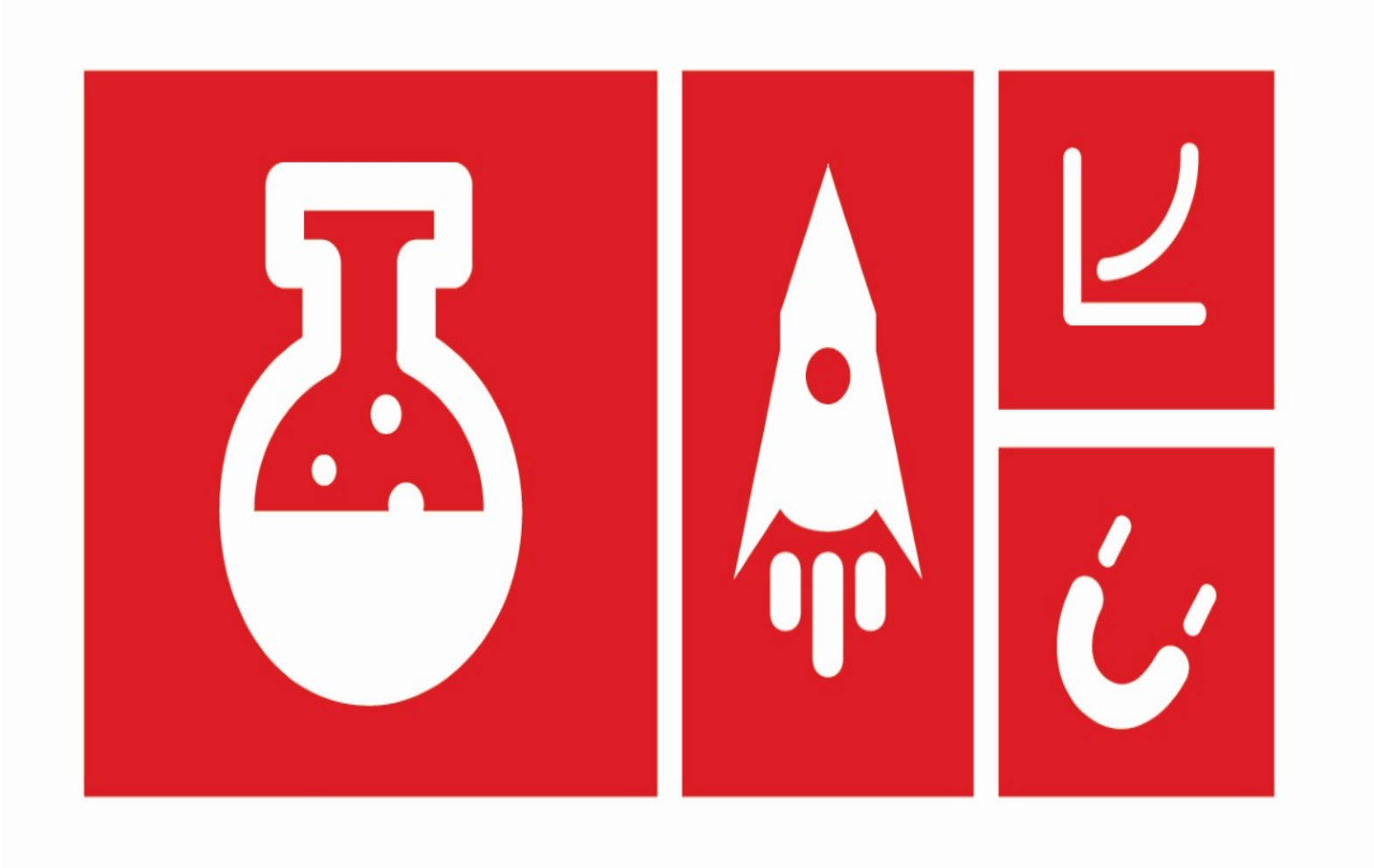
2018 Carmel Science Research Symposium



May 17, 2018

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Science Research Program Description

Carmel Science Research is a college level course offered through the University of Albany. The program focuses on guiding students through the process of scientific research. All students are asked, starting sophomore year, to choose a field of science that they find interesting. From there, students are asked to do ample amounts of research in order to derive an original research idea. All participants have the opportunity to work with some of the scientists in leading university and research institutions. After the students carry out their research, they compete in regional, and national competitions such as Regeneron Student Talent Search, Siemens Westinghouse, Westchester Science and Engineering Fair, Somers Science Fair, and so on. This program is very rewarding to both the students, teachers and the mentors.

Competitions

Eastern Junior Science and Humanities Symposium:
One of the most prestigious forums for young scientists in the country. Students are given the opportunity to observe student presentations and compete against science research students from the local area. Upperclassmen compete at competition, while sophomores observe. Students who place at the Eastern Section JSHS Sub-Regional will compete at the Upstate JSHS.

Regeneron Science Talent Search:
The Regeneron Science Talent Search, a program of Society for Science & the Public, is the nation's most prestigious science research competition for high school seniors. Since 1942, first in partnership with Westinghouse, then with Intel 1998-2016, and now with Regeneron, the Society has provide a national stage for the country's best and brightest young scientists to present original research to nationally recognized professional scientists.

Siemens Competition:
The Siemens Foundation established the Siemens Competition in Math, Science and Technology in 1999. The Siemens Competition seeks to promote excellence by encouraging students to undertake individual or team research projects. It fosters intensive research that improves students' understanding of the value of scientific study and informs their consideration of future careers in these disciplines.

Competitions

Somers Science Fair:
The Somers Science Fair is a poster competition for 1st-year science research students from Westchester County high schools. Last year, almost 400 students from 24 schools participated! This is the only science research competition of its kind in New York State that provides the opportunity for 1st-year science research students to present, in a competitive setting, their understanding of the information as well as their intended methodology and hypothesized outcomes of their original research project.

Tri-County Science Fair:
The Tri-County Science and Technology Fair was founded in 1990 by the Putnam Children's Discovery Center, a volunteer organization. The Fair's primary purpose is to reward children who have an interest in science, math and technology.

Westchester Science and Engineering Fair:
WESEF is a local science fair affiliated with the Intel International Science Fair serving budding scientists in Westchester & Putnam counties of New York State. It offers high school students from Westchester and Putnam counties an opportunity to present their research to scientists, business leaders, and the general public. Students prepare a poster detailing their projects which, in most cases, have involved complex research conducted under the guidance of a professional researcher in their field of interest.

Accomplishments

Eastern Junior Science and Humanities Symposium:

- **Raehannah Aslam** placed 2nd in Behavioral Science - Speaker category and was eligible to compete at the Upstate Junior Science and Humanities Symposium (state wide).
- **Akiah Watts** placed 2nd in Behavioral Science - Poster category.
- **Isabela Yepes** placed 3rd in Behavioral Science - Speaker category.

Westchester Science and Engineering Fair:

- **Rahul Atluri** placed 3rd in the category of Cellular and Molecular Biology.
- **Angela Castronuovo** was awarded the Greg Horrace Creative Approach to Research Award. It is awarded to projects that utilize a creative and innovative approach to research.
- **Karissa DiPierro** was awarded the Cornell University Food Science Award. It is awarded to outstanding projects in the study of food systems.
- **Danielle Kilcawley** was awarded the Cornell University Division of Nutritional Science Award. It is awarded to outstanding projects in the field of nutritional science.
- **Akiah Watts** placed 4th in the category of Behavioral and Social Sciences.
- **Isabela Yepes** was awarded the Stockholm Junior Water Prize. It was awarded to the top-water related project.

Accomplishments

Additional Science Research Accomplishments:

- **Gretta Silsdorf** was selected to receive the Second Annual NYIT Mini Research Grant Award for her research proposal. The review committee has determined her submission to have scientific merit and potential impact, and we are confident your studies will contribute to the field of science and technology.
- **Akiah Watts** placed 2nd at the Afro-Academic Cultural Technological-Scientific Olympics.
- **Isabela Yepes** was chosen to be a speaker presenter at the 2018 Northeast Natural History Conference.
- **Madeline Olsen**, **Isabel Leslie**, **Meghan Dillon**, **Deborah Heaslip**, **Grace Vaidian**, **Akiah Watts**, **Julia Pasquale**, **Monica Zheng** and **Daria Brennock** have been accepted into the 1000 Girls, 1000 Futures program, which is presented by the Global STEM Alliance of the New York Academy of Sciences. As part of the program, our students receive one-on-one mentoring from professional women in STEM fields, network with female STEM enthusiasts and professionals and complete coursework that emphasizes college readiness, leadership, communication and critical thinking skills.

Emily Alps

Sophomore

Mysterious Stone Chambers of Putnam County Historical Rationale

In Putnam County, NY there are 37 mysterious stone structures randomly scattered across the county. According to scientists some of them may align with the sun and stars on certain dates during the year. Archaeostronomy, the study of the alignment of structures with the heavens, is usually associated with such ancient wonders such as Machu Picchu in Peru or Newgrange in Ireland. Historians believe that these structures in Putnam County resemble the Neolithic Celtic stone chambers similar to those found in Europe. Many critics believe that these structures are really 18th century root cellars, which have inspired debate among amateur historians, Now, the structures have come center stage amid renewed controversy over their history and the effort to preserve these structures.

In her study, Emily plans on determining if the stone structures of Putnam County are stone chambers or root cellars. She plans on accomplishing this by using historical documents and maps to determine the proximity of the structures to the house of the land's owner(s). As well as astronomical tests to determine if the structures correlate in any way with the sun and stars. The following year, Emily will determine the value of the stone structures either agriculturally, religiously, economically, politically or socially using town records, journals and newspapers.

Emily is a sophomore in Carmel High School, as well as a competitive Irish dancer, she is a high honor roll students and participates in the track and tennis teams in her school. Emily aims to be a CHS mentor and be in the National Honor Society next year. Emily has always loved history from when she was little and is really excited to be tie history into her project. When Emily is older she wants to be an archeologist and travel the world. When not running or dancing you can find Emily reading about history or watching *The Office.*

Acknowledgements:

Her family and friends

Mrs. Monaco

Mrs. Lutz

Science Research Peers

Raehannah Aslam

Senior

The effect of the decrease in the growth of thicker axon structures in the prefrontal cortex on violence among males: A Meta-analysis

In 2016 alone, there were over a million violent crimes committed in the United States of America according to the Federal Bureau of Investigation. Crime has been on a decline since the 1990, however from 2015 to 2016 there has been a spike of 3.4% of violent crimes committed. Violence is clearly a prevalent issue in America. According to the Center for Disease Control violence is classified as a public health issue. Violence effects almost all aspects of human life; how people act, how people communicate and how people view one another.

Raehannah's research is on how to better understand violence and its causes. She mainly focused on the biological side of violence, although the environment plays a key role. The core of Raehannah's research is on the prefrontal cortex, a region of the brain known to have a key role in behavioral control. Her research looks into the role of the decrease in axon growth in the prefrontal cortex, and its effect on violence. Her study is a meta-analysis study and all data comes from previously published literature. Raehannah's study includes 100 pieces of literature from reputable medical journals, that she read and analyzed herself. She has found a connection between violence and decrease in growth of axon structures in the prefrontal cortex.

Raehannah is an honor student at Carmel High School. During her time in the science research program Raehannah has entered the Regeneron Science Talent Search, Siemens Westinghouse, Tri-County Science Fair, Westchester Science & Engineering Fair, Eastern Junior Science and Humanities Symposium and Upstate Junior Science and Humanities Symposium. She has placed 4th at Westchester Science & Engineering Fair and 2nd place at Eastern Junior Science and Humanities Symposium. When Raehannah is not working on her research she is either gardening, reading, or traveling.

Acknowledgements:

Her family

Ms. Nicole Monaco

Dr. Tanja Jovanovic, PhD

Rahul Atluri

Senior

Effect of PI3K Inhibition on Breast Cancer Cells

Cell death is a process that the body follows to maintain a certain number and organization of cell in tissues and organs. When cell death is compromised, controlling the numbers of cells becomes difficult for the body and can result in the formation of tumors. Cancer has become the second leading cause of death in the US. As cancers develop, cell death is inhibited and current therapies for cancer involve trying to reactivate cell death. One strategy to do this is to inhibit the PI3K-AKT pathway, which is involved in cellular functions such as cell growth, proliferation, and cell survival, and is mutated across a wide range of cancers.

Rahul examined how breast cancer cells would respond under the influence of several drugs that block the PI3K-AKT pathway. Working alongside a graduate student and a lab director at Memorial Sloan Kettering Cancer Center, Rahul reports that the inhibition of the activity of two kinases that act in the same pathway, PI3K and AKT, leads to the induction of entosis in tumor cell populations. Entosis is a form of cell death where cells are killed by their neighboring cells and within a cell population this is a competitive behavior.

Rahul will be graduating with an Advanced Regents Diploma. He is actively involved in the FBLA organization, National Honors Society, and a captain on the varsity tennis team. He will be attending Boston College in the fall to continue his education and wants to become a doctor.

Acknowledgements:

His parents for their love and support

Ms. Monaco for all her guidance

Dr. Michael Overholtzer and Dr. Jens Hamann for all their support

Gwynne Aull

Sophomore

The Effects of Animal Therapy on the High School Setting

Being around animals can help reduce anxiety, tension, and stress hormones, and even lower blood pressure and heart rate. Humans and animals, such has dogs, have a natural bond described by the Theory of Biophilia and the Human-Animal Bond Theory. Animal therapy has been shown to have significant benefits in the elementary and middle school setting. These effects include, motivation and attitude improvements, higher reading scores and therapy dogs stimulate memory and problem-solving skills. High school teachers are in need of an alternative teaching method to keep students intrigued and motivated. There is limited research on how animal therapy effects students at the high school level.

The goal of Gwynne's research will be to analyze how animal therapy enhances the climate of a high school classroom. This study will include students from Carmel High School, a teacher and a specialized therapy dog. The participants will complete a survey provided by the student researcher. This survey should provide information of how the students act and feel when the therapy dog is present vs. when the therapy dog is not present. Gwynne will also attend some classes to observe how the therapy dog affects the classroom climate. Gwynne hopes animal therapy will have a positive impact on high school classrooms.

Gwynne enjoys science and her other classes at Carmel High School. Gwynne also plays the flute in Carmel High School's band. She plays soccer, basketball and lacrosse throughout the year. She loves teaching younger kids how to play basketball and lacrosse. Gwynne is also taking honors classes such as, Algebra 2 Honors and Chemistry Honors. She is excited to start her study in the science research program.

Acknowledgements:

Ms. Monaco

Her family and friends

Her dogs

Daria Brennock

Sophomore

Lie Detection and the Untrained Eye

Deception occurs in one quarter of every conversation. During an average day, a person can hear up to 200 lies. There are two different indicators that arise when a person is telling a lie. The first indicator is verbal such as sentence structure and length of pauses. Verbal is defined as relating to or in the form of words. The second indicator is nonverbal such as arm movement and head movement. Nonverbal is defined as not involving or using words or speech. Lie detection is not a simple task. Individuals that are trained in lie detection perform no better than the average person does when attempting to distinguish lies from the truth.

The purpose of Daria's study will be to determine the accuracy of untrained individuals in detecting when being told a lie. She plans to compare the accuracy scores between students and teachers at Carmel High School. The participants will be asked to watch a series of videos depicting a situation and determine which of the videos contain a lie. Daria hopes her study will help improve law enforcement practices.

Outside of Science Research, Daria can be found playing on the Carmel field hockey and lacrosse teams. She enjoys reading books and petting dogs in her free time. Daria is currently in honors classes and loves learning World History. Daria hopes to be a forensic psychologist after graduating college.

Acknowledgements:

Ms. Monaco

Dr. ten Brinke

Her science research peers

Her family and friends

Angela Castronuovo

Senior

The Effect of an Unknown Distance on Rating of Perceived Exertion

Many people don't realize that race performance is affected by physical fitness as well as mental strength, among other factors. Coaches usually train athletes physically without addressing the psychological aspect of training. Further research on the psychological aspect of training could better assist athletes to attain their personal bests. Finding a new method of training could improve coaching techniques leading to better race performances.

From her previous research, The Effect of an Unknown Distance on Race Performance, Angela found that there is no difference in race performance whether runners know or don't know the race distance. After learning this result, Angela then wanted to determine, even though race performance didn't change, whether the perceived difficulty of a race would change when the distance was unknown. She asked participants to either run a time trial without the distance revealed or a time trial with the distance revealed. The mean rating of perceived exertion values of the unknown trial were then compared to the mean rating of perceived exertion values of the known trial. It was found that not knowing the distance does not affect rating of perceived exertion.

Angela is a senior who is currently taking classes in AP Government and Politics, AP Calculus A/B and B/C, and AP Psychology. Outside of school, she enjoys running and is part of the Carmel Cross Country and Track teams. At home, she spends time playing with her dogs and occasionally drawing and painting. Angela will be running for Boston University in the fall.

Acknowledgements:

Ms. Monaco

Carmel High School

Pat McGinn

Mrs. Leone

All of the participants

Her classmates

Her family

Vincent Castronuovo

Senior

The Relationship between Runners' Height to Stride Length Ratios and Impact Force

Running injury is one of the most serious problems in the world of runners, as it can sideline them for a substantial period of time. Overuse injuries are those that result from repetitive strain or impact on muscles, tendons, ligaments, or bone. One factor that contributes to the common overuse injury is over-striding, which is landing past the midline of the body while running. Over-striding increases the amount of loading placed on the body with each stride, increasing the risk of overuse injuries such as stress fractures.

The purpose of Vinny's study was to determine whether runners' height to stride length ratios affected impact force during running. He had participants run 30 meters in a hallway where stride lengths were enforced by placing tape in 1-meter and 1.5-meter increments. Halfway through the runway, a force plate recorded the impact force. Participants ran across the runway twice, and a radar gun was used to control for speed. Information was analyzed using a two tailed t test and a scatter plot with a linear correlation regression test. Vinny's results showed that stride length alone had a significant effect on impact force, while the height to stride length ratio did not affect the force of impact. Vinny also conducted a second study, investigating the effect of the 2D4D digit ratio on injury severity and frequency. He found that for males, the right hand digit ratio was significantly and positively correlated to injury frequency.

Vinny is Captain of Carmel's track and cross country teams. He was injured with tibial stress fractures for over a year, which inspired him to research techniques for preventing injuries. He is in all honors/AP classes and has been an honors student throughout high school. He is President of the Interact Club, providing community service whenever possible. Vinny will be attending Northeastern University in the fall, where he hopes to study sports medicine to help others overcome injuries.

Acknowledgements:

His science research teachers, Dr. Barish and Ms. Monaco, for all of their help throughout his project

His teammates for taking part in his study

His friends & family for their support

Shreya Chopra

Junior

Genetically Modified Organism's Effect on Soil Nutrient Content

Genetically modified organisms (GMOs) are living organisms with genetic material artificially manipulated through genetic engineering. GMOs are becoming prevalent around the world especially in the United States.70-80% of foods consumed in the United States has genetic modification, engineering or recombinant-DNA technology. Minimal research on GMO crop production trends has been conducted. In the past decade, GMO production increased until approximately 2015, when the percent of GMOs produced dropped drastically. The cause of this is unknown, however, it is hypothesized that the consumer awareness of GMOs is affecting the production rates across the United States.

The purpose of Shreya's study was to compare different amounts of GMO crops produced in fourteen different states with different gene types from years 2000 to 2017. The data was collected by taking averages from 14 different states of GMO crop production. The averages were calculated to determine if each state was a high or low GMO production state. Her study showed that each state had a relatively similar amount of GMO crops being produced; however, stacked gene variety was produced more often than insect resistant and herbicide tolerant. Next year, Shreya plans on comparing soil nutrient content in crops that are genetically modified to organic crops.

Outside of science research Shreya enjoys skiing, running and playing tennis. She likes to travel to different parts of the world and read. She hopes to pursue a career in the medical field. Science research can help her achieve her goals as a high school student and gain experience within the research field.

Acknowledgements:

Her Science Research teacher, Ms. Monaco for encouragement and advice throughout the program

Her mentor, Mrs. Mackin for her guidance and assistance

Family and friends for support

Meghan Dillion

Sophomore

The Correlation between Levels of Air Pollution and Death from Neurological Causes Across U.S States: Does Foggy Air Lead to a Foggy Mind?

Ambient air pollution is a great environmental risk to health – causing more than 3 million premature deaths every year (World Health Organization, 2012). One of the most dangerous pollutant to humans is Particulate Matter 2.5, which is extremely small and can be absorbed through the skin or inhaled through the nose and enter the blood stream. Past research has determined the effects of these particles on the lungs and heart, but little work has been completed on the effects of these pollutants in the brain. A recent study has found that pollutants similar to PM2.5 can wear down the Blood-Brain Barrier, a semipermeable membrane surrounding the brain that serves to keep harmful substances out.

Meghan plans to determine if there is a correlation between the amount of PM2.5 air pollution in an area and the number of deaths from neurological causes (ex. Parkinson's, Alzheimer). She will use the Center for Disease Control's WONDER database to determine the number of deaths and the CDC's Public Health Tracking Network to determine levels of PM2.5. She hypothesizes that because pollution wears down the Blood-Brain Barrier, areas with higher levels of pollution will have a greater number of deaths from neurological causes. She hopes that her research can help bring awareness to the devastating effects of air pollution and contribute to treatment of people with these diseases.

Meghan is an honor student at Carmel High School. She takes part in many clubs, and recently became NYS FBLA's District 3N State Vice President. She enjoys bowling and golfing, and her four cats. She hopes to graduate with high honors and attended college for medicine.

Acknowledgements:

Her family, especially her science-loving grandpa

Ms. Monaco

Her amazing friends

Mrs. Sager

Karissa DiPierro

Senior

A Comparison of Food Environment Factors on the State and Regional Levels

Obesity is one of the largest health problems facing the United States. It is a deadly disease, increasing one's risk for type 2 diabetes, heart disease, and cancer. With the percentage of obese persons tripling since the 1980s, the government and other groups have been working tirelessly to counter the epidemic. Part of what makes obesity so difficult to combat is the complexity of its causes. The rate of obesity in the United States varies at the regional, state, and even county levels. The current causes for this variance are unknown, but current research suggests that the surrounding environment may affect one's chances of being obese.

In Karissa's study, the influence of certain food environment characteristics on rate of obesity in both New York State and the Northeast region was observed. One's food environment includes the prevalence of eateries in one's location, one's accessibility of food, and one's food security (among other factors), which influences one's food choices and diet quality. Using data from the USDA's Food Atlas, the number of fast food and full service restaurants in each county was tested for correlation with the rate of obesity. Current data suggest that these variables do not have a strong influence on obesity neither in New York State nor in the Northeast region and, therefore, should not be the primary focus of future obesity prevention efforts. These results could be different for the rest of the United States, but further investigation is needed. Future research will focus on the influence of fitness facilities, farmer's markets, and convenience stores on obesity.

Karissa received the Cornell University Food Science Award for her obesity research at this year's WESEF competition. In September, she completed a continuation of her study, The Effect of Mounting Height on a Photovoltaic Device. She currently plans to major in nutrition, with hopes of one day going to medical school and becoming a general physician. While in college, she would like to continue her research in public health.

Acknowledgements:

Her parents for all of their love and support.

Her teachers, Ms. Monaco and Dr. Barish, for their guidance.

Mr. Saldicco, for his advice and aid.

Her Science Research peers, for their advice, friendship, and support over the years.

Andrew Fernandes

Senior

Survey of the Habitable Zones of known Stars and the Frequency of Exoplanets in Different Types of Stars

In 1995, the first exoplanet orbiting around a sun like star was found. This new planet, named 51 Pegasi, resulted in a competitive, new field of astrophysics charged with searching for new Earthlike worlds. Recently, the Kepler Telescope was launched into space and returned enough data to confirm 2,330 planets from 4,496 candidate planets. The amount of funding required for such endeavors is enormous—the Kepler mission alone reached an astounding $600 million. The next telescopic mission, the James Webb telescope, has reached an astounding $8.7 billion price tag, and is not yet in space. With such expenses, it is necessary to optimize the search for these planets by bolstering the process with statistical analysis.

In Andrew's study, information on a variety of stars were analyzed specifically for habitable zone size and rocky planet quantity. This study determined which type of star typically has the largest habitable zone and which type of star produces the greatest number of rocky planets from its proto-planetary disk. Using select exoplanetary systems, Andrew analyzed the habitable zone size in relation to its host star and the frequency of planets in each system to determine an optimal stellar type for planet formation. His findings showed that highest probability of finding earthlike planets are around K stars, due to the size of their habitable zones, and M stars, because they typically host a higher number of planets. His findings are cataloged and may be used to aid in the search for Earthlike planets. This examination maximizes the planet search efficiency and is a critical step in the search for exoplanets, and specifically rocky planets like Earth.

Andrew is a senior who is set to attend Villanova University in the fall and become a physics major. Andrew also plans to enroll in the ROTC programs available at Villanova. Outside of academics, Andrew enjoys playing soccer and working on cars, as well as playing music and volunteering in the community.

Acknowledgements:

Dr. Brian Abbott and the Hayden Planetarium for their assistance

Ms. Monaco for her help and guidance throughout his research

Carmel Central School District

His family for always loving and supporting him

Annalena Fusco

Junior

Stem Cell Misconceptions within High School Biology Education

About 3.5 million students […] were expected to graduate from high school in 2016-2017 and about 96% of those students will have received a biology credit" (NCES, 2016). Out of those 3,360,000 students, how many of them have a true understanding of a new biological scientific area such as stem cells? Misconceptions are an incorrect interpretation of a fact based on prior knowledge or a misunderstanding of the concept itself. In the controversial field of genetic engineering, misconceptions have a detrimental impact on scientific progress. By identifying factors that encourage the development of misconceptions earl on in high school education, it may be possible to improve scientific literacy, and hopefully the progression of many scientific fields.

Throughout her research project *Stem Cell Misconceptions within High School Biology Education*, Annalena identified correlations between people's demographics and personal opinions to a belief in stem cell misconceptions. Participants of Annalena's study were given a demographic survey, an opinion quiz regarding stem cells, and a quiz containing some stem cell misconceptions and some evidence supported fact about stem cells. After collecting the survey, Annalena determined existing correlations between the using a one-way T test. In total 90 of 546, about 16.5%, of the answers that were given by participants were misconceptions. One variable, the question asking people if they felt stem cells were ethical on the opinion portion of the quiz, had a statistically significant result. That question had those who "disagreed" (on a Likert scale) that stem cells are ethical had on average 3 more misconceptions accepted.

Outside of schoolwork, Annalena enjoys playing varsity softball and bowling, as well as playing softball on teams not associated with the school. She is also and honors students and is an active Girl Scout at the Ambassador level. Musically, she loves to play the flute and the piccolo for wind ensemble, and the saxophone for the Jazz Band. At home she enjoys playing with her two cats, Mario cart, and going bowling with her parents for fun.

Acknowledgements:

Her mentor Dr. Deborah L. Cunningham

Ms. Monaco and all of her science research peers

Her mom and her dad

Andriy Gura

Senior

How Do Different Types of Fertilizers Affect Soil Salinity and Microbial Biomass In the Rhizosphere of Red Beefsteak Tomato (Solanum lycopersicum) Plants?

Soil pollution occurs when the presence of toxic chemicals, pollutants or contaminants in the soil is in high enough concentrations to be of risk to plants, wildlife, and humans. Arable land is turning to desert and becoming non-arable at increasing rates, due largely in part to climate change, and agricultural fertilizers and pesticides, lessening the hope that we can feed our booming population. Within 40 years, there will be over 2 billion more people, requiring food production to increase by 40%. Today, people use fertilizers very loosely and the only solution is to understand their effects in order to create new regulations.

Andriy conducted a field experiment to investigate how different types of fertilizers (Sythetic, Organic, and Biological) affect the soils properties, specifically salinity and microbial biomass levels. The experiment lasted 15 weeks over the summer of 2017. In total there were 10 plots for the 100 plants; 1 accounted as the control, and the other 9 different experimental groups. There were three plots for type of fertilizer. Each plot accounted for either 1/2x, 1x, or 2x the recommended amount of fertilizer applied. The hypothesis stating that all the fertilizers would alter the soils properties was supported. These changes include: a decrease in microbial biomass, an increase in salinity levels, an increase in NPK (Nitrogen, Phosphorus, Potassium) levels, and a slight decrease in pH.

Andriy is an honor student and enjoys reading articles relating to environmental/wildlife science. During his free time, he enjoys painting and hanging out with friends. Andriy is so passionate towards environmental science that he will be attending SUNY Environmental Science and Forestry in the fall of 2018.

Acknowledgements:

His Parents

Ms. Monaco

Science Research Peers

Erin Hanahoe

Sophomore

Misdiagnosis of Neurological Disorders

Approximately 12 million Americans are misdiagnosed each year. The misdiagnosis of a neurological disorder can lead to over testing and wrongful treatment of a patient. This can not only be painful, but costly and in some cases potentially harmful. Diagnoses that are missed, incorrect or delayed are believed to affect 10% to 20% of medical cases, far exceeding drug errors and surgical errors. Neurological disorders are especially challenging to diagnosis since many share common symptoms.

Erin's research is specifically focusing on the prevalence of misdiagnosing multiple sclerosis, Parkinson's disease, and epilepsy. The study will be a meta-analysis, meaning the data is collected from previously published literature. She plans on using literature with specific key words from PubMed and Google Scholar. She hopes to read approximately 50 articles and accept at least 40 articles into her study.

Outside of science research, Erin is an honors student and plays field hockey for the schools' varsity team. Erin also enjoys spending time with her friends, family and being complimented by Michelle. She also hopes to one day pursue a career in medicine and is excited to see what opportunities science research brings to her.

Acknowledgements:

Ms. Monaco

Science research peers

Her friends and family

Michelle McNamara

Deborah Heaslip

Sophomore

Analysis of polymorphism in yellow spotted salamander eggs

Amphibians, a unique group of vertebrates containing over 7,000 known species, are threatened worldwide. As an effect many amphibians have adapted to survive in these new conditions. Some of these adaptations have occurred because of the consequences of global climate change. The effects of climate change on the Earth's ecosystems are expected to be profound and widespread. Many species of plants and animals are already moving their range northward or to higher altitudes because of warming temperatures. The animal responses to climate change is already alarming, and the yellow spotted salamander happens to be one of the animals who has shown a response.

Deborah hypothesizes that the yellow spotted salamander has adapted through its eggs, to increase survival. In response to the increased amounts of sunlight due to climate change, these eggs need to be protected. A cloudy membrane could act as a sunscreen to protect the embryo from major exposure to sunlight. She plans on going out into the field, observing naturally occurring clutches of eggs in vernal pools and taking an account of the amounts of the two types of eggs. She will also be looking at the amount of foliage coverage in order to identify a correlation between the amount of foliage coverage and the amount of cloudy eggs. She hypothesizes that the more foliage coverage there is the less cloudy eggs there will be. She hopes that the results from her study could shed some light on the subject. She additionally plans on collaborating with local conservationists and the Great Hollow preserve.

Outside of science research, Deborah is involved in the school’s varsity tennis team and varsity ski team. Deborah is an honors student at Carmel High School and has a profound passion for science. She plans to enter a pre-vet program in college and then to veterinary school. She very much enjoys taking care of animals and playing tennis in her free time.

Acknowledgements:

Ms. Monaco

Science Research Peers

Parents

Mack Hedman

Sophomore

Finding Correlations in Personality and Morals

For centuries, the human mind has piqued the curiosity of many people, including Plato and Albert Einstein. Mack, a Science Research student, is interested in the thought processes of different people. To be specific, he is intrigued by the way that one's personality works to develop their morality. As some may know, there are five core personality traits. Finding how those personality traits interact with morality could have mental health applications, answer questions dating from the time of Plato, and appease Mack's everlasting curiosity. As much as Mack is curious, he is speculative. He believes that everyone has basic morals that they abide to, and that those morals play a huge role in everyday life.

The question that has long eluded Mack is how personality affects one's morals. To determine how morals are dependent on personality, Mack will have participants complete a survey that will assess their morals and personality. Personality will be based on the Big Five Personality Traits, and morals will be based on a moral code. Mack has hypothesized that all personality traits will correlate with morality, except for neuroticism. One of the facets of neuroticism includes anger, and emotion that can lead someone to seek justice, or behave in a violent and irrational manor. Mack hopes that he will be able to find many people willing to participate and support him in his study.

Mack is an aspiring catalyst in the throngs of society. He wants change to be the only constant thing, and the only changes to be improvements tin daily life. He loves to play lacrosse, and is an active member of his Boy Scout troop. He has been on high honor roll multiple times, is scuba certified, and wants to be a sustainable cash crop grower when he gets older.

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Danielle Kilcawley

Junior

How eating patterns change post-injury within a dancer population

The advancing art form of dance has taken the world by storm. Unfortunately, as the number of young dancers steadily increases, the number of dance-related injuries increases correspondingly. Dance requires athleticism as well as abnormal ranges of motion. This consistent physical stress and manipulation of a dancer's body into molded standards opens the door to fatigue, strain and in many cases, injury. Due to the intense dedication required, dancers have been found to face severe psychological distress following an injury. Prior research has evaluated the psychological and physical effects of dance-related injuries; Danielle's research aims to bridge the gap between these two aspects dynamically.

The main goal of Danielle's research is to observe how an injury may trigger a change in eating habits among dancers. Participants were instructed to log eating habits and give themselves a daily rating on their portion control abilities and whether they considered each day "good" or "bad" in terms of dietary choices. Information was collected through surveys that asked questions highlighting the psychological state of each participant. Injured dancers were found to have a lower average portion control rating and a lower average daily rating in comparison to non-injured participants. Overall, this research links injury to a decline in healthy eating for dancers, and can help distinguish the need for intervention methods and social support.

Danielle is a junior at Carmel High School, as well as a competitive dancer at Seven Star School of Performing Arts. She is an honors student and participates in multiple extracurriculars outside of school. Danielle is part of the CHS mentor program, Students Assisting Students club, National Honor Society and she volunteers with a troop of elementary level Girl Scouts. She hopes one day to work with children for a career.

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Isabel Leslie

Junior

Feeding Preferences of Scavengers in Temperate Deciduous Forests

The field of forensic taphonomy is a field that examines how taphonomic forces (decomposition in soil, or interaction with insects and other animals) have altered evidence and how scavengers play a major role in the decomposition process. Scavengers can slow forensic investigations by moving bones away from the initial location. From studying disarticulation patterns, forensic scientists can determine the approximate radius for missing bones that may have been taken by scavengers. If researchers knew of a scavengers known preferences, then they could predict which scavengers had fed on a set of remains. If the scavengers had a known preference, then forensic scientists could predict which scavenger is feeding on the set of remains.

Isabel is planning to determine if the scavengers in temperate deciduous forests exhibit feeding preferences. She has conducted a meta-analysis to determine if there was significant evidence to claim that scavengers have preference for the prey they feed on. The widely varied data as well as prior knowledge on animal behavior from previous studies do not show any significant evidence to support the claim that scavengers have a feeding preference. Isabel hopes to continue this project in a temperate deciduous forest biome in order to see if the location effects preference.

Isabel is an honors student at Carmel High School. She sings in the CHS Concert Choir. Isabel is also an active member of the Students Assisting Students program, has participated in the spring musical, The Little Mermaid. She has been accepted into the mentorship program, 1000 girls 1000 futures, conducted by The New York Academy of Sciences. During the summer, she enjoys volunteering at the Kent Public Library. When she graduates, Isabel hopes to attend college and study education.

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Sophomore

The Effects of Personality Type on Learning Styles in High School Education

Between 20% and 24% of students do not fall cleanly into one learning style category, but exhibit a hybrid learning style that spans two or more of the four categories. Learning styles can be categorized into one of the four categories: Visual, Aural, Reading and Kinesthetic. Visual learning applies to students who prefer using images or diagrams, aural learning for students who prefer listening and speaking, reading for students who would prefer to read and write, and kinesthetic for those who prefer using their hands in experiments or other hands on learning techniques. Students with a hybrid learning style will have an advantage over others because they will do better in a variety of learning environments. Students who are aware of their learning style would be able to use it as an advantage and could utilize it to increase academic success.

Michelle's research focuses on how high school student's personalities will affect their learning style. Her focus is to determine if there is a correlation between student's personality type and learning style. She is using the Myers-Briggs Type Indicator to determine which combination of the four personality types are exhibited by the student. She will be giving out a three-part survey to participants including questions regarding learning style and personality type. She hopes to use the information gathered to help students use their predominant learning styles as an advantage to achieve their highest academic potential.

Outside of science research, Michelle is an honors student who hopes to pursue a career in medicine. Her favorite classes are science and spanish. She enjoys hanging out with her friends, listening to music, complimenting Erin, and reading.

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Michaela Ndono-Mfoula

Sophomore

The correlation between the prevalence of youth development programs and Juvenile Crime Rate in Westchester, Putnam, and Rockland County

Michaela Ndono's area of research is criminology, which is an area of sociology that focuses on the study of crimes and their causes, effects, and social impact. A criminologist's job responsibilities involve analyzing data to determine why the crime was committed and to find ways to predict, deter, and prevent further criminal behavior. Throughout the recent school year, the New Rochelle School District has had many incidents dealing with juvenile crime. In 2017, over the span of eight days, there were three violent incidents all committed by juveniles who attended the high school and one incident that occurred within the school. Spike in juvenile crime has put fear throughout the school and the city.

The purpose of Michaela's research is to determine the correlation between the opportunities of youth development programsand the juvenile crime rate in Putnam, Westchester, and Rockland counties. Throughout her study she will be collecting data from various databases including the Bureau of Justice. She will be reviewing information such as the occurrence of violent crimes, age, gender, recidivism rates, population, and explorer programs. She hopes to find out how much the juvenile crime rate has increased and why. She expects that areas with active youth development programs will have lower juvenile crime rates.

Michaela is a kind, curious, and knowledgeable person. She is a soccer and basketball player for Carmel High School. Outside of school she sings, dances, plays the violin as well and the ukelele. She recently won a Carmel Rotary Shootout.

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Madeline Olsen

Sophomore

What is the impact of a Therapy Dog on Social Interactions within the High School Classroom?

The use of therapy dogs is becoming a more common practice amongst U.S schools. Dogs have been shown to reduce stress within students and create a more positive atmosphere for learning and sociability. Which can lead to better interactions among peers and helps to establish healthy relationships with others. Being able to interact and socialize with your peers is a big part of high school. Without that, students can feel sad and lost, which can lead to mental health concerns. Students should be able to thrive in their educational environment and live a happy and healthy life. But, socializing with others, in a setting notoriously known for being negative and unwelcoming, can be difficult. Not only that, but students can struggle with shyness, social anxiety, that makes one more prone to isolation over socialization.

Luckily, studies show that the presence of a trained therapy dog has been shown to counter negative emotions and help lead to positive social interactions with others. With the presence of a canine-companion, this is hoped to make the chances more probable. This study will see whether the presence of a dog will help create positive social interactions amongst peers in a high school setting. The participants will have a dog present once a week over the span of two months, and they will be given questionnaires afterwards. The hope for this study is to help students to thrive in their educational environment through creating and maintain connections with their peers. With a therapy dog present, it is hoped that this will be made possible.

Despite furthering her knowledge on her research topic, Madeline enjoys spending her time in the arts and expressing her creativity such activities involve dancing, playing instruments, singing, drawing, and reading. Madeline is also involved in the Best Buddies program at her high school and various art extracurriculars. She is also an honors student and enjoys expressing herself through literature.

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Thomas O'Rourke

Junior

Evaluation of the Genotoxic Potential of Naturally Occurring Chemicals in the Chicken Egg Genotoxicity Assay (CEGA)

A large number of consumer products, including food, personal care, and household products, used throughout the world on a daily basis contain chemicals, many of which are unknown in their toxic potential. Some of these compounds within products can cause genetic damage, such as DNA strand breaks or adducts, eventually leading to mutations and cancer. Thus, such compounds require testing to assess their harmful potential. The primary focus of Thomas' study was to evaluate an alternative method for genotoxicity testing, the Chicken Egg Genotoxicity Assay (CEGA). His study also analyzed two commonly used compounds, resorcinol and perillaldehyde, for their genotoxic potential.

With CEGA, important genotoxicity testing can be achieved at a faster, more ethical rate than animal testing. In the resorcinol groups, there were no substantial dose dependent findings of DNA strand breaks, nor did any adducts form. Thomas' study concluded that resorcinol does not exhibit a genotoxic threat to organisms. A high mortality rate in the perillaldehyde dosed groups indicates that future testing is required at lower doses. The results of his study have proven CEGA to be an effective model for genotoxicity testing of chemical compounds. While both resorcinol and perillaldehyde were found to be non-genotoxic, the important takeaway is that CEGA can test any chemical found in commonly used household products. As more chemicals are tested, the public can be informed of the risks associated with those chemicals. Thus, consumers can make healthier decisions to protect themselves and their families from dangerous chemicals.

Thomas is an active member of the community. This past winter, he created an organization to provide snow removal for elderly and disabled veterans, dubbed "Snow Warriors." He is an active member of Putnam County Youth Court, NHS, and a CHS mentor. Thomas is an avid runner and the captain of Carmel's Cross Country and Track teams. During his free time, Thomas enjoys spending time in nature by either hiking or biking. After graduation, Thomas hopes to attend one of the nation's service academy and pursue a degree in engineering or physics.

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Helena O'Sullivan

Junior

An Accessible Reading Program for Children with Physical Challenges

20% of children with disabilities cannot read and will have challenges learning this essential tool without extra help. Though there are an abundant of suitable reading systems available, none of them are geared towards the needs of children with physical challenges. Everyone has the ability to learn how to read, but some children just need specific environments and technology to help them. . That is why Helena evaluated how certain assistive technology tools can be an aid for children with physical challenges when they are learning to read.

The purpose of Helena's project was to test how two assistive technology tools could potentially aid children with physical challenges when learning how to read. Since reading and communication go hand-in-hand, not being able to read, limits their options for communicating. The two assistive tools that Helena's experiment tested, were the symbols and a darkened screen, embedded in a digital reading program. The experiment assessed whether or not the presence of one or both of these assistive tools could increase the child's capability to learn how to read. Helena's project is ongoing and, with the assistance of her mentor, she will continue to analyze the effect that these two assistive technology tools have on children who are physically challenged.

As a junior, Helena is a High Honors and AP student. Helena also volunteers for Guiding Eyes for the Blind by socializing puppies. Helena is a member of the National Honor Society, Students Assisting Students and Youth Court. In addition, she was also voted as the Treasurer for the junior class and has held the position for three years.

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The effect of radiofrequency energy from smartphones on Drosophila Melanogaster

Cancer is the second leading killer of Americans, and the leading cause of death worldwide. According to the American Cancer Society, every year about 1.5 million new cases are diagnosed in the United States and more than half a million people die from the disease, according to the. Cancer is caused by changes (mutations) to the DNA within cells. Natural exposure of an organism to various environmental factors, such as radiation and chemical carcinogens can provoke cancer-causing mutations. Radiation of high frequency can penetrate cells. If it strikes a section of DNA on the way through, the radiation can easily damage the structure, causing mutations which can lead to cancer. Smartphones emit radiofrequency energy, a form of non-ionizing radiation. Non-ionizing radiation has been shown to damage DNA. Since the average person spends over four hours a day on their smart phones, it is crucial that they are aware of the harmful effects the radiofrequency energy emitted from their smart phones.

In her study, Julia plans to observe the effects of the non-ionizing radiation emitted from smartphones on *Drosophila melanogaster* (fruit flies). She will be exposing the flies to the radiation for a specific amount of time. The physical characteristics of the fruit flies will be recorded and compared to the control group of flies. The reproductive and mortality rates of the flies will also be recorded. Julia hopes that her research will provide further insights into the harmful effects of non-ionizing radiation on organisms and raise awareness due to the copious amounts of people being exposed to this radiation every day.

Julia is a high honor roll student, and a member of the varsity tennis, golf, and basketball teams. She is also a participant in the 1000 Girls 1000 Futures program, sponsored by the Global STEM Alliance of the New York Academy of Sciences. As a part of the program, the participants receive one-on-one mentoring from professional women in stem fields. Julia plans on studying multiple sciences in college, with hopes of becoming a cancer researcher.

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Gretta Silsdorf

Junior

Occupational Therapy and Its Effect on Sensory Processing Disorder

Sensory Processing Disorder (SPD) is a disorder that occurs when the brain has difficulty receiving and responding to sensory input. SPD affects approximately 1 in 20 people in the general population (Ahn, 2004). It is thought that SPD is inherited genetically. Although there is no known cure for SPD, treatment is available through Occupational Therapy (OT). OT can help improve the daily life of a child effected by SPD by introducing new ways to handle the overwhelming sensory information.

The goal of Gretta's research was to analyze methods of treating SPD. She reviewed current exercises for SPD and attempted to conclude which one was most effective. Her conclusions hinted that small hand exercises were the most effective at treating children with SPD. After the completion of this project, Gretta will begin a new study with a neurologist in New York City. Her new study will be comparing the positive and negative effects of opioids vs. anti-inflammatory drugs.

Gretta is a motivated student who is a mentor and works hard to keep her high honors status. She enjoys spending time with her family and friends, taking care of her animals, and practicing tae kwon do. She enjoys going snowboarding in the winter, traveling, and hiking. She recently was awarded the Second Annual New York Institute of Technology Mini-Research grant award.

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Grace Vaidian

Sophomore

Analyzing Fentanyl's Varying Postmortem Levels

In the past few years overdose deaths from the synthetic opioid fentanyl have skyrocketed. Fentanyl abuse has been present in over fifty percent of opioid overdose cases across the United States. Forensic Pathology is the study of the cause and time of death of humans. Forensic Pathologists are responsible for autopsies and determining the factors around overdose deaths, including recording toxicology results. Forensic Pathologists have noticed that in the past few years the levels of fentanyl found in decedent's blood from overdose cases have been very steep, with levels high above the fatal amount.

In Grace's research, fentanyl level/amounts from deadly overdose cases will be examined. Grace hypothesizes that there has been an increase in Fentanyl levels overtime. She also expects that this increase in fentanyl levels will correlate with an increased number of Fentanyl overdose deaths. Data will be obtained from the Dutchess County Medical Examiner's Office under the supervision of a qualified Forensic Pathologist. Grace hopes the study will bring awareness to the high level of variance in Fentanyl and its analogs (variants).

Grace is an honors student at Carmel Sigh School. She has a passion for science. In school she participates in various extracurricular activities like advanced art classes and Symphony Orchestra. In her free time Grace likes to read or draw. She hopes to one day become a doctor.

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Akiah Watts

Senior

Linguistic Analysis of Sentence Variety in College Application Essays

Fluency and syntactic maturity in essays include a variety of sentence types with a higher frequency of subordinate clauses. Since subordinate clauses are only found in complex and compound-complex sentence structures, one would assume that well written essays would be primarily composed of complex and compound-complex sentences. The book "100 Successful College Application Essays" by The Harvard Independent, contains compositions that were deemed effective application essays by Harvard, a prestigious Ivy League College. Since the essays were deemed successful, one would hypothesize that there would be more dependent clauses within these essays. However, these essays were found to be primarily composed of the simple sentence structure.

The study was expanded upon through the voluntary submission of essay compositions from high school seniors and by distinguishing sentence fragments from the simple sentence structure. The findings from the human participant study largely mirrored the ratio from the published study possibly because of the high academic rigor of the participants who chose to submit essays. Even though there was a heavy reliance on the simple sentence structure, there was still a presence of the other sentence structures which augmented the coherence of the composition. This finding suggests that the priority of the essay should be the fluency of the composition and the comprehension of the reader.

Akiah is the Treasurer of Science Club, Vice President of Service in the National Honor Society, Co-President of the Students Assisting Students Program and a member of the Track Team, Business Honor Society, Tri-M Honor Society and Mentor Program. She was named an AP Scholar with Honor for her academic achievements. And for her efforts in community service, Akiah was honored to receive the Youth for the Dream Award recognized by U.S. Senator Kirsten Gillibrand and she was selected as a National Semi-Finalist for the 2018 N.H.S. Scholarship Program. Akiah also published a novelette entitled "Fragments," which is available on Amazon in both the print and e-book formats. She looks forward to a relaxing summer before heading over to Dartmouth College where she plans on studying psychology, marketing and microeconomics.

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Isabela Yepes

Senior

Assessment of Current Health and Function Conditions for Several Freshwater Wetlands in the Mianus River Watershed
Effect of Foot Strike on Injury Location in Runners

Isabela has dedicated her time to completing two projects over the course of three years in the Carmel Science Research Program. In her first project, she worked with the Mianus River Gorge, a local preserve in Bedford, New York. Isabela assessed the health and function conditions of 39 wetlands in the Mianus River, which provides drinking water for 130,000 people in local communities. She identified the wetlands most in need of restoration and preservation as well as their relative value for the structure of the river's watershed. In 2017, she earned the Teatown Young Naturalist Award at WESEF. In 2018, she placed 2nd in Environmental Science and won the Stockholm Junior Water Prize. Recently in April, she was chosen to be a speaker at the prestigious 2018 Northeast Natural History Conference.

For Isabela's second project, she investigated the effects of foot strike on injury location in runners. Her research suggests that the metatarsal strike is the best strike for avoiding injury while running. Together with other literature, findings suggest minimalistic footwear which mimics barefoot running is the best way to achieve the metatarsal strike. Isabela was inspired to pursue this research after reading 'Born to Run' by Christopher McDougall and recommends the book for those interested in learning more. Her interest in running also stems from her experience on the school's track and cross country teams.

Academically, Isabela has been a high honor roll, AP student. She is a member of the National Honors Society, the Foreign Language Honors Society for French and Spanish, and was Co-Captain of the FIRST Robotics Team, where she became a Dean's List semi-finalist. Isabela received the AP+PLTW Student Achievement in Engineering and is an AP Scholar with Honors. She volunteers at the Somers Youth Track Camp as a Junior Coach in the summers. After graduating, she will be attending Columbia University.

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Monica Zheng

Sophomore

Perfectionism in High Achieving Suburban High School Students

Individuals with perfectionism set high standards for themselves and strive for these expectations in their performances. Perfectionism has been separated into two groups: healthy and neurotic. Healthy perfectionists strive for high performance standards with high academic achievements, have high levels of conscientiousness, productiveness, organization, and are more accepting of mistakes. On the other hand, neurotic perfectionists are motivated by the approval of others, have unrealistically high standards, and are constantly in a state of anxiety and stress. Hewitt and Flett (1991) have identified perfectionism as a multidimensional personal and social construct, divided into three dimensions: self-oriented perfectionism, other-oriented, and socially-prescribed. Many studies have investigated perfectionism's prevalence in gifted students; however, few have explored perfectionism in public high school adolescents, especially in suburban areas.

The purpose of Monica's project is to identify the types of perfectionism in a sample of suburban, public high school students, and determine if there is a correlation between perfectionistic type and certain traits in high achieving students. Therefore, participants will be asked to take two surveys: Multidimensional Perfectionism Scale and the Goals and Works Habits Survey. She hopes the findings will assist parents and teachers in understanding and identifying perfectionistic students who may be under stress and anxiety.

Monica is currently an honors sophomore student at Carmel High School. She is part of the Science Club, Art Club, Interact Club, Tri-M, 1000 Girls 1000 Futures Program, and Reading Buddies Program. She enrolled in the Science Research course because of her passion and interest for science. She chose a study in perfectionism because she is a perfectionist. In the future, Monica desires to pursue a career in science. Her hobbies include sleeping, reading, drawing/painting, and listening to music.

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Notes