of motion states that for every action there is an equal and opposite reaction.

Summary: After seeing and experiencing the above Newtons Laws of Motion, we can see how and why they were such an important discovery in rationalizing the world around us. We see each law working around us at every given point of time. It's just a matter of seeing them to understand them.

Team: **Team Electro (124)**
Title: Static Electricity
Participants: Pragya Rajesh, Abigail Connolly and Izabella Connolly

Objective/Goals: This study is aimed at demonstrating the concepts of Static Electricity.

Experiment 1: Dancing Balls

Materials: A tray, Aluminum foil, 4 wooden blocks, 6 Small Styrofoam balls, Polycarbonate Sheet and Cloth.

How it Works: The aluminum wrapped styrofoam balls were placed in the tray. Then the polycarbonate sheet was rubbed vigorously with a cloth. The rubbing makes the sheet pick up negatively-charged electrons from the cloth.This negatively-charged sheet attracts the positively-charged balls from tray.

Results: The balls stick to the bottom of the sheet. For a few moments they travel sporadically. When the top of the sheet is touched with a finger they start dancing around because of Static Electricity.

Experiment 2 : Stick Around

Materials: PVC Pipe, Cloth, Tape, Thread, Small wooden stick and Glass beaker

How It Works: A thread was tied to a small wooden stick and attached to the bottom of the glass beaker. Next, the beaker was turned over so that the stick hangs from the bottom of the glass. We then rubbed a cloth against a PVC pipe which transferred the negatively charged electrons. We held the PVC pipe close to the glass beaker and watched the hanging stick move.

Results: When you bring the PVC pipe close to the beaker the stick moves close to the PVC pipe and then away. This is because of the attraction of the negatively charged electrons on the PVC pipe.

Conclusions/Discussion: In conclusion this system can be used for pollution control by applying a static charge to dirt particles in smoke stacks.

Team: **Team Green (129)**
Title: Reduce, Reuse and Recycle
Participants: Aanya Muniyappa, Prahas Ramidi, and Anusha Vakkalagadda

Objective/Goals: The objective of this project is to convince people to start recycling. People can recycle milk cans, clothes, glasses, etc. We will show people that you can use available household materials to make items without the need to buy them, so saving money and the environment by preventing items ending up in landfills.

Methods/Materials: Team Green will be using common materials such as disposable containers, used clothes, etc. to create interesting and useful items that can be used at home.

Results: Various household items can be made by recycling common items.

Conclusions/Discussion: It just needs some thought, time and hard work to recycle and reuse common household items to make sure that these items do not end up in landfills. It is an attempt to save our natural resources and ensure that we keep the Earth clean for the future.

Team: **LP 3 Lightsabers (131)**
Title: Enlightening Experiments
Participants: Advaith Swaroop, Sunkalp Chandra and Samarth Sharma

Purpose: Multiple experiments involving light

Methods/Materials: Earth globe, light bulb, standalone electric socket with wires and switch, extension cord, golden foil, miniature Moon, small rod and thread for mounting Moon to the globe, large cardboard box for creating darkness with a viewing panel, materials for making periscope, kaleidoscope and light camera

Experiment 1: Show how the sun lights up the Earth and creates day, night and seasons

Experiment 2: Show different types of eclipses

Experiment 3: Show a periscope and explain its use

Experiment 4: Show a kaleidoscope and explain its use

Experiment 5: Show a light camera and explain how it works and is similar to the human eye

Team: **Junior Volcanologists (132)**
Title: Volcano Eruption
Participants: Lasenki Wijegunawardhana and Schayta Sharma

Objectives/Goals: Our goal is to show how a volcano erupts using a model. We will also explain the theory behind eruption. We want people to experience like they were in a volcano eruption. We also research about types of eruptions and shapes of volcanos.

Methods/Materials:
We used the following materials:

- ½ a cup of water
- ½ a cup of vinegar
- 2 tbs of baking soda
- A few drops of liquid soap
- Red coloring
- A plastic bottle
- Paper mache
- Brown and red paint
- Homemade clay

Results: The volcano erupted and blew because the baking soda worked with the vinegar to push the red mixture out to look like it was exploding. The soap gave a bubbly look which made it look like lava.

Conclusions/Discussion: Volcanos erupt because gas builds up inside the lava pushing the lava to the surface causing it to explode. This is what happened when the baking soda and the vinegar mixed. This is what we learned about volcano eruption.

Team: **The Mathemagicians (134)**
Title: Science of Circles
Participants: Pratyush Rajesh and Hael Raj

Objectives/Goals: Our objective is to educate the population on the many features of circles that we're missing out on. Also, these traits of circles are pretty cool. In a nutshell, we want the audience to experience the brachistochrone through tangential learning.

Methods/Materials:
Wood tracks, Balls and Camera

Discussion/Presentation: The brachistochrone is a way to get from one point to another point in the fastest time. Gravity and friction are still in effect but cancel each other out. We have wood tracks and marbles. The marbles will roll down the track and you, the judges, have to figure out which ball rolled down first. After you tell us your guesses, we will use a GoPro and use slowmo to reveal which ball rolled down fastest. A tautochrone is a feature in which anywhere on this track, a ball can roll down and reach the bottom at the same time as a ball on a different section of the track. The effect is all the balls will reach the bottom of the slope at the same time because of gravity and friction. You are able to put 1 ball, 1 foot from the bottom and 1 ball, 1 mile from the bottom,. The fact is, both balls will reach the bottom at the same time. An epicycloid is a shape being traced around the outside of another circle with a diameter in reference to the main circle itself. Examples include cardioids and nephroids. A hypocycloid is a shape being traced inside another circle. Examples are deltoids, asteroids, and the Tusi Couple. A trammel of archimedes is an ellipsograph.

Methods/Materials: First in the brachistochrone demonstration, we will make all the balls roll down a wooden tracks in the shapes of a brachistochrone, an L-shape with a slight curve, and a straight line from the top point to the bottom point and see which ball reaches the bottom the fastest. Next, in the autochrone, we make all the tracks, the brachistochrone track and put the balls at different points on the track. This should let them all hit the bottom at the same time. All of the brachistochrone tracks were made by carving tracks out of wood, by using a template created by a cycloid.

Conclusions: In conclusion, our presentation encompasses, not only the main topic of the brachistochrone, but also circles. It also includes the characteristics of these circles and their other correspondents, which we strive to introduce to the public. This is because all of these are cool and we think the public should know about this amazing mathematical concept.

Team: **AG Einsteins (138)**
Title: Why Do We Dream?
Participants: Gowri Bajagur and Anuva Kota

Objective/Goal: This study aimed to determine why and how human beings dream during their sleep.

Methods/Materials: Our methods includes researching established studies already done by various scientists on the study of dreams. Many scientist aren't 100% sure about the exact reason of dreaming, but they have many theories that are significantly close to the actual scientific explanation behind the actual reasoning. We are also keeping track of our sleep by reporting the duration, total sleep amount, how we feel when we wake up, do we remember our dreams, and what did we do before we went to sleep. Basically, overall we are trying to determine the results behind our curiosity of dreams. At our presentation we will explain why we are dreaming such things, and much more.

Results: Certain types of dreams occur to your mind during sleep, the things you dream about are mainly related to what you were thinking a lot during that day.

Conclusions/Discussion: In the end we learned more in depth of dreams. We learned that our dreams are mostly based on what we are thinking throughout the day. Think about your dreams in the past, I remember this one day I was playing with dogs a lot, that night I was dreaming about something related to dogs. I also remember when I went to frightfest one day, it was really scary, in my dreams that night, I was locked up in a haunted house alone. As you can see, dreams aren't just dreams, they have thought behind it.

Summary: Overall, we learned that dreams have much more to it, it's not as simple as you think. This shows us that the brain is a very complex organ.

"Do not go where the path may lead, go instead where there is no path and leave a trail."
- R. Emerson.

Team: **Go Green (141)**
Title: Organic Fertilizers
Participants: Akshita Krishnakumar and Harish Krishnakumar

Objectives/Goals:

- To promote the production and use of organic fertilizers which are renewable, biodegradable, sustainable and environmentally friendly.
- To create an awareness among people saying that by using organic fertilizers nutritious crops can be grown without effecting the soil fertility and microbial life.

Methods/Materials: Our plants need food: Nitrogen (N), Phosphorus (P), and Potassium(K) to grow healthy and strong. Usually fertilizers containing N-P-K are expensive to buy and we have tried simple ways of making it at home. We made a soil compost using vegetable and fruit scrapings. A liquid fertilizer was prepared using the following: banana peels (Potassium), eggshells(Calcium), black tea(Nitrogen), coffee grounds(Nitrogen), and grass clippings(Nitrogen). A grass tea extract was made by adding some grass to water and leaving it for a couple days which is a good source of nitrogen. Eggshells are 93% calcium carbonate and using egg shell powder to your potting mix gives healthy, beautiful fruits fit for seed saving. Even the milk residue will provide small traces of NPK. So, remember to rinse the milk can and use it for your plants. An organic fertilizer was also made by using Epsom salt (contains magnesium) – which encourages healthy plant growth and white vinegar – an inexpensive and effective fertilizer for acid loving plants like roses and berries.

Result: Organic fertilizers are slow-nutrient release to plants and that gives the soil the ability to hold more water, nutrients, and it improves microbial life. Organic fertilizers do not pollute the ground water and is safer to our environment.

Conclusion: Harmful chemicals destroy plant life. People choose organic fertilizers to feel closer to nature and keep their plants healthy. By doing so, we all can care for the environment, animal welfare, and nature.

Team: **Harry Potter Nerds (142)**
Title: Color Blindness
Participants: Ila Ranade and Abhigna Sala

Objectives/Goals: We heard that color blindness is more common among the male gender than the female gender. We decided to find out for ourselves by conducting a few tests and analyzing the results, because conducting tests are more fun than searching it up on Google. We decided to test a sample size of 100 people.

Methods/Materials: The materials that we'll use for the test are some Ishihara test plates. Ishihara test plates have a background with stone-like texture. A shape, number or letter are hidden in this plate. The shape and background are mingled making it hard to decipher the shape. During the test, the person being tested has to identify the shape or figure. If the person can't identify the figure, they might be color blind. If they can, then they're not color blind. To understand the causes of color blindness, we also studied the structure of the eye and how humans perceive colors.

Results: Test results of our experiment will be presented during the time of the presentation.

Conclusion/Discussion: Colorblindness is more common amongst males than females. From our study, we also learned that color blindness is hereditary. The X chromosome is the carrier of the color blindness gene. Males have xy chromosomes and females have xx chromosomes. For males if the X chromosome is a carrier of the color blindness gene, then they're color blind. Females, due to their X chromosome set up, have a lower chance of being color blind because if one x chromosome has the color blindness gene, but the other x chromosome doesn't, then the person will not be color blind because that chromosome is superior to the chromosome with the color blindness gene. Color blindness can also be hereditary and if your relatives have it, the chances are that you will have it too.

Summary: Color blindness is a hereditary disorder. Color blindness is caused due to the inability of red, blue or green cone cells to see that light. Depending on which of the cone cells lack the ability to perceive light, color blindness can be of different types like red-green, blue-yellow or monochromacy.

Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow.

-William Pollard

Team: **The Scientist Explorers (143)**
Title: Tornadoes
Participants: Siya Jain and Tisha Subhedar

Objectives/Goals: To study different types of Tornadoes, their cause and effects. The goal is to demonstrate how tornadoes can be formed.

Methods/Materials: Using 2 same size bottles of water and some soap/ food color we are able to simulate a tornado in a bottle. We also researched and used a hairdryer to give the effect of the tornado warning. We modeled a setting to show destruction caused by tornado. We used a shoe box, construction paper, paint/markers, toy car, play dough, crazy glue and scissors.

Results: We experimented with a wider slit, reducing by ¼" every time, down to ¼" to observe the effects on the shape and speed of the vortex. We also varied the height and position of the slit opening. All of these variations somehow change the character of the vortex. Each combination of "variables" affects the outcome. The proportions are important.

Conclusions/Discussion: Based on the research we did on tornadoes so far, too little updraft, too much updraft, too little inflow (too narrow a slit), too much inflow, at too low a speed, and no vortex will form.

Summary: This project attempts to simulate a tornado in a bottle and its causes and effects.

Team: **Four Musketeers (146)**
Title: Batteries and Food
Participants: Akshat Verma, Kailash Aravindhan, Madhav Narendra and Surya Vusthipalli

Objectives/Goals:

1. Batteries are everywhere, but how do they work? Goal is to demonstrate lemon battery to learn more about these very important devices.
2. Determine if picking up fallen food in five seconds or less prevents the transfer of bacteria from the ground.

Project:

1. Create a single cell battery using lemon, galvanized nail and copper plate or wire. Most metals are good conductors of electricity. Electrons will flow from the "-" electrode of a battery, through a conductor, towards the "+" electrode of a battery. Building more lemon batteries and connecting them with a metal wire from "+" to "-" adds the voltage from each cell.
2. The five-second rule states that food dropped on the ground will be safe to eat as long as it is picked up within 5 seconds of being dropped. This experiment will evaluate whether there is any truth to this theory using agar plates.

Results:
1. When two terminals of a voltage source (battery) are connected via a metal wire, the free electrons of the conductor drift toward the positive terminal, making them the electrical current carrier within the conductor
2. Bacteria are least likely to transfer from carpeted surfaces and more likely if moist foods make contact for more than five seconds with wood laminate or tile surfaces.

Conclusions/Discussion: As part of our lemon battery project we understood and proved that citric acid is a great conductor of electricity and for emergency people can resort to these simple easily available sources to charge their phones and digital clocks. In five-second rule project, we proved that the rule doesn't apply to all sort of food and all types of ground.

Team: **Energy Producer (149)**
Title: Energy Gizmo
Participants: Srihaas Chennavajjala and Gagan Voona

Objectives/Goals:
- A goal is to show the energy conversions in a simple and easily understandable mechanism.
- How to produce various energies with supporting each other.
- Interesting facts to know more about Mechanical, Kinetic and Electric energy.

Introduction: Energy Gizmo is a gadget designed to show energy conversions in a simple way. Energy Gizmo shows the energy conversions between kinetic energy, mechanical energy, electrical energy, potential energy, and light energy.

Methods/Materials: K'nex connector pieces, Pulley made from cardboard and bottle cap rings, Yarn, Toy car, Domino wrapped in tin foil, Push pins, Snap circuits, Thermocoil and Cardboard

Two pulleys are tied together with a yarn and placed on thermocol. Snap circuit is used to change pulley movement into electrical and light energies. Push pins are used to hold the circuit. So first we will start by explaining about the pulleys. The pulleys have potential energy because potential energy is stored energy and the pulleys are building up energy as we speak. When we pull the rope the pulley spins and converts potential energy to kinetic energy. Kinetic energy is the energy of motion. So the potential and kinetic energy converts to mechanical energy. Then the kinetic energy from the pulley pulls a toy car and the toy car is attached to a domino wrapped in tin foil. The car knocks down the domino creating kinetic energy. The domino falls on an open circuit therefore completing it. It creates electric energy from the flow of electrons. Also the light bulb from the circuit lights up and creating light energy. That is our energy conversions gizmo.

Procedure:
1. Pull a string to get the project into action
2. Then the string spins a pulley (made from cardboard cut outs and bottle cap rings)
3. That pulley spins another pulley
4. Next it pushes a small toy car into a domino wrapped in tin foil
5. That tin foil wrapped domino falls onto the two segments of an open circuit with a light bulb
6. The domino finishes the circuit and the light bulb lights up

Results: As predicted the gizmo displayed energy conversions (mechanical ->kinetic -> electrical -> light) successfully.

Conclusions/Discussion: The conclusion is that we are able to convert energy in different forms and makes the energy flow.

Team: **Electrifying Electrons (150)**
Title: Electric Circuits
Participants: Mukilan Chidambaram and Vaibhav Chari

Summary: The flow of electric current requires a closed circuit. In order for the electric current to flow, three important conditions must be met. One of this is the presence of the material, usually in the form of wire or cable that conducts electricity. This means that electrons can flow easily through the materials that are called conductors. In contrast, materials called insulators hold on to their electrons and resist the flow of current through them. The second requirement is the power source. Lastly, electric current requires a closed circuit. We designed a simple electric circuit, called the steadiness tester to learn and demonstrate the above three conditions. This circuit fulfills all the requirements of an electric circuit. The circuit we designed uses conductors that ensures electrons flows freely. The batteries that we have used in this circuit serve as the power source. The steadiness tester works only when the wire loop touches the tester. This act completes the circuit and hence ensures a closed circuit.

Team: **Shine Science (152)**
Title: Grow Salt Crystal
Participants: Smera Vijay and Jhanvi Singh

Objectives/Goals: We choose salt crystals because we liked how the way the crystals looked and experiment growing them. We also wanted to keep track of how the crystal grows and how it changes throughout the days with different temperatures (high and cold).

Methods/Materials: Epsom salt,Water, String, Pencil (Tying the String), Jar (for solution), Sponge, Spoon and Food coloring (optional)
1. Boil the water in a microwave or on the stove.
2. Remove the water from heat and add the Epsom salts. Stir the mixture until the salt is fully dissolved. If desired, add food coloring.

3. If you have floating sediment, you can pour the liquid through a tea strainer to remove it. Use the liquid to grow the crystals and discard the residue.
4. Pour the mixture over a piece of sponge (optional) or into a shallow container. You need just enough liquid to cover the bottom of the container. Tie a string to the Pencil and dangle it in the Jar.
5. For larger crystals, place the container in a warm or sunny location. Crystals will form as the water evaporates. For fast crystals (which will be smaller and delicate-looking), cool the liquid quickly by placing the container in the refrigerator. Cooling the crystals produces thin needles within half an hour.

Results: Larger crystals gets formed which is kept in a warm temperature. Fast and Smaller crystals get formed in a cooler temperature.

Conclusions/Discussion: The large swings in the temperature affects the crystal formation in the shape/ size/growth.

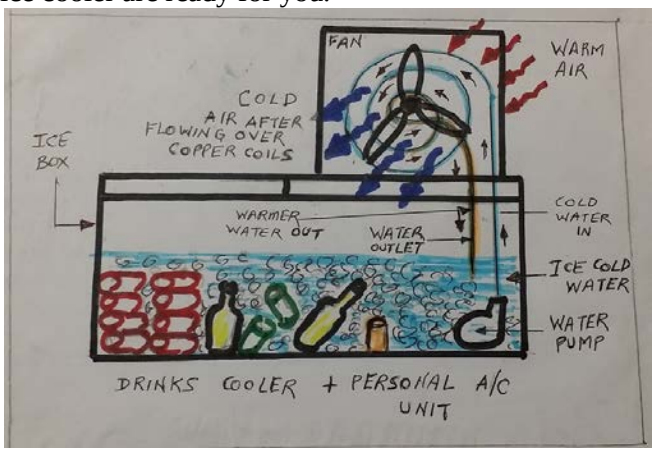
Team: **Team Khanna (153)**
Title: Eco-Friendly Personal Air Conditioner and Cooler
Participants: Prarthna Khanna and Vedika Khanna

Objectives/Goals: We would like to demonstrate the working of a portable battery operated device which can simultaneously work as a personal air-conditioner and ice cooler for use in the yard / beach / picnic / camps.

Materials:

- Battery Operated Fan
- Water pump for landscaping fountains (runs on 7.5 v battery)
- Drinks Cooler
- Copper Tubing

Procedure:
1. Fill the ice cooler with lots of ice, soft drinks and about half a gallon of water.
2. Run copper tubing around the fan. We used twisty ties from bread to secure the tubing to the fan!
3. We connected one end of the tubing to the water pump using a plastic tube. So, when we run the pump, ice cold water from the cooler will be pumped into the copper tube around the fan. The other end of the tube is an outlet, which is connected back into the cooler so that the cycle is closed. This cycle continues and keeps everything cold.
4. When the fan is switched on, air (which could be hot, since it's a summer day) flows over the copper tubes (which have turned ice -cold due the ice cold water flowing through them). The copper tubes immediately reduce the temperature of the air flowing over it and the cold air blasts out, pushing cold air on us. The ice and ice-cold water keep the drinks cool in the cooler.
5. Viola! Your very own portable air conditioner and ice cooler are ready for you.



Limitation: Ice is used as a coolant and this device can be used for a limited time depending on the size of the cooler.

Conclusions/Discussion: In an increasingly polluted world, we have created a simple machine that can work effectively without any emissions to pollute the air. This device does a double job: that of a cooler and an air conditioner. If you try, you can help save the environment with the smallest, simplest machines instead of big ones. We are working to save the world, one breath at a time!

Summary: This eco-friendly device uses ice cold water from the ice cooler as the coolant and uses battery power so it is pollution free. The ice cooler can be used to keep drinks and food cool on a hot summer day and simultaneously give a fresh blast of cold air to beat the summer sun!

> Innovation distinguishes between a leader and a follower
>
> - Steve Jobs

Middle School Projects

Team: The Scientists of Tomorrow (102)
Title: The Mrs. Fusion Home Energy Reactor: The Transportation of Tomorrow
Participants: Aanya Subhedar and Kirtana Krishnan

Objectives/ Goals: This team's goal was to design and model an environmentally-friendly city using renewable energy. We wanted to come up with innovative forms of transportation, and research which method was the most effective.

Methods/ Materials: Our team decided to compare electricity with electromagnetics, wind-power, and solar-power in order to find the most beneficial way of powering our city. To do this, we integrated wind-power by using turbines, that, when turned by the wind, will generate electricity using motors. Similarly, solar power will used to generate electricity, for the city as well as cars. Using solar powered cars can be effective if used in the right way. Solar energy can be turned into electricity and go directly towards powering the vehicle while also retaining some electricity for times when solar energy is not abound. The electricity generated in this city not only goes towards powering cars and home facilities, it will also power the roads. Our group wanted to have hovering cars. The roads will have coils of wires, and through them, we will make an electrical current flow through them. This will create a magnetic field that will be strong enough to support the weight of the cars.

Results: Solar power and wind energy were the most environmentally friendly and cost-efficient.

Conclusions/Discussion: After analyzing methods of energy and developing an ideal city that functioned with the least amount of environmental waste, we concluded that using solar and wind energy is the most effective way to power a city. Nonetheless, as energy is constantly evolving and the market is always changing, there is not an absolute conclusion to our research. Once you exclude variables such as these, our research is plausible.

Team: Golden Gals (103)
Title: Balloon Hovercraft
Participants: Sitora Chernobilsky, Vedika Shah, and Jessica Rajasekar

Objectives/ Goals: This project attempts to determine how much weight the balloon hovercraft can carry depending on how much support it has. For example, if there are two hovercrafts, they will most likely not be able to carry as much weight as four hovercrafts.

Methods/ Materials: The materials used are a hot glue gun, several old cd's (that are unneeded, because they will get damaged), Pop up cap (sports cap), push pin, tape.

The steps of making our balloon hovercraft is:

- First we take an old cd
- Then, we take tape and put it on top of the hole
- Next, we take the push pin and poke 6 holes in the tape, symmetrically
- After, we hot glue the pop-up sports cap on top of the hole.
- We blow up the balloon, twist the end of the balloon so no air gets out
- We place the balloon on the cap (make sure the cap is open and is popped up) and untwist it
- Lastly, we give the balloon hovercraft a push and it will fly across a smooth surface. We keep pushing the Balloon Hovercraft until all the air in the balloon is gone.

Results: The balloon hovercraft was triumphant. The balloon successfully glided across the surface.

Conclusions/Discussions: Based on our research, the bigger the balloon is, the longer it will be able to last. The lighter the object is, the longer the balloon can carry it. Future experiments could include stronger balloons, and the hovercraft being able to move on its own and quicker.

Summary: The point of this project is to connect four balloon hovercrafts, to make one big one. Another goal is for our hovercraft to carry objects around, although this will only work on smooth surfaces, such as tabletops.

Team: πr^2 (106)
Title: Hydrogen Fuel Cell
Participants: Akil Anthony, Ashwin Kumar, Gauri Banginwar and Sprihaa Singh

Objectives/Goals: This experiment aimed to create Hydrogen Fuel Cell(s) to create clean, renewable energy without harmful by-products, for a healthier environment

Methods/Materials: The materials used in this experiment were alligator clips, wires, beaker, water, salt, lead pencils, voltmeter, 9-volt batteries, switch, motor, and LED diode bulbs. First, fill beaker(s) with 12 ounces of water. Then, add 5 teaspoons of salt in the beakers, and mix into a solution of salt water. After that, tape two pencils (sharpened on both ends) in beaker(s), and insert into salt water solution. Next, clip two alligator clips onto the sharpened ends of the pencils that are protruding, and connect the other ends of the wires to the 9-volt batteries. Let it charge for approximately two minutes. Bubbles should be forming at this point. Unclip the alligator clips from the 9-volt batteries, and attach it to the two ends of the voltmeter to read the charge of the fuel cell. It should read about 2.36 volts. Finally, attach the clips to LED diode bulb(s), each to its correct wire. It should then light.

Results:
Using a 9-volt battery to charge the salt water solution, creates an electrical charge of approximately 2.36 volts.

Conclusions/Discussion:
Our study has shown, development in the field of making fuel cells. A fuel cell is a device that converts chemical energy from a fuel into electricity. Fuel cells' price can go to costing thousands. Our Hydrogen Fuel Cell experiment, has demonstrated a cheap way to make a fuel cell. Overall, our experiment exemplifies a clean, non-harmful energy, using a fuel cell.

Summary:
This study creates a low-costing Hydrogen Fuel Cell(s) to create clean, renewable energy, without producing harmful by-products, to reach our goal for a healthier environment.

Team: **Space Bunnies (107)**
Title: Mars Colonies
Participants: Chakshu Mittaln and Shriya Simha

Objectives/Goals: Our goal is to make the best colonies on Mars, so that it can be a place where humans can also spend their life.

Summary: In Mars Colonies Project, we will use, Cardboard sheets to make mars, and then paint it. Next, we will make colonies with doll furniture.

Team: **Ecofy Scientists (112)**
Title: The Eco House-Eco Farm
Participants: Chakshu Mittal and Shriya Simha

Objectives/Goals: Our goal is to utilize manure and the biomethane emitted from it. Manure, specifically farm animals, pigs, chickens, goats, and cows manure emits more than one third of greenhouse gases and warms the world 20x faster than carbon dioxide.

Methods/Materials: We created interview/survey questions. We went to different farms to gather information on how the farm disposes their manure, and if they use the biomethane gas. We were detectives and looked around the farm, in hope of more information and a visual on how manure gets used. We were surprised to find a lot more information about how each farm used their manure.

Results: We found that most farms don't really consider using the biomethane. But, they do reuse the manure as fertilizer or compost after all of the biomethane has been released. One farm aged the manure for six months and spread it on their vegetable fields as fertilizer, which actually helps the plants grow healthy.

Conclusions/Discussion: In summation, there needs to be better measures on using biomethane. Most farms think they are being eco friendly by reusing the manure as compost or fertilizer. We would like to highlight the opportunity to use the biomethane gas, instead of letting it harm the environment. On an average, farm animals for example, cows intake fifty-five pounds of food daily. Since they eat so much, they produce a whole lot of manure! Sixty-five pounds a day to be exact, and twelve tons in a year! To make good use of the manure, you can use 41 pounds of it, to get 1 pound of biomethane. As you can see, if we use the biomethane from manure, it will be beneficial for the environment and us humans too.

Team: **Visionary (115)**
Title: Solar-Powered 110v and USB Outlet
Participants: Sheel Dixit, and Anish Aluri

Objectives/Goals: Solar-Powered 110v and USB Outlet

Materials/Methods Solar panel, battery, Inverter, Conduit cords.

Results: Charged my iPhone, and laptop. It worked! This is a very convenient mechanism. It is a solar-powered USB, and outlet input. You can charge things like your phone, a tablet, computers, and even plug in a light! Additionally, this is solar powered, and is convenient because you will use less electricity. Therefore, you will save money, from using this. This is how our mechanism works, first the solar panel collects the solar energy, then the converter converts that solar energy into electrical energy, after that the electrical energy needs to be trapped, so it is captured in a

battery, then the inverter is powered by the electricity stored in the battery. Then, basically works like a regular 110v outlet, and passes electricity through whatever you plug in!

As mentioned earlier, this helps people and the environment. It reduces how much you have to pay for your electricity bill, since you are using solar energy (energy from the sun) collected by a solar panel. This also provides power just like a regular outlet! This reduces the need for harmful power plants that pollute the world and the sky. This is the importance of this mechanism.

Conclusion: In conclusion everyone should get this product. It is helpful to the environment and for you to. It will reduce the need for power plants and that leads to less pollution. It uses the sun's power to charge your electronics and power other stuff and that reduces your electricity bill. In the end you should get this product because it will be beneficial to mostly people.

Team: **139 baker street (117)**
Title: GMO v.s All-Natural: The Pros and Cons
Participants: Hima Vadlamani and Aayushi Naik

Objectives/Goals: It is well known that GMO has more negative effects than positive. However, the effects of GMO go far beyond just longer-lasting food. GMO foods can give you cancer, increases toxicity in your body, cause mood disorders, and more.

Methods/Materials: We are using GMO and organic corn to demonstrate the differences between the two. We list the pros and cons of both types of food. We are also using punnett squares to demonstrate how the alleles of GMO foods are passed on.

Results: GMO does eventually cause many diseases, along with cancer. However, there is an very small chance of this actually happening. Organic foods are preferable, and eliminate all chances of getting these diseases.

Conclusions/Discussions: It is definitely preferable to eat organic foods, but GMO foods are okay to eat.

Team: **Simple Solutions (118)**
Title: Finding pH of Drinking Water
Participants: Isha Shrivastava, Poojitha Kalasapati and Roshni Raghuraman.

Objectives/Goals: Check if pH level in our drinking water sources is neutral, acidic or alkaline.

Methods/Materials: Bottled water (various brands), Tap water (multiple sources), Camera, Safety goggles, Gloves, Log book, Plastic cups, Universal pH indicator solution and pH color chart.

1. Wear safety goggles and gloves.
2. Line up various water sources.
3. Place labeled empty plastic cups in front of each water source.
4. Fill plastic cups with 50 ml. of water (one cup for each water source).
5. Add 5 drops of universal pH indicator solution to each cup.
6. Mix well. Note the color change in the water.
7. Match the color with pH color chart. Record the pH value.
8. Take photos.
9. Repeat steps 4-8 for each water source.

Results:

Sample Number	Water source	pH	Neutral/Acidic/Alkaline
1	Poland Spring	7.0	Neutral
2	Smartwater	7.0	Neutral
3	Aquafina	5.5	Acidic
4	Sparkling	3.0	Acidic
5	Tap (Home)	6.5	Alkaline
6	Fiji	7.5	Alkaline
7	Tap (Linwood school)	6.5	Alkaline
8	Dasani	5.5	Acidic

Conclusions/Discussion:

- Drinking pure water is the best. But in our study, drinking water ranged from acidic to basic.
- Of the tested bottled water brands, Fiji was the most alkaline, while Sparkling water was the most acidic.
- Three sources tested best fit for drinking:
    - The pH level of Smartwater and Poland Spring was very close to neutral.
    - Interestingly, tap water was slightly basic.

This experiment has opened a whole new world of science to us. The water we drink is pretty healthy! Natural running water need not be best.

Summary: This project helped determine that various drinking water sources could be neutral, acidic or alkaline.

Team: **The Scanner Girls (123)**
Title: Finger Print Sensor Technology
Participants: Gia Dorawala, Leah Hughes and Sreenidhi Ravishankar

Hypothesis: We worked really hard on this finger scanner and we hope it will benefit other students. We are using our knowledge and making something we think is great. A big thank you to Gia for coming up with this amazing idea. We hope this project is successful and inspires kids to follow their dreams. Our project's goal is to stop loitering and horseplay in the hallways. It will help kids easily access their lockers efficiently. This project demonstrates scanner technology. This works because everyone has their own unique fingerprints and saves time in between classes. It will help kids be on time to class. It will be beneficial to all students. Our hypothesis was that the Fingerprinting locker would be most efficient. We based our hypothesis on recent studies that showed the Fingerprinting locker is a reliable electronic locker.
So in our project, we will be using a locker and a circuit. With the circuit, we will start programming it to our unique fingerprint. We will also use a finger scanner base. We are attaching the finger scanner base to the circuit board and will install our prints. We will use the fingerprint sensor instead of a lock. Our locker will be displayed with fingerprints scanner in a mini version.

Procedure: We took metal combination locker that is 5.9 x 5.6 x 4.8 inches and 1.1lbs weight in blue color to be tested how long it would take to open the locker. We took digital locker that is 5.6 x 5.5 x 7.3 inches and 1.1lbs weight in white to be tested how long it would take to open the locker. We took manual locker that is 4.2 x 4.2 x 10.8 inches and 1.5lbs weight in blue to be tested how long it would take to open the locker. We took USB wire, USB Serial converter, Finger Scanner and Connecting wires to be install on blue manual locker that is 4.2 x 4.2 x 10.8 inches and 1.5lbs weight. We took picture of all lockers to be tested. Once all of the lockers have been tested, we placed all lockers on the table to check which locker is the most efficient and quickly opens.

Results: The original purpose of this experiment was to determine which locker was most effective and saves time to open the locker. The results of the experiment were that Fingerprint scanner locker is the faster way to open the locker and it saves enough time in between classes.

Conclusions/Discussion: Our hypothesis was that Fingerprint Scanner Locker would be best and faster to open the locker than most of the combination and digital lockers. The results indicate that this hypothesis was correct. As you can see, based on our experiment, it is possible for technology to recognize unique fingerprints. We were inspired by apple technology on iPhones and the struggle of lives of students. We hope this will inspire kids to go for their dreams by getting on time to class. Students will feel safer because less bullying will go on in hallways. This may stop locker breakages and unsafe situations.

Team: **Blue Tide (125)**
Title: Better Water, Better Life
Participants: Anjali Aravindhan and Mariam Farook

Objectives/Goals: The goal of the experiment was to take lake water and decontaminate it to make it cleaner and usable. And to show and test the difference between filtration and decontamination.

Methods/Materials: Water Bottle, UV Lamp, Cell Phone, Sand, Pebbles, Coffee Filter and Lake Water.

To decontaminate the water, we started by getting water from a nearby lake and put them into water bottles, which then were boiled for some time, and also put under a UV lamp to decontaminate them. To show filtration we layered different types of sand, pebbles, and a coffee filter at the bottom of a top half of a soda bottle. Then we poured the water through them, and it was filtered. To prove the difference between filtration and decontamination, we built a cell phone microscope out of the camera of a cell phone, and checked that with an actual microscope.

Results: Decontamination is the inactivation or reduction of contaminants from surfaces by physical, chemical, or other methods to meet a cleanup goal. And our project showed results in decontaminating and filtering water to make it cleaner and safer us and the environment.

Conclusions/Discussion: Nearly every city, town, and waterside settlement discharges some type of pollution to surface waters . Human wastes that are collected in sewers and piped to municipal sewage treatment plants ultimately are discharged to surface waters as treated wastewater. Older systems with combined sewer and storm water systems discharge untreated sewage to rivers or lakes during heavy rainfall that overwhelms the drainage system. But in general, treatment processes remove solid material, many of the chemical pollutants, and then disinfect the treated sewage to kill disease-

causing organisms before releasing the treated wastewater to the receiving water body.

Team: **Team Emoji (128)**
Title: Optical Illusions
Participants: Alyssa Mikita, Stacy Rappolt, Gabriella Seiden, and Aruhi Vakkalagadda

Objectives/Goals: Optical Illusions are things that create false and misleading impressions of what's going on in reality, something that you seem to see but that is not really there. So the objective of this study was to evaluate if gender, age and/or prescription glasses have an effect on the optical illusion that the person is observing.

Methods/Materials: The materials that were used in this experiment were: optical illusion printouts and a custom questionnaire to capture the first perception by people when they viewed the illusion. Selected illusions were shown to friends, family and strangers. The questionnaire was used to record the perception and people's age category, gender and whether or not they wear prescription glasses. The effect of size of the optical illusion was also studied as part of the study, where the same illusion was printed in three different sizes and the perceptions were noted on the questionnaire.
The recorded data were then analyzed to see if gender, age category, prescription glasses and size of the illusion had any effect on the perception of illusions by observers.

Results: Based on the data available so far, no effect of gender, age category, prescription glasses and size of the illusion could be seen. More data will be collected before making any conclusions.

Conclusions/Discussion: Conclusions from the study will be provided at the presentation.

Team: **The Hover Boys (130)**
Title: Hover Shoes Debunked!
Participants: Caleb Samet and Collin S. Rizk

Objectives/Goals: How can a person hover above the ground? This study aims to show that you CANNOT use 9 volt batteries, wires and magnets and a steel beam on the floor to levitate. In addition, this study also aims to explore other ways you *can* levitate objects through the use of magnets, using mechanical constraint (pseudo-levitation) with our "Legolev" structure and diamagnetic materials or "Diamag" display.

Materials: Neodymium magnets, pyrolytic graphite, Lego Bricks, lift magnets, 9V Batteries, steel plate, wires, shoes, and a "willing test subject."

Results: The "hover shoes" video is fake.

Methods/Materials: In order to debunk the hover shoe video, we followed the step by step instructions. For the "Legolev," we created a simple structure out of Lego bricks and neodymium magnets to show the concept of pseudo-levitation. For the "Diamag" display, we put neodymium magnets together with a small piece of pyrolytic graphite to show how diamagnetic levitation works.

Conclusions/Discussion: When discussing magnet levitation, it is important to remember that Earnshaw's theorem proves that when using only materials like ferromagnetic iron, it is impossible for a static system to stably levitate against gravity. In order for an object to levitate using the force between the magnets, mechanical constraint is necessary for stability. Another way to achieve magnetic levitation is through diamagnetically stabilized levitation. Michael Faraday discovered that many materials exhibit a weak repulsion from a magnetic field. He coined the term diamagnetism. When placing a very light material like pyrolytic graphite or bismuth over a moderately strong permanent magnet, it will levitate.

Summary: Through our experiment, we determined that the video on hover shoes was fabricated. An object can levitate but only when using such sound scientific principles like pseudo-levitation and diamagnetic levitation.

Team: **The Hydro Girls (133)**
Title: Renewable Energy Project
Participants: Naachammai Ramu and Daksha Nair

Objectives/goals: In this project, we are going to make a water wheel, that is going to help us to harness different amounts of water to harness our on hydropower.

Methods/Materials: The materials we used were:
2-liter plastic soda bottle, Ruler, Marker, Craft knife/butter knife, Scissors, 2 corks, 1 wooden barbecue skewer, Sewing thread, Small objects to lift - eraser, paper clip, penny, pen cap, water bottle cap, Water can (homemade), Duct Tape, Large Funnel and Paper clips.

We first made our cork which will spin and generate energy. Then, we attached it to the funnel with paperclips and tape. This is our hydro-power generator.

It allows us to pick up objects. After that, we attach our small objects to the sewing thread and squirt the water on our generator to see if our generator picks up our objects. Our last step is to record the movements of our generator.

Results: Our hydro-powered generator was able to pick up the objects that we tied onto the sewing thread. Therefore, We can make an assumption that the cork-spinner picks up the energy from the force of the water and continues onward with it.

Conclusions/Discussion: Hydro-power was generated using the force of the water. This forced motion pushes the water down due to anti-gravity and gives a result of a continuous action. This continuous action permits the water to continue the cycle. Imagine the wheel on your bike. The only reason that keeps it going is the pedaling of your feet. Your feet physically push the pedals for the wheels to keep spinning. In a likely manner, the water is the source which pushes the wheel. Therefore, this allows the machine to pick up small objects using the thin sewing thread. In summation, this small action that we have assembled for you to view is called generating hydro-power.

Team: **The Survivalists (135)**
Title: Elemental Power
Participants: Chinmayee Latkar and Meghana Chintla

Objectives/goals: This study is aimed to determine which energizer best powers household commodities, to create an eco-friendly energy system.

Materials/Methods: Common materials, such as coins, tape, cardboard, and (optional) alligator clips were used to create the coin battery. Flour, salt, sugar, and water were used to create the dough. The fresh and saltwater batteries were created by using simple tap water, kosher salt and a cup. We chose tap water instead of purified water due to its added minerals. Finally, we used leftover soda for our carbonated drink battery. To determine the voltage of each "household battery", we hooked all of them to the alligator clips. After doing so, we first began to see what they could power. We started with a mini LED light, on to flashlight, and then a TV remote.

Results: The coin batteries surpassed the results, doing much better that the rest.

Conclusions/Discussion: Based on meticulous experimentation we have concluded that the home made batteries are one of the most effective forms of household energy. While water is a simple form of energy to power several appliances it is not always extendable to power the vast number of appliances as a battery. Physical research and literary analysis of previously performed experiments have demonstrated that the coin battery is the power source of the most competency. For these reasons, we have concluded that when put in a situation of survival, home made batteries are the most adequate and eco-friendly source of surrogate power. Future experiments could include testing the efficiency of heat power, wind power, and other elemental potentiality.

Summary: This project attempts to determine which natural homemade energizer, best powers general household commodities.

Team: **Brunswick Bros (136)**
Title: Safety Methods for buildings
Participants: Rajeev Achar and Sachin Gokhale

Objectives/goals: To create stable buildings to withstand earthquakes and reduce fatalities.

Materials/Methods: Battery operated motor, 2 layers of Styrofoam, Pipe cleaners, Rubber bands, Zipties, Metal washers, Shoe box/ cardboard, Styrofoam balls, Metal springs/ dampers, Legos and Jenga blocks.

We use shake tables to demonstrate an earthhquake causing severe damage to structures built with cheap material (such as what happened in Haiti). We may demonstrate a shake table with or without a battery operated motor (manually or mechanically). Our shake table has two layers of Styrofoam, we'll add two clear, plastic, flexible tubes in between them, and hold it together with rubber bands. Build three buildings (one poorly built, ok built, and well built) to demonstrate extent of damage and fatalities. Building with jenga blocks to show a poorly built building. Building with-styrofoam balls and pipe cleaners to create the form of a symmetrical building (for ok built building). This building features hang washers at the top center of building to show stabilization of the building and harnessing the top layer to the ground cause internal collapsion . Lastly we'll build a building of appropriate materials which will be constructed out of lego blocks showing a form that will withstand strong lateral forces

We'll add dampers then steel plates to form one layer and stack them to absorb vibration and we'll also Hang washers at the top center of building just like building 2(to show stabilization).

Results: The poorly built building will show a poor structure without any extra safety features (with jenga blocks). The second building will be made out of styrofoam balls and pipe cleaners to have a more stable and stronger structure, with a stabilization feature at the top. Lastly, the best building will be constructed out of legos to have the best structural support out of the three buildings, This building will have multi-layer dampers and steel plates at the bottom to absorb vibrations. it will also have the same safety feature that the second building had.

Conclusion/Discussion: According to our research , Graphene is found to be the lightest (one atom thick), and very flexible material known to man, yet a very strong metal. This material will help create a good material for dampers to absorb vibrations created from the earthquakes.

Summary: This project was to give an idea to provide better structures for reducing fatalities from destructive earthquakes. This also shows how buildings have advanced in the past, and should advance in the future.

Team: **Brains of Steel (139)**
Title: Unfolding Origami
Participants: Vedika Sengar and Miranda Byszynski

Objectives/Goals: Explore and establish how origami is related to science in the world around and within us.

Methods/Materials: In order to present our collected information to our audience we have used various methods such as pieces of informative text, physical demonstrations of origami, and explanatory imagery. Our method of finding information is through multiple types of thorough research. The materials used are various types of media and papers as well as a poster board to collectively present our gathered knowledge.

Results: Origami can be an efficient tool within science and can be used in many more ways than portrayed within the typical paper sculptures.

Conclusion/Discussion: The form of paper folding known as origami is one of the most resourceful systems in science, mathematics, technology, engineering, and art. Origami can be found all around us, as well as within us. This project attempts to examine and explore the ancient techniques of origami in a modernized way. Our project will explain the different ways we can use origami and how is has been used within our surroundings previously. Future and current ways of using origami can evolve in many ways that are yet to be discovered. It is up to scientists of the modern era to develop, use, and preserve these older techniques as well as improve them.

Summary: Overall, the idea of using origami for art and science has been in the past and is crucial to the technology to be used by our posterity in the future.

Team: **MasterMinds (144)**
Title: Home Automation with Internet Of Things (IoT) – Pressure Sensor Device
Participants: Karan Choudhari, Pranav Rana, Praney Hirpara and Shrey Jain

Objectives/Goals: These days, security needs to be extremely efficient and reliable. There are many robberies and carjacking's taking place, and we have just the solution to take care of this. Our product will help minimize these thefts and crimes, securing your personal belongings. Our goal is to build a vibration sensitive device which connects to the Wi-Fi and directs alerts to your phone and to the police when the vibration reaches a certain point. This will help the police to catch the crooks, and help keep your house and car safe.

Methods/Materials: The materials necessary to complete this project are the following:

- A Sensor Module Kit for Arduino Uno R3, Mega, NANO. This is a crucial part of our project because It is like 'the brain' of our project. It contains all the programming for our project to work.
- Auto-Ranging Multimeter. This will be used to check the current flowing through the device. An Arduino Microcontroller is necessary to connect all parts of our project together.
- Power supply module provides power.
- The Wi-Fi serial Transceiver Module is used to connect our device to the Wi-Fi, which allows it to wirelessly connect to a storage device and a server.

Results: In order to test if our project worked, we attached it to a sheet of glass and threw rocks at the glass. The result we were hoping for was that a message would be sent to the user. We successfully received the message, proving that our machine works.

Conclusions/Discussion: Approximately 2 million home burglaries get reported in the United States per year. The crime rates from 1960 to 2015 increased by over 100 million. This number is growing at an exponential rate. Thus, we hope that our product will make a difference in these statistics and even if our creation doesn't win, we still hope we are able to bring awareness to this idea in the future, to help mankind against miscreants of our world.

Summary: This project attempts to use the Smartphone with internet, Wi-Fi, and the help of vibration sensors as a connection to make security for your car, and home more reliable.

Team: **SUL Labs (147)**
Title: Inexpensive Solar Cell
Participants: Laasyasri Sandy Chennavajjala, Sanjana Vellanki, and Ujjayi Pamidigantam

Objectives/Goals: This project is to demonstrate how to make an inexpensive solar cell with fruit juice

Methods/Materials: In this project conductive glass, titanium oxide, fruit juice, paper clips, graphite pencil, Ziploc bag, and pipettes are the main materials used to create an inexpensive solar cell. The method involves preparing an anode and cathode with proper coatings of the fruit juice and titanium dioxide. Then assembling the solar cell and testing the solar cell.

Results: The solar cell fabricated in this project is an inexpensive alternative compared to that of the currently available silicon based solar cell.

Conclusions/Discussion: This is a great inexpensive alternative to silicon based solar cell.

Summary: This project attempts to determine that inexpensive solar cells can be manufactured as an alternative to the silicon based solar cell. This way more and more solar energy can be tapped and used in most parts of the world where there is water scarcity and where people cannot afford to buy electricity.

Team: Fab Labs (148)
Title: Green Plastic
Participants: Anjali Vellanki and Udgita Pamidigantam

Objectives/Goals: This project will show how to make a biodegradable plastic

Methods/Materials: In this project we used corn starch, glycerin, food coloring, water, cooking pan, spatula, and stove. We mixed the corn starch with water in required proportions. Then the mixture needed to be cooked on the stove until it forms a clear gel. We used glycerin as a plasticizer to reduce the brittleness of the corn starch plastic. We also used food coloring to produce the colored plastic.

Results: Green plastic/biodegradable plastic is successfully made out of vegetable starch.

Conclusions/Discussion: With this project, we proved that plastic can be made with biodegradable materials which are ecofriendly, unlike the plastics that are made from petro chemicals. These plastics that are based on petro chemicals take millions of years to decompose and hence harmful to our ecosystem.

Summary: This project attempts to determine that eco-friendly green plastic can be made out of vegetable starch.

Team: **R.A.I.S (154)**
Title: Electro-Magnetic Pulleys
Participants: Akshay Muniyappa, Isaac Chernobilsky, Robert Cannuni and Simon Chernobilsky

Objectives/Goals: Our objective during this project is to show how humans have evolved throughout the ages and to show how we believe the future will be affected with new technologies such as electro-magnetics.

Methods: We used the legos and the hand cranked toy elevator to how people originally used pulleys. We used the erector set to build a pulley system to demonstrate modern day technology such as the pulley systems in elevators. Finally we used the 2 transformers to show how the future of pulley systems may work.

Materials: Erector set, transformers, Hand cranked toy elevator and Lego™

Results: The electromagnets were used to show electromagnetic pull.

Conclusions/Discussion: We were able to to show how humans technology evolved by using pulleys as examples. These different pulleys show human technology past, present and future. We were able to show how with further technological evolution how everything was, is, and will continue to be much simpler. We showed how buttons, sensors, and electromagnets to show how when humans progressed the workload became less manual and more electronic/digital.

Summary: In conclusion, electromagnetic technology and electronic technology has developed and will continue to develop to match human needs and help to innovate certain tasks.

High School Projects

Team: **INOV8 Tech (105)**
Title: ERV(Emergency Rising Vehicle)
Participants: Ritika Anthony and Trinity Mills

Objectives/Goals: This study focused on using hydraulics to create an add-on feature in a vehicle to widen and raise up the vehicle body.

Introduction: Commuting brings traffic congestion to mind. Congestion can cause fatalities if ambulances, firetrucks or police can't respond on time. Can this issue be eliminated - introducing the ERV (Emergency Rising Vehicle).

Research: Numerous reports state that congestions block emergency vehicles resulting in fatalities - most recently at the country-wide anti-Trump protests in Jan/Feb 2017.

Materials: Syringes, tubes, water/oil, metal plates, extendable metal rods, DIY car kit.

Methods: Three hydraulic lifts were built using syringes of different areas. Metal plates were attached to the moving pistons while the fixed piston acted as the hydraulic cylinder. Tubes were attached for fluid movements between the cylinders. Two hydraulic lifts were attached horizontally to each of the rods which were connected to the wheels. The third lift was attached vertically under the body of the vehicle. On operation, the vehicle got wider and body rose allowing it to pass over another vehicle.

Results: The ERV could rise and drive past other stationary vehicles.

Conclusions/Discussion: Based on research and the results, traffic congestion has caused delays to responders and the ERV can definitely help in eliminating that issue. Risks include vehicle dropping when taking speed. I would suggest further improvements in the technical aspects of the ERV and try other mechanisms for hydraulics, comparing which is more feasible.

Summary: This project attempts to use hydraulics to create an add-on feature for a vehicle that will expand the wheel distance and raise up the body of the vehicle so it can pass over other vehicles during traffic congestion.

Team: **Nefarious Wizards 2.0 (109)**
Title: The Sphere of Life
Participants: Abhitej Bokka, Varun Chari, Pramod Mitikiri, and Ethan Lee

Objective: To create pseudo-lifeforms using household materials. We will explain how the complex behaviors of life can emerge from simple chemical properties.

Methods: Various chemicals can be used to create microspheres. The only requirements are that these chemicals are organic and amphipathic. In layman's terms, they must contain carbon and have both polar and nonpolar regions. The nonpolar regions of organic molecules are always trailing carbon chains. These areas are nonpolar because electrons are shared evenly in bonds between carbon and hydrogen. Nonpolar regions include oxygen and nitrogen because these atoms are greedy for electrons. These electronegative atoms unevenly share electrons in their bonds. When molecules have both polar and nonpolar regions, they are called amphipathic because they both attract and repel water (which is a polar molecule). Amphipathic molecules submerged in water form bubbles called microspheres, coacervates, micelles, or lipospheres based on their composition.

Materials:

- Safety goggles
- Lab apron
- Heat-protective gloves
- 500mL beaker
- Hot plate
- 125 mL Erlenmeyer flasks, 2
- Ring stand with clamp
- Balance
- Amino acid mixture (of at least six different amino acids)
- Glass stirring rod
- Tongs
- Clock or timer
- Saline
- 50mL graduated cylinder
- Dropper

- Microscope slide
- Coverslip
- Compound light microscope
- 1% sodium hydroxide (NaOH) solution

Results: The end result are spheres of organic molecules. These spheres have amazing properties. These bubbles represent the use of a cell membrane. You see, the cell membrane has an amazing property where it is semiperiphery. The cell membrane is easily able to allow passage for small molecules that are nonpolar. It does not allow passage for big/polar molecules since it would disrupt the order of the membrane, repelling the substance away, and not allowing passage. Our spheres also share other properties with cells. By adding more of the component chemicals to the bubbles, we can make the bubbles larger. We can even cause the microspheres to replicate by carefully pinching them in two.

Conclusions/Discussion: Living organism display a wide variety of complex behaviors. It may seem magical, confusing, and incomprehensible. These traits: growth, semipermeability, division, are the results of simple chemical properties. Biology still holds many secrets, like the origin of life. But, these secrets can still understood by knowing the principles behind them.

Team: **EPIX (127)**
Title: Uses of Robots in Medical Fields: MediBot
Participants: Khushi Arora and Tanya Bonde

Background: Hospitals use robots for many tasks all around the world. Pharmacists and Chemists can use the help of robots to mix and dispense medicines. The first known robot to be used in the medical field was in 1995, called Puma. This robot helped perform a prostate surgery on a patient, and it also placed a needle for a brain biopsy. Ever since this science development, the robotic world has been greatly improving for medical uses. Using this background and information, we have decided to create a prototype for a medical robot. In the upcoming world of technology, robots are a high demand due to their efficiency and precision of work.

Objectives/Goals: Our objective is to demonstrate the uses of robots in the modern medical world. In the project we researched the multitude of uses that robotics has in medicine. In addition we will build a robot which is meant to efficiently help doctors perform everyday procedures.

Methods/Materials: In this study research was used to create a prototype for a medical robot. That performs basic procedures such a blood work, vaccination, and is able to show patients medical records. In addition research was done on other way that robots could be used in the medical world such as surgery and pain perception.

Results: This study showed that robotics has a profound effect in modern medicine and that many basic medical tasks can be performed more precisely and effectively using robots.

Conclusion/Discussion: The aim of this project was to show how robotics can be integrated into medicine. The use of robots in medicine may become very prominent in the future. With the use of robots surgery can become more precise and safer. Vaccination can be done quickly and accurately to ensure patient comfort. In addition robotics can be used in pharmaceutical.

Summary: This project shows the many ways robotics can be used in medicine.

Team: **Double A Minders (137)**
Title: Water2Power
Participants: Anudeep Revuri and Ashwin Gokhale

Objectives/Goals: By using Water2Power, we can discover more ways to implement a basic technology into many different places.

Methods/Materials: To start our project we needed a galvanic cell, which we extracted from a water powered alarm clock that had a galvanic cell built into it, with nodes to hook up wires to it. We also got a soldering iron, with solder, in order to hook up the wires and LED's to the circuit. We also have a multimeter, in order to test the voltage that comes out of the galvanic cell. The overall cost for this project was $30.

Results: The galvanic cell was able to produce enough energy to light up an LED bulb.

Conclusions/Discussion: The galvanic cell (designed for the clock) outputs a small amount of electricity, and is not suitable for even a cell phone, but only for small devices, such as an LED. However, it is possible to build a generator that is larger, but much more practical, and economical. Water2Power can function as a large generator designed to work with seawater driven into the generator by tides, and for people who don't live near the coastline, and can use regular municipal water to generate electricity. It can be used in several places, where sunlight and energy are very rare, but water is plentiful, such as the North and South Pole. Another aspect of our project is to innovate it and enlarge the idea so that it can be used in larger projects such as powering a small village with electricity and to harness mother nature to gather and convert rain to power as well.

Summary: After getting the raw galvanic cell to the contact points, the LED was able to be powered, proving that the project does indeed work. Then, a large scale version of this project was theorized, and proven to work using science, technology, engineering, and mathematics.

Team: **The Unpredictables (140)**
Title: LFG, the Forgotten Power Source
Participants: Kusum Gandham, Laisa Duarte

Objectives/Goals: To find a better way to collect methane from landfill gas. The collection of methane is often flawed. We will be reverse engineering to create a new model.

Methods/Materials: A forgotten fact today is that landfills are providing one third of the energy. When we looked more into it we found some flaws within the system. We found out the wells that collect the methane can also collect other harmful chemicals. New expensive technology like a fuel cell (also known as CO2 wash) has a filtering technology that filters halogenated contaminants. But these contaminants must be incinerated. But we had the idea of putting those harmful contaminants into the leachate mixture which is evaporated by the LFG gas.

Results: The cleanest way to collect methane and other gases from landfills. And the concept of filtered gas can be put to use.

Conclusions/Discussion: In all honesty what we are proposing in not cheap. But paying more for the future lives of our society is what matters the most. Harmful chemicals and methane gas revealed into our atmosphere can increase the risk of cancer. We must do everything in our power to avoid it.

Summary: The fuel cell has brought the idea of filtering technologies. We built on that idea by putting the filtered waste along with the leachate. It is the cleanest way to help the society from the harmful things that comes from landfills.

Team: **Team Rocket (145)**
Title: Potato Chips Packaging
Participants: Yechan Kim, Surya Ananthu, and Kunal Bhatt

Objective/Goal: When left in the open for a long time, potato chips tend to go stale, becoming flexible and no longer having a "crunch" when bitten into. This worsens the taste of the chips, and in most scenarios, they go to waste. Our goal is to make the freshness of regular potato chips last longer, rather than going stale.

Methods/Materials: Our group left the potato chips open for a long time in order to see whether the chips would change. After 2-3 hours, we noticed that the chips were soft and flexible (stale). Then, we decided to perform an experiment in order to find a best bag material for the potato chips. In our experiment, we placed chips into bags with different materials. We used bags such as plastic bag, napkin, aluminum foil, and paper bags.

Results: We observed that napkins (tissues) were not able to keep the chips "crunchy" for a long time. Then,

the paper bag was the next material that made the chips soggy. Furthermore, Aluminum foil was another material that resulted in the chips being soggy. On the contrary, plastic bags were able to keep the chips fresh and prevent them from turning stale. After the experiment, we discovered that the plastic bag was made out of polyethylene, which is one of material that is contained in the potato chip bags.

Conclusions/Discussion: During this experiment, we were able to understand the science behind why chips go stale. We figured out that staleness is a direct effect of excessive moisture. In order to prevent sogginess, we figured out that we had to use special materials that were able to prevent the moisture from reaching the chips which was polyethylene.

Team: **Team Rome (151)**
Title: Artificial Pancreas
Participants: Meha Pandejee and Robbie Neumann

Objectives/Goals: The project that we have chosen was the making of a model of an artificial pancreas. Models of real artificial pancreas' are being developed now to aid people that have diabetes. However, such a device is a challenge to be constructed by modern day medical scientists. Since the goal of the artificial pancreas would be to automatically adjust a patient's blood sugar levels that would stop a diabetic person from having low/high blood sugar, such a device is proving to be a challenge to make. The objective of our project was to build a model of an artificial pancreas that displayed the challenges of getting such a device to work. The overall goal of our project, however, was to actually make the model function properly.

Methods/Materials: The materials we used were mostly electrical materials (breadboard, resistors, jumper wires, potentiometer, alligator clip, batteries, bare copper wire, blue indicators, liquid pump). The bare copper is best usage of getting the proper results of a pump. This is a procedure that requires a lot of patience because it does not always work. A diabetic patient uses needles on a daily basis for insertion of insulin, however compared to the pump a patient is less scared of the equipment. The materials were hard to obtain because they needed to be ordered from a corporation. The materials also provided variables for the experiment because if one thing from the circuit was broken, as a result, the entire procedure would not work.

Results: The first test we ran; the result was not very accurate. However, certain variables make the pump function in different ways. After multiple experiments, the results gradually got more and more accurate.

Conclusions/Discussion: More efficient parts and more advanced medical knowledge and experience would be beneficial to the making of a real artificial pancreas to benefit people who are actually diagnosed with diabetes. It is up for discussion about what to do if a pump was replaced with what is being currently used.

Summary: This project is making a replica of the pump and figuring out whether investing in a pump is the best option or actually discovering a mechanical pancreas.

"The most beautiful experience we can have is the mysterious. It is the fundamental emotion that stands at the cradle of true art and true science."

"There are two ways to live: you can live as if nothing is a miracle; you can live as if everything is a miracle."

"Why does this magnificent applied science, which saves work and makes life easier, bring us so little happiness? The simple answer runs: Because we have not yet learned to make sensible use of it."

- Albert Einstein

Meet the Speakers

Aditya Pandyaram

Aditya Pandyaram grew up in North Brunswick, NJ. He attended John Adams Elementary School, Linwood Middle School, and North Brunswick Township High School. While at NBTHS he was a captain of the school's Robotics team, which went on to win several competitions and engineering accolades between 2005 and 2007. Following NBTHS, Aditya pursued a Bachelor's degree in Electrical Engineering at the University of Illinois at Urbana-Champaign, and a Master's degree in Computer Science from the Georgia Institute of Technology. During his college years he was involved in artificial intelligence and distributedpower systems research.

Aditya has worked in a variety of roles throughout the years, ranging from large companies to startups. While at General Electric he worked in several industries including Smart Power Grids, Oil & Gas, Locomotives and the Internet of Things (IoT). He's held roles in software development, data science, embedded systems design, and product management.

Currently in NYC, Aditya is the VP of Product at Troops (www.troops.ai) - a venture backed Artificial Intelligence startup that has raised $10MM to date. He also serves as a Venture Partner at Indicator Ventures (www.indicatorventures.com), a seed stage venture capital firm with technology investments across the US. Outside of work, Aditya has a deep passion for the democratization of STEM education, which led to the development of Intellection Institution (www.intellectionnj.com) - a 501(c)(3) NBTHS alumni founded nonprofit that provides underprivileged students with the requisite supplies, mentorship, and financial support to succeed in STEM careers.

Varun Garla

Varun has been a certified EMT for the past 8 years. He joined the Marlboro First Aid Squad in 2009 as a Cadet (Junior EMT) in high school and became a Regular Member in 2011. He has a strong passion for helping people and giving back to the community. During his time as an EMT, he used to drive the ambulance and first responder vehicles while on call. Varun has responded to the scene of a patient in cardiac arrest where he performed CPR and recieved a lifesaving achievement pin. He continued his membership at Marlboro First Aid throughout college on Active Student Leave while riding on weekends. Varun holds a bachelor's degree in Finance from Rutgers Business School and is currently a Consultant at GEP (formerly known as Global e- Procure) based out of Clark, NJ. Varun has run three half marathons, several 5K's and recently a 200 mile Ragnar Relay Race which was a 48-hour race throughout Michigan. Varun used to weigh close to 200 pounds in high school and found that the best way to stay in shape was to develop a passion for running. Training to run a marathon can take several months of consistent running. Running helps him practice time management skills since he needs to create goals and stay on target to achieve them every week. In terms of his diet, running is the key to keeping his body in shape since he needs to stay away from his favorite chocolates and fatty foods. In his free time playing golf and traveling. Varun currently resides in Marlboro, NJ.

Josh Baker

Josh Baker started his career in pharmaceutical market research before realizing his true passion was finding innovative digital solutions to everyday problems and galvanizing others around the product. He transitioned into the role of an entrepreneurial product manager where he had the opportunity to inspire others to help bring his mobile app ideas to market. He loves the creative process of watching his ideas take shape and reaching out to users to learn where a product can be improved.

Judges At A Glance

Angela Swercheck

Miss Angela Swercheck, Fifth grade teacher, is delighted to be a judge for the Science Symposium this year. Miss Swercheck has always had a passion for Science. Growing up, Angela participated in S.I.G.H.T. Science competitions. Currently, Miss Swercheck is completing her Masters in Middle School Science. Miss Angela Swercheck has enjoyed teaching Science at Judd Elementary School for the past nine years.

Dr. Madhusudan Reddy

Dr. Reddy obtained M.Sc.in Chemistry from Osmania University, Hyderabad and Ph.D. from National Chemical Laboratory, Pune, India in year 1990. He has worked at Imperial College, London and University Laval, Quebec as post-doctoral fellow on projects to develop the selective absorbents and catalytic materials for fine chemical processing. He moved to USA in 1994 and served as a research faculty at Energy & Fuel Research Center, PennState University where has taught graduate course on catalytic materials and also worked on multiple research projects in the development of catalysts for fuel processing. All through his research career Dr. Reddy has published multiple research papers in international journals and filed patents in various countries. The Council of Scientific and Industrial Research (CSIR), India has recognized him for his patent on the material and process for the selective cracking of hydrocarbons for the dewaxing process of petroleum processing. Dr. Reddy is currently working at the Consolidated Edison of New York.

Dr.Luci O'Reilly

Dr. Luci O'Reilly is currently a faculty member of the North Brunswick Township High School Science Department, where she teaches chemistry at both the College-preparatory and the Advanced Placement levels. Dr. O'Reilly received her doctorate in Molecular Biology and Biochemistry from The University of Medicine & Dentistry of NJ's School of Biomedical Sciences (Piscataway), where her research focus was the interaction of retroviral particles with the host cell. Dr. O'Reilly is also an alumnus of Rutgers College (New Brunswick, NJ). Prior to receiving her doctorate, Dr. O'Reilly worked in both academic and biotechnology/pharmaceutical laboratories and has taught at the college level.

Daniel Bachalis

Dan Bachalis is an Informatics Analyst in the Translational R&D IT department of Bristol-Myers Squibb, supporting Clinical Pharmacology and Pharmacometrics. With a bachelor's degree from Rutgers University in Chemistry and Biology, Dan has worked across the pharmaceutical industry starting as an analytical chemist, through instrumentation and automation, validation and regulatory work, to his current position in IT and informatics. In his downtime, Dan enjoys motorcycle riding, skiing, amateur carpentry and home improvement.

Stacie Oliveri

I have been teaching in North Brunswick for 20 years. I have taught second, third and currently fourth grade. I am on both the math and science committees for the district. I am also in my fourth year with the CNJ PEMA project where our district has partnered with Rutgers University taking graduate classes to enrich both math and science in our classrooms.

Michael Kestlinger

My name is Michael Kestlinger and I am a physics teacher at North Brunswick High School. I graduated Monmouth University with a Bachelors in Chemistry and Secondary Education, with a Physics Minor. I am currently continuing my education by pursuing a Master's degree from Montclair University. This is my second year being involved with the Science Symposium and I still think back to some of the investigations and experiments that students did last year. I feel honored and privileged to be involved in a community event that is as impressive as the Science Symposium. Nothing brings me more pride as a teacher having the opportunity to watch children embrace the concepts of science and engage their curiosity. I very much look forward to all that awaits from the children of North Brunswick.

Dr. Madhav Vasanthavada

Dr. Madhav Vasanthavada is a pharmaceutical professional with over 13 years of experience in oncology marketing, oncology sales, market access, strategy and R&D functions. In his current role as Deputy Director at Bayer Oncology he is responsible for managing growth of a prostate cancer brand in the US.

Madhav started his career as a scientist in Novartis' Pharmaceutical Development division in New Jersey developing new chemical entities into marketable products. During his 5 years at Novartis, he worked across the pre-clinical, clinical development and manufacturing phases together with cross-functional teams in the US and Switzerland. His work resulted in commercialization of two flagship cardiovascular products as well as multiple scientific publications and patents.

Madhav moved to the commercial side of pharmaceutical industry following a full-time MBA training. He joined Bayer Pharmaceutical and worked in a variety of commercial roles over the last 7 years - starting as a strategy consultant, 'chief of staff' to the Bayer U.S. President, Head of Pricing, Reimbursement and Patient Assistance; and held sales and marketing managerial positions launching new oncology brands. He is passionate about developing innovative products that meet the needs of customers and patients, particularly in the field of oncology. Madhav has a Ph.D. from The University of Rhode Island and an MBA from Harvard University.

Ed Szemis

Ed Szemis has been programming computers since his first day of high school in 1972. He was valedictorian of his high school class in 1976, and graduated with honors from Clarkson University with a BS in computer science. He has worked on Wall Street since graduation, first as a consultant, and later for Merrill Lynch and Bank of America. During his time working with computers and financial systems he has seen many changes, including Ethernet based local area networking, distributed processing, relational databases, the internet, artificial intelligence, and object oriented programming. He lives in West Windsor, has been married for over 30 years, and has three sons ages 26, 24, and 19.

Dr. Liliana Falzon

Liliana Falzon is a science teacher at North Brunswick High School. After graduating with a Bachelor's Degree in Biology and Chemistry from the University of Malta, EU, she moved to the United States to further her studies at the University of Mississippi Medical Center, where she received a Ph.D. in Biochemistry. Her thesis work involved the Kinetics of Enzyme Action. In 2002, she was offered a Postdoctoral Fellowship at the Biochemistry Department Robert Wood Johnson Medical School, where she studied the kinetics of protein folding/misfolding with Prof. Masayori Inouye, a world-renown protein chemist. In 2010, she started the Alternate Route to Teaching program to pursue full-time teaching, and she has been a chemistry teacher at North Brunswick High School since 2015.

Dr. Vijay Reddy

Vijay Reddy, PhD, is a Principal Scientist in the Department of Pharmacokinetics and Drug Metabolism, Merck Research Labs, Kenilworth, NJ. Dr. Reddy obtained BSc degree from Osmania University, Hyderabad, MSc degree from Kakatiya University, Warangal, and PhD degree from the Indian Institute of Science, Bangalore.

Following post-doctoral research at Oregon Health Sciences University, Portland, OR, Dr. Reddy joined drug discovery group at Merck Research Labs in 2000. His research is focused on the discovery of novel therapeutics for the treatment of diabetes, obesity and other metabolic diseases.

In addition to his research activities at Merck, Dr. Reddy is also passionately involved in health education, disease prevention and exploration of alternative treatment options.

Naresh Chintalacheruvu

Naresh Chintalacheruvu has a Bachelor of Engineering from Vasavi Engineering College and a Masters (MS) from New Jersey Institute of Technology (NJIT), USA.

Naresh Chintalacheruvu has been working for AT&T for more than 20 years, where he is responsible for a team who delivers Quotas, Results, & Performance Analysis for the sales operations infrastructure. The team provides process and systems development, training, financial modeling, quota setting, forecasting, results tracking and analysis, as well as attainment calculations at all levels for sales compensation. He is also a recipient of AT&T ACE Award for Achievement, Creativity and Excellence.

Naresh lead an AT&T Finance Shared Services Technical Council whose mission is to support technical resources within Finance Shared Services organization by collaborating, networking and sharing ideas. He served as an AT&T training lead for Leadership Excellence And Development Program (LEAD) on technology training courses. This training program was designed to excel finance management employees in technology, network engineering, and strategic planning areas.

Naresh is serving as a Director for Lead India 2020 which is a non-profit organization. Lead India 2020 is

an NGO with a mission to empower 540 Million youth of India as responsible citizens through value-based education and "Aap Badho Desh Ko Badhao - ABDB" leadership training to realize a developed India by the year 2020. This is initiated and guided Dr. A.P.J. Abdul Kalam, the former president of India.

Dr. Randy C Dockens,

Randy C Dockens, PhD, recently became the Clinical Operations Lead regarding Phase 1 studies for a group with Bristol-Myers Squibb (BMS) which covers assets within cardiovascular, fibrosis, and immunoscience. Prior to that he was Group Director for Clinical Pharmacology Scientific Operations (CPSO) within Early Clinical & Translational Research (ECTR), Bristol-Myers Squibb (BMS). He led three groups within CPSO: Clinical Pharmacology Analysis and Reporting (CPAR) which handles the non-compartmental pharmacokinetic analyses for early and late phase studies conducted by BMS, Clinical Pharmacology Operations (CPO) which is a group of Study Directors that guide the development and reporting of clinical pharmacology studies that are outsourced to preferred providers, and Data Sciences (DS) composed of several data scientists and programmers who prepare datasets for pharmacokinetic and pharmacometric analyses and data visualizations for translational research and development (TR&D) teams. He received his B.S. in Pharmacy and Ph.D. in Pharmaceutics from Auburn University, AL. Before joining BMS, he worked as a Pharmacokinetic Reviewer with the Food and Drug Administration (FDA) for 4 years in the Division of Biopharmaceutics and the Pilot Drug Evaluation Group responsible for anesthetics and pain management. He joined BMS in 1991 with the Metabolism and Pharmacokinetics Department and was later migrated into Clinical Pharmacology and Pharmacometrics within ECTR, and more recently transitioned into his current position. During his 26 years at BMS he has worked in several therapeutic areas: Cardiovascular; Metabolic Diseases and Neuroscience. Most projects have been in Neuroscience in such therapeutic areas as anxiety, depression, and Alzheimer's Disease. He now works across therapeutic areas within his current role which supports all therapeutic areas, excluding immuno-oncology, on several operational fronts.

Thank You Volunteers

The NBT Science Symposium Team would like to thank all the youth and adult volunteers who helped make this community event possible.

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