We are happy to welcome the Best of Science in the High School to the

28th Annual Upstate New York Junior Science and Humanities Symposium

March 13 and 14, 2013

Over four hundred students and teachers from thirty-three high schools from Westchester County to Western New York have come together to participate in the 28th Annual Upstate New York Junior Science and Humanities Symposium.

The sixty-six students presenting their original scientific research as speaker or poster presenters over the next two days are the finalists from among 400+ talented science research students in upstate New York. The presenters come to the Upstate NY JSHS from three sub-regional symposia held in Western/Central New York, Eastern New York and Westchester/Rockland Counties.

The research presented today is the result of the students’ hard work and passion for their projects, the guidance of trained teachers and scientist mentors, and the support of family and classmates.

The work of these students will be reviewed and judged by teams of scientist judges with expertise in the fields of research represented at the Symposium. In addition, science teachers serve as teacher judges, moderators and recorder. This team of volunteer professionals ensures that the presenters’ works are given the full consideration and appreciation they so deserve.

The final five winners of the Upstate NY JSHS not only receive recognition and scholarships, but an invitation to the National JSHS to be held May 1 – May 5, 2013 in Dayton, Ohio. The top two winners will present their research at the National JSHS.

We hope you enjoy the next two days of student presentations, special guest speakers, workshops, awards, food, and fun.

This year, we are able to provide three of the final winners at the Symposium with scholarships. First, second and third place winners will be awarded scholarships (1st place: $2,000; 2nd place: $1,500; 3rd place: $1000) by the U.S. Army, Navy and Air Force, sponsors of the JSHS program.

As part of its ongoing support of JSHS, the American Chemical Society – Corporation Associates will award a $750 scholarship to the student with the most outstanding paper in chemistry.

We gratefully acknowledge the support of our sponsors, listed on page 3, who have made these scholarships and opportunities available to our presenters. Enjoy the 28th Annual Upstate New York Junior Science and Humanities Symposium!

Cover artwork: Spiral galaxy (NGC 7331) in constellation Pegasus located 50 million light-years from Earth. Image by Calar Alto Observatory.
Figure provided by George Robinson:
*Map of the Marcellus Shale Formation underlying New York State counties, (data from USGS), with locations of operating natural gas wells (data from NYS DEC).*

We are especially honored this year to have Dr. George Robinson as our keynote speaker. George Robinson has participated in the JSHS programs since joining the faculty of the University at Albany, SUNY in 1993. He is currently Associate Professor of Biological Sciences and Coordinator of the UAlbany Graduate Program in Ecology and Evolutionary Biology. He completed his M.S. and Ph.D. in Botany at the University of California, Davis in 1989, and held post-doctoral positions at the University of Kansas and Rutgers University, and is certified at the rank of Senior Ecologist by the Ecological Society of America. He is a founder and Co-Director of the UAlbany Graduate Program in Biodiversity, Conservation and Policy, and is a participant in the SUNY Statewide K-12 Teacher and Leader Education Network.

He holds concurrent appointments as Associate Scientist, NY State Museum, as a member of the Scientific Working Group of the NY State Biodiversity Research Institute, and as a member of the NY State Invasive Species Advisory Council. He lives in Albany, with his wife, Dr. Ingrid Peters Robinson. A former member and vice president of the Edmund Niles Huyck Preserve’s Board of Directors, he serves as chair of the preserve’s Science Advisory Committee, and he recently completed a year’s term as Visiting Scientist with NY State Parks. His research focuses on forest ecology, biodiversity distributions, and ecological restoration.
Thanks to our Sponsors

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Schedule of Events

**Wednesday, March 13, 2013**

10:00am  
Registration for attendees, speakers, poster presenters and guests  
(Outside Ballroom)

12:15pm  
Registration, orientation, and lunch for judges, moderators and recorder (CC 370)

12:30pm  
Symposium Opens (Ballroom)  
*All must attend*

1:15 – 4:35pm  
Concurrent speaker presentations (CC 375, Terrace Lounge, Assembly Hall, Standish Room, Physics 129)

4:35 – 6:00pm  
Posters judged and deliberation  
(Fireside Lounge)

**Thursday, March 14, 2013**

7:00 – 7:45am  
Breakfast at hotel

8:15am  
Buses drop off students and teachers *  
(meet in Campus Center)

9:00 – 10:40am  
Final speaker presentations (Ballroom)

10:45am – 12:00pm  
Workshop or Campus Tour:

1. Workshop by John Delano:  
   “Astrobiology: NASA’s Multi-disciplinary search for life in the galaxy” (Assembly Hall)  
   **OR**

2. Campus tour: Starting and ending at Campus Center (main entrance)

*See page 36 for more details

12:15 – 1:45pm  
Lunch and announcement of final upstate NY JSHS winners (Ballroom)

Announcement of American Chemical Society scholarship award

1:45pm  
Closing remarks

2:00pm  
School buses pick up students *

Thanks for coming! Have a safe trip home!

*Buses drop off and pick up students at the Science Library*
2013 Upstate New York Junior Science and Humanities Symposium
JUDGES, MODERATORS & RECORDER

Speaker Judges
Behavioral Science
Dr. Bruce Dudek, Department of Psychology, University at Albany
Dr. James Neely, Department of Psychology, University at Albany
Dr. Micki Friedlander, Department of Educational & Counseling Psychology, University at Albany
Kimberly Fleming, White Plains High School
Moderator: Beth Schoenbrun, Scarsdale High School
Room Supervisor: Elana Stein

General Biology and Environmental Science
Dr. Scott Miller, Atmospheric Science Research Center, University at Albany
Dr. James (Chip) Kilduff, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute
Dr. Robert Osuna, Department of Biological Sciences, University at Albany
Rachel Koenigstein, Walter Panas High School
Moderator: David Keith, Byram Hills High School
Room Supervisor: Julie Fontana

Molecular Biology and Medicine I
Dr. Kathleen McDonough, Wadsworth Center, New York State Health Department
Dr. Joe Wade, Wadsworth Center, New York State Health Department
Dr. Kathleen Bove, Technology Leader, Molecular Diagnostics Platforms, General Electric Global Research
Moderator: Ed Gruber, Eastchester High School
Room Supervisor: Karsten Bischoff

Molecular Biology and Medicine II
Dr. Bill Wolfgang, Wadsworth Center, New York State Health Department
Dr. Pauline Carrico, Wadsworth Center, New York State Health Department
Dr. Haijun Chen, Department of Biological Sciences, University at Albany
AnnMarie Lipinsky, John Jay High School
Moderator: Michael Inglis, Briarcliff Manor High School
Room Supervisor: Michelle Westfall

Physical Sciences
Dr. Eric Eisenbraun, College of Nanoscale Science and Engineering, University at Albany
Dr. Eric Kathe, Benét Laboratories, Watervliet Arsenal
Dr. Wayne Roberge, Department of Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Institute
Moderator: Steve Baltecas, Pelham Memorial High School
Room Supervisor: Len Behr

Final Session Judges
Dr. Brian Gregg, Chemical Development Small Scale Manufacturing, Albany Molecular Research
Dr. Ben Szaro, Department of Biological Sciences, University at Albany
Dr. Paula McKeown-Longo, Center for Cell Biology and Cancer Research, Albany Medical College
Dr. David Hodgson, Department of Mechanical Engineering, Union College
Moderator: Dr. Daniel Wulff
Recorder: TBD
Poster Judges

All judges are University at Albany Undergraduate students majoring in a science related subject

Section 1:
Jessica Fine
Matt Burchfield
Cece Hong
Jose Guillen
Prince Jacob

Section 2:
Asia Foster
Alex Schin
Kamilla Hussein
Kelsey O'Leary
Clare Miller

Section 3:
Michael Wilczek
Kathryn Fanning
Bryan Nugent
Sabith Choudhury
Josh Rismany

Section 4:
Anna Di
Katarzyna D. Hanaj
Joseph Sledz
Michelle Nolan

The Upstate New York Junior Science and Humanities Symposium is one of 48 nationwide symposia of the National Junior Science and Humanities Symposium Program.

Dr. Daniel Wulff, Co-Director
Dr. Donald Orokos & Dr. Timothy Lance, Co-Directors
Upstate New York Junior Science and Humanities Symposium and Science Research in the High School Program

Leonard Behr, Administrator
Science Research in the High School Program/University in the High School Program, Science Research Liaison

Abigail Jensky, Coordinator
Upstate New York Junior Science and Humanities Symposium-University in the High School Program

For more information, contact Abigail Jensky at 518-442-4148 or by email at AJensky@albany.edu
Congratulations to the 2013 Winners of the Upstate New York Junior Science and Humanities Symposium

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https://twitter.com/amriglobal
http://www.linkedin.com/company/amri

North America | Europe | Asia
Campus Center Ground Floor

To Standish room: Neuroscience and Behavioral Science
Room on 3rd floor of Science Library
Campus Center Second Floor

Assembly Hall

Elevators

Fireside Lounge

Registration

Patroon Room

Ballroom

Registration: Outside of Ballroom

Speaker Session
Assembly Lounge: Environmental Science and Biology
Speaker Session
Room 375: Biomedical Science
JSHS Clarification of Fees

Over the past twenty-eight years the Upstate New York JSHS has grown from a small, under attended symposium to the large gathering that it is today. The costs of running this endeavor have also changed a great deal due to rising prices and the change in our venue. The money contributed by the Armed Services to run the symposium has not come close to keeping up with the costs over the years.

Since there has been some confusion regarding the fee structure, we have created this page to remind attendees how the fees are structured. Please read it carefully. It will be our guide, and yours, to setting the costs for your school’s students for the years to come.

For the teacher and the first three students: The flat rate fee is $75.00 if registered before the February 20 deadline and $80.00 after that date. This includes attendance to the entire symposium (including presentations and workshops), the shuttle bus to and from the hotel, the first day’s dinner, and the second day’s lunch. It does not include transportation from schools to the symposium (as well as back home), lodging, and other meals.

For additional teachers, chaperones, and students: The fee is $60.00 per person if registered before the February 20 deadline and $70.00 per person after that date. This entitles attendees to the same participation as outlined above.

We recognize that some wish to attend the first day only AND leave before the dinner. The fee for these attendees is still $75.00 for the teacher and first three students ($80 after the February 20 deadline). Each additional visitor is $10.00 per person until the February 20 deadline. After that it increases to $25.00 per person.

For those who wish to attend the first day only AND take part in the dinner and festivities, the fee is $25.00 per person regardless of registration date.

If you have any questions about registration fees or the symposium, please contact our office at uhs@albany.edu
**Speaker Sessions 1:30 – 4:30pm**

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**Behavioral Science**

**CC Room 375**

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**1:30 – 1:47pm**

**The Effect of Emoticon Stimuli on Human Facial Muscle Activation and Social Evaluation using Electromyographic Technology: A Novel Determination**

Abigail Orlando  
Eastchester High School, Eastchester, NY  
Teacher: Edward Gruber  
Mentor(s): Dr. Daniela Schiller, Mount Sinai School of Medicine

When we see another person smiling or frowning, we automatically mime their facial expression. This effect is known as facial mimicry. In digital conversations we tend to use schematic representations of faces, known as emoticons, to convey emotion. Do we mimic these simulated facial expressions during digital conversation? Phase 1 addressed these physiological responses by recording facial movements while participants were exposed to happy, neutral and sad emoticon stimuli. Electromyography (EMG) was used to record minute changes in the electrical activity of select facial muscles. Phase 1 found that there was significant activation of: zygomaticus major when viewing happy emoticons ($p < 0.001$); corrugator supercili when viewing sad emoticons ($p < 0.001$). These findings led to Phase 2, which asked the question: does the usage of emoticons in digital communication affect our social evaluations and decision-making? Subjects interacted with four different simulated users via chat windows and then evaluated each on likeability, trustworthiness and compatibility. The users who included emoticons throughout their conversations were rated significantly higher ($p < 0.001$) in all of the aforementioned social evaluation categories. This is the first study to detect physiological responses to the emoticon using EMG and subsequent social evaluations of emoticon users.

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**1:55 – 2:12pm**

**Is Nutrition Education In Schools Causing an Increase In Eating Disorder Behaviors In Adolescence?**  
Elizabeth Silcocks  
Walter Panas High School, Cortlandt Manor, New York  
Teacher: Ms. Koenigstein  
Mentor: Bryn Austin, Childrens Hospital Boston

To minimize the obesity problem in America, many schools are implementing obesity prevention education programs in both the elementary and middle school grade levels. Very few people however, pay attention to the “other side” of this problem known as, an eating disorder. In the last decade, there has been a 119% increase in the rate of children younger than twelve years of age diagnosed with eating disorders (Underwood et al., 2010). This study’s objective was to see whether or not obesity prevention education in schools is a cause for body dissatisfaction, and disordered eating behaviors in adolescents. To do so, a survey was distributed to students in seventh and eighth grade health classrooms both before and after the students was exposed to nutrition education as a part of the New York State health curriculum. After collecting and analyzing the data from both the pre- and post survey it was concluded that there was a significant change is the mean values ($p<.05$) of the students restrictive eating, social pressure to be a certain weight, and changes in healthy behaviors. An accurate conclusion can be made that there is a substantial risk factor involved in exposing adolescents to nutrition education.
Quantifying the Impact of Nighttime Light Exposure and Sleep Duration on Melatonin Levels in Adolescents
Caleb Hersh
Ossining High School, Ossining
Teacher: Mr. Angelo Piccirillo/Ms. Valerie Holmes
Mentor(s): Dr. Eva Schernhammer, Harvard University, School of Public Health

The circadian hormone melatonin, suppressed by nighttime light exposure, has wide-reaching effects on adult physiology, and is demonstrated to suppress cancer proliferation in adults. However, for adolescents, the impact of nighttime light exposure and other potentially modifiable behavioral factors, such as sleep duration, on melatonin levels is not well understood. This study was a cross-sectional examination of 100 healthy adolescents (mean age: 15.7, 55 female, 45 male), who completed a self-administered questionnaire assessing their physiological characteristics and nighttime behaviors. First morning urine samples were collected to assess urinary 6-sulfatoxymelatonin (aMT6s) levels. Levels of aMT6s were lowest among those who reported turning on a light during sleep interruption (sleep never interrupted, aMT6s 43.0 ng/mg creatinine versus turned on light at least once, aMT6s 24.6 ng/mg creatinine, P = 0.03). Sleep duration, however, did not significantly predict aMT6s levels (5-6 hours sleep, aMT6s 35.5 ng/mg creatinine, versus 7-8 hours sleep, aMT6s 44.1 ng/mg creatinine, P = 0.15). While high ambient light levels and longer sleep duration were not associated with lower melatonin levels (P > 0.05), exposure even to low levels of light during sleep interruption suppressed melatonin in the study population. This research is the first to examine relationships between physiological and behavioral factors and melatonin in adolescents, and offers a novel perspective into how nighttime behaviors may affect the adolescent circadian system.

Perception Versus Reality: A Study of Brand Equity Effects on Women's Sheepskin Boots
Emma Goodman
Byram Hills High School Armonk, NY
Teacher: Mrs. Stephanie Greenwald
Mentor: Dr. Kevin L. Keller from the Tuck School of Business at Dartmouth College

Brand equity refers to the marketing effects uniquely attributable to a brand and can explain purchasing decisions among functionally similar and seemingly identical products. This research explores the effects of brand equity on perceptions of luxury women’s sheepskin boots and concludes that consumer perceptions of brand dominate the online purchasing decision, substantially overwhelming quality considerations. This phenomenon demonstrates the ability of an aggressive marketer to both build a new product category and dominate market share by promoting brand identity. Additional findings include an inverse relationship between price and quality indicating that luxury women’s sheepskin boots behave as a “Veblen Good,” and consumers may be falsely using price and brand as a signal for quality and performance. This study employed research techniques from social science, materials science, and social media. A traditional consumer-branding questionnaire was used to establish purchasing preferences, brand awareness, loyalty and satisfaction; these results were refined by individual respondent using a network node analysis. Brand awareness conclusions were confirmed by observing Internet search activity. Original test equipment was designed and constructed to measure tangible quality attributes to create an overall quality score for each brand. The qualitative survey results were then compared with the objective empirical results to reach conclusions.
The Effects of Listening to Mainstream Background Music at the Start of the School Day on Student Behavior in School throughout the Day
Jennifer Urmston
Valley Central High School, Montgomery, New York
Teacher: Joseph Fracalossi
Mentor: Cathryn Magielnicki, Tufts University

Music is utilized in various settings to achieve certain results. Music is used in restaurants to increase socialization time, stores to influence purchases, and gyms to improve exercise motivation. Music style can also affect emotions. This experiment hypothesized that background music played through a high school public address system in the morning before class would reduce the number of student discipline referrals. Mainstream music was played because of its familiarity among participants. Songs with uplifting messages were used to create positive moods. The dependent variable was the number of discipline referrals from February and March of 2011 and 2012. Music was played in 2012 and discipline data was compared to that of 2011, when no music was played. Although there was a 20% drop in discipline referrals, the drop did not reach statistical confidence (p=.55). However, student loitering did show a statistically significant drop of 83% (p=.037). Trends in other discipline categories showed a decrease, but not at statistically significant levels. Future research should include playing music between class changes, throughout the day, rather than only in the morning. It is believed that playing music throughout the day would improve school climate and lead to a reduction in discipline referrals.

The effect of prenominal and postnominal syntax on First Responders’ reaction times
Megan Ahern
Byram Hills High School, Armonk, NY
Teacher: Stephanie Greenwald
Mentor: Mr. Felix Carcano, CEO of The Paladin Center, Carmel Hamlet, NY 10512

Syntax efficacy during object-location was tested to decrease First Responders’ reaction times (RTs). 21 First Responders completed 72 tasks in PowerPoint. Slides contained seven distractors and one target, and corresponding prenominal or postnominal commands. Prenominal indicates a noun preceded by an adjective. Postnominal is the reverse. The PowerPoint included Condition A slides, which favored prenominal syntax and presented a target and nonidentically colored distractors; three shared an identical noun with the target. The PowerPoint also included Condition B slides, which favored postnominal syntax and presented a target and distractors of nonidentical nouns; three shared identical color with the target. RTs were analyzed using a Student’s t test, alpha was 0.05. The following results were expected: prenominal commands elicited significantly faster RTs than postnominal commands in Condition A; postnominal commands elicited significantly faster RTs in Condition B than in Condition A; prenominal commands elicited significantly faster RTs in Condition A than in Condition B; prenominal commands in Condition A were not significantly different than postnominal commands in Condition B. The following results were unexpected: postnominal commands in Condition A were not significantly different than prenominal commands in Condition A; prenominal commands were not significantly different than postnominal commands in Condition B.
Empathy in Early Childhood: A Novel Approach to Determining Social Abilities based on Age and Gender
Nola Waill
John Jay High School, Cross River, NY
Teacher: Ms. Ann Marie Lipinsky
Mentor: Dr. Tricia Striano, Hunter College, How Babies Learn

Empathy is a driving force behind human interaction. However, males and females act differently in this respect. Simon Baron-Cohen’s Empathizing-Systemizing (E-S) theory generally states that females tend to empathize more often than males and males tend to systemize more often than females. Baron-Cohen also suggests that in certain diagnosed conditions (including Autism Spectrum Disorder), individuals express extremely male-like traits, otherwise known as the Extreme Male Brain (EMB) theory. “Male-like” indicates excessive systemization and a lack of empathetic ability. Developing simultaneously with the understanding of the social mind is the understanding of the human body. These two ideas can be joined in order to develop an effective means of measuring empathy in children. In this study, subjects were asked to locate differences between two cartoon people. A preference for the face was expected in females while a preference for the extremities was expected in males. The study was developed with an eye towards detecting unusual levels of empathy based on gender. Results were not consistent with those expected under the E-S theory, with 77% of all participants noticing the feet before the eyes. However, this test should be further modified to increase its utility.

General Biology and Environmental Science
Assembly Hall

Sustainable Fluidic Biochips Enhancing Cell Sensitivity and Longevity for Water Toxicity Measurements in the Field
Sam Rude
Ossining High School, Ossining, NY
Teacher: Mr. Angelo Piccirillo and Ms. Valerie Holmes
Mentor(s): Ioana Voiculescu, City College of New York

Detecting water toxicity is time-consuming and expedited alternatives are limited, creating vulnerability to chemical weapons targeted at water supplies. We present novel cell-based biosensors for rapid water toxicity detection via electric cell-substrate impedance sensing (ECIS). On-chip cell longevity testing evaluated device shelf life using 1) media replenishments versus 2) no media replenishments, instead relying upon novel microfluidic chamber designs to supply cells with sufficient media. Our results showed cell survival for ~1 month without expensive media replenishments, which is comparable to experiments using media replenishments. Toxicity tests were conducted with ammonia above the 2mM military exposure guideline (MEG) and below this threshold for the first time, defining different responses between toxic and non-toxic samples. We used commercial ECIS electrodes and novel, reusable sensors utilizing ECIS and a quartz-crystal microbalance: a dual sensor designed for enhanced reliability. Cells exposed to toxic ammonia died in a mean 1.6 hours as indicated by a significant decline in impedance (p<.001) on commercial and novel electrodes. Subsequent microscopy confirmed the validity of ECIS measurements. Significantly slower cell response times (p=.0015) when using non-toxic ammonia and subsequent correlations suggest that response times may be inversely related to threat (R=-0.55), and that our device can also successfully detect trace concentrations of toxins. These findings produce a sensitive and robust cell-based water toxicity sensor feasible for field detection of chemical waterborne contaminants, where they will enhance water security and limit waste.
1:55 – 2:12pm

The Effect of Ultrasound Irradiation on the Physical and Biological Characteristics of Raw Water
Michael Park
Yorktown High School, Yorktown Heights, NY
Teacher: Mr. Michael Blueglass
Mentor(s): Dr. Peter Santhanam

Current methods of water purification can only filter out certain pollutants during water treatment, leaving harmful residuals like smaller colloids and viruses behind. Ultrasound may be a more effective method of water treatment due to its ability to physically agitate solutions, facilitating the coagulation and settling out of contaminants without the use of chemical additives. Ultrasound waves also produce tiny cavities within irradiated solutions that produce an extreme expenditure of heat and pressure following collapse. These extreme conditions may be able to kill harmful bacteria within water without the use of chemical disinfectants. During physical analysis, irradiated and non-irradiated samples containing raw river water and distilled air flotation solids were tested for pH, temperature, conductivity, and turbidity. Microbial analysis consisted of a heterotrophic plate count for similar irradiated and non-irradiated control samples to assess ultrasound’s disinfection capabilities. Results showed that ultrasound irradiation may not further reduce turbidity when compared to the process of natural sedimentation which was tested via the control samples. Microbial analysis however showed that a half hour of ultrasound irradiation produced a statistically significant decrease in heterotrophic bacteria, suggesting that ultrasound irradiation may have the potential to act as a chemical free disinfection process for non-potable water.

2:20 – 2:37pm

Diversity and Evolution of Endogenous Retroviruses in Afrotherians
Kathryn Evans
Scarsdale High School, Scarsdale, NY
Teacher: Ms. Beth Schoenbrun
Mentor: Dr. Robert Gifford, Aaron Diamond AIDS Research Center, Rockefeller University

Genomic integration of retroviruses into the gametes of host species provides evidence that retroviruses have been infecting vertebrates for millions of years. These genomic integrations, known as endogenous retroviruses (ERVs), have not been fully explored in publicly available genomic sequence data. This study characterizes ERV diversity in the mammalian superorder Afrotheria, a diverse group of predominantly endangered animals including elephants, sea cows, hyraxes, aardvarks, elephant shrews, tenrecs, and golden moles. A computer-based genome screening procedure was performed on the four fully sequenced Afrotherian genomes: rock hyrax (Procavia capensis), African bush elephant (Loxodonta africana), West Indian manatee (Trichechus manatus), and lesser hedgehog tenrec (Echinops telfairi). The evolutionary relationships of Afrotherian ERVs were estimated using a phylogenetic approach, which grouped the total ~88,000 ERV loci discovered into at least 25 distinct lineages. One insertion amenable to future investigation suggests a historical viral cross-species transmission event between tenrecs and lemurs, similar to the event that introduced HIV to the human population. The screening also revealed several novel trends of Afrotherian ERV distribution that warrant further investigation. For example, the majority of Afrotherian ERVs were derived from an ancient ERV-L lineage. This explorative study provides the first comprehensive overview of ERV diversity in Afrotheria.
Determining the Effects of Small-Scale Eurasian Watermilfoil Hand Harvesting on Biocontrol Populations
Klara Widrig
Burnt Hills Ballston Lake High School, Burnt Hills, NY
Teacher: Mrs. Regina Reals
Mentor: Mr. Brent Kinal, New York Natural Heritage Program

Invasive Eurasian watermilfoil (*Myriophyllum spicatum*), a threat to aquatic ecosystems, has been shown to be negatively impacted by biocontrol agents such as the milfoil weevil (*Euhrychiopsis lecontei*) and the acentria moth (*Acentria ephemerella*). Rarely co-dominating in the wild, it is important that lake managers know which species is dominant before implementing a biocontrol program. In a 2011 population study of the Chateaugay Lakes system, acentria moths were found to be dominant ($p=0.042$). Previous studies indicated milfoil weevil populations were negatively impacted by hand harvesting, a common control method used in the Chateaugay Lakes. It is therefore recommended that areas where biocontrol is to be promoted are not harvested. A study to determine the effect of small scale harvesting on biocontrol populations in the direct vicinity was conducted in 2012. A drop in the number of adult weevils was observed in the surrounding area immediately after harvesting ($p=0.0435$), followed by a drop in the number of larvae one week later ($p=0.02151$).

Assessing the Collapse of North American Late Pleistocene Megafauna
Henry Tareque
Ossining High School, Ossining NY
Teachers: Mr. Angelo Piccirillo and Ms. Valerie Holmes
Mentor: Dr. Guy Robinson, Fordham University – Lincoln Center

The late Pleistocene megafauna extinctions are well-documented globally, however the causes of such massive biotic upheaval are still unclear in North America. This study identified and differentiated factors including abrupt climate change, human interaction, and change in vegetation, leading up to the megafaunal extinctions. Spores of the fungus Sporormiella, were used as tracers for local megafauna populations, micro-charcoal for human activity, pollen quantities for vegetation, and soil records for biotic content, to create a detailed account of before, during, and after the extinction. Soil samples were obtained from the excavation sites of a stag moose skeleton and a mammoth tusk in Southern New York and a core sample from Jenny Jump State Park, New Jersey, at various intervals. Mammalian herbivore populations remained consistently high until 13,700 14C years BP, displaying a distinct disconnect in megafauna populations with the rapid Younger Dryas cooling at 11,000 14C years BP. In conjunction with micro-charcoal inversely mirroring Sporormiella trends, our findings suggest the megafaunal extinction occurred prior to the Younger Dryas climatic reversal, downplaying the role of climatic factors. Instead our data supports a protracted extinction initiated by humans and compounded by culminating climate change that led to the final collapse of North American megafauna.
Experimental evaluation of the effect of humus depth on the impact of red-backed salamanders on invertebrates
Amy LeBel
Burnt Hills-Ballston Lake High School, Burnt Hills, NY 12027
Teacher: Mrs. Regina Reals
Mentor: Dr. Douglas Fraser, Siena College

Due to the abundance of red-backed salamanders in the northeastern forest-floor ecosystem, their impact on the forest floor invertebrate communities has been assumed. Recent studies have suggested the humus-depleting activities of invasive earthworms may impact the salamander food chain. However, there are few critical tests of this hypothesis. In this study I tested specifically 1) if salamanders depleted invertebrates in their immediate environment, 2) if all invertebrate taxa were affected equally by salamanders, and 3) if depth of humus mattered in this relationship. Two experiments were used to test my hypotheses, the first an open field study to determine the invertebrate taxa affected by salamander predation in their immediate foraging territory under cover boards. The second was a mesocosm experiment designed to test whether humus depth alters the salamander effect on invertebrate populations. Over two years, I determined salamander effect through quantifying invertebrate taxa in the presence and absence of salamanders. The results indicate that salamanders may deplete invertebrates in their ambient environment. Not all invertebrate taxa were affected equally and salamanders only affected invertebrate abundances in deep humus. In conclusion, salamanders may impact certain taxa, but the behavior of invertebrates under certain conditions may overpower a salamander effect.

The Role of Retinol-Palmitic Acid Treatments and the microRNA-23b Cluster on Activated Hepatic Stellate Cells for the Potential Treatment of Cirrhosis
Daniel Fulop
John Jay High School, Cross River, NY,
Teacher: Dr. Burke
Mentors: Dr. Charles E. Rogler and Dr. Leslie Rogler, Albert Einstein College of Medicine

Cirrhosis of the liver affects over 100,000 people each year with a mortality rate of approximately 30%. Hepatic stellate cells (HSCs) transform into activated fibroblasts during cirrhosis, producing fibrous matrices and irreversible scar tissue. Activated fibroblast HSCs lose the ability to store 70% of the body’s Vitamin-A, mainly in the form of retinylpalmitate. MicroRNAs (miRNAs), small noncoding regulatory RNAs, are dysregulated in a plethora of diseases. The miR-23b cluster has been shown to cause abnormal liver features in mouse studies. For these reasons, this study aimed to determine whether activated fibroblasts could be reverted to the normal, quiescent state with both retinol-palmitic acid treatments and antisense-expressing miRZip plasmids. The combination retinol-palmitic acid treatment restored cell lipid droplet uptake and reduced gene expression levels of both ACTA2 and COL1A, indicators of HSC reversion. The next part of the study examined whether down regulation of the miR-23b cluster would yield similar results. The miR-23b cluster alone dramatically altered gene expression levels in a way indicative of reversion to the quiescent phenotype. The successful reversion of HSCs with both retinol-palmitic acid treatments and miRZip transfections is reflective of a mechanism that could potentially stop the progression of cirrhosis.
**1:55 – 2:12pm**

**Fluid Shear Stress Upregulates bFGF and EGF in mBends**

Evan Bowman  
Shaker High School, Latham, New York  
Teacher: Mr. Nathaniel Covert  
Mentor: Dr. Deanna Thompson - RPI

An endothelium within the brain called the blood-brain barrier allows specific factors such as EGF and bFGF to diffuse into the CNS. Past studies have demonstrated that blood flow over vascular endothelial cells upregulates bFGF and EGF, but it is unknown whether a similar effect results from flow across the BBB. To determine the effects of flow on soluble factor production in BBB tissues, an in vitro model was used. Flow and static chambers were assembled and sterilized, and the 3 million mouse brain endothelial cells were seeded into each. After five days, the flow plates were placed in a cone and plate viscometer and 10 Dynes/cm³ of laminar shear was applied to the mBend monolayers for 24 hours. 0.5 mL samples were taken hourly. Elisa testing was run on the sample media to reveal that flow can be used to upregulate soluble factor production in mBends. A marked increase of over six fold of bFGF and EGF concentration was observed.

**2:20 – 2:37pm**

**Determining the functional roles and disulfide crosslinking of cysteine residues in the extracellular loop of the BK potassium channel β3 subunit**

Shivani Mohan  
Suffern High School, Suffern, NY  
Teacher: Mr. Wendall Hala  
Mentor(s): Dr. Steven Marx

The big potassium channel, found in the brain and smooth muscle, is an important potassium channel due to its large conductance and Ca²⁺ sensitivity. It is composed of four α subunits with seven transmembrane(TM) helices (S0-S6). The α subunits associate with one of four β subunits(β1 – β4), which modulate the function of α and stop toxins from entering the pore. This depends on disulfide bonds in the extracellular loop that connects the two TM helices, TM1 and TM2. β1 has four cysteines(Cys) in its loop, that are conserved in the other β subunits, which have three or four additional Cys. β3 has only seven Cys in its loop, indicating that one is unpaired. This unpaired Cys presented an opportunity to examine the interaction of the β loop with the α subunit, and determine the disulfide crosslinking pattern of the loop. pWT mβ3a disulfide crosslinked to α with a Cys substituted in S0. To determine which Cys was responsible for this, site-directed mutagenesis was performed on each Cys. The mutant β3a subunits were studied using biochemical and electrophysiological techniques. The mutation of Cys152 in mouse β3a subunit eliminated the crosslinking between α and β indicating that Cys152 is unpaired. Mutations of the four conserved Cys led to loss of modulation of α by mβ3a. The disulfide bond pattern of the non-conserved Cys was identified and the role of the conserved Cys in mediating the function of the β3a subunit was shown.
Identifying the relationship between protein phosphatase methylesterase-1 O-GlcNAcylation and protein phosphatase 2A demethylation as a regulatory mechanism critical to the emergence of neurofibrillary tangles in Alzheimer’s disease

Brett Roston
Byram Hills High School, Armonk, New York
Teacher: Mr. David Keith/
Mentor: Dr. Fei Liu, New York State Institute for Basic Research for Developmental Disabilities

Neurofibrillary tangles, one of the primary hallmarks of Alzheimer’s disease, form from the hyperphosphorylation of tau protein. Critical to NFT formation may be alterations in the O-GlcNAcylation levels of protein phosphatase methylesterase-1 (PME-1). HEK-293T cells with anti-O-GlcNAc (RL2) were transfected with pCI/OGT and immunoprecipitated in preparation for analysis. Western blot analysis revealed high-density bands of O-GlcNAcylation on PME-1, demonstrating the O-GlcNAcylation of PME-1. Another line of HEK-293T cells were transfected with either OGT or shOGT and subjected to analysis with anti-demethylated-PP2A-C (4B7) and anti-PP2A-Cα/β (FL-309). Total PP2A levels (PP2A:GAPDH) significantly increased when transfected with PME-1 and shOGT (p<0.01). Demethylated PP2A levels (demethylated PP2A:PP2A) significantly decreased when transfected with PME-1 and OGT (p<0.05). Thus, shOGT may serve to activate PME-1, which demethylates PP2A. Conversely, when PME-1 O-GlcNAcylation is upregulated with OGT, total PP2A levels remain constant, while demethylated PP2A levels significantly decreased. So, OGT may inactivate PME-1, which restricts its ability to demethylate PP2A. OGT may ultimately induce tau dephosphorylation, which could serve as a target for therapeutic intervention in undoing the cognitive defects associated with Alzheimer’s disease.

Modulation of Blood Brain Barrier with Common Pharmaceuticals - A Possible Approach to Mitigating the Effects of Traumatic Brain Injury

Luke Pumiglia
Schuylerville High School, Schuylerville, NY
Teacher: Mr. Dave Conneally
Mentor: Dr. Peter Vincent, Dr. Kevin Pumiglia, Albany Medical College

Traumatic Brain Injury is recognized as a significant contributor to dementia, Chronic Traumatic Encephalopathy and Epilepsy. A major mechanism of traumatic brain injury is post-injury edema. Leakage of fluid through the blood brain barrier causes surrounding brain tissue damage. The blood brain barrier is regulated by junctional proteins such as Claudin V and VE-Cadherin, which in turn can be regulated by the signaling pathway, GSK-3B, and the master regulator, mTOR. My research aims to regulate permeability using common commercially available pharmaceuticals, such as valproic acid and metformin. In this study, we hypothesized that by reducing signaling through these pathways we can reduce vessel leakage and in turn hopefully minimize damage from concussions. After Western Blotting and ECIS experimentation, we have seen very effective inhibition of the signaling pathway mTOR, and erratic modulation of the GSK-3B pathway. This coupled with limited changes in junctional electrical resistance. We conclude that Metformin and Rapamycin may be effective modulators of endothelial mTOR signaling, however they are unlikely to result in direct effects on junctional protein expression. Whether these agents can modulate permeability by other mechanisms is an important area for further research.
An Exploration to Determine if Fab Molecules are Efficacious in Neutralizing Influenza H1 and H3 Subtypes
Nicholas Poulton
Briarcliff High School - Briarcliff Manor, NY
Teacher: Ms. Kim Dyer
Mentor(s): Mr. Robert Durso and Dr. Adam Vigil (Ph.D.)

Causing upwards of 500,000 deaths worldwide each year, influenza infection is a major source of global morbidity and mortality that also poses an eminent threat of a pandemic. Thus, there is an urgent need for new antiviral therapies. Monoclonal antibodies (Mabs) present a promising new class of antiviral drugs due to their high specificity to influenza. Phage-display technology is a new method of developing Mabs that utilizes fragment antigen binding (Fab) molecules as an intermediate step in antibody development. This research sought to determine the neutralization activity of Fabs against influenza. Fabs of two published antibodies and several unpublished antibodies were produced in competent TGF- E. coli. Neutralization by both Fabs and Mabs was determined by examining protection of MDCK cells from several H1 and H3 viruses. Although the total number of antibodies tested is relatively small, the results suggest that some antibodies may work better in the Fab form and others may work better in the Mab form. Additional work needs to be done to fully determine the differences in neutralization between Fabs in Mabs. However, preliminary results indicate that certain Fabs may be more efficacious in neutralizing particular H1 and H3 viruses.

Dual inhibition of the AKT and ERK pathways using a single small molecule for the treatment of oncogene-addicted cancers
Daniel McQuaid
Ossining High School, Ossining, NY
Teacher: Ms. Valerie Holmes
Mentor(s): Dr. Goutham Narla, Case Western Reserve University

The PI3K/AKT and MAPK/ERK pathways downstream of the Epidermal Growth Factor Receptor (EGFR) drive a significant portion of lung cancers and are therefore targets of lung cancer therapies. Tricyclic neuroleptics have been shown to negatively regulate AKT and ERK activity, though their extrapyramidal side effects hamper clinical potential. We successfully derivatized the tricyclic neuroleptic Clomipramine to decouple its antidepressant and antiproliferative effects. The new compound, TRC-382, was able to potently inhibit the AKT and ERK pathways without inducing antidopaminergic toxicities in vitro and in vivo. Inhibition of these pathways induced feedback that activated upstream EGFR. TRC-382 showed additivity with FDA-approved EGFR inhibitors, identifying a combination therapy that can confer a therapeutic benefit in cancer patients. We observed similar anticancer efficacy of TRC-382 in cancer cell lines of other subtypes harboring mutations in the EGFR pathway, demonstrating the broad applicability of our molecule. Additionally, a kinome activity screen showed that TRC-382 does not directly inhibit any kinases, suggesting a novel mechanism of AKT and ERK inhibition. Combined, our results indicate that we successfully removed the antidopaminergic properties of Clomipramine and strengthened its antiproliferative properties, and in doing so, have identified a promising monotherapy to treat cancers with hyperactive AKT and ERK.
Serotonin Plays a Proinflammatory Role in Necrotizing Enterocolitis
Juliet Strauss
Mamaroneck High School, Mamaroneck, NY
Teacher: Mr. Guido Garbarino, Mamaroneck High School
Mentor: Dr. Kara Gross Margolis, Columbia University

Necrotizing Enterocolitis (NEC) is a disease of severe intestinal inflammation that causes death in up to 10% of premature infants. Serotonin (5-HT) is a monoamine neurotransmitter synthesized in the intestine. Enteric mucosal serotonin has been previously implicated in various intestinal inflammatory diseases. Because mucosal serotonin has been previously implicated in intestinal inflammation, we hypothesized that it also plays a proinflammatory role in NEC. To test this hypothesis, we induced NEC in normal mice as well as mice that lack serotonin production in the intestinal mucosa (TPH1 KO; use of a TPH1 inhibitor) or overproduce serotonin in the gut (SERT KO). We followed survival, weight changes, histology and upregulation of proinflammatory cytokine levels in the intestine, to evaluate the proinflammatory potential of serotonin in NEC. We found that serotonin was a critical proinflammatory mediator in this murine model of NEC. Further, we also confirmed that LP-920540, a non-absorbable oral TPH inhibitor, which inhibits intestinal mucosal production of serotonin, decreased enteric inflammation and improved survival. We therefore believe that mucosa-derived enteric serotonin plays an important role in NEC and that blocking production of enteric mucosal serotonin may be a feasible treatment for NEC in future human studies.

The Relationship between Pregnancy/Postpartum and Subarachnoid Hemorrhage
Maria Mavrommatis
Yorktown High School, Yorktown Heights, NY
Teacher: Mr. Michael Blueglass
Mentor(s): Dr. Sander Connolly, Kerry Vaughan

Subarachnoid Hemorrhage (SAH), the deadliest form of stroke with a 50% mortality rate, has been suggested to positively correlate with pregnancy/postpartum. The goal was to conduct a patient-by-patient analysis of pregnant or recently pregnant patients to determine if pregnancy/postpartum and SAH severity statistically significant compared to other possible risk factors. It was hypothesized that the relationship would be significant due to hemodynamic changes that tend to elevate blood pressure during pregnancy/postpartum. 954 female SAH patients were examined using WebCis, a clinical information system. It was determined that ~7.3% of patients experiencing SAH were either pregnant or recently pregnant; however, pregnancy/postpartum and SAH severity did not correlate as expected (r = -.05), indicating that pregnancy/postpartum do not place women at a higher risk for a more severe stroke than other demographics. Other elements, however, such as a higher admission Hunt-Hess score and simultaneously higher SAH sum score (r = 0.75), cocaine use in the past 24 hours (p = .06), and ruptured aneurysms > 20mm in diameter (p = .08), did positively correlate with increased SAH severity. By identifying these correlations, I was able to determine distinct traits that isolate certain individuals as more likely to experience severe SAH.
Assessing the role of IDO and RST Type in Lyme infection: Linking *Borrelia* dissemination to host immune suppression
Matthew D’Emic
Ossining High School, Ossining, NY
Teacher: Ms. Valerie Holmes
Mentor(s): Dr. Mary M. Petzke, New York Medical College

*Borrelia burgdorferi* (*Bb*), the spirochetal agent of Lyme disease, is deposited into the skin by an infected tick and elicits an influx of immune cells that manifest as the characteristic erythema migrans rash. The factors that determine the capacity for dissemination are unknown. In the present study, *Bb* clinical isolates with varying pathogenic potential were examined for their ability to associate with specific innate immune cells at 4°C and 37°C. Clinical isolates were then examined for expression of indoleamine 2, 3–dioxygenase (IDO), an immunomodulatory enzyme expressed in the presence of certain interferon (IFN). Expression of IDO protein by human peripheral blood mononuclear cells (PBMCs) in response to various *Bb* isolates was measured via Western immunoblot. Disseminating isolates induced significantly higher levels of IDO compared to non-disseminating isolates and unstimulated PBMCs (*p*<0.05 and *p*<0.01 respectively). A disseminating *Bb* strain and a *Bb* mutant that does not disseminate were tagged with green fluorescent protein and analyzed for their ability to associate with specific human immune cell populations in PBMCs using flow cytometry. Disseminating *Bb* isolates associated at significantly higher levels with mDC1 and PBMC populations compared with the non-disseminating mutant (*p*<0.01 and *p*<0.05 respectively). These findings suggest that disseminating and non-disseminating *Bb* isolates are differentially phagocytosed by dendritic cells, and that IDO may play a role in the pathogenesis of *Bb*.

Vaccinia Viruses GLV-1h100 and GLV-1h164 are Effective against Hepatocellular Carcinoma Cell Lines
Amanda Carew
Pelham Memorial High School, Pelham, NY
Teacher: Mr. Steven Beltecas
Mentor: Kelly Mojica

Hepatocellular cancer (HCC), the most common primary liver malignancy diagnosed worldwide, has a poor prognosis. Only 10 - 20% of hepatocellular carcinomas can be completely removed surgically. In patients where complete surgical extirpation is not possible, median survival is two to four months. This study evaluated the use of oncolytic vaccinia viruses GLV-1h100 and GLV-1h164 to treat hepatocellular carcinoma. The virus was tested against three HCC cell lines at various multiplicities of infection: 0.01, 0.1 and 1.0. Cytotoxicity and viral growth were determined by LDH assays and viral titers. Protein expression in the infected HCC cells was measured at 8, 24, 48, and 72 hours post infection using a Bradford assay. Immunofluorescence staining with Red Fluorescence protein (RFP) was used to show protein expression of HNET, GLAF-2, and Vaccinia proteins encoded by the viruses. Both viruses expressed HNET and Vaccinia, while GLAF-2 was only expressed in GLV-1h164. The virus was able to replicate in the cell lines as demonstrated by the viral growth curves. HNET and GLAF-2 were increasingly expressed at 8, 24, 48, and 72 hours in GLV-1h164. This study is the first to demonstrate killing of HCC by vaccinia viruses GLV-1h100 and GLV-1h164 *in vitro*. 
Induction of a Gut-Tropic, Anti-HIV Immune Response via DEC-205 Targeted Intranasal Vaccination

Jordan Poles
Horace Greeley High School, Chappaqua, NY
Teacher: Dr. Trudy Gessler
Mentor: Dr. Saurabh Mehandru, Mt. Sinai Medical Center

The development of an effective human immunodeficiency virus (HIV) vaccine is a critical goal of HIV prevention. The mucosal surfaces of the gastrointestinal (GI) tract are targeted by HIV, resulting in profound depletion of GI CD4+ T cells and massive viral expansion within days of infection. The induction of an effective GI mucosal immune response, through vaccination, could significantly abrogate the risk of productive HIV infection. We illustrate the ability of an IN administered vaccine to induce a gut homing response that is comparable, if not more potent than, existing routes of mucosal vaccination such as IP, and far superior to systemic routes such as SC or IM. We also demonstrate the increased potency of a DEC-205+ or dendritic cell targeted vaccine over an untargeted immunization, showing a twofold increase in CD4+ IFN-Gamma+ responsiveness to the targeted vaccine. Finally our results show that a targeted/IN vaccine is capable of producing a vigorous anti-HIV immune response as soon as one week or as many as 3 months after vaccination. Though the present paper describes a proof of concept murine study, targeted IN vaccination shows great promise for future containment of the HIV pandemic. Research was supported by the AGA Broad

The Role of Semphorin7A in Cortical Circuitry Development: Implications for Autism Spectrum Disorders (ASDs)

Sania Khalid
Ossining High School, Ossining, NY
Teacher: Angelo Piccirillo and Valerie Holmes
Mentor(s): Dr. Shekhar Patil, Mount Sinai School of Medicine

Understanding the molecules that govern brain development is crucial for comprehending the neurobiology of Autism Spectrum Disorders (ASDs). This study investigated the protein, Sema7A’s role in the anatomical and biochemical development of cortical connections using immunofluorescent localization methodology and western blots on Wild-type (WT) and Sema7A Knockout (KO) mice. Our results reveal that Sema7A is highly expressed in the cortex and thalamus during postnatal day 3 (P3) through P14, then decreases from P30 through adulthood (>P60). The somatosensory cortex in Sema7A KO mice was found to be less organized, with smaller barrel areas than the WT mice barrels (p=.002). The dendrites of the Sema7A KO neurons were abnormally oriented compared to WT neurons (p=.03), making them unable to form a barrel (an indication of somatosensory circuitry). Additionally, we found that Sema7A signals through β1-integrin receptors and in the absence of Sema7A, levels of glutamate receptor subunit 2B (GluN2B)-containing receptors failed to decrease at P16 as they do normally in WT mice, suggesting abnormal functionality of the thalamocortical synapse in the absence of Sema7A. Overall, Sema7A expression and localization suggest that this protein is involved in the fine-tuning of synaptic circuitry in the somatosensory cortex. These novel findings reveal that Sema7A ablation results in abnormal development of the somatosensory pathways, a factor that may contribute to sensory deficiencies present in ASDs.
**4:00 – 4:17pm**

**Quantitative real time PCR reveals dedifferentiation in NOTCH up-regulated rhabdomyosarcoma.**
Kahlil D’Souza  
Edgemont High School, Scarsdale, NY  
Teacher: Dr. Tracy Durkin  
Mentor: Dr. Myron Ignatius, Massachusetts General Hospital/ Harvard Medical School

Embryonal rhabdomyosarcoma (ERMS) is a devastating pediatric muscle sarcoma. The Notch signaling pathway is implicated in normal muscle development and maintenance, but little is known about Notch’s signaling effects in ERMS tumors. This study examines the role of Notch by investigating its effects on the differentiation status of ERMS tumors in a zebrafish model. Less differentiated tumors are likely to be more aggressive. mRNA samples were extracted from both ERMS tumors and ERMS tumors where Notch had been over expressed. The mRNA was converted into cDNA and then genes known to mark different stages in muscle development were tested for their relative levels of expression with quantitative real time PCR. The data revealed Notch overexpression caused a shift in tumor composition. Notch caused an increase in muscle stem cells gene expression marked by increased expression of genes like myf5, c-met and pax7. myf5-expressing cells have been found to label the cancer stem cell population in zebrafish ERMS. The increase in expression of muscle stem cell genes indicates that Notch could increase the numbers of cancer stem cells in ERMS making this cancer more aggressive and resistant to treatment. It also indicates that Notch could be a target for future therapies.

**1:30 – 1:47pm**

**The Detection of Near Earth Asteroids (NEAs) using Astrometrica and CCD imaging**
Alexandra Taber  
Carmel High School, Carmel, NY  
Teacher: Dr. Lois Barish  
Mentors: Dr. Patrick Miller, Hardin-Simmons University, Abilene, TX

Asteroids are believed to be the remnants of our protoplanetary disk. In the past, asteroid research had been conducted with the goal of furthering our understanding of the solar system. Recently however the goals have shifted to focus on the detection of NEAs in hopes of gaining a deeper understanding of impact risks and formulate appropriate responses to the threats of asteroid collisions. Astrometrica was the softwared program used in this research study in order to detect NEAs. Because asteroids do not give off light, observers must rely on sunlight reflected off their surface. This makes it possible for Near Earth Asteroids to be detected using charged coupled device astronomy (CCD astronomical imaging). Astrometrica was used for the data reduction of CCD images. By using Astrometrica and the NASA asteroid magnitude glossary, it was determined that the detected asteroid Lex003 fell into the category of hazardous NEAs. This is due to the fact that it has a diameter ≈ 5.303 km, which is considered hazardous. This research supports the hypothesis that simple computer software can effectively be used to detect NEAs. Lex001 was detected on February 28, 2012. Lex003 was detected on March 3, 2012.
1:55 – 2:12pm

Determining the Differences in Detection Ability Between Chemiluminescent and Colorimetric Detection Systems Through Western Blot Analysis
Turner Pecen
Union-Endicott High School, Endicott, NY
Teachers: Mr. Douglas Huber and Dr. Timothy Newton
Mentor: Dr. Susannah Gal, Binghamton University

When detecting and quantifying proteins using western blots, a choice exists between chemiluminescent or colorimetric detection methods. The question is which method is better. For our experiments, we used pure p53 protein, an important tumor-suppressor protein that induces cell death following DNA damage and prevents tumor growth. In this experiment, we compared these detection methods by determining the upper and lower detection levels of the protein and the ability of each method to differentiate between varying levels of protein. We hypothesized that chemiluminescent detection would be superior to colorimetric. To test this, western blots were performed using different p53 levels, probed with the appropriate antibodies and then developed either colorimetrically or chemiluminescently. The resulting bands were generated for data analysis. For both methods, the lower limit of detection was 0.5 ng of purified p53. The upper limit of detection for both methods was 40 ng purified p53. Based on these results, it was determined that chemiluminescent detection was more sensitive to subtle differences between the p53 levels and, the development time required much less than that of colorimetric detection, making it more efficient. Thus, it was determined that chemiluminescent protein detection was, in fact, superior to colorimetric protein development.

2:20 – 2:37pm

A Cellular Automaton Model for Critical Dynamics in Neuronal Networks
Jiayi Peng
Horace Greeley, Chappaqua, NY
Teacher: Dr. Trudy Gessler
Mentor: Prof. John M. Beggs, Department of Physics, Indiana University

Recent experiments in cultured and acute cortical slices have found scale-invariant neuronal avalanches, suggesting that neuronal networks are operating near a critical point. Critical dynamics are beneficial for neuronal networks as criticality enables optimization of a wide variety of information-processing functions, whereas deviations from criticality may indicate presence of brain disorders, such as Alzheimer’s disease and epilepsy. To better understand the critical dynamics in neuronal networks, we propose a cellular automaton model that combines short-term synaptic plasticity with long-term metaplasticity to investigate how these two mechanisms contribute to attaining and maintaining operation at the critical point. We examine the criticality of the system through power-law distributions, finite-size scaling, scaling of non-critical states, and avalanche shape scaling. We find that short-term plasticity is sufficient to allow the system to attain the critical state, if the level of plasticity is properly chosen. However, it is not sufficient to maintain the criticality if the system is perturbed. But metaplasticity, a change in the efficacy of the short-term plasticity on the long time scale, allows the system to recover from perturbations. Working together, these two time scales of plasticity could help the system to attain and maintain criticality, leading to a self-organized critical state.
Analyzing the spectral absorption of carbon nanotubes at optical and infrared frequencies for effective signal transmission
Alexandru Stan
John Jay High School, Cross River, NY
Teachers: Mrs. Jodi Riordan, Mrs. AnnMarie Lipinsky
Mentors: Dr. Zhifeng Ren, Boston College MA; Dr. Hengzhi Wang, Boston College MA; Dr. Gabriela Smeureanu, Hunter College NY; Cristina Veresmortezan, City College of New York NY

With the decreasing size of current technology, the size limit will eventually be reached. This limit is essentially how small such things as microchips and other devices can be made before they either become too expensive, or components cease to function due to the fact that properties of matter change as it reaches the molecular level. Carbon nanotube nano-antennas can help in this dilemma by eliminating the need to create links in and between microchips or other systems in a device; there by decreasing the size of devices like cameras, phones, super computers, etc... Currently there is a need to learn more about the properties of such constructs and their limits. As devices and materials shrink to the micro and nano scale, the properties they display can change. In regards to antennas, there is one property or effect that is very important, and that is the length effect. This effect, in essence, states that an antenna is most effective when its length is a multiple of the half the wavelength that it interacts with. One problem that may occur is that the properties of antennas will change when it reaches the nano scale. The main focus of this project is to determine if this effect will change at the nano scale. By using a spectrometer to measure the absorption of CNTs at different wavelengths we can then compare the data to their actual length and see if the length effect holds true.

A Comparison of Conventional CPR and CPR Using a Novel Automatic Transport Ventilator
Christopher Di Capua
Byram Hills High School, Armonk, NY
Teacher: Mrs. Stephanie Greenwald
Mentor: Leo Penzi, M.D., North Shore LIJ Health System

Mouth-To-Mouth Ventilation (MTMV) CPR is the current standard for out-of-hospital cardiac arrest. Yet it has limitations: the fear of disease transference, the interruption of chest compressions (CCs), and the ineffectiveness of rescuer’s gasses (15% oxygen) for ventilation. To combat these issues, I engineered a novel ventilator, the Automated Ventilator with Assisted Compressions (AVAC). Forty-four participants learned how to perform MTMV CPR and AVAC CPR by viewing instructional videos, and were tested on a manikin. The portable AVAC provides 3.5 L of minute ventilation (100% oxygen), and functions without user settings: once turned on, the rescuer can perform uninterrupted and continuous CCs. A metronome aids rescuers in CC rate timing. Subjects using the AVAC delivered: over 6 times more minute ventilation; over 7 times more non-dead space ventilation; 44% more CCs; an almost 8 fold reduction in non-compression time; and a 14 fold reduction in time required to deliver a successful first breath, compared to MTMV. All results were found as statistically significant with p-values less than 0.001. Furthermore, post-survey results show AVAC CPR was preferred in all categories: satisfaction, ease of use, rank, and protection from body fluids (p<0.001). AVAC CPR was found to be more effective than conventional MTMV CPR.
Bioremediation of 3’3 Dichlorobenzidine Through the Use of Cathodic Reduction in Two Chamber Microbial Fuel Cells
Wendy Willner
Briarcliff High School, Briarcliff, NY
Teacher: Mr. Michael Inglis
Mentor: Dr. Venkataramana Gadhamshtety

3,3’ Dichlorobenzidine (DCB) represents a carcinogenic compound that was frequently used in the manufacturing of textiles and dyes. This study evaluates the viability of bioelectrochemical reduction of DCB compounds in biocathodes of microbial fuel cells (MFCs). In MFCs, exoelectrogenic bacteria oxidize organic substrates in the anode, and subsequently generate electrons that can be used to reduce oxidized contaminants in the cathode. Three MFCs were used in this experiment: one utilizing a DCB and Methanol based biocathode, one with a DCB based Cathode, and one with a DCB based anode. The three MFCs were operated in a batch fed mode. The results shows that both MFCs with biocathodes were able to reduce the concentration DCB within a sample, indicating that DCB is a viable electron acceptor in biocathodes. The MFC with the DCB based biocathode was able to reduce the concentration of DCB within a sample by 24% in 24 hours and produced a maximum voltage output of 300 mV. The MFC with a DCB and Methanol in the biocathode was able to reduce the concentration of DCB within a sample by 96% and produced a maximum voltage output of 28mV. The results further indicated that the MFC with a DCB based anode was able to produce electricity, with a maximum voltage of 520 mV, indicating that DCB is a viable electron donor in the anode of MFCs. This research shows that MFCs are a viable technology for bioremediating DCB, because of their ability to reduce concentrations of DCB while producing electricity.

The Census of Blue Stars in the Eighth Data Release of the Sloan Digital Sky Survey
Samantha Scibelli
Burnt Hills – Ballston Lake High School, Burnt Hills, NY
Teacher: Mrs. Regina Reals
Mentor: Professor Heidi Jo Newberg, Rensselaer Polytechnic Institute

The Sloan Digital Sky Survey (SDSS) is an astronomical survey mapping one-quarter of the sky. When using the survey, inconsistencies were noticed within the catalog. The purpose of this study was to examine spectra of blue stars and determine if they were accurately classified. All 12,113 objects bluer than $(g-r)_0 = -0.25$ were compared by eye to the template assigned by the SDSS, resulting in 1203 objects deemed misclassified. I created eleven new categories in which to place the stars, including: ‘DB white dwarf’ and ‘featureless’ stars. A comparison between O, B and A star colors in the SDSS and the Small Magellanic Cloud as well as an examination of bad photometric flags revealed that many of the stars observed possessed colors too blue for normal main sequence stars; proper motions were also examined. Of the 1203 misclassified stars, 559 were previously classed, while 629 had yet to be classed before this research. I suggest that future data releases include additional templates to match these rarer types of stars.
1. A Novel Zinc Finger Protein Targeted Approach to Active DNA Demethylation of VEGF-A
Gregory Fishberger
Byram Hills High School, Armonk, NY
Teacher: Mr. David Keith
Mentor: Dr. Frank Giordano, Yale University School of Medicine

2. Adolescent Stress: An Analysis of Coping Strategies
Sarah McElheny
Horace Greeley High School, Chappaqua, NY
Teacher: Dr. Trudy Gessler
Mentors: Dr. Elizabeth Schilling, Dr. Robert Aseltine

3. Semaphorin7A and Cadherin-8 are Crucial for Cortical Circuitry Development: Implications for Autism Spectrum Disorders (ASDs)
Amrita Ramesh
Ossining High School, Ossining NY
Teachers: Angelo Piccirillo and Valerie Holmes
Mentors: Dr. George Huntley, Dr. Shekhar Patil, Ms. Lauren Friedman

4. The Impact of Music Tempo and Volume on Sales in a Restaurant
Benjamin Gunderman
Sleepy Hollow High School, Sleepy Hollow, NY
Teachers: Mrs. Janet Longo-Abinanti, Mr. David Erenberg
Mentor: Ronald E. Milliman, Western Kentucky University

5. Forecasting and Managing Solar Energy
David Linus Hamann
Yorktown High School, Yorktown Heights, NY
Teacher: Michael Blueglass
Mentor: Dr. Jen-Yao Chung at IBM Watson

6. The Effects of Paternal Birth Weight and Infant Birth Order on Infant Birth Weight
Olivia Bauer
White Plains High School, White Plains, NY
Teacher: Kimberly Fleming
Mentor: Dr. Dona Schneider

7. Comparative Analysis of Georeferenced Datasets for Ascertaining the Accuracy of Geographic Origin Estimates of Chimpanzee Populations in Nigeria and Cameroon
Maya Schank
Burnt Hills-Ballston Lake High School, Burnt Hills, NY
Teacher: Mrs. Regina Reals
Mentors: Dr. Katy Gonder, University at Albany
8. Layer-by-Layer Three-Dimensional Constructs of Adherent and Non-Adherent Cells in Hydrogel
Sahir Jaggi
Shaker High School, Latham, NY
Teacher: Mr. Nathaniel Covert
Mentor(s): Dr. Douglas B. Chrisey, Tulane University

Section 2

9. Effects of Water Vapor on Hydrogen Permeation Through a Metal Membrane
Chloe Wang
Dobbs Ferry High School, Dobbs Ferry, NY
Teacher: Mr. Thomas Callahan
Mentors: Dr. Hendrik Bluhm, Dr. Christoph Rameshan, Lawrence Berkeley National Laboratory

10. Associative Learning with Odors in an Academic Environment
Rebecca Amorese
Lakeland Senior High School, Shrub Oak, NY
Teacher: David Sarli, Lakeland Senior High School
Mentor: Dr. Thomas Hummel, University of Dresden

11. A New Automated Method of Diagnosing Colon Cancer Using Digital Image Analysis
David Vernik
Yorktown High School, Yorktown Heights, NY
Teacher: Mr. Michael Blueglass and Mrs. Maria Pace
Mentors: Dr. Sean Carlin, Memorial Sloan-Kettering Cancer Center

12. Bioinformatic Meta-analysis Derived Transcriptome of Psoriatic Skin Reveals Changes in Apoptosis Signaling Pathways and Genes Associated with Increased Risk of Atherosclerosis
Claudia Mimoso
Ossining High School, Ossining, NY
Teachers: Mr. Angelo Piccirillo and Ms. Valerie Holmes
Mentor(s): Dr. Miroslav Blumeberg, New York University Langone Medical Center; Dr. Claire Qiufan Wang and Dr. James G. Krueger, The Rockefeller University

13. The Relationship between White Matter Integrity and Self-Awareness in Multiple Sclerosis using Diffusion Tensor Imaging
Ben Silver
Suffern High School, Suffern, NY
Teacher: Mr. Wendell Hala
Mentor: Dr. Helen Genova, Kessler Foundation

14. A Preliminary Study Of A School-based Pedometer Program And Its Relationship To Childhood Well-being Indicators.
Maheen Saeed
Union-Endicott High School, Endicott, NY
Teacher: Dr. Tim Newton/
Mentor: Dr. Susan Terwilliger
15. Finemapping of narcolepsy susceptibility regions using imputation
Valentine Olivier
Mamaroneck High School, Mamaroneck, NY
Teacher: Mr. Guido Garbarino, Mamaroneck High School
Mentor: Dr. Juliette Faraco, Stanford University

16. Differences in Body Image Perception between Hispanic and Caucasian Pre-adolescent Girls
Sarah Permut
Ossining High School, Ossining, NY
Teacher: Mr. Angelo Piccirillo
Mentor: Dr. Edward Honcharski

Section 3

17. The role of novel cellular factors in the HIV-1 uncoating process
Karan Goyal
Byram Hills High School, Armonk, NY 10504
Teacher: Mr. David Keith
Mentors: Dr. Felipe Diaz-Griffero, Albert Einstein College of Medicine

18. Endothelial Cells Regulate Immunosenescence
Jami Nicholson
Mamaroneck High School, Mamaroneck, NY
Teacher: Mr. Guido Garbarino, Mamaroneck High School
Mentor: Dr. Jason Butler, Weill Cornell Medical College

19. Post-anoxic dissolved oxygen concentrations impact nitrous oxide emissions in the full nitrification process
Edward Aryee
Ossining high school, Ossining, NY
Teacher: Ms. Valerie Holmes
Mentor: Dr. Kartik Chandran, Director of water treatment program at Columbia university

20. The Effect of Sunlight on Coated Photoactive Nanoparticle Aggregation
Shawn Kollesar
Spackenkill High School, Poughkeepsie, NY
Teacher: Mrs. Amy Matts, Spackenkill High School
Mentor: Dr. Greg Lowry, Carnegie Mellon Department of Environmental Engineering

21. Optimization of Ground-Source Well Locations
Tanvi Tiwari
Yorktown High School, Yorktown Heights, NY
Teacher: Michael Blueglass
Mentors: Dr. Chandu Visweswariah, IBM
22. The Application of ShRNA in SKBR3 and MCF7 cells to identify BLNK as a possible Therapeutic Target in Breast Cancer.
Zonaira Sarwar
Shaker High School, Latham, NY
Teacher: Mr. Nathaniel Covert
Mentors: Dr. Douglas Conklin, University at Albany

23. A Cure for Malaria? Assessment of Toxoplasma gondii Nitric Oxide Resistance Mechanisms as a Potential Therapeutic Target
Emma Iaconetti
Yorktown High School, Yorktown Heights, NY
Teacher: Mr. Michael Blueglas
Mentors: Dr. Dana Mordue, New York Medical College

24. Novel Reduction in Prion Protein Aggregation Via Up-Regulation of Quality Control Proteins
Jackson Ruzzo
John Jay High School, Cross River, New York
Teacher: AnnMarie Lipinsky
Mentor: Hermann Schätzl, MD, PhD, University of Wyoming

Section 4

Mark Moretto
Briarcliff High School, Briarcliff Manor, NY
Teacher: Mrs. Kimberly Dyer
Mentors: Dr. Michael A'Hearn, Dr. Lori Feaga, University of Maryland

26. The Brain Needs Downtime: Effects of Digital Devices on the Memory Consolidation of High School Students in a Classroom Setting
Victor Russak
Rondout Valley High School, Accord, NY
Teacher: Mrs. Elissa Jury
Mentor: Dr. Corwin Senko, SUNY New Paltz

27. Investigating the Decline of Juvenile Anguilla rostrata Decline in Hudson River Tributaries Using Physicochemical Properties and Biotic Indicators of Water Quality
Pamela Brigleb
Ossining High School, Ossining, NY
Teacher: Mr. Angelo Piccirillo and Ms. Valerie Holmes
Mentor: Christopher Bowser, New York State Department of Environmental Conservation

28. The Role of Microbial Enzymes and the Formulation of the Enzyme Hypothesis
Jamie Tanzer
Scarsdale High School, Scarsdale, NY
Teacher: Ms. Beth Schoenbrun
Mentors: Dr. Marc Rothenberg, Cincinnati Children’s Hospital
29. The Way to an A: Uncovering reasons why students don't attend extra-help sessions; increasing efficiency for the future
Jessica Yuan
Yorktown High School, Yorktown Heights, NY
Teacher: Mrs. Michael Blueglass
Mentors: Ms. Lori Roberts, Yorktown High School

30. Properties of Twitter Network Communications among Teenagers
Gili Rusak
Shaker High School, Latham, New York
Teacher: Mrs. Jessica Sanderson, Shaker High School, Latham, New York
Mentor: Professor Sibel Adali, Rensselaer Polytechnic Institute, Troy, New York

31. Motivational Factors and Level of Competitiveness in Adolescent Fantasy Football Participants
Tyler Friedman
Briarcliff High School, Briarcliff Manor, NY
Teacher: Ms. Kimberly Dyer
Mentor: Dr. Brendan Dwyer

32. Bird Diversity, Richness, and Abundance in Areas of High and Low Density of Selected Invasive Plants in an Urban Park
Eamon Corbett
Pelham Memorial High School, Pelham, NY
Teacher: Mr. Steven Beltecas
Mentor: Dr. Nancy Clum, Ornithology Curator, The Bronx Zoo

Congratulations to the students at the Upstate New York Junior Science and Humanities Symposium

Richard C. Iannuzzi, President
Andrew Pallotta, Executive Vice President
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Astrobiology: NASA’s Multi-disciplinary search for life in the galaxy

Astrobiology is a bold initiative by NASA to learn more about the origin and distribution of life in the galaxy. This task involves dynamic collaborations among astronomers, biologists, chemists, and geologists, all of whom bring important perspectives to bear on this complex problem.

Professor John Delano will present an overview of the many exciting results, experiments, and missions that are currently underway by NASA-funded scientists, including processes and environments that may have led to life on Earth. Astrobiology challenges us to discover processes, pathways, and environments that transform initially sterile, lifeless worlds into worlds having dynamic, evolving biological systems. While the answers remain elusive, the hard work is providing important progress and deep excitement among scientists, and has captured the imagination of millions of people on Earth with the discovery of nearly 3000 planets currently known to be orbiting nearby stars.

John Delano earned a Ph.D. in Geochemistry at Stony Brook University, and is currently a Distinguished Teaching Professor and Associate Dean at the University at Albany. He is also the Associate Director and scientific Co-Investigator at the New York Center for Astrobiology, a NASA-funded center headquartered at Rensselaer Polytechnic Institute in collaboration with Syracuse University, the University of Arizona, and the University at Albany. He has served on and chaired many NASA advisory panels, including those for Discovery and New Frontiers space missions. He has published 60 scientific papers in the professional literature.

Campus Tours

There will be campus tours available:

10:45am — 12:00pm: Tour group will be picked up at main entrance to the Campus Center and then tours will end at the same place.
Schools Participating in the 28th Annual Upstate New York Junior Science and Humanities Symposium

1. Academy of the Holy Names  
2. Briarcliff High School  
3. Burnt Hills-Ballston Lake High School  
4. Byram Hills High School  
5. Charles E. Gorton High School  
6. Dobbs Ferry High School  
7. Eastchester High School  
8. Edgemont High School  
9. Germantown High School  
10. Gloversville High School  
11. Hendrick Hudson High School  
12. Hoosic Valley High School  
13. Horace Greeley High School  
14. John Jay High School  
15. Lakeland Senior High School  
16. Mamaroneck High School  
17. New Paltz High School  
18. Ossining High School  
19. Pelham Memorial High School  
20. Rondout Valley High School  
21. Scarsdale High School  
22. Scotia- Glenville High School  
23. Shaker High School  
24. Sleepy Hollow High School  
25. Spackenkill High School  
26. Suffern High School  
27. Taconic Hills High School  
28. Tom’s River High School  
29. Union Endicott High School  
30. Valley Central High School  
31. Walter Panas High School  
32. White Plains High School  
33. Yorktown High School

We wish to extend a special thanks to our volunteers for contributing their time and talents to making the Upstate New York Junior Science and Humanities Symposium the best experience it can be:

Sub-regional Directors: The students who are presenting their original research at the Upstate NY JSHS are finalists from three sub-regional events that are held during January and February in New York State. The sub-regional directors who make these symposia possible are:

**Eastern JSHS**
Regina Reals  
Burnt Hills-Ballston Lake High School  

**Central/Western JSHS**
Leonard Behr  
UHS Science Research Liaison

**Westchester and Rockland Counties JSHS**
Ann Marie Lipinski  
John Jay High School

Symposium Help: Special thanks to all the students and teachers who have volunteered to help. The symposium wouldn’t be able to run smoothly without everyone’s generous help and consideration. Thank you to all the judges and moderators and to everyone else who helped with registration and AV equipment.