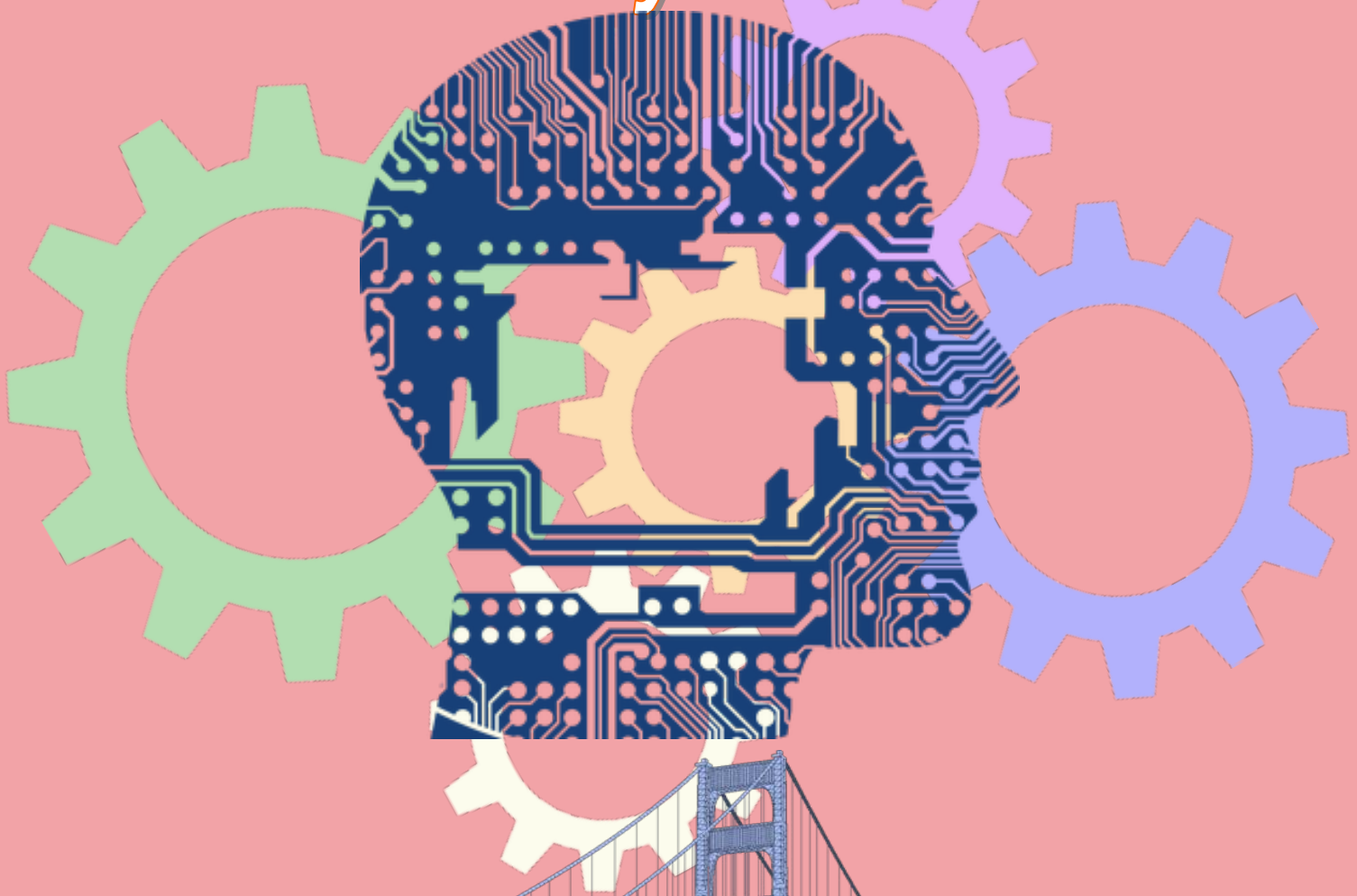
Science Symposium

"Where Creativity Meets Innovation"



ABSTRACT BOOK - 2018

Organized by

NBT Science Symposium Committee

(A Service Project of Agraj Seva Kendra)

SCIENCE SYMPOSIUM

NORTH BRUNSWICK

We cordially invite everyone to the
4th NBT Science Symposium
to be held on

Sunday, May 5, 2019

North Brunswick Township High School
98 Raider Rd, North Brunswick, NJ-08902

Registration Deadline Feb 4, 2019

Please visit our website:
www.nbtscientists.org
Contact: sciencenbt@gmail.com

Presented by: **NBT Science Symposium Committee (A Service Project of Agraj Seva Kendra)** in Association with North Brunswick Board of Education and Department of Parks, Recreation & Community Services, North Brunswick

NBT SCIENCE SYMPOSIUM 2018

NBT
Science Symposium
Executive Committee

Gangadhara Rao
Vakkalagadda

Surendar Reddy Revuri

Sudharani Kanakanala

Govinda Rajan
CEO-Agraj Seva Kendra

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Learn and explore the possibilities in STEM!

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- British Swim School Central Jersey
- Cici's Pizza, North Brunswick
- Intellection Institution
- Ms. Jhansi Reddy
- Mr. Michael Lin
- Rotary Club of Plainsboro, North and South Brunswick

"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,

It gives me immense joy to welcome all of you to the 3rd annual NBT Science Symposium, held at the North Brunswick High School on the 6th of May, 2018. I am proud to say that the past two years have been a tremendous success, made so by the enthusiasm, commitment, support and dedication of all the participants, parents, sponsors, speakers, judges and volunteers. As I do every year, I would like to reiterate the thought that "each and every student that participates is a winner, whether or not their team wins an award." To elaborate, the time spent on these projects, the thinking process, the scientific approach, discussions, analyses and the presentation on the day of the event are experiences that are like trophies that they can display throughout their life! It is extremely motivating to see such an overwhelming response by young scientists three years in a row, and we are humbled to provide them a venue to explore and pursue their interests in science.

We are very happy to announce that this year, we have partnered with "Intellection Institution" to bring some added incentive for high schools students to join us in bigger numbers. Intellection is a nonprofit organization that was founded by our own North Brunswick Township School Alumni to provide financial support to students in the areas of STEM. Intellection has offered to give a scholarship to the high school winners starting this year. We are deeply honored and excited about this partnership and look forward to our future collaborations.

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. This partnership makes this event unique and successful.

I wish every student a great success today and always! Once again, I want to close the address with a hope. I hope you can reflect on this Science Symposium with a positive and inspiring sentiment later in your life!

Thank you,

Gangadhara Rao Vakkalagadda
Chairman, NBT Science Symposium Committee

Messages

Govinda Rajan

Dear Brothers & Sisters,

On behalf of Agraj Seva Kendra and NBT Science Symposium Committee, I welcome you all to the Third Annual Science Symposium. More than one hundred students will showcase their talents in this unique competition thus improving their competitiveness. The students also have an opportunity to listen to the talks of talented and successful scientists from the community.

By cultivating an interest in Science in elementary and middle schools, the chances of STEM success in High School can be greatly improved. By participating in this service project, students who lag behind can catch up. I wish the participants all success.

I extend my gratitude to the educators and the Board of Education for making this event a success. I thank the sponsors, judges, speakers, volunteers and the parents and participants. I heartily congratulate Gangadhara Rao Vakkaladadda and his team for their efforts in bringing out this event.

Sincerely,

Govinda Rajan
CEO, Agraj Seva Kendra

Dr. Brian Zychowski

Dear Community Member,

Enrico Fermi, the great Italian-American physicist and creator of the world's first nuclear reactor, stated; *"There are two possible outcomes: if the result confirms the hypothesis, then you've made a measurement. If the result is contrary to the hypothesis, then you've made a discovery"*.

The **North Brunswick Township Science Symposium** is about the challenges of discovery and learning. Students are igniting their curiosity through this process while acquiring new or modifying existing knowledge.

Students are being exposed to this rigorous challenge of creating science projects that they must present and defend. This educational endeavor captures the embodiment of the **North Brunswick Township Science Symposium.**

The North Brunswick Township Board of Education supports *Project Based Learning* and commends the NBT Science Symposium Committee and Department of Parks, Recreation & Community Services for generating an alliance with our district in making the **North Brunswick Township Science Symposium** a reality. This event has stimulated great interest amongst our community because it highlights our students' work. I look forward to discussing the many projects with the student inventors.

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 achieving the highest levels of discovery.

Sincerely,

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

NBT SCIENCE SYMPOSIUM 2018

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 (Room# 420) Judges • Luci O'Reilly • Naresh Chintalacheruvu • Akintunde Bello Room 2 (Room# 423) Judges • Giridhar Tirucherai • Jenna Delledone-Ballard • James Thomson • Randy Dockens Room 3 (Room# 424) Judges • Manohar Sriramoji • Keith Chapman • Aditya Pandyaram
1 PM	Welcome address by Gangadhara Rao Vakkalagdda Address by Ms. Janet Ciarrocca Address by Aditya Pandyaram Symposium Speaker Randy Dockens Symposium Speaker Madhav Vasanthvada Symposium Speaker Paul Mikita
2 PM	Vote of Thanks by Surendar Revuri Awards Distribution

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.

Abhitej Bokka
Akshay Muniyappa
Anjali Gupta
Anudeep Revuri
Ayush Raja
Blisse Vakkalagadda
Jessica Rajasekar
Khyatishree Kalasapati
Meher Sukhija
Nithyasree Balaji
Rajireddy Komatireddy
Rishi Patel
Rohan Chappidi
Sanjana Achar
Sanjana Punduru
Shashi Thanikella
Shivani Sunki Reddy
Siddarth Peddi
Srikar Viswanathan
Yamuna Mani

NBT SCIENCE SYMPOSIUM 2018

Room 1 (Room # 420)

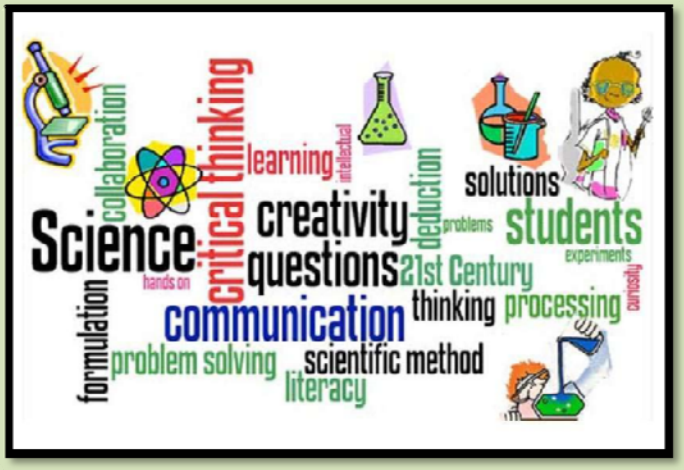
Team #	Team Name	Judging Time
11	The Challengers	10.00 AM
17	The Motion Maniacs	10.10 AM
13	ChemiKids	10.20 AM
14	Intelligents	10.30 AM
15	Light	10.40 AM
16	Magneto	10.50 AM
12	The Wise Trio	11.00 AM
18	Science Buddies	11.10 AM
19	Wings of Fire	11.20 AM
20	Science Maniacs	11.30 AM
21	L$L Science Corp.	11.40 AM
22	Wacky Wizards	11.50 AM

Room 2 (Room # 423)

Team #	Team Name	Judging Time
23	Horizon Security	10.00 AM
24	Team Manat	10.10 AM
25	Team Geo Kids	10.20 AM
26	Newtonians	10.30 AM
27	Team KAP	10.40 AM
28	Curious creators	10.50 AM
51	Sikat	11.00 AM
52	Team Rocket	11.10 AM
53	The Planet Protectors	11.20 AM
54	S.T.A.U.N.C.H	11.30 AM
55	New Point of View	11.40 AM
57	Robosmart	11.50 AM

Room 3 (Room # 424)

Team #	Team Name	Judging Time
31	ShiningStars	10.00 AM
38	A square	10.10 AM
33	Team IoT	10.20 AM
34	Brunswick Bros	10.30 AM
35	Fantastic Duos	10.40 AM
36	Masterminds	10.50 AM
37	Mathemagicians	11.00 AM
32	Team Emoji	11.10 AM
39	Bio-Bot	11.20 AM
40	Whiz Kidz	11.30 AM
43	Simple Solutions	11.40 AM
44	Innov8	11.50 AM



Abstracts

Elementary School Projects

Team: The Challengers (11)
Title: Ocean Acidification
Participants: Kailash Aravindhan, Surya K Vusthipalli, Madhav Narendra

Objective/ Goals: The goal for our project, is to study ocean acidification and to prove that increasing levels of carbon dioxide lowers the pH of water, making it more acidic. We also demonstrate consequences of ocean acidification – the destruction of coral reef habitats and modification of ecosystems.

Materials/Methods: We used materials - 1 liter empty water bottle, Tap water, rubber hoses, air-tight plastic bag, pH paper, stop watch, masking tape, car which runs on gasoline, vinegar. We measured pH reading of tap water, water with carbon dioxide from humans, water filled with carbon dioxide from cars running on gasoline and sea water using pH paper. We compared the pH results. In addition, we studied the impact of acidity on seashells by leaving them in water and in vinegar for 24 hours. Sea shells in vinegar eroded a lot compared to the ones in water,

Results: Increasing the level of carbon dioxide in water will lower the pH level of the water, thus making it more acidic, is proven to be true. The acidity of the water increased when a higher concentration of carbon dioxide was used.

Conclusions: The global consequences of ocean acidification could be extremely serious – the destruction of coral reef habitats and modification of ecosystems may have severe implications for fisheries, aquaculture, tourism and coastal communities. Ultimately the only way to slow the rise in ocean acidity is to reduce the amount of CO_2 in the atmosphere, by cutting emissions.

Summary: Ocean acidification is real threat to coral reef habitats and it is modifying eco systems.

Team: The Wise Trio (12)
Title: The Effect of Types of Music on Memory
Participants: Aanya Muniyappa, Prahas Ramidi & Anusha Vakkalagadda

Hypothesis: Listening to music helps in enhancing memory and concentration. The type of music has an effect on memory and concentration. Familiar music will increase concentration.

Objectives/Goals: The objective/goal for this experiment is to investigate the relationship between gender, age group, type of music, familiarity & memory. Based on the conclusions, the type of music will be recommended for different genders and age groups.

Materials/Methods: The experiment included recording the time people took to complete a memory game, while the person was and was not listening to music. Once the game was completed, information was captured on a data chart which included gender of the person, age group, type of music the person was made to listen to, sequence of playing the memory game with and without music, the familiarity of the chosen music and the time to complete the game. The data were then analyzed graphically and conclusions were made.

Conclusions: The conclusions from our experiment will be presented at the science symposium. The relationship between the variables included in the experiment will be presented. Based on the conclusions, the type of music will be recommended for different genders and age groups.

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: Chemikids (13)
Title: Magnetic Slime
Participants: Arya Nair and McKenna Rizk

Objectives/Goals: To compare how different chemicals in the slime change the attraction to the magnet.

Ingredients: Glue, Elmers Magic Liquid Solution (baking soda and contact lenses solution, Borax (mixed with water), Black Iron Oxide, Neodymium Magnets.

Methods/Materials: The materials we are using are Glue, Activator, Black Iron Oxide and Neodymium Magnets. We started by pouring 1/4 cup of liquid glue into a bowl. Then we added 2 teaspoons of Black Iron Oxide (magnetic powder) into the glue. After that, we added ¼ cup of Magic Liquid into the glue mixture. Next we did the same thing but instead of using a ¼ cup of Magic Liquid, we added ⅛ cup of Borax mixed with water. Next, we did the same thing again, but this time we only used glue and Tide and 2 teaspoons of Black Iron Oxide. Last, we picked all of the slimes and started kneading all of it.

Results: We put the neodymium magnet 2 centimeters from each pile of slime. Slowly, the slime started to move towards the magnet. We did the experiment three times.

Conclusions: In all three experiments, the slime with only Tide made it to the magnet first.

Summary: The use of an activator like Borax or Elmer's Magic Liquid did not make the slime more magnetic.

Team: Intelligents (14)
Title: Tinkering with Tops
Participants: Mukilan Chidambaram, Tejas Krishnan, Vaibhav Chari

Objectives/Goals: The goal for this project is to design our own spinning top using the principles of angular momentum that can spin for at least 10 seconds within a circle 30 cm in diameter. The team's objective is to experience the joy of playing with tops and explore the science behind them.

Methods/Material: We will use the trial and error method using household materials to create a spinning top with a crown, shoulder, body and point. We will reflect on what we did and evaluate the effectiveness of our spinning tops. We will also see how we improved our design and which of our tops will spin the longest.

Everyday items can be used for this project such as sharpened pencils, pens, toothpicks, coffee stirrers, CDs, marbles, clay, pennies, scissors, stopwatches, ruler, tape, string, metal washers, paper plates and bottle caps.

History: Tops are one of the oldest toys that kids played with. The first top was most likely a rock or acorn spun by a child. Clay tops have been found dating back to 3500 BC in the Middle East. Wooden tops found in Egypt are believed to date back to 2000 – 1400 BC. Tops have been found in Greece from as early as 500 BC. In Rome, tops made of bone dating from 27 BC have been discovered.

Observations: We made several observations thoroughly testing the different tops we built. We noticed that some spins faster than others, while some spins longer than others.
We discovered that there are many design factors such as the material, different quantities of weight and placement of those weights as well as the distance between the body of the top and the point will affect the spinning top and the total time spun within a circle of 30cm diameter.

Science behind spinning tops: We studied angular momentum concept and gyroscopic effect- the science behind the balancing act of the spinning top that contributed to the observed differences.

Summary: This project taught us about the ways & lives of humans, as far as 3500 BC, and how their curiosity and ingenuity lead to the invention of spinning tops. It was fascinating to know that spinning tops continue to entertain and educate generations of humans with simple scientific principles.

Team: Light (15)
Title: Photosynthesis in Plants
Participants: Aaditya Kaushik, Pranay Salikuti, Pranet Godavrty

Objectives/Goals: The objective of this study is aimed to understand the process of Photosynthesis in plants. The goal of this experiment is to understand how plants make food and oxygen using carbon dioxide, water and sunlight which is the key for life on planet Earth.

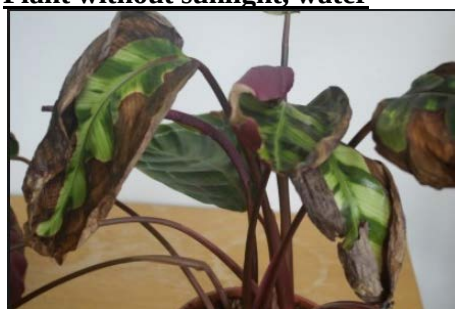
Materials: The materials used in this experiment are water, soil and sunlight.

Methods:
1. Place two plants in a sunny place.
2. Cover one plant with a brown paper bag.
3. Give both plants the same amount of water.
4. Observe the plants for two weeks.

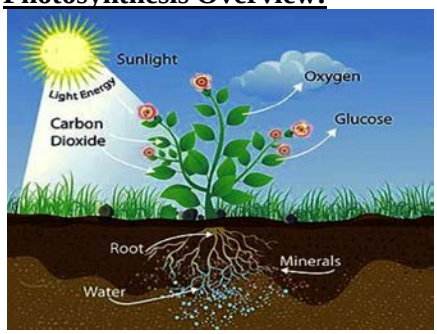
Results:
Plant exposed to sunlight was healthy, grew taller with more leaves while plant covered with brown paper bag didn't look healthy. Its leaves became pale and didn't grow in size.

Plants grown with sunlight, water and Soil :

Plant without sunlight, water



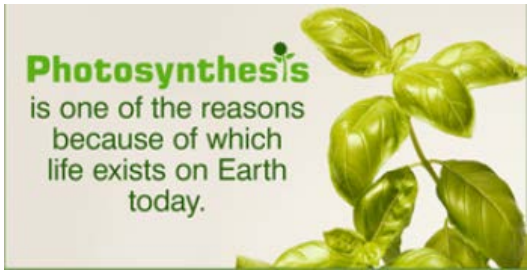
Photosynthesis Overview:



Hypothesis:
- Plants need sunlight to grow.

Conclusions: Both the plants used for this experiment were of almost same size and equal number of leaves, received same amount of water, but the plant covered with paper bag could not get sunlight that's why it could not grow whereas the other plant exposed to full sunlight grew more leaves and became taller and looked healthier.

Summary: Photosynthesis is the one of the key for life on planet earth. Plants can make their own food in the presence of sunlight with the help of carbon dioxide, water and nutrients from soil by the process of Photosynthesis and they give food (glucose) and oxygen.
Carbon dioxide + Water + Sunlight → Glucose + Oxygen
Without Photosynthesis process, plants cannot make food and there will be no source of energy on Earth. That's why it's very important to save trees and plant more.



Team: Magneto (16)
Title: The Magic of Electromagnetism
Participants: Bhargav Patri, Pranav Patri and Yajat Sharma

Objectives/Goals: To make an electromagnet by wrapping a copper wire around a screwdriver.

Materials:

- Screwdriver with plastic handle
- Insulated wire
- 4.5 volt battery
- Tape
- Ruler
- Steel paper clips
- Wire strippers or scissors

Methods/Results: We first wrapped insulated wire around the metal part of the screwdriver, leaving some extensions at the end. The extensions of wire were stripped on the end. They were then connected to the terminals of the 4.5-volt battery. Finally, to show that we had made an electromagnet, we touched the end of the metal part of the screwdriver to some paper clips, and the screwdriver was picking up the paper clips.

Conclusions: When electricity flows, it produces a magnetic field. When the current is turned off, the magnetism disappears. So when the wire extensions were connected to the battery terminals, the magnetism allowed the paper clips to attach. But when disconnected, they lost magnetism and would no longer attach.

Summary: This project displays that electricity and magnetism are very closely related. Electromagnetism is useful for devices where a magnetic field is only needed some of the time, such as loudspeakers or disk drives.

Team: **The Motion Maniacs (17)**
Title: How to explain Newton's third law of motion using a balloon-powered rocket car
Participants: Sunkalp Chandra, Devin Sanghvi, and Milav Shah

Objectives: Why does a balloon zip around the room when you let it go? Our objective is to prove Newton's Third Law of Motion. Our experiment builds a balloon car to demonstrate Newton's Third Law.

Discussions: Using a balloon car we will try to prove Newton's Third Law of Motion: **"For every action, there is an equal and opposite reaction."**

This is used in real rockets that shoot a high-speed stream of gases out the back of their engines, shooting the rocket forward.

For our project, we used this principle to build a model car that is propelled forward by the stream of air escaping a balloon as it deflates. Our goal is to get the balloon car to shoot forward several inches, using Newton's third law of motion.

Action: When we inflate a balloon and release the nozzle, the rubber shrinks and pushes the air out.
Reaction: The air pushes back on the rubber, thrusting the balloon and simultaneously moving the car in the opposite direction.

The scientific concepts demonstrated in this model car are:

- Kinetic Energy (energy of motion)
- Newton's Third Law of motion.

Methods: Building the car: We built a model car using a plastic bottle, straws, wooden skewers, and bottle caps.

Experiment: The car is run by a balloon. As the air streaks out of the nozzle (action), the model car moves forward (reaction). The movement of the car is the reaction to the air escaping the balloon. We will use three different sized balloons to determine the change in speed and distance the balloon car's travels.

Results: We set the model car down and watched it move. As the balloon deflated, the car moved forward, therefore proving Newton's Third Law of Motion.

Team: **Science Buddies (18)**
Title: Iron/Steel Rusting
Participants: Ridhi Boggavarapu and Poorna Thoguluva

Objectives: We did this experiment to determine what substances cause iron to rust.

Materials: The materials used for this experiment were:
Test Tubes (x 4)
Steel Wool (which is rich in iron)
Water
Calcium Chloride (a drying agent)
Oil
Salt
Air (Oxygen)

Methods: We added the following in each of the test tubes:

Test Tube 1 - Steel wool, water, and oxygen (air).
Test Tube 2 - Steel wool, Calcium Chloride and oxygen (air).
Test Tube 3 - Steel wool, water and oil.
Test Tube 4 - Steel wool, water, salt and oxygen (air).

Observations & Results: In Test Tubes 2 and 3, there was no rust. In Test Tubes 1 and 4, the steel wool showed rust. Rusting is a chemical reaction. Iron reacts with water and oxygen to form hydrated iron oxide, which is basically rust.

Conclusions: Iron and steel rust when they come in contact with water and oxygen. That is why Test Tube 1 and Test Tube 4 showed rust. Test tube 4 showed more rust because the salt acted as a catalyst (helper) and sped up the process of rusting. On the other hand, Test Tube 2 had no water and Test Tube 3 had no oxygen, so the steel wool in these test tubes did not rust.

Summary: This experiment attempted to determine how iron rusts. The results clearly demonstrated that iron and steel rust when they come in contact with water and oxygen.

Team: Wings Of Fire (19)
Title: Extracting DNA from Fruits
Participants: Sunandita Krishnadas, Hridya Nookala, & Prisha Khubchandani

Objectives: The purpose of this project was to learn further about DNA and to compare different DNA extractions. We came up with this idea when we were gathering topics we were interested in. Then, we started looking for books on DNA and online articles. We learnt that DNA is the blueprint for life and every living thing has DNA in their cells. DNA tells an organism how to develop and function, and it is passed on from one generation to the next. We watched videos on how to extract DNA from fruits with household items. We used different fruits and vegetables.

Methods/Material: The ingredients we used were:

- Fruits or vegetables
- Salt
- Dish Soap
- Plastic bags
- A cup
- A strainer
- 70% rubbing alcohol
- Tweezers

First, we took strawberries and placed them in a plastic bag, added dish soap and salt, and smashed it together. We strained the mixture and added the rubbing alcohol so that it creates a fine layer above the fruit mixture because rubbing alcohol is less dense than the fruit mixture. Finally, after we waited for a while, we saw something cloudy formed to the top of the rubbing alcohol. This is the DNA that has been separated from the fruit mixture. We used the tweezers to take out the DNA to examine it.
Mashing the fruits caused their cell walls to burst and adding dish soap helped pop open the cells releasing DNA into the solution and salt helped to create an environment where the DNA strands could gather and clump, making it easier for us to see. Adding rubbing alcohol helped to precipitate the DNA out of the liquid.

Conclusions: This project is unique because we are researching about a topic that we have not learnt about. It's not a topic that most people focus or think about. Some people don't know that fruits and vegetables have DNA.

Team: Science Maniacs (20)
Title: Reducing Air Pollution
Participants: Maharsh Khatri & Samarth Sharma

Objectives/Goals: This study is aimed to reduce Emissions/Air Pollution and to find out simple and efficient ways to achieve that.

Methods/Materials: The materials that we're using are:

- A 12 volt CPU blower
- A motorcycle filter
- A 12 volt battery
- A DC wire

This is to show a model of an air purifier, that most people can afford to make at home. An air purifier can reduce most polluted air in a room. First of all, we attached the motorcycle filter and the 12 volt CPU blower together. Next, we connected the DC wire to the 12 volt battery and, the CPU blower turned on.

Results: After some period of time, the filter would be dirty with dust and other pollutants, but the filtered air coming out of the blower, would get purified and be clean.

Conclusion/Discussions: In summation, this air purifier is an efficient, and really easy way to reduce air pollution. By using simple materials, such as, a CPU blower, an air filter, a 12 volt battery, and some DC wire, you can make an efficient air purifier to help your environment stay clean. This concept can also be used for a ceiling fan, or air conditioner and, would be an even faster way to reduce pollution in your environment, instead of buying a separate and more expensive purifier.

Team: L$L Science Corp. (21)
Title: Make Snow Wonders at Home
Participants: Lasenki Wijegunawardhana and Schayta Sharma

Objectives/Goals: Our main goal is to make snow using chemicals. Chemicals can be found all around us and even in the air. Sometimes this unbelievable air can create things that don't even belong in a particular season. Like in March, instead of having nice warm sunny days, we got SNOW!! We would like to feel snow in the summer that doesn't even melt! Our audience might like to "cool" down in the "snow" during that time too! This is a perfect time to be a chemist and do this experiment to have fun and learn! BONUS: We also be using the color wheel for this experiment. We will be asking about your favorite color to make that color snow! So put your artist and chemist hats on and get ready!

Materials: Below are the materials we used for this project:

A small amount of Calcium Chloride
A few drops of Sodium Silicate
½ Cup of Water (In a test tube or small glass)
Food coloring (Your choice)
Test tubes or a small glass

Results: The calcium chloride and sodium silicate react together in the water creating calcium silicate. The calcium silicate also forms as a byproduct when the food coloring reacts with the chemical to create "snow" that will have the same color as the food coloring. Calcium silicate or $CaSiO_4$ really happens when the calcium in the calcium chloride mixes with the silicate in the sodium silicate.This chemical reaction happens best in the water because the sodium silicate is a liquid and the calcium chloride is a powder. When the two mix together the "snow" crystals form. With only a little bit of liquid in the powder in the experiment, it will not mix right and it could go off. Unlike some chemicals there needs to be a specific amount of liquid and powder for this to work` if you have wrong measurements you will have one BIG mess!

Conclusions: We have learned that chemicals can be used to generate predictable results. The result of any two chemicals is different. Sometimes it is a liquid and others it is a powder. In this case our "snow" turned to be as fluffy as a pillow. Also, we found out that when the chemical reaction is happening it can be in different ways. Such as fizzing, bubbling, fire, and simple liquid gushing or pouring out. Our snow made the reaction of bubbling and fizzing. In some cases, such as this one there is a mixture of activities. We have found this interesting and hope you do too! So, put your snow gear on to play in the "snow'!

Team: Wacky Wizards (22)
Title: Clean-o-bot
Participants: Yash Choudhari and Naina Choudhari

Objectives/goals: Our goal is to create a mini autonomous machine with sensors that can clean our world and make it a better place for our society.

Methods/Materials: In this project, we will be building a mini autonomous smart robot using a Vex IQ kit. This robot will be collecting trash and cleaning our streets. We will put a sensor on the front of the robot which will detect litter on the ground. It will then scoop it up and dump it in a bucket attached to the back. The robot will be programmed to move on its own or move using a controller in the hands of humans. It will be able to go in places we usually can't get to, such as gutters, narrow paths etc. It will also pick up sharp or dirty items, such as broken glass. People, in general already have a lot of work, so this will take some pressure off their shoulders and give them a sense of pride when they walk down clean and healthy streets. Not only will this creation go further in technology, but will also help a major worldwide problem: litter and trash.

Results: Clean-o-bot was a huge success. It picked the litter as expected. Keep the streets clean if you like to go Green.

Conclusions: Robots can make life very easy for Humans. As we advance, we will slowly move towards developing this even further so that soon Advanced Clean-o-bot would be able to keep Oceans and Lakes also clean.

Team: Horizon Security (23)
Title: Home Security
Participants: Brian Lin, Faith Lin and Karthik Parambath

Summary: There are a lot of thefts in New Jersey, as well as The United States of America. There are many ways to protect your home from theft. Examples include: alarm systems, video systems, and usual clues of people home such as, lights, television, or radios being left on. Information was found by researching different types of security for homes and data collection on successful methods. It was discovered that a security system connected to the police were burglarized less. It is recommended that to secure a home, one uses an alarm system along with other simple strategies.

Team: Team Manat (24)
Title: Practical Uses of Electromagnetism
Participants: Atharv Rege, Nimmat Sukhija, Tisha Subhedar, Mohit Pradhan, Advait Gattu

Objectives/Goals: This study aimed to determine how the strength of an electromagnetic field varies by various tertiary factors like the length of the coil used to transmit the charge, the diameter of the coil, the diameter of the screw used to wrap the coil around, the strength of the battery originating the charge etc.

Methods/Materials: Two common magnetic materials Iron and Copper were chosen for this study. An experimental apparatus was constructed through which the strength of the magnetic fields was changed and tested. The testing was done via the weight of various apparatus such as the number of paper clips etc. that were picked up. Great care was taken to cancel out unwanted variation caused by the experimental setup including sidewall collision, air friction, and weight differences between elements. The results of the study are being scrubbed and will be demonstrated on the day of the symposium.

Team: Geo Kids (25)
Title: Geothermal Heat Pump
Participants: Adithya Mysore, Nethra Gujja & Jay Pindipol

Objectives/Goals: To show geothermal heat pump as the most energy efficient, cost effective and eco-friendly, environment safe technology for the residential heating and cooling needs.

Methods/Materials Geothermal heat pumps are also known as Ground Source Heat Pumps. They operate by collecting heat from the Earth, the largest solar collector in the world. Unlike ordinary systems, geothermal systems don't burn fossil fuel to generate heat; they simply transfer heat to-and-from the earth to provide a more efficient, affordable and environmentally friendly method of heating and cooling. Typically, only a small amount of electricity is used to operate the unit's fan, compressor and pump. Geothermal closed-loop system uses a continuous loop of buried polyethylene pipe. The pipe is connected to the indoor heat pump to form a sealed, underground loop through which an environmentally friendly antifreeze-and-water solution is circulated. A closed-loop system constantly re-circulates its heat-transferring solution in pressurized pipe, unlike an open-loop system that consumes water from a well. Most closed-loops are trenched horizontally in areas adjacent to the building. However, where adequate land is not available, loops are vertically bored. Any area near a home with appropriate soil conditions and adequate square footage will work.

In this project, we studied a 4 ton geothermal heating/cooling system to replace a conventional propane furnace and central air conditioner for a 2500 sqft, well insulated single family home in Central Jersey, demonstrating the cost savings. We also created a model to show how geothermal heat pump can work efficiently in summer and winter.

Results: Our studies indicated high efficiency rates combined with low operating/maintenance costs results in cost savings up to 70% for heating and 50% for cooling compared to conventional systems. Total costs of a geothermal heat pump including the cost of equipment and installation are usually $25,000 - $30,000. Final cost of installation discounting federal tax credit of $10,000, comes around $15,000. Overall 50-60% reduction in energy costs translates to roughly $2,000-$2,500 in annual savings. That means the

investment payback time is usually somewhere between 6-8 years.

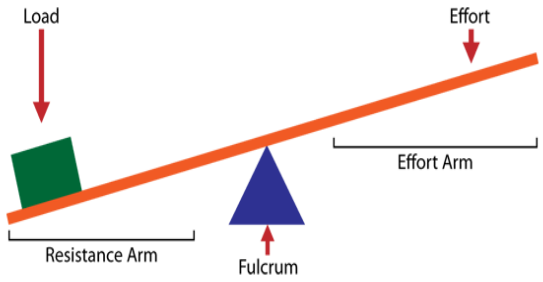
Conclusions/Discussions: Geothermal heat pump technology uses constant temperature below the earth's surface. It doesn't need to work as hard as a conventional system for heating and cooling there-by offering 4 to 5 units of energy for every 1 unit used to power the system. Geothermal systems are practically maintenance free. The buried loop will last for generations. The unit's fan, compressor and pump are housed indoors, protected from the weather and contamination. They work with nature, not against it. They emit no greenhouse gases - which have been linked to pollution, acid rain and other environmental hazards. Closed-loop antifreeze will not harm the environment in the unlikely event of a leak.

Summary: Geothermal heat pumps are the most efficient and eco-friendly system for the residential heating and cooling. Offers much lower operating costs than other systems. Uses clean, renewable energy (the sun). Are much quieter than other cooling systems (generally as loud as a refrigerator). Has low maintenance and long-lived - average lifespan of 24 years. Has proven track record; 1 million installations in the U.S. Are eligible for renewable energy federal tax credit.

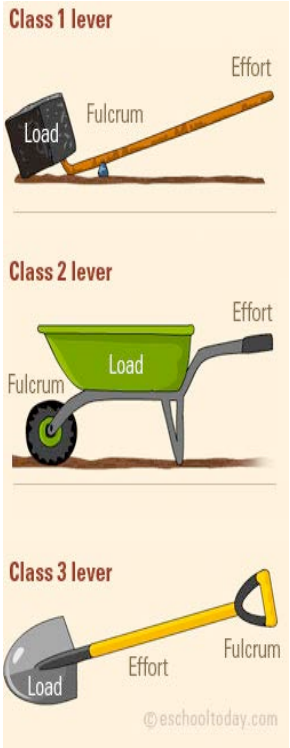
Team: **Newtonian (26)**
Title: The Magic of Levers - Work smart not hard
Participants: Nirek Shah, Sachit Arora and Anay Choudhari

Objectives/Goals: To demonstrate how levers make our lives easier.

Levers definition: A rigid bar or rod resting on a pivot, used to help move a heavy or firmly fixed load with one end when effort is applied to the other. Levers are a form of Simple Machines.



The Class of Levers:
There are three types of levers a Class one lever, a Class two lever, and a Class three lever.



Class one lever: In this class, the Fulcrum is between the Effort and the Load. The mechanical advantage is more if the Load is closer to the fulcrum. Examples of Class One Levers include seesaws, boat oars and crowbar.
Class two lever: In this class, the Load is between the Effort and the Fulcrum. The mechanical advantage is more if the load is closer to the fulcrum. Examples of Class Two Levers include wheelbarrows.
Class three lever: In this class, the Effort is between the Load and the Fulcrum. The mechanical advantage is more if the effort is closer to the load. An example of Class Three Lever is a garden shovel.

Materials:
Long piece of wooden plank
5 pound weight
Screw & washer
Paint of different colors (to make it look colorful)
Piece of wood (for fulcrum)
Help from Parents

Methods: We sanded the wood to get rid of splinters. We painted the 40 inch long wooden plank in different colors to make it look colorful. Also we painted the fulcrum. Let the paint dry. We drilled a hole on one side of the wooden plank and screwed in the 5 pound weight. We put a fulcrum underneath the wooden plank and applied force on the other side of the plank to test my lever

Results: We tried to lift a 160 pound grown up man with muscle power ONLY but didn't succeed. Next we tried with lever to lift the same weight and it was easy as a breeze.
Was this magic no it was pure Science

Team: **Team KAP (27)**
Title: The Top Three Types of Learning
Participants: Ashley Kouras, Kylie Mikita, and Peyton Mikita

Methods/Materials: We researched the top three learning types which are visual, auditory and kinesthetic and we found a survey that we we are using and we are using it to gather data to use in our experiment. The survey we are using is online, but we are printing it out too gather our data.
Here is a link to the survey we have chosen http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml

Results: Results will be determined off gender and learning types.

Conclusions/Discussions: Conclusions will be made at the end of our experiment.

Summary: We are trying to determine which of the 3 learning types people are.

Team: **Curious Creators (28)**
Title: Meristem Cells - Primary Growth of Plants

Participants: Srihaas Chennavajjala, Gagan Voona and Saanvi Vidyadhara

Summary: Understanding how plants grow and can change the way we study them. When we think in only one way, we limit our thought process. Once we start challenging common beliefs will we only go forward. We are really interested in plants and learn about their growth. We always found it weird that plants NEED soil to grow. When we saw plants grow without water for the first time, we were shocked. We created an experiment where we check growth speeds of plants with soil as the primary growth source compared to plants without soil. We believe that this is important because it can change the way we think about agriculture in general. If growing plants without water is faster than with soil, we can focus more on cheap aquaculture instead of costly agriculture.

A meristem is the tissue in most plants containing undifferentiated cells (meristematic cells), found in zones of the plant where growth can take place. Meristematic cells give rise to various organs of the plant and keep the plant growing.

Middle School Projects

Team: **Shining Stars (31)**
Title: Solar-Powered 110v and USB Outlet
Participants: Sheel Dixit, and Anish Aluri

Objectives: Solar-Powered 110v and USB Outlet

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

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.

Results: Charged my iPhone, and laptop. It worked!

Conclusions: 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: Team Emoji (32)
Title: The Effects of Everyday Routines on Stress Levels
Participants: Vedika Shah, Aruhi Vakkalagadda, Stacy Rappolt, Alyssa Mikita, Gabriella Seiden

Hypothesis: If people receive the right amount of sleep, exercise, and water then their stress levels will be lower.

Objectives/Goals: Stress is a common issue throughout all ages and across genders. People's everyday routines, such as the hours of sleep, the amount of water intake, and/or the amount of exercise may affect the levels of stress in a person. Our goal is to find a relationship between these variables and stress. Our overall goal is to try to find ways to reduce or eliminate stress by recommending changes to daily routines.

Materials/Methods: A questionnaire was used to capture the gender, age, amount of water intake, hours of sleep per day, amount of daily exercise, and the stress levels. The stress levels were defined on a scale of 1-10, 1 experiencing the least amount of stress, and 10 experiencing the most amount of stress. The responses to these questions spanning different age groups were recorded on a data chart. The data were sorted and analyzed graphically.

Conclusions: The relationship between the amount of stress, the number of hours of sleep, the daily intake of water, the amount of daily exercise, age, and gender will be presented at the symposium. At the presentation, based on our findings we will recommend ways to reduce stress by making changes in daily routines and lifestyles.

Team: Team IoT (33)
Title: Internet Of Things
Participants: Ila Ranade and Abhigna Sala

Lately have been hearing this word IoT a lot (from parents and other adults) and we did not know what it means and hence decided to investigate and understand this better. A wish to understand was the drive for our project.

IoT means 'Internet of Things', 'things' speaking or communicating with each other. These 'Things' could be anything like your car or your refrigerator, your washing machine, switches in your house etc, and what would these 'things' tell each other? Maybe the car can tell the house that you're getting home shortly, so please turn of the lights and warm up the house. Would be pretty cool in the winter! Which brings us to the next question , if there is a desire for these 'things ' to speak with each other, how would that happen, because , there needs to be a medium over which the things can 'see' each other and 'communicate' with each other and this medium is the 'Internet'. Which brings up the next question, how do these devices connect to the internet? In home Wi-Fi networks have become really common these days(the wireless router/modem you have at home) , just like our smart phones and smart TVs connect to the home Wi-Fi, then maybe newer models of these 'things' can also include the ability to connect to the internet.

The internet of things has at least these elements: Sensors to detect inputs from the world around them. Software to look at sensor data then follows rules to make decisions about how to respond to data. Software to manage the operation of a device which includes one or more sensors. An internet connection to transmit and receive data and instructions from other devices.

For example, to heat up the house when a message from the car is received, both the the thermostat and the car would need certain features/abilities.

The car would need: An internet connection to be able to send the command to the thermostat. Address of the thermostat to know where to send the command. Software to evaluate if commands need to be altered , if say you are stuck in traffic or take an impromptu detour. A basic operating system, to run the software evaluating data and to establish internet connection

The thermostat would need: An internet connection to be able to receive the command form your car. A software to interpret this command and take a decision on the further course of action. A basic operating system, to run the software evaluating data and to establish internet connection

We see that to communicate, every device will need its own unique address. Imagine someone has the unique address for your thermostat and knows how to make the software in your thermostat turn itself off, as a prank; you would arrive home to a cold house brrr! This is a security risk and currently the biggest problem to solve for the Internet of Things.

Like any other technological development, it is up to

us to decide how much of our daily lives are we willing to be controlled by technology.

Team: Brunswick Bros (34)
Title: Hydraulic Powered Scissor Lift
Participants: Rajeev Achar and Sachin Gokhale

Objectives: We will be demonstrating our knowledge of hydraulics by building a miniature scissor motion lift using simple materials.

Goals: The miniature hydraulic lift should be able pick up 3 different items of 3 different weights in order to test its strength and see what capabilities it has.

Materials:
Cardboard- used as the structure of the lift
Syringe- used to push water back and forth lifting the lift surface
Plastic tubes- used to direct water flow
Cardboard crate- to hold the object
Skewers/toothpicks- acts as axils to help the cardboard beams move
Water- to fill the pipes and make our hydraulic lift function
Plastic Straws- to help keep the lift stable

Methods/Procedure: We cut out a rectangle piece from the cardboard to form a base. Next, we cut out smaller rectangular pieces, poked holes in them, and stuck toothpicks through them forming "X" shapes (to make the structure collapsible, also making a scissor motion). Then, for the bottom, middle, and top axils, we put straws around the skewers for a sturdier structure. But for the edge axils, we kept toothpicks there. We glued the "X" structure to the base. We glued the cardboard crate on the top of the "X" structure. Lastly, we filled the syringes with water, connected them with pipes, and attached it to the base. We positioned the syringes so one of them is pushing the structure back and forth making a scissor motion (collapsing and rising the crate), and the other is being pushed and pulled manually.

Results: The lift we designed is more efficient and uses natural resources. Although using water instead of electricity, it is as efficient.

Conclusions: Based on recent research, hydraulics is a topic in science using fluids that create pressure in the tubes which influences movement when pushed or pulled (by syringes for our project). In our project, the scissor beams have a collapsible design to make it easier to lift.

Summary: Using simple materials and our knowledge of hydraulics, we were able to construct a miniature hydraulic lift that performs just as efficient as a real lift.

Team: Fantastic Duos (35)
Title: **B**ridge **B**earing **C**apacity
Participants: Prakash Nayak and Suryan Srivastava

Objectives/Goals: The objective is to find out what style of bridge can hold the most weight.

Methods/Materials: The three bridges built were Plank, Suspension, and Truss to see which one can hold the most weight. Each bridge that we made was built to be the same length with wood glue, binder clips, cotton swabs, popsicle sticks, and straws. From here, we set each bridge on 2 buckets, one on each end, to symbolize the land between them. Then, we placed a box on the middle of the bridge, to symbolize a cars weight. We added calibration weights in the box until the bridge collapsed and calculated how many grams made them collapse.

Results: The Plank bridge can hold 400 grams, the Suspension bridge can hold 855 grams, and the Truss bridge can hold 1200+ grams.

Conclusions/Discussions: The truss bridge can hold the most weight. Plank bridges are held by two supports over short distances. The bridge's beam is compressed by each abutment and the load on the bridge causes the bridge to compress downwards. The beam is not compressed as much as other bridges so if it is long, the beam will snap because the bridge can handle limited compression. Suspension bridges have taller/ stronger abutments allowing the roadway to handle more compression. The suspension bridge has a curved wire, which was held by vertical wires to give the bridge maximum support. The truss bridge, which is the
strongest, is a beam bridge but with triangular designs to help reinforce the bridge. Each triangle gives off an equal amount of compression/tension which stabilizes the bridge.

Summary: This project finds out which bridge can hold the most weight: The truss bridge.

Team: **Masterminds (36)**
Title: Electrify the Competition
Participants: Karan Choudhari, Praney Hirpara, Pranav Rana and Shrey Jain

Objectives/Goals: The goal of this project was to determine if thermoelectric energy is a possible energy source for the future.

Discussions: Between 2013 and 2040, natural gas consumption is expected to increase by 13.4% and is expected to continue to be America's leading source of energy consumption. Fossil fuels take millions of years to form, and we are running out of our main source of energy. They can also cause potentially irreversible consequences of global warming. Thermoelectric energy is an alternate source of energy that doesn't affect the environment and a source of energy that is renewable, unlike fossil fuels. Thermoelectric energy is often overlooked by most people over other sources of energy such as solar and wind, but it is an alternate source of energy that can offer endless possibilities and can overtake the energy forms in use today.

Methods/Materials: The experiment we were building involved using our body heat to power a flashlight, so we used Peltier tiles to generate the electricity. The tiles work by applying heat to one side and cold to the other, so we used a heat sink for the cool side and our body heat for the heat side. We ran into a problem while building this, however, which was that the tile itself did not generate enough energy to power a small handheld flashlight. To solve this problem, we made a joule thief and connected it. A joule thief gradually collects energy until it has enough, then releases it all at once. Once we built it, we connected it to the tile and flashlight. After a couple of moments, the joule thief gathered enough energy to power the bulb

Results: The heat our body emits can in-fact generate thermoelectric energy, and from this we are able to power technology.

Summary/Conclusions: After conducting the experiment, we found that thermoelectric energy is a valid energy type. If we amplify what we did in our experiment, we could power even larger things, such as light bulbs, phones, and more. On top of this, it does not instigate more problems in the ecosystem like the main source of energy today, and it would overall be much better for it.

Team: **Mathemagicians (37)**
Title: Mining Cryptocurrencies
Participants: Hael Raj and Sibi Thiagarajan

Objectives: Our objective is to study and investigate the methods of mining cryptocurrencies. We will also review the algorithms used in cryptography.

Introduction: Cryptocurrencies are digital units of monetary value that are encrypted to protect the holder's account. Cryptocurrencies also use BlockChain technology, a global ledger system, in which everyone has a copy of every transaction. Cryptocurrencies can be earned by hashing, an extremely data-intensive process. Hashing is a slow and arduous process, which involves decrypting complex hashes.

Project Setup: We will be demonstrating a few hashing algorithms that help explain the mathematics behind how cryptography works. The demonstration will involve live audience who will participate in encoding and decoding cryptic messages.

We will also setup and display a mining rig using a Raspberry pi and a Graphics Processing Unit (GPU). We will contribute our computing resources towards mining pools such as MinePeon and BitcoinCZ, that will combine ours' and other miners' resources. This will help hash and validate transactions in the Blockchain.

Results: Using our project, we hope to enlighten the audience about the topic of cryptocurrencies and algorithms behind them. Our contributions to the mining pool have been beneficial to us and other miners who are participating in said mining. We managed to turn out a profit of $_____.

Conclusion: In conclusion, cryptocurrencies are a valuable tool, in educating and initiating the public's technological knowledge. Our world is headed on a path full of technological opportunities and cryptocurrencies just might be the key to ushering in a new age.

Summary: This project attempts to shed light on the complex cryptography behind cryptocurrencies and the advantages of said cryptocurrencies

Team: A Square (38)
Title: Contaminated WHAT?!- ER
Participants: Aarav Gupta and Aarav Hathiramani

Objectives / Goals: This project is aimed at finding the most useful and inexpensive way of purifying taps water at home.

Materials: For our experiment include -3 quarts of tap water, a pot used for boiling water, a clean cloth to strain water, 4-6 pieces of lemon and orange peels(NOT SURE ABOUT THE PEEL QUANTITY), a water pitcher filter, and a total dissolved solids (TDS) meter equipped with automatic temperature compensation (ATC).

Methods: First, we will take three quarts of tap water and equally divide the water into quantities of 1 quart each to initiate our three different water purifying methods. We will then measure each quart of water separately using our ATC tester and record our findings regarding the quality of water purity. We will then take the first one quart of water and soak the lemon and orange peels in the water for 36 hours. After the set time, we will remove the peels from the water and test the water purity with the TDS meter and record our findings. We will then move to our second water purifying method, and take one quart of water and boil it. After water has boiled, we will strain the water using a clean cloth to obtain the 'purified' water. Again, we will test the water purity with the TDS meter and record our findings. Our third method to purify water is to use a water pitcher with filter. We will pour one quart tap water in the water pitcher through the filter and again test the water purity with the TDS meter and record our findings. After we complete all three water purifying methods, we will compare the results of water purity for each method against the original tap water test reading and find out which method of water filtration is the best and most cost effective.

Hypothesis: If the price and effectiveness of the three different water purification methods are compared, boiling water will be the most cost effective.

Discussions: Why this project matters: About 85% of all Americans get their water from the tap. This means that about 300 million people in a first world country get their water tested and regulated by the government; however the government may sometimes fail us. There are numerous cases, right from the water crises in Flint, Michigan, to data obtained in 2016 from the Environmental Protection Agency, revealing that 41 states have reported higher than acceptable levels of lead in drinking water. Many people in America take clean water for granted making a shortage of reporting on water contamination. Few people have gone to the extent of purifying their own household water by buying filtering jugs/ faucets or trying other things. As a result, we decided to do this project to see if these methods are truly effective and can be used in helping resolve America's contaminated water crisis.

Team: Bio-Bot (39)
Title: The Biobot
Participants: Steven Biju George and Manish Vankadhara

Crisis and Objectives: Our world is tortured by an environmental crisis. The constant decrease of animal populations points to an inevitable ecosystem failure due to our excessive poaching. Scientists say that at this rate every day at least a dozen species goes extinct

Here is an example of this very issue:

- Hawk eats Snake
- Snake eats Mouse
- Mouse eats Grass and Vegetation

Now what would happen if snakes were to go extinct because of the high demand for their skin on markets. Hawks would lose a majority of their food source and they decline in population. However, the mice will increase in population and lead to a shortage in vegetation for us humans and other species.

Our objective is to produce a solution to this evolving problem within our planet.

Methods and Solution: Our solution to this soon to come disaster is a robot programmed with an AI to take on the role of any animal decreasing in population and control the bursting population of its prey. It could take the role of hawk and snake controlling the mice population and getting the hawk and snake populations back on their feet. Throughout history, there have been instances where this idea has been tried and tested, but with human hands, and not with an artificial intelligence. For example, on a nearly uninhabited island in the ocean, an instance occurred where Golden eagles burst in population and began devouring a special and rare island fox population. Volunteers helped by trapping these predators and relocating them in order to save the population of island foxes. What if this could be done with a robotic

AI much more capable of slowing down and bringing up populations. What if we had a robotic AI that has more able hands than us humans, capable of doing and going more places safely. With more engineering advancements could take the robotic AI to the sky, the earth, or to the ocean. One thing that we needed to keep in mind is that the robot has to have a mix breed of at least a few defining features from all animal kingdoms. This bot we knew, would also have to demonstrate a capability to endure difficult terrain and predatory situations. It would also need to be able to endure natural adaptations in the wild in order to live out its purpose as an aid for this environmental crisis.

Conclusions and Summary: In summation, with proper testing and refining, our Biobot could become a universal solution to this rising threat. Everyday animals are hunted and killed illegally for their exotic natural features and money, leaving a lasting impact on the ecosystem. As the dominant species of this planet it is our responsibility to take care of this problem as soon as possible. Using the BioBot, let's help the problem that we've started with our greed and fervent need to torture inferior species.

Team: Whiz Kidz (40)
Title: Smarter Water – It takes a lot of Blue to save Green
Participants: Aarav Yadav, Rohan Bhatia and Sahil Choudhari

Objectives/Goals: The objective of our project is to demonstrate how we can Reuse, Reduce and Recycle water using affordable and effective methods. Our goal is to make water less scarce, save it and use it more wisely.

Methods/Materials: Water is the most valuable natural resource needed for sustaining life. However, water scarcity has become a global issue which means that saving water is imperative to our future. Many countries across the globe are already running low on water. If this continues, the entire human race will face the threat of getting extinct like many other creations of Almighty. Every drop counts and we all need to realize that saving water today can make a huge difference tomorrow. We humans have advanced so much in science and technology, but when it comes to survival 'Water" the essence of life is still something that needs to be used frugally because we have not found a technique yet for it to be abundantly available to the ever growing population.

Our project strives to demonstrate three ways in which we can conserve water:

- **Rainwater Harvesting System:**

Creating an easy barrel storage system to collect and use rainwater readily available around the house.

- **Graywater Recycling:**

Showcasing a simple method to reuse otherwise waste water from the laundry and sink for landscaping etc.

- **Flood Water Management**:

Projecting how if smartly planned, flood water that creates destruction can be used in a constructive manner and help prevent water scarcity.

Conclusions/Discussions: In summation, there needs to be much more awareness in order to conserve this precious resource. Utilizing these methods will not only make your garden healthier but will also make your wallets happier.

Team: Simple Solutions (43)
Title: Linwood Middle School Chatbot
Participants: Isha Shrivastava, Poojitha Kalasapati, Reina Fukahori, and Roshni Raghuraman

Problem Statement: Most of the time parents are running around to find the information about school clubs. All the information is available, but it is not organized and easy to discover. We're trying to create a simple solution to solve these problems.

Objectives/Goals: Develop a cognitive chat bot
Provide artificial intelligence based simple solutions to parents, students, and teachers which address their school club queries

Methods/Materials: Firstly, we find out the intents of the users; what they may want to know or are looking for. Consecutively, we think of all the questions one could ask depending on their intent and come up with how the bot will respond to those questions.
After that, we collect all the information about our school's clubs. Based on the intents, questions, and information, we build a dialogue flow, basically how people will be able to interact with the chat bot.

To do all this, we need:
A Laptop, IBM Watson Assistant Service, Internet Connection to access the service

Results: An easy to use chat bot which effectively and efficiently provides updated information about Linwood Middle School's after-school clubs, in a conversational question and answer mode.

Conclusions/Discussions: We believe that this is easier to use than our school's website generic search. Our bot will contain all the necessary information and will easily help parents/guardians to know what they are looking for.

Team: **Innov8 (44)**
Title: Bioplastics in the world of 3D
Participants: Anjali Aravindhan and Mariam Farook

Objectives/Goals: The goal for our project, is to study bioplastic materials and to demonstrate its use in 3D printers.

Materials: Bioplastic made up of like corn starch, banana, potato, vinegar etc., Printer equipment materials,Design software, Programming Knowledge Computer/Laptop

Results: 3D printing refers to processes in which material is joined to create a three-dimensional object, with material being added together. 3D printing is one of the greatest innovation of this century and it is a boon for humans. It can be used to print anything we need – prosthetic limbs to machinery parts to food to science models for class rooms. We assembled a 3D printer successfully and demonstrate its capabilities by creating plastic toys using its filaments. These filaments are made up of plastics which are environment hazards. Though 3D printing is a great invention, if bioplastics are used instead of plastics, it can result in less hazardous waste than oil-derived plastics, which remain solid for hundreds of years. We studied bioplastic materials made up of commonly available items and studied its usage in 3D printing.

Conclusions/Discussions: 3D printing will revolutionize out life as it evolves rapidly. Replacing plastics with bioplastics wherever we can will lead to healthier environment for all creatures on planet Earth.

Summary: 3D printing is changing our life in a remarkable way. Let's try not to use plastics and if that's not possible use bioplastics instead.

High School Projects

Team: **SIKAT (51)**
Title: Understanding the Evolution of the Kidney
Participants: Katelyn Freebern and Siya Kakumanu

Objectives/Goals: To explore the evolutionary relationships between kidney-specific genes and kidney function

Introduction: More than half of the millions of proteins in the human body are expressed in the kidney indicating that the kidney is home to a complex protein environment that has evolved over the years. In order to examine the evolution of the kidney, kidney-specific genes and proteins will be compared by their identity and homology.

Methods: Through a series of BLAST searches, using for example the National Center for Biotechnology Information databases and the Human Proteome Atlas, a kidney-specific gene, such as Uromodulin, will be compared to a shared-function (liver-kidney) gene, such as N-acetyltransferase 8. Additionally, a housekeeping gene, such as, glyceraldehyde-3-phosphate dehydrogenase, will be used to validate the search.

Results: Initial blastn searches have showed that Uromodulin has matched with Homo sapiens uromodulin with an E-value of 0.0 and 100% identities, indicating that it is highly conserved in humans. Uromodulin also only matched in specifically vertebrates. Based on these initial search results the evolution of the kidney cell will be further explored by comparing other genes that are highly conserved and vary amongst different vertebrates.

Conclusions: The objective of this project was to understand how the kidney has evolved since its original development, through a series of BLAST searches that would compare the conservation of specific genes in the kidney. However, after conducting a search on the kidney-specific gene, Uromodulin, it is evident that although this gene has been conserved in many cases, mutations have arisen that are associated with kidney disease. Further characterization of kidney-enriched genes and proteins and their functions will provide information on the evolution of kidney.

Team: **Team Rocket (52)**
Title: Machine Learning Applications
Participants: Surya Ananthu, Kunal Bhatt, and Yechan Kim

Objectives/Goals: To develop a code to allow a computer to play a computer game autonomously

Methods: After developing a python based variant of the commonly known game "snake" on a square grid - whereby the primary objective being to superimpose the playable 'snake' onto a randomly generated 'food' coordinate, while simultaneously avoiding collision with the game boundaries- we developed a neural network which eventually taught the game to play itself. The neural network, after inputting a large number of randomly generated test games as data, eventually was able to play the game to a high functioning degree via machine learning. Two neuron architectures would be tested, one with only one input layer and an output layer, the other with two input layers and an output layer.

Results: The computer was able to play the game itself.

Conclusions: After multiple sessions of debugging, the program was able to function at the intended level, by reaching a considerably high score.

Summary: This project shows the capabilities of computers and coding.

Team: **The Planet Protectors (53)**
Title: Global Water Shortage and Public Health
Participants: Aanya Subhedar and Kirtana Krishnan

Objectives/Goals: Our goal is to provide a supply of safe water to people in areas that do not have access to clean drinking water. We plan to do this by researching which filtration method is the most efficient and effective in eliminating the harmful bacteria found in water.

Materials and Methods: We used the method of experimentation by testing a variety of different cleaning techniques and machines. For example, we tested UV lights and Filter systems by using UV lights to eliminate bacteria from water and then a filtration system filter impurities from water. Our materials were: UV Light, Dirty Water, Filter and boxes to make the models

Results: The UV light method was more expensive, but more effective in eliminating bacteria.

Conclusions/Discussions: The UV light was costlier but more effective in filtering the impurities from the water. Nevertheless, the filtration system still worked in the end. Therefore, we conclude that the UV system is best for extreme cases, while the filtration system will best suit milder water conditions. Overall, our data and methods of implementing them will greatly help solve the global water shortage problem and provide basic public health to all those across the world.

Team: **S.T.A.U.N.C.H (54)**
Title: SimulaTed grAvity UsiNg Centrifuges vs Humans
Participants: Abhaysai Vemula and Ujjayi Pamidigantam

Summary: Throughout human history, civilizations have dreamed of space exploration and reaching beyond the stars. During the last half century this goal has been accomplished and humans have made it into space. Unfortunately, we still face many difficulties during our journeys in space. The most dangerous thing for an astronaut is the lack of gravity, called microgravity. Gravity is essential to the survival of astronauts in space. That is very our project comes into play. It explains the theoretical science behind simulating gravity in space. Even though the thought of Artificial Gravity may seem like fiction, it is achievable through the use of a space station spinning like a centrifuge. To create artificial gravity we need to build a space station built like a centrifuge. A centrifuge is: a machine with a rapidly "rotating container that applies centrifugal force to its contents, typically to separate fluids of different densities or liquids from solids" (dictionary.com). To understand a centrifuge you must understand centrifugal force. Centrifugal force is:"an apparent force that acts outward on a body moving around a center, arising from the body's inertia." Moving on, to calculate the perfect velocity needed, you would need to use the formula a=(w^2)*r. In the formula *a* is the acceleration, *w* is the angular velocity and *r* is the radius. The formula shows that angular velocity equals to the angular rotation, 2π, over the RPM. Since we want our space station to have similar gravity to Earth and want to figure out the radius we would input the values as 9.807= (2π/60)^2*r. If we solve for r we get about 894 feet, which is the length of the Titanic. So with all of the information we gathered, why create

such a space station? It seems like a waste of money but, the space station can easily be achieved through cooperation between organizations and the government. With serious concentration this goal can be achieved today.

Team: New Point of View Crew (55)
Title: Understanding Diabetes
Participants: Kusum Gandham, Nyjah Howard, Khushi Patel

Objectives/Goals: To study the rate, the glucose in the blood while having an insulin pump as more intake of glucose is taken. This will give a better understanding on how someone with Type 1 Diabetes is able to control the sugar in their blood with an insulin pump.

Methods/Materials: In the experiment, we used someone who has Type 1 Diabetes to measure the glucose in the blood. They drank three tablespoons of orange juice every hour for three hours. A short while after taking the orange juice each time they measure their glucose level in the blood. Then we evaluate the number to determine the relation of the levels of glucose.

Results: The first hour the glucose number was 345. Second hour was 290 and then following 210 on the third hour. The line of best fit for these numbers was $y = -67.5x + 416.67$. So the blood sugar has a negative slope in which it decreases.

Conclusions/Discussion: Knowing the rate the glucose in the blood helped us understand how the insulin pump helped maintain the blood sugar. It is important to learn how an insulin pump works in a diabetic patient to ensure it is working properly. As more juice was taken into the body the harder the insulin pump worked to maintain the blood sugar. This was not what we predicted in our hypothesis. We believed the blood sugar would increase but the insulin pump was able to keep the blood at normal levels.

Team: Robosmart (57)
Title: Artificial Intelligence(AI) by Smart Robot
Participants: Saurav Vidyadhara, Aamir Jalal, Laasyasri Sandy Channavajjala, Pragnya Adapa

Objective/Goal: Using neural networking APIs along with Tensor Flow and Raspbian to create an inexpensive, but powerful Artificial Intelligence platform that small companies can actively use and develop on.

Methods/Materials: Our materials include:

- Cardboard
- A Raspberry Pi v3
- Custom PCBs
- An Arcade Button(w led)
- Tensor Flow Software
- Samsung EVO card
- Google AIY Raspbian

As mentioned earlier, our apparatus consists mainly of cardboard. Our goal was to make the project really affordable and effective. In order to make sure that the work we were doing was effective, two of our members focused purely on research. We used our background in platform development and engineering to make sure that all of our parts were cooled. We also took great care to make sure that our chassis was durable. After ironing out every nook and cranny, we made sure to make the product look as appealing as possible.

Methods include:

- Neural Networking
- Tensor Flow and AI App Integration
- Marketing
- VUI Development

Results: We are still in the beginning phase, but we were able to create the basis for our platform, including the VUI, server, and chassis

Conclusions/Discussions: Artificial Intelligence is changing the way we think, learn, and evolve. Still, this kind of program has downsides. The industry is benefiting only two groups, large companies and homes. Small companies can't add AI because of price and accessibility. Companies want modularity and control over AI. That's where our innovation comes in. PAM, or Powerful AI Module, is great for small companies and businesses because of the materials. The body is made of cardboard, perfect for a cost effective and affordable robot. The robot has a custom VUI and because the brain is a Raspberry Pi, the robot can take in motors, allowing for a movable, voice controlled, autonomous robot, that only costs 50 bucks. Our innovation can change the way companies integrate AI.

Summary: Using Artificial Intelligence and Neural Networking, we can create a robot that can benefit small companies through modularity, simplicity, and programmability.

Meet the Speakers

Dr. Randy C Dockens (Also a Judge)

Dr. Randy C Dockens, recently became the Clinical Operations Lead regarding Phase 1 studies within Innovative Medicines Department, Bristol-Myers Squibb (BMS). Prior to that, he was Group Director for Clinical Pharmacology Scientific Operations (CPSO) within Early Clinical & Translational Research, BMS. He led three groups within CPSO: Clinical Pharmacology Analysis and Reporting (CPAR) which handles the non-compartmental pharmacokinetic (PK) 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 vendors, and Data Sciences (DS) composed of several data scientists and programmers who prepare datasets for PK 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 PK Reviewer with the Food and Drug Administration (FDA) for 4 years and joined BMS in 1991.

In addition, Randy has a creative side. He earned a doctorate in Biblical studies from Louisiana Baptist University in 2014 and has recently combined this interest with his scientific background into a futuristic fictional literary series called The Coded Message Trilogy with books entitled *T-H-B*, *F-S-H-S*, and *T-U-L-E*. An astrophysicist, working on a Mars mission, stumbles upon a world secret that plunges him and his friends into a covert adventure of mystery and intrigue. Randy uses science in his writing to add a feel of authenticity to the storyline but still makes the story fun to read. One can learn and be entertained at the same time. He is currently in the process of writing another futuristic series.

Mr. Paul Mikita

Paul A Mikita II, RN, is the Lead Emergency Preparedness Specialist who oversees the Emergency Preparedness education and training of the Robert Wood Johnson University Hospital – New Brunswick and the Robert Wood Johnson University Hospital – Somerset campuses.

He obtained an Associate Degree in Nursing from Raritan Valley Community College, a Bachelor of Science in Biology from Rutgers University and a Master Degree in Emergency and Disaster Management from American Military University. He maintains active certifications as a Certified Emergency Nurse and a Certified Healthcare Emergency Professional, he has also maintains additional training in Basic Disaster Life Support, Advanced Cardiac Life Support, Advanced Disaster Life Support, Advanced HAZMAT Life Support, Pediatric Advanced Life Support and as a Mobile Intensive Care Nurse and an advanced trauma nursing provider.

Paul holds over 25 years of experience with an extensive background in emergency medicine and emergency preparedness and is an Eagle Scout. Furthermore, in order to stay up to date on all developments in his field, he maintains professional memberships with the Emergency Nurses Association, the International Board for Certification of Safety Managers and the Association of Healthcare Emergency Preparedness Professionals.

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.

Judges At A Glance

James Thomson

James Thomson is an Associate Director, Business Insights & Analytics at Bristol-Myers Squibb

Mr Thomsons leads customer insights and market research for the GI Franchise within Bristol-Myers Squibb's Immuno-Oncology portfolio. Prior to joining BMS, he was a management consultant focused on helping life sciences and pharmaceutical companies solve their key marketing and sales business problems. He started his career in finance, with analytics roles at PepsiCo and Watson Wyatt.

Mr Thomsons received his MBA from the Darden School of Business at the University of Virginia, and received a BS in Biometry & Statistics from Cornell University

Keith Chapman

Keith Chapman has B.S. from Rutgers University. Mr Chapman first started out as an environmental consultant as a hydrogeologist, dealing with groundwater and soil contamination assessment and remediation. Mr Chapman currently have a Masters degree in teaching from Monmouth University and teach chemistry at North Brunswick Township High School.

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, he 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 distributed power systems research.

Mr Pandyaram 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, he is the CEO of Code Ahead (www.codeahead.io) - where he helps K-12 students learn the fundamentals of computer science to prepare them for a future in our increasingly technology driven world. In addition to Code Ahead, 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, he 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.

Dr. Manohar Sriramoji

Dr. Sriramoji obtained PhD in Physical Chemistry from Osmania University in 1991. Following Post Doctoral Fellowship at University of Oklahoma Norman. Dr. Sriramoji joined Chemtex, Port Arthur, TX as Analytical Chemist. During the course of his reserach period, he submitted number of publications in varios International journals. Dr. Sriramoji currently works at Merck in Information Technology division.

In addition, Dr. Sriramoji is actively involved in social activities including establishment of "Srinivasa Memorial Trust" in his native village in India and has been providing scholarships to first & second rank students in 10th grade for the past 13 years. He has also sponsored "Lead India 20-20", a three days program to inspire young students in the very high school where he graduated from.

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, she

worked in academic and biotechnology/ pharmaceutical laboratories and has taught at the college level.

Akintunde Bello

Dr. Akintunde Bello is currently the Head, Clinical Pharmacology & Pharmacometrics at Bristol-Myers Squibb. He is a pharmaceutical professional with more than twenty-five years of experience in the fields of Clinical Pharmacology, Preclinical Pharmacokinetics (PK) & Drug Metabolism with international pharmaceutical companies. He has managerial and leadership roles in early and late stage clinical development across multiple therapeutic areas (oncology, infectious diseases, CNS, CV, metabolic and respiratory diseases). He has had interactions with various regulatory authorities; end of phase 2, pre-NDA/BLA, scientific advice (EMA), FDA advisory board and post approval activities.

Dr. Bello has recruited, trained, mentored, and developed colleagues. He has earned many awards throughout his career and to list some: The Rhone Poulenc Rorer PhD Studentship (King's College, University of London), Bristol-Myers Squibb Triumph Award, Pfizer Nextgen Leader Program and the PowerList top 100 most influential Black People in The UK. He currently chairs the Innovation and Quality Consortium Clinical Pharmacology Leadership Group (IQ CPLG), he has coauthored more than 85 articles in peer-reviewed scientific journals.

Dr. Bello has a Ph.D. in Pharmaceutical Sciences - King's College, University of London, Department of Pharmacy, London, UK, MSc. in Instrumentation and Analytical Science - University of Manchester Institute of Science and Technology (UMIST), Manchester, UK and BSc. (hons) in Biomedical Sciences - Portsmouth Polytechnic (University). Hampshire, UK.

Jenna DelleDonne Ballard

Jenna DelleDonne-Ballard is a fourth grade teacher at Livingston Park Elementary School. Ms Ballard attended Ramapo College of New Jersey from 2007-2011, where she double majored in Elementary Education and Psychology, and she is currently in pursuit of Master's Degree in Educational Leadership with a minor in Curriculum/Instruction. Over the past six years, she had taught on multiple elementary grade levels and truly loved being a part of the North Brunswick Township School District. Being an active and integral participant within her school community is something she find joy in and to be rewarding.

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.

Mr 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. He is also a recipient of AT&T ACE Award for Achievement, Creativity and Excellence.

Mr Chintalacheruvu 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.

Mr Chintalacheruvu 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. Giridhar Tirucherai

Dr. Giridhar Tirucherai graduated with an interdisciplinary PhD in Pharmaceutical Sciences and Pharmacology from the University of Missouri-Kansas City in 2002. His doctoral research was in the area of ocular drug delivery and pharmacokinetics of antiviral prodrugs of ganciclovir. Shortly after graduation, he joined Quintiles Kansas City, a global contract research organization, as an Associate Scientist in the Clinical Pharmacology department. He worked at Quintiles for 8 years and had leadership of the Early Clinical Development function at Quintiles. Dr. Tirucherai joined Bristol-Myers Squibb in Lawrenceville, NJ in 2010 and has since served in various scientific leadership roles. Giri is currently Director of Clinical Pharmacology and pharmacometrics, leading research and development efforts in the area of genetically defined rare diseases. Dr. Tirucherai is widely published and is a recognized expert in the area of cardiovascular safety evaluation in clinical research. Dr. Tirucherai enjoys spending time with family and friends, and is an avid crossword and Sudoku enthusiast.

2017 NBT SCIENCE SYMPOSIUM WINNERS

Team#	Team Name	Category	Participants	Award
134	The Mathemagicians	Elementary School (3-5)	Hael Raj	1st Place
134	The Mathemagicians	Elementary School (3-5)	Pratyush Rajesh	1st Place
141	Go Green	Elementary School (3-5)	Akshita Krishnakumar	2nd Place
141	Go Green	Elementary School (3-5)	Harish Krishnakumar	2nd Place
120	Whiz Kids	Elementary School (3-5)	Sahil Choudhari	3rd Place
120	Whiz Kids	Elementary School (3-5)	Aarav Yadav	3rd Place
120	Whiz Kids	Elementary School (3-5)	Rohan Bhatia	3rd Place
144	MasterMinds	Middle School	Karan Choudhari	1st Place
144	MasterMinds	Middle School	Pranav Rana	1st Place
144	MasterMinds	Middle School	Shrey Jain	1st Place
144	MasterMinds	Middle School	Praney Hirpara	1st Place
125	Blue Tide	Middle School	Mariam Farook	1st Place
125	Blue Tide	Middle School	Anjali Aravindhan	1st Place
136	Brunswick Bros	Middle School	Sachin Gokhale	2nd Place
136	Brunswick Bros	Middle School	Rajeev Achar	2nd Place
105	INOV8 Tech	High School	Ritika Anthony	1st Place
105	INOV8 Tech	High School	Trinity Mills	1st Place
151	Team Rome	High School	Meha Pandejee	2nd Place
151	Team Rome	High School	Robbie Neumann	2nd Place
137	Double A Minders	High School	Anudeep Revuri	3rd Place
137	Double A Minders	High School	Ashwin Gokhale	3rd Place
114	Electrons	Elementary School (3-5)	Sibi Thiagarajan	Outstanding Research
114	Electrons	Elementary School (3-5)	Lukesh Mohindra	Outstanding Research
114	Electrons	Elementary School (3-5)	Varun Ramanathan	Outstanding Research
153	Team Khanna	Elementary School (3-5)	Prarthna Khanna	Outstanding Design
153	Team Khanna	Elementary School (3-5)	Vedika Khanna	Outstanding Design
149	Energy Producer	Elementary School (3-5)	Srihaas Chennavajjala	Outstanding Presentation
149	Energy Producer	Elementary School (3-5)	Gagan Voona	Outstanding Presentation
121	Wacky Wizards	Elementary School (3-5)	Yash Choudhari	Outstanding Creativity
121	Wacky Wizards	Elementary School (3-5)	Naina Choudhari	Outstanding Creativity
148	Fab Labs	Middle School	Udgita Pamidigantam	Outstanding Research
148	Fab Labs	Middle School	Anjali Vellanki	Outstanding Research
128	Team Emoji	Middle School	Aruhi Vakkalagadda	Outstanding Design
128	Team Emoji	Middle School	Gabriella Seiden	Outstanding Design
128	Team Emoji	Middle School	Stacy Rappolt	Outstanding Design
128	Team Emoji	Middle School	Alyssa Mikita	Outstanding Design
123	The Scanner Girls	Middle School	Gia Dorawala	Outstanding Creativity
123	The Scanner Girls	Middle School	Leah Hughes	Outstanding Creativity

2017 NBT SCIENCE SYMPOSIUM WINNERS

123	The Scanner Girls	Middle School	Sreenidhi Ravishankar	Outstanding Creativity
140	The Unpredictables	High School	Kusum Gandham	Outstanding Design
140	The Unpredictables	High School	Laisa Duarte	Outstanding Design
109	Nefarious Wizards 2.0	High School	Abhitej Bokka	Outstanding Creativity
109	Nefarious Wizards 2.0	High School	Pramod Mitikiri	Outstanding Creativity
109	Nefarious Wizards 2.0	High School	Varun Chari	Outstanding Creativity
109	Nefarious Wizards 2.0	High School	Ethan Lee	Outstanding Creativity
104	The Science Stars	Elementary School (3-5)	Devin Sanghvi	Popular Choice Award- 1st place
104	The Science Stars	Elementary School (3-5)	Milav Shah	Popular Choice Award- 1st place
104	The Science Stars	Elementary School (3-5)	Anish Vuthaluru	Popular Choice Award- 1st place
118	Simple Solutions	Middle School	Isha Shrivastava	Popular Choice Award- 2nd place
118	Simple Solutions	Middle School	Poojitha Kalasapati	Popular Choice Award- 2nd place
118	Simple Solutions	Middle School	Roshni Raghuraman	Popular Choice Award- 2nd place
110	The Einstein Minions	Elementary School (3-5)	Anish Bokka	Popular Choice Award- 3rd place
110	The Einstein Minions	Elementary School(3-5)	Atharv Rege	Popular Choice Award- 3rd place
110	The Einstein Minions	Elementary School (3-5)	Mohit Pradhan	Popular Choice Award- 3rd place

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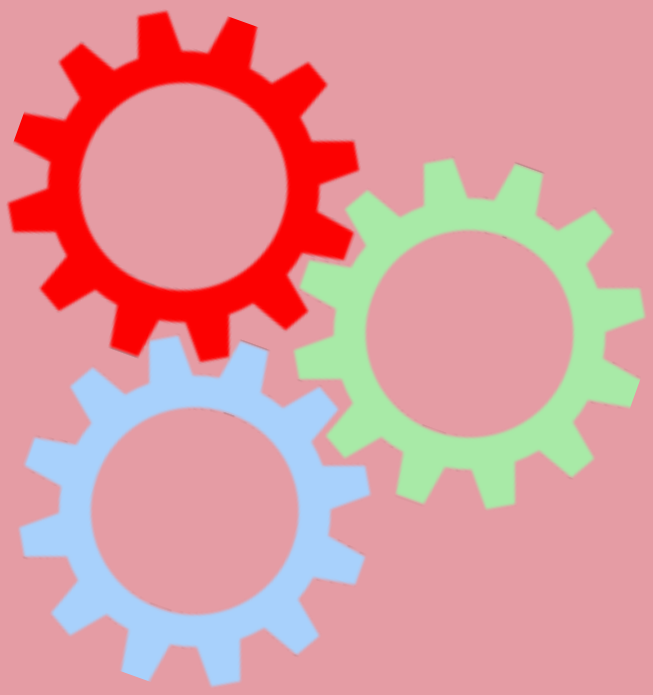

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