

NEW JERSEY SOUTHERN

**JSHS**

JUNIOR SCIENCE AND  
HUMANITIES SYMPOSIUM

FEBRUARY 24, 2023

LAKEHURST, NJ



[www.ocean.edu](http://www.ocean.edu)



# 7th Annual New Jersey Southern Junior Science and Humanities Symposium



Dear New Jersey Southern Junior Science and Humanities Symposium Students:

Welcome to Ocean County College, New Jersey's first and finest community college. We are pleased to host the annual Symposium for the seventh time.

Every year, we are impressed with the caliber of participating students and their research projects. The students are certainly the finest and brightest of New Jersey's high school STEM students, demonstrating the dedication and desire to learn and understand the complicated areas of science, technology, engineering and mathematics. The outstanding research projects presented have addressed some of the most current areas of focus for modern science and society.

New Jersey Southern Junior Science and Humanities Symposium students exemplify the creative nature required for successful scientists to meet challenges and find solutions at each step of their journey. Their determination carries them to the conclusions they draw and the next questions to ask. We are very proud of their accomplishments and very excited for their futures.

For those who have been selected to represent the New Jersey Southern region at the National Competition, we extend to you our very best wishes. Congratulations to you, your parents, and your teachers.

A special thank you to the members of the Symposium Executive Committee for their commitment to the success of this Symposium year after year. Our military and environmental partners make time in their busy schedules to prepare for and guide wonderful opportunities for all of the students who participate.

And a final thank you to all of you for participating in and supporting the New Jersey Southern Junior Science and Humanities Symposium.

Jon H. Larson, Ph.D.  
President, Ocean County College

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## Friday, February 24, 2023

**LOCATION: Joint Base McGuire-Dix-Lakehurst Flight Deck  
Community Center, Building 484**

**8:00–8:30 a.m.**

**Arrival / Breakfast Fare**

**8:30–9:00 a.m.**

**Greeting - Opening - Introduction**

**Dr. Mary-Ellen Rada**, Director,  
New Jersey Southern Junior Science and  
Humanities Symposium Ocean County College

**Welcome Address**

**Dr. Jon Larson**, President, Ocean County College

**NAVAL STEM: WE NEED YOU!**

**Ms. Kathleen P. Donnelly, USN**, Executive Director  
Naval Surface Warfare Center  
Aircraft Division (NAWCAD), Lakehurst, NJ

**9:00-10:30 a.m.**

**Session 1: Oral Presenters**

Moderator: Mr. Thomas A. McGrath

**9:02-9:17 a.m.**

**Aditya Khurana**, Moorestown High School  
*Cloud Enabled IoT Based Alert System for Aged,  
Blind and Disabled Individuals*

**9:20-9:35 a.m.**

**Keerthana Gauthaman**, Freehold High School  
*Effects of Bacopa Monnieri on Dopaminergic  
Neurodegeneration in Caenorhabditis elegans*

**9:38-9:53 a.m.**

**Victoria Yakes**, Marine Academy of Technology and  
Environmental Science  
*Analysis of Tannin Interference on Enterolert\*  
250 Testing of Enterococcus SPP*

**9:56-10:11 a.m.**

**Daniela Gonzalez**, Princeton High School  
*Two Steps Forward, One Step Back: Improved Walking  
Habits of Polypterus senegalus Fish with the  
"Shortbody" Mutation*

**10:14-10:29 a.m.**

**Katherine Fang**, High Technology High School  
*Surveying Water Surface and Wetlands in Delaware Bay  
Using Cloud-Removed LandSat Data*

**10:30 – 10:45 a.m. Break**

**10:45 a.m.-12:05 p.m. Session 2: Oral Presenters**

**10:45-11:00 a.m. Riya Savalia**, Freehold High School  
*Effect of Aloe Vera on Gut Inflammation Caused by the Accumulation of Polystyrene Microparticles in Danio rerio*

**11:03-11:18 a.m. Joseph Field**, Freehold High School  
*Application of Lemna Minor for In-Situ Phytoremediation of Perchlorate in Martian Regolith*

**11:21-11:36 a.m. Adrien Cristian**, Princeton Day School  
*Machine Learning Based Controller for Soft Robotic Arm in Simulation*

**11:39-11:54 a.m. Abigail Graf**, Freehold High School  
*The Effects of a Combination of L-DOPA and EGCG on the Motility of NL5901 Caenorhabditis elegans*

**11:57 a.m.-12:02 p.m. Riya Pawar**, Freehold High School  
*Effect of Aloe Vera on Gut Inflammation Caused by the Accumulation of Polystyrene Microparticles in Danio rerio*

**12:05-12:45 p.m. Lunch**

**12:45-2:20 p.m. Poster Presenters**  
Moderator: Ms. Carolyn Showalter

**12:45-1:00 p.m. Julia Takla**, Marine Academy of Technology and Environmental Science  
*Phase III: The Implementation of an LED-UVC Irradiated Shopping Cart Handle and Exploring its Microbicidal Activity*

**1:03-1:18 p.m. Bethany Suliguin**, Marine Academy of Technology and Environmental Science  
*Utilizing Lemna spp. To Quantify Nutrient Uptake and Release as a Potential Phytoremediation Strategy for the Barnegat Bay Watershed, New Jersey*

- 1:21-1:36 p.m.** **Brianna Suliguin**, Marine Academy of Technology and Environmental Science  
*Porcelain Berry (*Ampelopsis brevipedunculata*) and Autumn Olive (*Elaeagnus umbellata*) in New Jersey: An Invasive Plant Biofuel-Based Management Strategy*
- 1:39-1:54 p.m.** **Nicholas Hagedorn**, Princeton High School  
*Strict Inequalities of for the  $n$ -crossing Number*
- 1:57-2:12 p.m.** **George Kopf**, Princeton High School  
*Observing the Capabilities of Pufferfish to Exhibit Visual Social Learning*
- 2:05-2:20 p.m.** **Sumuk Anand**, Princeton High School  
*A Novel Method to Accelerate the Degradation Rate of Plant-based Tableware Using Compost Tea*
- 2:30-3:00 p.m.** **Break**
- 3:00 p.m.** **Awards Announcements**
- Announcement of Placings for Poster Winners**
- Announcements of Winners moving on to compete at the National Junior Science and Humanities Symposium**
- Fifth Place: Competing in the Poster Presentation**
- Fourth Place: Competing in the Poster Presentation**
- Third Place: Competing in the Poster Presentation**
- Second Place: Competing in the Oral Presentation**
- First Place: Competing in the Oral Presentation**
- 3:45 p.m.** **Congratulations and Closing Remarks**

## INTRODUCTORY REMARKS



### **Ms. Kathleen P. Donnelly**

Executive Director  
NAVAL AIR WARFARE CENTER  
AIRCRAFT DIVISION  
JOINT BASE MCGUIRE-DIX-LAKEHURST

Welcome to Joint Base McGuire-Dix-Lakehurst, where over 80 organizations from the Army, Navy, Marine Corps, Air Force and National Guard become as one, in defense of our nation. We are happy to host your prestigious symposium, which has been successfully and continuously run for over 60 years, as a regional competition for the National Junior Science and Humanities Symposium.

Welcome to the Lakehurst side of the Joint Base, where our Naval Air Warfare Center Aircraft Division organization supports Navy and Marine Corps aviation! We are again honored to support this annual symposium sponsored by Ocean County College and the Department of Defense. This competition has continued to inspire the next generation of New Jersey high school students to use your creativity and ingenuity by advancing your minds in applying Science, Technology, Engineering and Math.

We are most appreciative to be hosting this symposium in person, as the last three years have witnessed the competition virtually, due to the COVID-19 pandemic. While these last several years have produced disruption to our everyday lives, the challenges provided opportunities for us to rise and shine – to innovate and recreate a better way – in support of our nation’s defenses. Similarly, you, the Junior Science and Humanities Symposium students participating in this competition, have had the opportunity to meet your own unique and individual challenges in completing your research projects and being here to present yourselves.

Along with our co-sponsors from the Army, Air Force, Department of Homeland Security, National Oceanic and Atmospheric Administration and fellow Navy organizations, it is you, the participating students, and your deep curiosity and desire for learning, that we pledge ourselves to support your journey towards discovery and wonderment. We look forward to listening to each of your presentations and watching you Rise and Shine!

# REVIEWERS, MENTORS, AND JUDGES OF STUDENT PAPERS

## U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND, COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS, CYBER, INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE (C5ISR) CENTER

---

David Arty	Lauren Johnsky
Georgia Belesis	Thomas Kesolits
Konstantinos Belesis	Robert Kimball
Corbin Borrero	Dr. Jenna Klubnick, MD
Glenn Briceno	Christopher Kramer
Kevin Brower	Chen Lai
Alena Calm	Walter Lucchesi
Matthew Casey	Richard Lo, Veterans Affairs
Ettore Ciaffi	Doug Mayo
Tyler Cook	Thomas Newsome
Aaron Covirg	Jin Park
Laura Cristo	Charles Seal, AUSA
Sorin Davidovici	Shailesh Shah
Danielle Duff, PMP	Charles Strimpler
Thomas Duffe	Brandon L. Underwood
Mary Jo Egbert, PMP, DynoVelocity	Stephen Wilkowski
Gayle Grant	David Wong, USAR COL (ret), SAME
Linda Hammell	Joseph Zaroff, Aspen Consulting Group, AOC
Robert Jackson	

## Naval Air Warfare Center Aircraft Division, JB MDL, Lakehurst (NAWCAD)

---

Paul Abatemarco	Justin Garr	Michael Nguyen
Michelle Bower	Ari Goodman	Robert Pellegrino
Patrick Brannick	Samantha Gravatt	Kipsy Quevada
Michael Cannon	Bridgette Hall	Juan Rodriguez
Farhad Choudhury	Charles Homoki	Michael Rossini
Gilbert Espinoza	Kevin Larkins	William Stockham
Valerie Fabretti	Bill Leach	Dr. Christopher
Jacqueline Farkas	Aaron Leeb	Thajudeen
Luke Fennimore	Gaetan Mangano	Rose Webster
Ron Fevola	Steve Mclaughlin	



# REVIEWERS, MENTORS, AND JUDGES OF STUDENT PAPERS (CONT.)

## Naval Surface Warfare Center

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Jonkristoffer Bisda  
Michelle Flood  
Eric Hoover  
Michael Kelly

George Lambert  
Elizabeth Lee  
Nicholas Zecchino

## NJ Sea Grant Consortium (NJSGC)

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Joseph Bilinski  
Michael Danko  
Carisa Davis,  
Kean University  
Michelle Esposito,  
Georgian Court University  
Chris Free,  
Rutgers University  
Lucas James Kirby,  
Kean University  
Adam Kustka,  
Rutgers University-Newark  
Nancy LaFleur,  
Kean University  
Lori Lester,  
NJDEP

Ling Ren,  
George Mason University  
Brenna Levine,  
Kean University  
Robert Lippincott,  
NJDEP  
Dan Millemann,  
NJDEP  
Sasmita Mishra,  
Kean University  
Jean Parry,  
Georgian Court University  
Joel Pecchioli,  
NJDEP

## Ocean County College (OCC)

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Joseph Amoroso  
Dr. Jeremy Andreatta, Ph.D.,  
Worcester State University  
Dr. Angel Camilo  
Dr. Caterina Gibson, DC  
Carolyn Showalter

Emily Stone  
Duane Grembowicz  
Marc LaBella  
Dr. Mary-Ellen Rada, DC  
Vijay Ramdeen

## Stockton University

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Dr. Adam Aguiar, Ph.D.  
Steven Shaak

Melanie Schroer

# ACKNOWLEDGEMENTS

## The New Jersey Southern Junior Science and Humanities Symposium gratefully acknowledges the following for offering awards to the student paper presenters:

- The U.S. Army, Navy, and Air Force for undergraduate tuition scholarships that are distributed by The Academy of Applied Sciences for a total of \$4,500.
- Scholarships awarded at \$2,000, \$1,500, and \$1,000 to the top three New Jersey Southern Junior Science and Humanities Symposium (NJSJSHS) finalists. Scholarships are payable upon matriculation and upon meeting the Junior Science and Humanities Symposium (JSHS) scholarship conditions.
- The National JSHS brings together over 400 participants in a program of educational and scientific exchange. (A list of JSHS national-level scholarships is available at [www.jshs.org](http://www.jshs.org).)
- An invitation to present their original research investigation at the **2023 National Science and Humanities Symposium's Event** will be extended to the top two NJSJSHS finalists.
- Teacher Award.
- National Scholarship.

**AFCEA, GREATER MONMOUTH CHAPTER** independently chooses and awards up to three outstanding papers in AFCEA-related fields (computer science, electronic engineering, and communications): 1st Place - \$300, 2nd Place - \$200, 3rd Place - \$100.

**AOC (ASSOCIATION OF OLD CROWS), GARDEN STATE CHAPTER** for awards of \$140 to each student paper presenter (\$1,400) and a 4-year AOC Student Membership.

**ASPEN CONSULTING GROUP** for awards of \$75 to each student paper presenter (\$750.00).

**ARMY AVIATION ASSOCIATION OF AMERICA, JERSEY CHAPTER** for award of \$50 to the 1st Place paper.

**NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, LAKEHURST CHAPTER OF THE NAVAL CIVILIAN MANAGERS ASSOCIATION)** for award plaques to the paper presenters in recognition of their novel research and experimentation.

The **NEW JERSEY SAME (SOCIETY OF AMERICAN MILITARY ENGINEERS)** for awards of \$50 to each student paper presenter (\$500).

The **OCEAN COUNTY COLLEGE FOUNDATION** for awards of \$100 to each student paper presenter (\$1,000).

- All scholarships and awards are funded independently of Ocean County College and are subject to change.
- To qualify for the regional and national scholarships, U.S. citizenship or proof of permanent residency will be required.
- U.S. Army, Navy, and Air Force scholarships are payable upon college matriculation, meeting the JSHS scholarship conditions, and are subject to the availability and release of government funding.

## **The New Jersey Southern Junior Science and Humanities Symposium gratefully acknowledges the following for offering awards to the student poster presenters:**

**ASPEN CONSULTING GROUP** for awards of \$50 to each student poster presenter (\$300).

**AOA (ASSOCIATION OF OLD CROWS), GARDEN STATE CHAPTER** for awards of \$100 to each poster presenter (\$600), 4-year student membership.

**AUSA (MONMOUTH CHAPTER OF THE ASSOCIATION OF THE U.S. ARMY)** for awards of \$100 to each poster presenter (\$600).

**NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, LAKEHURST CHAPTER OF THE NAVAL CIVILIAN MANAGERS ASSOCIATION** for awards plaques to each of the six poster presenters.

**THE NEW JERSEY SAME (SOCIETY OF AMERICAN MILITARY ENGINEERS)** for awards of \$50 to each student poster presenter (\$300)

The **OCEAN COUNTY COLLEGE FOUNDATION** for awards of \$50 to each of the six poster presenters (\$300).

### **Additional Awards**

**THE NEW JERSEY SEA GRANT CONSORTIUM (NJSGC) TOP ENVIRONMENTAL PAPER AND POSTER PRESENTER AWARD.** The NJSGC independently chooses and awards the top two outstanding papers in environmental-related study. The Top Environmental paper presenter will receive \$300 and Top Environmental poster paper will receive \$200.

- All other scholarships and awards are funded independently of Ocean County College and are subject to change.
- To qualify for the regional and national scholarships, U.S. citizenship or proof of permanent residency will be required.
- U.S. Army, Navy, and Air Force scholarships are payable upon college matriculation, meeting the JSJS scholarship conditions, and are subject to the availability and release of government funding.

- All scholarships and awards are funded independently of Ocean County College and are subject to change.
- To qualify for the regional and national scholarships, U.S. citizenship or proof of permanent residency will be required.
- U.S. Army, Navy, and Air Force scholarships are payable upon college matriculation, meeting the JSJS scholarship conditions, and are subject to the availability and release of government funding.

## **NJSJSHS gratefully acknowledges the following:**

*THE NATIONAL SCIENCE TEACHING ASSOCIATION, Arlington, Virginia for all of their help and support in making this a successful program.*

*THE JUNIOR SCIENCE AND HUMANITIES SYMPOSIA (JSHS) Program ([www.jshs.org](http://www.jshs.org)) is jointly sponsored by the United States Departments of the Army, Navy, and Air Force, in cooperation with leading research universities throughout the nation. The Department of Defense generously provides funding for the national symposium and JSJS scholarships.*

*THE OFFICE OF NAVAL RESEARCH, Arlington, Virginia, the U.S. Army Research Office, Research Triangle Park, North Carolina, and the Air Force Office of Scientific Research, Bolling AFB, Washington, DC for having joined forces to encourage and reward the next generation of scientific and engineering talent. Resulting from this tri-science partnership, scholarships will be annually awarded to outstanding high school students who compete in symposia affiliated with the Army/Navy-sponsored Junior Science and Humanities Symposium (JSJS). Additional tri-service sponsored awards include the faculty award and participant certificates.*

*THE NATIONAL ASSOCIATION OF SECONDARY SCHOOL PRINCIPALS ([www.principals.org](http://www.principals.org)) has placed JSJS on its National Advisory List of Student Contests and Activities.*



**College Drive, Toms River, NJ 08754-2001**

*Ocean County College is an Equal Opportunity Educational Institution.*

**Dr. Sylvia Riviello**

Dean, School of STEM  
Ocean County College

A native to the tri-state area, Dean Riviello was born in Philadelphia and lived in the surrounding areas for many years. She received her undergraduate degree in Chemistry from Immaculata University and Ph.D. in Physical Chemistry from Bryn Mawr College. Dean Riviello's professional career is quite diverse.

She entered academia as an assistant professor of Chemistry at Rosemont College. Her next career led to Lockheed Martin where she was an engineering manager for 10 years. At Lockheed Martin, Dean Riviello assisted in the development of fourth generation materials for GPS and many satellites used today for our cell phones. And if you ask her the 'infamous' question, yes, she is a bonafide rocket scientist. A small hiatus from rocket science, Dean Riviello entered the family business and eventually became the sole owner of a multi-million dollar manufacturing facility.

After 15 years in manufacturing, Dean Riviello came full circle and returned to her first passion, which was her love of teaching and her students' success. She re-entered academia and became the department head of Science and Math at Neumann University and several of the community colleges in the area, namely Camden County College, Burlington County College and Delaware County Community College.

At the request of her immediate family, who by this time had transplanted to Florida, Dean Riviello accepted the position of associate dean of Science and Math for the Online Campus at Broward College. Even though the sun shines almost every day, after three years she decided to return to her roots and accepted the offer as the dean of the School of STEM at OCC. As soon as Dean Riviello stepped foot on the OCC campus, she knew she had arrived home.



### **Dr. Mary-Ellen Rada**

College Lecturer II: Chemistry, Anatomy & Physiology, Holistic Health and Wellness, Study Abroad-Global Education  
Ocean County College

Dr. Mary-Ellen Rada is a graduate of Stockton University and a summa cum laude graduate of Sherman College of Chiropractic, where she attained her Doctor of Chiropractic degree and was awarded the Garfunkel Valedictory Award, the Academic Achievement Award and the B.J. Palmer Philosophy Distinction Award. While at Sherman College, she was also named to the National Dean's List and Outstanding Young Women of America. Dr. Rada has since been named to Who's Who in Executives and Professionals. She maintains a private practice from 1990 to the present in Jackson, New Jersey.

In 2001, Dr. Rada was appointed by Governor Whitman to the New Jersey State Board of Chiropractic Examiners and served for ten years. She was elected as the first female president in 2003. Dr. Rada was also elected by her peers to serve on the Board of Directors for the National Board of Chiropractic Examiners as well as on their executive committee from 2006-2009. She served on the Sherman College of Chiropractic Board of Trustees in 2010-2011 and has been a guest speaker at the Harvard/MIT Conference on Alternative Medicine and at Yale University Medical School's Alternative Medicine Conference.

Dr. Rada began her tenure at Ocean County College as an Adjunct Professor in 2012 and was hired as a full-time College Lecturer II in 2014. She was named to Who's Who in Community College Educators in 2018. Dr. Rada teaches across three disciplines: Chemistry, Anatomy & Physiology, and Holistic Health & Wellness, wherein she authored and teaches ten courses and developed the Holistic Health & Wellness Certificate Program. She also conducts Global Science Education through study abroad courses to Italy, The Science of the Renaissance and Ireland, *The Science of Ireland*. Dr. Rada was named Director of the New Jersey Southern Junior Science and Humanities Symposium in 2019.

NEW JERSEY SOUTHERN  
**JSHS**  
JUNIOR SCIENCE AND  
HUMANITIES SYMPOSIUM



## EXECUTIVE COMMITTEE

### **Dr. Mary-Ellen Rada**

Director, New Jersey Southern Junior Science and Humanities Symposium; Ocean County College, Toms River, NJ

### **Dr. Sylvia Riviello**

Dean, School of STEM, Ocean County College, Tom River, NJ

### **Kelly Aker**

Supervisor of Science Grades K-12, Woodbridge Township School District; District Chemical Hygiene Programs and Guidance, Woodbridge, NJ

### **Dr. Adam Aguiar**

Stockton University, Pomona, NJ

### **James Danch**

Science Research Teacher, Colonia High School, Woodbridge Township School District, Woodbridge, NJ- retired

### **Michael Danko**

Assistant Director of Extension, Marine Recreation Agent - Fisheries and Boating, New Jersey Sea Grant Consortium, Sandy Hook, NJ

### **Gayle Grant**

U.S. Army C5ISR Center AI&E Engineering Support Branch Chief, Lakehurst, NJ, AFCEA Greater Monmouth Chapter Past President, AOC Garden State Chapter Past President

### **Donna Leonardi**

Research Consultant Bergen County Academy, Hackensack, NJ

### **Gaetan P. Mangano**

U.S Navy NAWCAD Education Outreach Site Lead and Workforce Development Supervisor, Lakehurst, NJ

### **Thomas A. McGrath**

Supervisor, Naval Packaging, Handling, Storage, and Transportation Center, NSWC IHEODTD Det, Picatinny, NJ

### **Vijay Ramdeen**

Assistant Professor, Broward Community College, Davie, FL

### **John Rosendale**

NOAA Fisheries - Northeast Fisheries Science Center, Sandy Hook, NJ

### **Carolyn Showalter**

Assistant Dean, School of STEM, Ocean County College, Toms River, NJ





**2023**  
**Student Paper Presenters**

NEW JERSEY SOUTHERN   
**JSHS**  
JUNIOR SCIENCE AND  
HUMANITIES SYMPOSIUM

**Student Paper Presenter:  
Adrien Cristian**

Princeton Day School  
Princeton, NJ  
Advisor: Dr. Steven Gadd

***Machine Learning Based Controller  
for Soft Robotic Arm in Simulation***



Adrien Cristian is a 10th grade student attending Princeton Day School (PDS). Ever since he can remember, he has been curious. His curiosity has led him to explore various different fields and topics, in hopes of finding one that he can explore to the deepest levels possible.

Recently, Adrien has expressed a particular interest in Astronomy, Physics, Robotics, and AI and Machine Learning. He is an active member of the Science Olympiad Club at PDS, participating in both the regionals competition and the states tournaments since 6th grade. The Science Olympiad gives him the opportunity to explore and discover new and interesting topics that stimulate further investigation.

Furthermore, the research in soft robotics Adrien conducted at Cambridge Center for International Research with Dr. Thuruthel was a very informative and inspirational experience, motivating him to continue with experimentation and research.

In his free time, he enjoys playing various sports (his favorite one is skiing), reading, and traveling with his parents.

**Student Paper Presenter:  
Katherine Fang**

High Technology High School  
Middletown, NJ  
Advisor: Dr. Dina Ellsworth, Mr. Craig Queenan

***Surveying Water Surface and Wetlands  
in Delaware Bay Using Cloud-Removed  
LandSat Data***



With an innate curiosity about how things work, Katherine has a strong interest in math and science. Studying at one of the top STEM high schools, Katherine loves how research allows her to gain insight and knowledge and to solve problems through innovation.

Since traditional water and wetland surveys are often time-consuming and costly, she is currently working on a digital method in Delaware Bay using USGS satellite images.

Scientific research is a passion Katherine hopes to pursue in years past high school. Katherine is equally enthusiastic about sharing her research experience. As Vice President of her school's experimental research club, she supports her schoolmates in their scientific explorations.

She enjoys other STEM activities as well, including VEX robotics and Technology Student Association (TSA). She also helps organize cypHER, an annual coding workshop for middle school girls.

Aside from STEM, Katherine loves classical music. She plays the flute and is an officer of her school's Classical Music Club. Being involved in the arts allows her to channel her energy in serving her school and the community. In her spare time, Katherine enjoys reading, drawing, and daydreaming.

**Student Paper Presenter:  
Joseph Field**

Freehold High School  
Freehold, NJ  
Advisor: Ms. Kim Saulnier

***Application of Lemna Minor for In-Situ  
Phytoremediation of Perchlorate in  
Martian Regolith***



Joseph Field is a senior at Freehold High school who moved from Nevada at age ten. Joseph is a four-time platinum competitor, three-time team captain, and a semifinalist in the Air Force Association's Cyberpatriot competition. In addition to being the co-president of the High School's Cybersecurity club, Joseph also serves in the school's drama club as the lighting director for three school productions and now acting as Seymour Krelborn in the club's production of "Little Shop of Horrors!" As an upperclassman in the school's prestigious Medical Sciences magnet program, Joseph assists underclassmen in their research projects and helps them learn to face the highly rigorous course load by being a tutor.

Joseph enjoys spending his time outside of school volunteering for his town of Freehold, participating in the many events that happen around the town, such as the Halloween Spooktacular and the kindness rock movement. During his downtime, Joseph likes to bowl with his father and help his mother with her various art and community service projects. Watching the space shuttles fly and reading about the solar system as a child, Joseph's biggest passion has been spaceflight since a very young age.

Joseph likes to spend his free time using computer programs to design his own rockets and simulate missions, and it is his ultimate dream to study aerospace engineering to design bleeding-edge spaceflight technology to send humans back to the moon, onto Mars, and beyond.

**Student Paper Presenter:  
Keerthana Gauthaman**

Freehold High School  
Freehold, NJ  
Advisor: Ms. Kim Saulnier

***Effects of Bacopa Monnieri on  
Dopaminergic Neurodegeneration in  
Caenorhabditis elegans***



Keerthana Gauthaman is a senior attending the Medical Sciences Magnet Program at Freehold High School. She has had an interest in science from a very young age, going as far as reading the science section of her encyclopedia. Beyond that, she has many interests straying from the STEM field, such as her love for art, dancing to music, reading, and writing. She is most notably a part of the leadership committee for the school's band and Model UN. She is also an officer for the Medical Sciences magnet program.

Upon graduating from her dance academy, with certification from the International Dance Committee (affiliated with UNESCO), Keerthana is now an instructor for the younger groups in her academy. She has nearly finished all eight piano levels of the internationally acclaimed ABRSM curriculum. She has also volunteered at CentraState Medical Center.

Keerthana has always had a fascination with how the brain works. The brain controls every aspect of our existence, yet we know little about it. This fascination sparked her interest in her research topic, which explored dopaminergics, and how to remedy them, in a degenerative brain. This concept is the topic of her current research paper.

Keerthana hopes to continue researching in college and further.

**Student Paper Presenter:  
Daniela Gonzalez**

Princeton High School  
Princeton, NJ  
Advisor: Mr. Mark Eastburn

***Two Steps Forward, One Step Back:  
Improved Walking Habits of *Polypterus  
senegalus* Fish with the “Shortbody”  
Mutation***



Daniella has attended Princeton High School (PHS) for the past four years, and has participated in the PHS Research Program during grades eleven and twelve, along with conducting research over the past two summers.

Last year, she was on the team that won the National Grand Prize in the Samsung Solve for Tomorrow Competition, where their project focused on using black soldier fly larvae to reduce food waste. These insects can produce high-quality oil, which is then used to make products like soap. With this new way to reduce dependence on environmentally-destructive products such as palm oil, she is in the process of starting a business called *Sol Feliz*, which means “Happy Sun” in Spanish.

Every year that Daniella has been in high school, she has worked a full-time job, but found time to support the PHS Latinos Unidos Club that promotes awareness of Hispanic cultures and organizes events.

She also serves her evangelical church, Fraternidad Cristiana de Trenton, two or three times per week by participating in a group known as *Jóvenes de Impacto*, or “Youth of Impact.” During the year, they conduct various activities, the most important being a youth camp called “Con Todo” that takes place every summer. Her pastimes include conducting research investigations about the many interests she has, learning new things, listening to music, and thinking... which means to her taking a moment of her life and developing an idea or analyzing situations.

She also enjoys walking and riding bicycles with her younger brother.

**Student Paper Presenter:  
Abigail Graf**

Freehold High School  
Freehold, NJ  
Advisor: Ms. Kim Saulnier

***The Effects of a Combination of  
L-DOPA and EGCG on the Motility of  
NL5901 Caenorhabditis elegans***



Abigail is a member of the National Honors Society and has been a competitor in the national CyberPatriot competition since middle school.

In 2019, her all-girls middle school team won the state championship, and in 2020, her high school team achieved third place in the state. In her junior year of high school, Abigail completed a research class and wrote a formal research paper about treatments related to Parkinson's Disease.

Within her personal life, Abigail works a job and volunteers at her local church. In her free time, Abigail enjoys a good book and taking walks at the beach. She credits her faith, family, and friends for all she has accomplished so far as a part of the Medical Science program at Freehold High School.

She plans to pursue a career in research and attend college somewhere sunny and 75°.

**Student Paper Presenter:  
Aditya Khurana**

Moorestown High School  
Moorestown, NJ  
Advisor: Mr. Sean Watson

***Cloud Enabled IoT Based Alert System for  
Aged, Blind and Disabled Individuals***



Aditya (Adi) Khurana is a freshman student at Moorestown High School in New Jersey. He is enrolled in honors classes in Algebra II, Latin, Biology, English and Programming, and is an active member of the honors programming and science clubs.

Adi has been playing piano since he was five and has competed in regional and national competitions. He also recently graduated with distinction after nine years of formal Hindi education, represented his local Hindi school in annual national Hindi poem recital competitions and consistently won top prizes over the years. He is now a volunteer teaching assistant at the Cherry Hill chapter of Hindi USA school.

At age 11, Adi started a limited-edition sneaker reselling business which became a six-figure business in early 2022. He is committed to providing exceptional service to his customers, leveraging 21st-century technology tools to scale his business, and making a meaningful impact on society.

In his spare time, he also participates in hackathons, prepares for Math and Piano competitions, works on passion projects, teaches himself programming languages, plays basketball, watches NFL and NBA games, and Shark Tank.

Adi plans to attend a college program in the field of technology, management, and entrepreneurship at a reputable university.



**Student Paper Presenter:  
Riya Pawar**

Manalapan High School  
Manalapan, NJ  
Advisor: Ms. Jelena Komitas

***Comprehensive Cyber Defense System A  
Look into Adaptive Protection for the Most  
Common Ransomware Attacks***



Riya is a junior in Manalapan High School's Science and Engineering Magnet Program, where she was selected from hundreds of applicants to be in a class of 25 students. As the only female in the program, she works to motivate women to pursue difficult science and math subjects.

She recently took on the lead for her school's hackathon, where she also conducted a cybersecurity workshop, based on her research and internship. During her summer internship with Commvault Systems, Riya was one of the youngest interns in the company. In her six weeks at Commvault, she learned about ransomware attacks, which sparked her interest in researching cybersecurity. She applied her knowledge in C++ towards developing code that effectively created and deleted honeypot files in order to prevent attacks. Riya's code is now part of Commvault's commercial product.

Riya is in the Columbia Science Honor's Program, where she learns about algorithms and data structures at a college level. Riya won the Miss India Teen New Jersey Pageant in 2021 and represented her state in the Miss Teen India USA Pageant, where she was in the top 5 nationally. She was the youngest in her category and the youngest ever in the top 5 at 14 years old. Riya won the Youth Icon Award at the Bruhan Maharashtra Mandal (BMM) 2022 Convention in Atlantic City. She was recognized for her achievements in performing arts, extracurriculars, and academics. She was selected out of all Marathi teens in the US and Canada.

**Student Paper Presenter:  
Riya Savalia**

Freehold High School  
Freehold, NJ  
Advisor: Ms. Kim Saulnier

***Effect of Aloe Vera on Gut Inflammation  
Caused by the Accumulation of Polystyrene  
Microparticles in Danio rerio***



Riya Savalia is a senior in the Medical Sciences magnet program at Freehold Borough High School. Riya has completed over 135 hours of community service at CentraState Medical Center as a Patient Transporter, has been working as a barista at her local Starbucks for the past six months, and is currently learning how to write in Hindi.

At school, she is one of the stage managers at FHS's Dramatic Arts Club, on the Principal's Executive Student Cabinet, and a member of the HOSA Future Health Professionals club and Spanish Honor Society.

She has received an award for Outstanding Achievement in the Medical Sciences magnet program and is an AP Scholar with Distinction. Her hobbies include acrylic painting, photography, and comics.

In college, she will be majoring in neuroscience with a minor in mathematics and aims to become a Physician Assistant. Riya completed her research, on the ability of aloe vera to reduce inflammation caused by plastic in the ocean, over the course of her junior year of high school and is honored to be presenting at the New Jersey Southern Regional Junior Science and Humanities Symposium.

## Student Paper Presenter: Victoria Yakes

Marine Academy of Technology  
and Environmental Science  
Stafford Township, NJ  
Advisor: John Wnek

### ***Analysis of Tannin Interference on Enterolert\* 250 Testing of Enterococcus SPP***



After deciding to attend MATES, Victoria has only grown her interest in STEM studies and strives to better herself every day. She has involved herself in research studies during her last three years, earning awards at fairs such as the Delaware Valley Science Fair, and has practically made the school lab her second home. In addition, she enjoys aiding other students in their research endeavors as a leader of a Research Assistance and Development Team and is a volunteer for an outreach initiative to support the local terrapin species named Project Terrapin.

Outside of academics, Victoria finds importance in helping and educating her community. She regularly tutors and provides feedback to underclassmen from her hometown and has presented her research to environmental committees to raise awareness of plastic pollution.

Victoria is also a member of the varsity soccer team and volunteers to coach players during the summer. Of course, she always makes time to partake in leisure activities, some of her favorites being crocheting and Friday movie nights. Victoria hopes to further her research while majoring in biomedical sciences; aspiring to, one day, work with artificial organs at one of the schools she is in the midst of exploring.



**2023**  
**Student Poster Presenters**

NEW JERSEY SOUTHERN  
**JSHS**  
JUNIOR SCIENCE AND  
HUMANITIES SYMPOSIUM



## Sumuk Anand

Princeton High School  
Princeton, NJ  
Advisor: Mr. Mark Eastburn

### ***A Novel Method to Accelerate the Degradation Rate of Plant-based Tableware Using Compost Tea***

Sumuk Anand is a senior at Princeton High School. He has ranked high in geography and history competitions such as the National Geography Bee, US Geography Olympiad, International Geography Bee and National History Bowl.

His extended interest in geography has led to interdisciplinary studies in geography and science. He has been conducting research for several years in the pursuit of finding sustainable solutions for the biodegradation of plant-based plastic alternatives. With his findings, he has presented at the Rutgers Junior Humanities and Sciences Symposium and has won regional science fairs, such as the Bergen SciChallenge, which qualified him for Broadcom Masters. He has three publications on National Center for Biotechnology Information's GenBank sequence database for the analysis of three novel *Landoltia Punctata* sequences.

He has continued exploring different fields and techniques through Princeton High School's three-year selective research program. In school, he is an officer for the UNICEF club and an active member of the History Bowl team. He is a two-time national semifinalist for North South Foundation's Panacea Challenge, focusing on diversity and inclusion.

He has actively volunteered to teach elementary school students in various areas such as STEM, geography, Taekwondo, and chess. Sumuk aspires to pursue a career in the fields of Environmental Science, Biotechnology and Computer Science to help solve global environmental issues.



## Nicholas Hagedorn

Princeton High School  
Princeton, NJ  
Advisor: Mr. Mark Eastburn

### ***Strict Inequalities of for the n-crossing Number***

Nick Hagedorn is a junior at Princeton High School. His STEM interests primarily concern mathematics, where he has conducted research into knot theory, specifically studying crossing-number bounds on  $n$ -crossing knot projections.

He has attended the Ross Mathematics Program two consecutive summers, the second time as a Junior Counselor in 2022. There he studied number theory and took graduate-level classes in Ergodic Ramsey theory.

Nick is also the Vice-President of the national organization “Absolute Value,” a 501(c)(3) non-profit dedicated to engaging middle schools in math.

Outside of math, he competes in Public Forum debate, having placed third in the state of New Jersey. Nick also enjoys orchestral music composition and programming.



## George Kopf

Princeton High School  
Princeton, NJ  
Advisor: Mr. Mark Eastburn

### ***Observing the Capabilities of Pufferfish to Exhibit Visual Social Learning***

George is a senior at Princeton High School. His main interests in the sciences are engineering and biology.

There's so much unknown about how things work on a microscopic level. From the iridescent jewels of diatoms to the steady walk of dynein motors, the microscopic world is as beautiful as it is fascinating.

He is the Bio Captain of his school's Science Olympiad team, as well as the Captain of the Science Bowl team.

George volunteers at the local elementary school's gardens helping children build raised beds and tending to their plants. He also volunteers in Stem Roots where he meets with young children to teach them about science.

In PHS's research program, he has worked on a variety of projects like the black soldier fly bioreactor that won the national Samsung Solve for Tomorrow challenge.

With his free-time he enjoys running a D&D campaign for his friends and building with Lego bricks. Other interests include reading, volleyball, tea, and collecting tiny potted plants from Home Depot by the windowsill.



## Bethany Suliguin

Marine Academy of Technology and Environmental Science  
Stafford Township, NJ  
Advisor: John Wnek

### ***Utilizing Lemna spp. To Quantify Nutrient Uptake and Release as a Potential Phytoremediation Strategy for the Barnegat Bay Watershed, New Jersey***

Bethany Mariel Suliguin is a senior at the Marine Academy of Technology and Environmental Science (MATES). Developing a passion for biological and environmental sciences, Bethany became motivated to find possible solutions for her town's infamous water quality issues.

She has conducted independent research for four years in other disciplines such as health sciences and microbiology, and she has received recognitions from venues such as the Delaware Valley Science Fair.

Bethany was also named a New Jersey Governor's School in the Sciences scholar where she was in a computational biochemistry investigation on aldo-keto reductase reactivity. One of her long-term goals is to educate others with her ever-growing skillset.

Bethany is a Co-Chair for Rally for Barnegat Bay, a collaboration between the NJDEP, Clean Ocean Action, and Save Barnegat Bay to monitor water quality and raise awareness about water pollution. Furthermore, she is currently NHS President and a Research Assistance and Development (RAD) Leader for underclassmen eager to begin independent research.

When Bethany is not in the field collecting samples nor in the laboratory preparing agar plates, she explores her interest in classical piano, receiving three consecutive gold medals from the Golden Key International Music Festival and performing in Carnegie Hall.

She is also the pianist for the Kean University Preparatory Symphony Orchestra. Bethany also enjoys finding the best eateries, whether it be boba shops or french fry joints.

Bethany is eager to combine molecular biology and environmental science to better comprehend human health and hopes to pursue a career in pathology.





## Brianna Suliguin

Marine Academy of Technology and Environmental Science  
Stafford Township, NJ  
Advisor: John Wnek

### ***Porcelain Berry (*Ampelopsis brevipedunculata*) and Autumn Olive (*Elaeagnus umbellata*) in New Jersey: An Invasive Plant Biofuel-Based Management Strategy***

Brianna Melanie Suliguin is a senior at the Marine Academy of Technology and Environmental Science (MATES). Entering high school with a strong interest in STEM, she involved herself in research starting in freshman year, analyzing yeast metabolism of various sugars.

Through her school's environmental science focus, Brianna discovered her interest in synergizing the field with her strengths in chemistry and biochemistry, bringing forth her investigation of New Jersey invasive plants' potential for biofuel production.

Brianna won first place at the New Jersey Academy of Science with this project and will be inducted as a Fellow of the American Junior Academy of Sciences. Brianna continues to dedicate herself to community outreach and collaboration.

At school, she is one of the Research Development and Assistance Leaders, helping fellow researchers with project design and presentation skills. As class president, she organizes fundraisers and spirit events for the student body.

Outside of school, Brianna explores her lifelong musical talents: she is the Concertmaster of the Kean Preparatory Symphony Orchestra, performing at local churches and schools during the holiday season. Furthermore, she continues to expand her solo piano skills, auditioning for the Golden Key International Music Festival and performing at Carnegie Weill Hall and Lincoln Center Bruno Walter Auditorium.

In college, Brianna plans to pursue research projects focusing on environmental impacts on skin. Fascinated by the science behind her skincare products, Brianna hopes to travel the world as a cosmetic dermatologist, working across different countries and implementing medical research into the cosmetic industry.



## Julia Takla

Marine Academy of Technology and Environmental Science  
Stafford Township, NJ

Advisor: John Wnek

### ***Phase III: The Implementation of an LED-UVC Irradiated Shopping Cart Handle and Exploring its Microbicidal Activity***

Julia Takla's passion for the sciences blossomed at the Marine Academy of Technology and Environmental Science (MATES), where research stimulated her inquisition of the natural world. Her study during the past two years primarily consisted of an engineering endeavor to mitigate the spread of microbes in a store setting.

By constructing a UV-light irradiated shopping cart handle, pathogenic spread in such environments can be inhibited. Influencing factors such as UV-C dosage, residence time, and light intensity were quantified in order to reach the highest degree of accuracy whilst remaining in a suitable safety range for public usage.

Julia has received various forms of recognition, such as the IEEE Woman in Engineering Award and category awards at the Jersey Shore Science Fair and the Delaware Valley Science Fair.

With a keen interest in helping her community, Julia plans to continue her research in future years, steadfastly nurturing this passion. In addition, Julia enjoys playing the cello with the Kean University Preparatory Symphony Orchestra as well as the South Jersey Regional Band and Orchestra. She plays soccer for the Twin County Soccer Association and loves taking pictures for the MATES Yearbook Club.

Other hobbies include playing ping-pong, traveling, baking, and reading. Julia plans to major in biomedical science while immersing herself in academically-diverse activities.



**2023**  
**Participating Schools**

NEW JERSEY SOUTHERN  
**JSHS**  
JUNIOR SCIENCE AND  
HUMANITIES SYMPOSIUM

## 2023 NJSJSS: PARTICIPATING SCHOOLS

Freehold High School  
High Technology High School  
Manalapan High School  
Marine Academy of Technology and Environmental Science  
Moorestown High School  
Princeton Day School  
Princeton High School  
Princeton International School of Mathematics and Science  
The Lawrenceville School  
Toms River High School East  
Toms River High School North  
Toms River High School South

## Complete list of 2023 Student Research Papers Submitted

### FREEHOLD HIGH SCHOOL

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**Joseph Field:** Application of *Lemna Minor* for In-Situ Phytoremediation of Perchlorate in Martian Regolith

**Keerthana Gauthaman:** Effects of *Bacopa Monnieri* on Dopaminergic Neurodegeneration in *Caenorhabditis elegans*

**Abigail Graf:** The Effects of a Combination of L-DOPA and EGCG on the Motility of NL5901 *Caenorhabditis elegans*

**Lauren Nagy:** The Impact of Gut Microdiversity on Survival in the Presence of Sodium Nitrite in *C. elegans*

**Riya Savalia:** Effect of Aloe Vera on Gut Inflammation Caused by the Accumulation of Polystyrene Microparticles in *Danio rerio*

**Melodie Seadaros:** The Effects of Apamin on Alpha-Synuclein Aggregation in *Caenorhabditis elegans* Overexpressing

**Eva Sood:** Effect of HSP90 Inhibitor Geldanamycin on Delaying Reproductive Aging Amongst *Caenorhabditis elegans*

**Yael Spector:** The Effect of L-Carnitine on the Regeneration of *D.Dorotocephala* Planaria

## HIGH TECHNOLOGY HIGH SCHOOL

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**Hanyi Deng:** Role of Serotonin in Regeneration of Planarian Anterior and Posterior Segments

**Katherine Fang:** Surveying Water Surface and Wetlands in Delaware Bay Using Cloud-Removed LandSat Data

**Nikhil Osuri:** Novel Design that Prevents Classroom Chairs from Causing Head Injuries

**Shravani Vedagiri:** Comparing the Effects of Varying Glucose Levels on Insulin Production in Wildtype and Ilp 2 Mutant *D. melanogaster*

## MANALAPAN SCHOOL

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**Riya Pawar:** Comprehensive Cyber Defense System A Look into Adaptive Protection for the Most Common Ransomware Attacks

## MARINE ACADEMY OF TECHNOLOGY AND ENVIRONMENTAL SCIENCE

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**Megan Thomas:** An Evaluation of Olfactory Dysfunction Symptoms in Post COVID-19 Individuals

**Andrew Fata:** Relationship Between Temperature and *Ambystoma mexicanum* Larva and Egg Development

**Nicholas Guerriero:** Shellfish Growth and Seasonal Water Factors

**Emilia Savich:** The Effects of Different Active Ingredients in Mouthwash on *Streptococcus mutans* in Saliva

**Bethany Suliguin:** Utilizing Lemna spp. To Quantify Nutrient Uptake and Release as a Potential Phytoremediation Strategy for the Barnegat Bay Watershed, New Jersey

**Brianna Suliguin:** Porcelain Berry (*Ampelopsis brevipedunculata*) and Autumn Olive (*Elaeagnus umbellata*) in New Jersey: An Invasive Plant Biofuel-Based Management Strategy

**Julia Takla:** Phase III: The Implementation of an LED-UVC Irradiated Shopping Cart Handle and Exploring its Microbicidal Activity

**Karen Tsang:** Biogeochemical Analysis of Soil in Salt Marsh Zones in a Fragile Coastal Ecosystem at Barnegat Bay, NJ

**Victoria Yakes:** Analysis of Tannin Interference on Enterolert\* 250 Testing of *Enterococcus SPP*

## MOORESTOWN HIGH SCHOOL

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**Aditya Khurana:** Cloud Enabled IoT Based Alert System for Aged, Blind and Disabled Individuals

## PRINCETON DAY SCHOOL

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**Adrien Cristian:** Machine Learning Based Controller for Soft Robotic Arm in Simulation

## PRINCETON HIGH SCHOOL

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**Sumuk Anand:** A Novel Method to Accelerate the Degradation Rate of Plant-based Tableware Using Compost Tea

**Michael DiGiacchino:** The Effect of Academic Stress on Cognitive Brain Function Object Categorization in Early Adolescence

**Daniela Gonzalez:** Two Steps Forward, One Step Back: Improved Walking Habits of *Polypterus senegalus* Fish with the “Shortbody” Mutation

**Nicholas Hagedorn:** Strict Inequalities of for the  $n$ -crossing Number

**Shrey Khetan:** Catalytic Carbon Capture: A Low-Cost Climate Change Mitigation Strategy

**George Kopf:** Observing the Capabilities of Pufferfish to Exhibit Visual Social Learning

**Julian Velazquez:** Ciao, Amici: Microevolution Across Populations of the Italian Wall Lizard, *Podarcis sicula*, Between Natural Habitats in North America

## PRINCETON INTERNATIONAL SCHOOL OF MATHEMATICS AND SCIENCE

**Yiwei Liang:** The Computational Detection and Identification of Binding Molecules to the Immune Checkpoint T Cell Immunoreceptor with Ig and ITIM Domains (TIGIT)

## THE LAWRENCEVILLE SCHOOL

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**Bhushan Mohanraj:** CodOp: Enhancing Heterologous-Protein Synthesis for Efficient Drug and Vaccine Development by Applying Deep Learning and Natural-Language Processing to Codon Optimization with a Host-Independent Data Pipeline

## **TOMS RIVER HIGH SCHOOL EAST**

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**Aidan Basile:** Carpal Tunnel Bracing; A Multimodality Approach for Effective Treatment of Carpal Tunnel Syndrome

**Hailey Mastej:** The Efficacy of Sunscreen Brands on Various Skin Types

**Venisse Rae Mandanas:** Efficacy of Non-Operative Treatments for Adolescent Idiopathic Scoliosis

## **TOMS RIVER HIGH SCHOOL NORTH**

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**Kaitlyn Culbert:** Year 3: Developing a Linear Regression Model to Predict Winter Honey Bee Colony Loss Based on Local Summer Weather Conditions

## **TOMS RIVER HIGH SCHOOL SOUTH**

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**Ryanne Gethard:** Phenology of Milkweed in Toms River, New Jersey



**NEW JERSEY SOUTHERN**  
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