

59th Annual Meeting of the New Jersey Academy of Sciences Junior Academy Program

Microbiology

Room: Hunterdon 118, Moderator: Bartorsky

Time	Presenters	Title
9:45	Erica Cai	ANTIBACTERIAL EFFECT OF PROPOLIS
9:55	Tiffany Zhao	INVESTIGATING LOW-COST METHODS OF CARBON DIOXIDE GENERATION FOR TEMPORARY CULTURE OF HELA CELLS
10:05	Eric Liu, Rohan Kodialam	THE EFFECT OF TERMAMYL AMYLASE ON THE ADHERENCE AND GROWTH OF <i>S.epidermidis</i> BIOFILMS ON TITANIUM
10:15	Ashley Winters	THE COMBINED EFFECTS OF PIPERLONGUMINE, VITAMIN C, AND VITAMIN D ON LIFESPAN IN A <i>Caenorhabditis elegans</i> MODEL AFTER HEAT SHOCK
10:25	Brian D'Agostino, Kelsey Murray, Amanda Siriram	THE EFFECTS OF $CaCl_2$, KCL, NaCl, AND DH_2O ON CELL COMPETENCE IN THE TRANSFORMATION OF <i>Escherichia coli</i> MM294
BREAK		
10:35	Julia Flores	EVALUATION OF AGAROSE GEL ELECTROPHORESIS AS A MOLECULAR TYPING METHOD FOR THE IDENTIFICATION OF <i>S. epidermidis</i> , A MODEL ORGANISM FOR MRSA
10:45		

ANTIBACTERIAL EFFECT OF PROPOLIS

Erica Cai (student), High Technology High School, Lincroft, NJ 07738

Propolis has long been used as a remedy for wounds and inflammation and marketed as an antiseptic and immune-boosting health product. This research was carried out to study the antibacterial effect of the natural bee product propolis. LB broth containing two different concentrations of propolis and no propolis were added to *E. coli* K 12 strain grown on the plates. The colony counts of the *E. coli* K 12 strain on plates containing higher concentration of propolis (17% of raw propolis) were substantially lower than *E. coli* grown on the plates with no propolis. On the other hand, there was no obvious reduction of *E. coli* colony counts on plates with low concentration of propolis (4% of raw propolis). It is also observed that *E. coli* colonies grown on plates containing propolis are much smaller in size. The p-value from a statistical T-test between the growth of the control group and the higher concentration propolis-treated bacteria group is 0.015, smaller than the alpha value 0.05, suggesting that 17% propolis can kill *E. coli* and suppress *E. coli* growth. However, such antibacterial effect is concentration dependent.

INVESTIGATING LOW-COST METHODS OF CARBON DIOXIDE GENERATION FOR TEMPORARY CULTURE OF HELA CELLS

Tiffany Zhao (student), High Technology High School, Lincroft NJ 07738

This study compared two low-cost carbon dioxide generation methods for the temporary culture of HeLa cells, a common cell line. Because of their rapid cell cycle, HeLa cells are frequently used as cell biology models. If HeLa cells could be temporarily cultured in high schools, they could serve as advanced cell biology models and experimentation mediums. However, maintaining the carbon dioxide concentration necessary to culture HeLa cells, between 30,000 and 50,000 parts per million, is costly. The methods compared in this study were the antacid tablet method and carbonated water method. The research hypothesis was that there would be a significant difference between the duration of desired carbon dioxide concentration using the antacid tablet method versus the carbonated water method. The methods were compared by generating carbon dioxide into an enclosed container (mimicking an incubator) and using a carbon dioxide sensor and data-logging software to determine the duration of the desired carbon dioxide concentration. The student researcher discovered that there was a significant difference between the duration of desired carbon dioxide concentration using the antacid tablet method versus the carbonated water method. The duration of the desired carbon dioxide concentration was significantly longer using the carbonated water method.

THE EFFECT OF TERMAMYL AMYLASE ON THE ADHERENCE AND GROWTH OF *S.epidermidis* BIOFILMS ON TITANIUM

Eric Liu (Student), Rohan Kodialam (Student), High Technology High School, Lincroft NJ 07736

Several technologies have been utilised to help prevent the inception and spreading of these harmful biofilms, including the application of antibiotics to surfaces and attempting to limit the adhesion of bacteria to a surface by adding coatings of hydrophobic materials or chelators to hold metal ions in place (Chen, Yu & Sun, 2013). The antibiotic treatment, while common, has the severe drawback of being ineffective against resistant bacteria commonly found in biofilms, and overuse of antibiotics can possibly lead to the evolution of resistant strains of bacteria (Høiby, Bjarnsholt, Givskov, Molin, & Ciofu, 2010). The objective of this experiment is to evaluate the effectiveness of glycosyl hydrolases in preventing the adherence of bacterial biofilms to metal surfaces, and to compare the relative efficacies of enzymatic techniques and standard antibiotics in providing long-term resistance to the spread of biofilms on metals. Specifically, titanium metal, which is a key part of medical alloys including those used in implants, will be used as a base for the biofilms to grow on. For comparison, ampicillin antibiotics will also be used; their effectiveness against a similar bacteria (*S. mutans*) was established by Liu, Ling, Zhang, Huo & Ning (2012). The researchers believe that the application of amylase to a surface will provide more sustainable protection against biofilm formation, as it will effectively dismantle the exopolysaccharide molecules that join the bacteria to the surface. Furthermore, promising results were obtained during previous research on the use of enzymes to disrupt *P. fluorescens* biofilms in the past (Molobela, Cloete & Beukes, 2010).

THE COMBINED EFFECTS OF PIPERLONGUMINE, VITAMIN C, AND VITAMIN D ON LIFESPAN IN A *Caenorhabditis elegans* MODEL AFTER HEAT SHOCK

Ashley Winters (student)

Cancer is a mutation of DNA, causing the cells to proliferate uncontrollably. The trouble with curing cancer is finding a method to reprogram the damaged cells to undergo apoptosis, all the while sparing healthy, vital cells. The current cancer treatment, chemotherapy, induces apoptosis in tumor cells, but is also extremely toxic for the surrounding cells. Drugs which induce apoptosis have shown significant promise in killing cancer cells. Recently, researchers have been exploring the usefulness of manipulating the p53 gene for cancer treatment. The p53 gene is a tumor suppressor gene that is mutated in over half of all human tumor cells. When activated, p53 can stimulate DNA repair and apoptosis, making it crucial in the killing of tumor cells. The focus of this research is to determine the combined effect of piperlongumine, vitamin D, and vitamin C on the p53 gene in the *C.elegans* strain JR1279 lifespan after cellular stress of heat shock.

THE EFFECTS OF CaCl_2 , KCl , NaCl , AND dH_2O ON CELL COMPETENCE IN THE TRANSFORMATION OF *Escherichia coli* MM294

Brian D'Agostino, Kelsey Murray, Amanda Siriram (students), Biotechnology High School

Bacterial transformation is common in high school laboratories. The cost-effective and safe procedure allows students to undergo complex studies in their classroom. During bacterial transformation, the most effective technique for preparing competent cells is electroporation, however, this technique is not feasible due to the cost. Instead, CaCl_2 is used to create competent cells. This investigation was conducted to determine a possible alternate salt component of heat shock, instead of CaCl_2 , that will result in higher transformation of *Escherichia coli* MM294, compared to CaCl_2 . We investigated the effects that various components of heat shock (CaCl_2 , MgCl_2 , KCl , NaCl , and dH_2O) have on cell competence in the transformation of *Escherichia coli* MM294. We predicted that CaCl_2 will have the highest transformation of *Escherichia coli* MM294. To test our hypothesis, we performed a bacterial transformation using different salt components of heat shock (CaCl_2 , MgCl_2 , KCl , NaCl , and dH_2O) to lyse *Escherichia coli* MM294. The ampicillin resistance gene in the pGreen plasmid was our selectable marker. We plated the bacteria on LB agar/amp plates after transformation and allowed them to incubate. Then we counted the number of transformed colonies for each salt component of heat shock. In our investigation, CaCl_2 was the most viable salt for heat shock. There was a significant difference between the number of transformed colonies for CaCl_2 and the other salts. CaCl_2 had more than double the amount of transformed colonies compared to the other salts. CaCl_2 should continue to be used for creating competent cells before heat shock.

EVALUATION OF AGAROSE GEL ELECTROPHORESIS AS A MOLECULAR TYPING METHOD FOR THE IDENTIFICATION OF *S. epidermidis*, A MODEL ORGANISM FOR MRSA

Julia Flores (student), Morristown High School, Morristown, NJ 07960

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a resistant bacterium that causes severe cutaneous infections. During a MRSA outbreak it is essential to identify the exact strain and clone of the bacterium so paths of transmission can be traced and surfaces can be disinfected. There are multiple molecular typing methods used to do this, but most are expensive, time-consuming, and complicated. Agarose gel electrophoresis has been shown to be highly discriminatory when identifying strains of bacteria and is comparatively cheaper, faster, and simpler than the current methods. The purpose of this study was to determine the feasibility of using agarose gel electrophoresis to identify *Staphylococcus epidermidis*, a model organism for MRSA. To accomplish this task, DNA was extracted from cultured bacteria, extracted DNA was cut and serially diluted by a factor of ten, and samples were run in three agarose gels. The gels were run over a period of two hours, stained with ethidium bromide, and visualized under UV light. Results were analyzed to determine whether appropriate identification was achieved. Bands were not produced by any of the experimental samples. For future studies, it is recommended that research be conducted using a higher proof isopropanol during DNA extraction and possibly an alternate restriction enzyme.

Engineering/Physics

Room: Hunterdon 120 Moderator: Mitra Shojani-Feizbadi

Time	Presenters	Title
9:45	Rahul Rangwani	THE EFFECT OF SOCCER CLEAT WEIGHT ON KICK DISTANCE
9:55	Vivian Qiang	COMPARISON OF THE WATER RESISTANCES OF DIFFERENT SWIMSUIT FABRICS
10:05	Tien-Sheng Wang	COMPARISON OF PLACEMENT OF RIM SENSORS
10:15	Samantha Soliman	INTUITIVE BANDAGES: A NOVEL INFECTIONS DETECTION METHOD USING NANO HEAT SENSORS
10:25	Soohee Lee	SUPERCAPACITORS
BREAK		
10:35	Nicholas Ciulla	EFFECTS OF A CONVEX LENS AND MIRRORS ON GENERATION OF SOLAR POWER
10:45	Eugene Lim	SYNTHESIS OF MICROFLUIDIC CHANNELS FOR USE IN BIOMEDICAL RESEARCH
10:55	Eugene Kim	ABNORMAL FUNCTIONAL CONNECTIVITY IN THE BRAIN AS A CRITERION FOR LOCALIZATION IN CRYPTOGENIC CASES OF FOCAL EPILEPSY
11:05		

THE EFFECT OF SOCCER CLEAT WEIGHT ON KICK DISTANCE

Rahul Rangwani (student)

Since modern soccer cleats (shoes) have been in production, players, coaches, and manufacturers alike have argued about how the weight of the cleat affects the distance of a kicked ball. The purpose of this research experiment was to determine whether there is a significant difference in the distances of kicks from a heavy soccer cleat and a light soccer cleat. The two cleats that were tested were the Nike Tiempo Brasileiro and the Adidas F50 AdiZero. The Nike cleat weighed 10.5 ounces, while the Adidas cleat weighed 5.5 ounces, which provided a big contrast. The hypothesis of this experiment stated that there would be a significant difference in the distances of the kicks between the two cleats. To eliminate large amounts of human error, a kicking machine was built and used to kick the ball with a near constant force for each trial. In order to minimize variation in ground conditions, testing was done on a level turf field located at Holmdel High School (HHS). After the data was collected, a two-tailed t-test was used to analyze the data. The analysis results showed that there was a significant difference, suggesting that the weight of a soccer cleat does affect kick distance. In the future, this research can be used by players to determine which cleats to wear.

COMPARISON OF THE WATER RESISTANCES OF DIFFERENT SWIMSUIT FABRICS

Vivian Qiang (student), High Technology High School, Lincroft NJ 07738

Swimsuits are used around the world for recreational activities and competition. For competitions, swimmers demand the swimsuit with the least water resistance and drag. Many top swimmers choose Speedo's Fastskin swimsuit (74% polyester and 26% Lycra), marketed to have ridges like a shark's denticles, to compete in. However, other swimmers choose suits like Speedo's Endurance swimsuit (50% polyester and 50% PBT), which is meant to endure against chlorine, but is also thought to reduce drag. Most competitive swimmers shun one type of suit, used most often in recreational swimming. The "Regular" swimsuit (80% nylon and 20% Lycra) is professed to increase drag relatively substantially. Few experiments have been done comparing drag of different swimsuits, but those that were conducted contradict each other and contain many sources of human error. To reduce human error and provide accurate results, this experiment will compare drags of Fastskin, Endurance, and Regular materials using a student designed and engineered apparatus and well-controlled setup. Water will be forced through a narrow channel lined on one side with the testing material inside the apparatus, causing drag that slows water flow. The more time taken for water to pass through the apparatus, the more drag, and vice versa.

INTUITIVE BANDAGES: A NOVEL INFECTIONS DETECTION METHOD USING NANO HEAT SENSORS

Samantha Soliman

The field of biomedical engineering applies the principles of engineering to medicine and biology for the advancement of the treatment and diagnosis of medical conditions. The attention of biomedical engineers is needed to help design devices that address the health problem of acute wound infections. The purpose of this study is to design, develop, and test an intuitive bandage that can detect the presence of an infection. A prototype was constructed by a strain gage sensor attached to a Wheatstone Bridge Circuit, and a mini LED light will be connected to the circuit. Prototypes will be tested to evaluate an increase in wound temperature as detected by the strain gage sensor and indicated by the LED LIGHT.

COMPARISON OF PLACEMENT OF RIM SENSORS

Tien-Sheng Wang(student), Michael Roche, High Technology High School, 765 Newman Springs Road, Lincroft NJ 07738

Twenty-four second shot clocks are used in basketball to keep the pace of the game. It is reset when the ball hits the rim, and not when it hits the backboard. A shot clock is control by an official, who determines when to reset the clock. This means that shot clock accuracy is limited to the reaction time and judgment of an official. This takes away seconds of valuable play time and causes disputes. As a solution to this, the student researcher prototyped a device that will automatically reset the shot clock using sensors (on the rim and the backboard) to determine whether the ball hit the backboard or the rim. However, he needed to find a way that the rim sensor would pick up least interfering backboard vibration. The student researcher tested two placements of the rim sensors for significant difference in picking up backboard interference: on the base of the rim, or on the edge of the rim in parallel with a 3.333 nF capacitor. He then recorded the voltages of the sensors when a ball hit the backboard. The student researcher used an independent t-test comparing the peak voltages recorded. From this data analysis he determined that there was a significant difference. Placing the sensor closer to the edge of the rim picked up less backboard vibration.

SUPERCAPACITORS

Soohee Lee

Compared to conventional batteries, supercapacitors have much higher rate of charge and discharge, provide a surge of energy in a short amount of time, and do not wear out. The problem with current supercapacitors, however, is their low energy density. Thus, increasing energy density of the current supercapacitor has potential to significantly increase efficiency of today's energy storage technology, especially for applications to electrical cars. The combination of graphene and carbon nanotubes has a potential for a material used in a supercapacitor, as it can have synergistic effects on thin film capacitance. Composite of reduced graphene oxide (rGO) and multi-wall carbon nanotubes (MWCNTs) can lower sheet resistance and increase surface area of the graphene electrode which creates potential for higher capacitance. The effect of mass percent MWCNT in arGO/MWCNTs composite thin film on the sheet resistance was measured. rGO/MWCNTs weight ratios of 1:9, 2:8, 1:2, and 2:1 were tested so that the minimum amount of MWCNTs that can significantly reduce sheet resistance can be found. It is hypothesized that with the addition of more conductive MWCNTs in arGO/MWCNTs film, sheet resistance will decrease. The sheet resistance significantly decreased with even the minimum fraction of MWCNTs to rGO.

EFFECTS OF A CONVEX LENS AND MIRRORS ON GENERATION OF SOLAR POWER

Nicholas Ciulla (student)

The problem in question throughout the course of this project was how a convex lens or a mirror affects the voltage output of solar panels. The original hypotheses state that the lens would allow panels to produce voltages significantly different than both the control and the panel with a mirror. The hypotheses also predict a significant difference in the voltage output of a panel with a mirror from that of a normal panel. The procedure of the experiment requires the setup of 3 separate configurations, the first being the normal panel, the second being the panel with a mirror, the last being the panel underneath a lens. A light will be positioned at 3 different angles, and 14 voltages will be collected from each configuration at each angle, for 126 total raw data points. After analysis, the collected data appear to support all of the alternate hypotheses, yielding an overall p-value of 2.33×10^{-31} . The analysis supports a significant increase between each of the configurations. It also shows that the lens increased voltage output of the panel by a much greater amount than the mirror.

SYNTHESIS OF MICROFLUIDIC CHANNELS FOR USE IN BIOMEDICAL RESEARCH

Eugene Lim (student) Bergen County Academies, Hackensack NJ 07601

Microfluidics, the manipulation of liquids at a scale smaller than ten micrometres, has shown promising advances in many processes such as chemical synthesis and in-vitro diagnostics. Recently, researchers have created lap-on-a-chip with over 100 microfluidic chambers, each containing single cells that can be individually modulated with different chemical stimuli. One advantage of microfluidics over other methods of biomedical protocol is its low cost and low maintenance design. This experiment emphasizes this advantage by synthesizing microfluidic channels with a low cost molding agent, known as Polydimethylsiloxane (PDMS). The microfluidic channels will be created by a process of reverse molding, using a solid ink template printed on a transparency. Nano-structural imaging, along with an SEM, will be used to image the microfluidic channels. Upon imaging and determining the depth of these channels, the theoretical amount of liquid the channel should hold will be compared to the actual amount of liquid the channel holds.

ABNORMAL FUNCTIONAL CONNECTIVITY IN THE BRAIN AS A CRITERION FOR LOCALIZATION IN CRYPTOGENIC CASES OF FOCAL EPILEPSY

Eugene Kim (student), Bergen County Academies, NYU Langone Epilepsy Center, Hackensack NJ 07626

Current procedures for localizing the epileptogenic zone in patients with focal epilepsy entail the use of Magnetic Resonance Imaging (MRI). However, there are times when a MRI is unable to visualize the lesion; such cases are called cryptogenic or MRI negative cases. MRI negative patients are often unable to receive resective surgery because the presence of a detectable lesion is an important criterion for surgical candidacy. This study evaluated the effectiveness of a voxel-based statistical analysis of the brain's functional connectivity through the use of functional MRI. The eighteen subjects were MRI negative patients who underwent surgery and were confirmed to have focal epilepsy by a post-operative pathology analysis. Creating a connectivity map of the patient's brain and comparing it to a post-operative image of the brain revealed areas of abnormal connectivity in relation to the location of the resected lesion. It was discovered that areas of abnormal connectivity have a tendency of being located within a lesion, proving that localizing epileptogenic tissue by detecting abnormal functional connectivity is a viable method. This novel detection method can be used to aid the pre-surgical evaluation of a patient by marking potential target lesions based on areas of abnormal functional connectivity.

Math
Room: Hunterdon 123 Moderator: Shivani Patel

Time	Presenters	Title
9:45	Hill Chang	AN ANALYSIS OF FACTORS INFLUENCING THE EFFECT OF SOCIAL MEDIA ON LASTING FAME GROWTH
9:55	Eric Chang	A STRATEGY FOR INVESTIGATING THE CORRELATION BETWEEN NUMBER OF TWEETS MENTIONING AN ELECTRONIC PRODUCT AND ITS REAL WORLD SALES
10:05	Kunal Singh	ANALYZING SOCIAL MEDIA CONTENT FROM CANCER PATIENTS
10:15	Iris Rukshin	ON THE PROGNOSTIC VALUE OF THE NEUTROPHIL TO LYMPHOCYTE RATIO FOR THE INCIDENCE OF ACUTE CARDIOVASCULAR EVENTS IN STROKE PATIENTS
10:25	Ananya Joshi	DETERMINING AN OPTIMAL AMINO ACID SEQUENCE AS A FIBRILLOGENESIS INHIBITOR OF A β <i>IN SILICO</i>
BREAK		
10:35	Jesse Doppelt	AN EVALUATION OF STATISTIC BASED PREDICTIONS IMPLEMENTED INTO FANTASY FOOTBALL
10:45	Newton Xie (Student), Matt Koutsoutis	PREDICTING SHORT TERM FLUCTUATIONS IN STOCK PRICES DURING EVENTS
10:55		

AN ANALYSIS OF FACTORS INFLUENCING THE EFFECT OF SOCIAL MEDIA ON LASTING FAME GROWTH

Hill Chang, High Technology High School, Lincroft, NJ 07738

More and more organizations are looking into using the internet, especially social media, to increase publicity. One rapidly-growing facet of this expansion is the Reddit AMA post, where users can invite the public to “Ask Me Anything”. Though a significant and immediate increase in public interest nearly always occurs after hosting a Reddit AMA, this increase is not always lasting. The purpose of this experiment is to analyze the factors influencing interest growth retention following a Reddit AMA post. Several major factors were compared, among them being the time of the post, the reason for the AMA, the demographics of the AMA host, the fame of the AMA host, the connection of the AMA host to Reddit, the popularity of the post, the latent class of the host, and the quality of the AMA post itself. The interest growth retention rates for each post, determined using Google Trends, were calculated by finding the difference between the sums of the Google trends search term interest for the two weeks prior and two weeks following the AMA. Correlation between the dependent and independent variables was done using t-tests with an alpha value of 0.05 and Pearson’s product-moment correlation coefficient with an alpha of 0.5. The research showed that lasting fame growth following a Reddit AMA is influenced more highly by who hosted the AMA than any other factor.

A STRATEGY FOR INVESTIGATING THE CORRELATION BETWEEN NUMBER OF TWEETS MENTIONING AN ELECTRONIC PRODUCT AND ITS REAL WORLD SALES

Eric Chang (student), High Technology High School, Lincroft NJ 07738

The purpose of this study was to determine whether Twitter is a reliable and accurate source for measuring and predicting the success of real world products. A computer program was written in Java with Twitter4J that connected to the Twitter API through the use of OAuth. The program collected data such as the number of favorites and retweets for the top fifteen most popular tweets that contained the product’s name in the past week. The program then outputted a number for “Twitter popularity” using the found data. These numbers were then correlated with the units sold (in millions) for each product in a certain time period. The results found that a correlation indeed existed, as the Pearson product-moment correlation coefficient for the data sets was positive, which shows that there was a positive correlation.

ANALYZING SOCIAL MEDIA CONTENT FROM CANCER PATIENTS

Kunal Singh (student)

This project analyzes content from a breast cancer social media chat, characterized by the hashtag #bcsm. It is one of the oldest cancer patient communities on Twitter. The problem I explored was the effectiveness of these chats for cancer patients. My null hypothesis was that there is no significant difference between the engagement, linguistic, and psychological levels of patients while participating in the chats and while tweeting at other times (out-of-chat). I collected tweets containing “#bcsm” between July 2013 and February 2014. I identified 66 cancer patients and survivors who were active members of the community. I analyzed their tweets for three metrics: number of tweets, replies, and retweets. I then used the LIWC software to extract levels for linguistic and psychological facets from the chat tweets and out-of-chat tweets. Paired t-tests were used to test for a significant difference between the levels of the metrics and facets in/out of the chats. These tests yielded p-values <0.05, rejecting the null hypothesis. The result shows the effectiveness of social media chats for cancer patients for the purposes of information exchange and support. Finally, I applied time series analysis to selected facets to show the potential for monitoring patient well-being.

ON THE PROGNOSTIC VALUE OF THE NEUTROPHIL TO LYMPHOCYTE RATIO FOR THE INCIDENCE OF ACUTE CARDIOVASCULAR EVENTS IN STROKE PATIENTS

Iris Rukshin (student), High Technology High School

The role of inflammatory markers in cardiovascular diseases has been studied extensively and a consistent relationship between various inflammatory markers and cardiovascular diseases has been established in the past. This relationship is believed to be a possible participant in the active atherosclerotic process. Previously, the total White Blood Cell (WBC) count was used as an indicator and quantifier of inflammation. However, the ratio of neutrophils to lymphocytes is emerging as a new inflammatory marker. The Neutrophil to Lymphocyte Ratio (NLR), which is calculated from complete blood count with differential, is an inexpensive, easy to obtain, widely available marker of inflammation, which may be able to contribute to the recurrence risk stratification of recurrent cardiovascular events in stroke patients.

It has been established that a myocardial infarction is the most common cause of death in patients who have suffered an acute cerebrovascular accident. Thus, this unprecedented study proposes to investigate the prognostic value of the NLR in patients with a stroke diagnosis prior to discharge for the incidence of future cardiovascular syndromes. The presence of a relationship can be used as a deciding factor in the treatment course, observation, and discharge of a patient.

DETERMINING AN OPTIMAL AMINO ACID SEQUENCE AS A FIBRILLOGENESIS INHIBITOR OF A β IN SILICO

Ananya Joshi, High Technology High School , Lincroft NJ 07738

Alzheimer’s disease is characterized by A β amyloid clumps (or aggregates), which form the core of dangerous neurotic plaques. The amyloidogenic sequence KLVFF, which binds to itself, is responsible for these clumps. To prevent KLVFF from binding with itself, there needs to be fibrillogenesis inhibitor of KLVFF. By using a 5 residue amino acid sequence that on one side, binds to the KLVFF sequence, and on the other side does not bind, each KLVFF sequence will remain isolated and will not bind to another one.

Because there are 20 amino acids for 5 spots, there are a total of 3.2 million possible inhibitors of KLVFF- far too many to be tested experimentally. Thus, simulation can offer a better way to find the optimal sequence. Several constraints were identified in order to create a model of how each of the sequences would fare in the human body. The experimental protein model of A β was heavily modified, and the sequences were filtered from to 600 based on fold specificities. Each sequence was then run for several days through carefully designed workspaces that were able to take a simple 5 letter code, and model the molecular dynamics in 3D. One of the promising solutions is EWWMY, with a binding energy at -71.17 kCal/mol. This novel model, workspace, and approach can extended to find inhibitors for other diseases as well.

AN EVALUATION OF STATISTIC BASED PREDICTIONS IMPLEMENTED INTO FANTASY FOOTBALL

Jesse Doppelt (student), High Technology High School, Lincroft NJ 07738

This experiment sought to determine whether a proposed algorithm would be able to predict fantasy football points more accurately than ESPN. This is a valuable subject of study because fantasy football is growing in popularity as it is becoming a cardinal part of sports gambling and the generation of revenue for many large companies. After going through a series of mathematical processes, the formula was able to produce a projection of fantasy points over an 8 week span for 15 quarterbacks. The accuracies of the projections were evaluated as the difference between the average points of the

quarterback per week and the average projected points per week. The results of the experiment showed that there was an insignificant difference in accuracy between the proposed algorithm's projections and ESPN's projections. This conclusion was come to after a one tailed t-test produced a p-value of .271, compared to the alpha value of .05. This result means that the algorithm was unsuccessful in predicting fantasy football points more accurately than ESPN, but not to a significant degree. This shows that the formula needs to be altered, and also that predicting athletic performance to a high degree of accuracy is near impossible.

PREDICTING SHORT TERM FLUCTUATIONS IN STOCK PRICES DURING EVENTS

Newton Xie (Student), Matt Koutsoutis (student), High Technology High School

Macroeconomics textbooks contend that it is hard to "beat the market" with the multitude of money managers who pay close attention to the companies. However, an effective prediction mechanism could potentially take advantage of relatively unexplored ways to get ahead in the market. By using event-driven trading, an investment strategy that exploits pricing inefficiencies, this research project attempted to lay a blueprint for such a mechanism. A total of 797 stocks of interest were selected using a program to remove personal bias. Those chosen had an average daily trading volume of over 1 million between 2011 and 2013 and were valued at over \$5 per share; these criteria aimed to identify stocks most likely to display consistent price patterns. A formula was devised by analyzing the stock prices preceding the events and recognizing common recurrences between the result of the event and the deviation over the previous market day. During the three year period, there was a statistical significance between the formula and market performance when there was a 1.10% price change. Other factors, such as market cap and sector, could also be examined to further perfect the formula and discover a method to the madness of event-based stock trading.

Cell & Molecular Biology

Room: Hunterdon 110 Moderator: TBA

Time	Presenters	Title
9:45	Liz Kuhlman	GENOME PROJECT OF PLASMID AND STRESS RESPONSE OF PLASMID IN CYANOBACTERIA <i>Synechococcus</i> IU 625
9:55	Diljeet Kaur	THE ROLE OF DICER IN HYPER-METHYLATION
10:05	Marshall Guo	THE EFFECT OF NICOTINAMIDE ON β -AMYLOID AND TAU PROTEIN LEVELS
10:15	Grace Kwon	THE ROLES OF STAT5 AND MCL-1 IN THE PROLIFERATION OF K562 CELLS
10:25	Emily Trimm	ALZHEIMER'S AND AMD: THE IRON CONNECTION
Break		
10:35	Ryan Lee	THE EFFECTS OF A COMBINATION TREATMENT, BASED ON THE INGREDIENTS OF KIMCHI, ON GASTRIC CANCER CELLS
10:45	Andrea Thomas	ROLE OF C-MYC AND MAD1 IN YAP1-DOWNREGULATED HaCaT AND MDA-MB-231
10:55	Kiran Bhutada	BACK TO THE ROOTS: CURCUMIN INDUCED CHEMO-SENSITIZATION OF OVARIAN CANCER CELLS
11:05	Caroline Kratka	CONTRACTION AND EXPANSION OF THE MOUSE BLASTOCYST IN VITRO
11:15		

GENOME PROJECT OF PLASMID AND STRESS RESPONSE OF PLASMID IN CYANOBACTERIA *Synechococcus* IU 625

Liz Kuhlman (student at Lakeland Regional High School), Jaroslaw Slusarczyk (mentor), Chemistry Department, Lakeland Regional High School, Wanaque, NJ, 07465

Cyanobacteria are one of the largest groups of photosynthetic bacteria that have been linked to environmentally harmful algal blooms (FHAB). FHAB deteriorate water quality by reducing available water resources for drinking and irrigation of water supplies. Some cyanobacteria can create cyanotoxins that affects plant and animal life in aquatic ecosystems. *Synechococcus* sp. IU 625 (S. IU 625) is one of the cyanobacteria that have been responsible for the production of algal blooms. Due to

easiness to culture, it has been used as a potential environmental pollution indicator. Various heavy metals have been used to test for the heavy metal resistance genes in *S. IU 625*. Some of these metals were Hg, Cd, Pb, Zn, and Cu. Steps were taken to isolate the plasmid of *S. IU 625* and the OligoPerfect™ Designer was used to create primers based on *S. elongatus PCC 7942* sequence. PCR assay was carried out and PCR products were sequenced and assembled. Different concentrations of HgCl₂ (0.1, 0.5, and 1.0 mg/L) were used to study the stress responsive genes on the plasmid. Expression levels of these genes were evaluated using qPCR. Results showed that cyanobacteria have resistance genes to help the cells survive in the stressed environment.

THE ROLE OF DICER IN HYPER-METHYLATION

Diljeet Kaur (Student), Bergen County Academies, Hackensack NJ 07604

Hyper-methylation of DNA is a common occurrence, found in many cancer types. It could be the explanation for tumor suppressor gene silencing when there is absence of genetic mutations. In a study, it was found that the miR-290 cluster specifically targets the RB1₂ gene, and thus controls global DNA methylation. DICER is involved in the biogenesis of miRNAs. Thus, this study was done to determine whether the DICER complex plays a role in hyper-methylation. CDKN2A is a tumor suppressor gene. The CDKN2A protein is expressed in normal pancreatic cells. However, the pancreatic cancer CFPAC-1 cell line has a wild-type CDKN2A sequence, but the protein is not expressed. This suggests that the CDKN2A promoter is probably hyper-methylated in CFPAC-1 cells. CFPAC-1 cells were transfected with siRNA against DICER at different concentrations. After a period of 48 hours, cell viability was analyzed. An ELISA to test for the presence of CDKN2A protein was conducted. An apoptosis assay will also be conducted on transfected cells. The data shows DICER knockdown leads to a decrease in viability. Also, it shows that lower concentrations of siRNA increase CDKN2A protein. This data was not expected and more analysis is needed. More data pending.

THE EFFECT OF NICOTINAMIDE ON β-AMYLOID AND TAU PROTEIN LEVELS

MarshallGuo (student), Donna Leonardi, Research Mentor, Academy For Medical Science Technology, Hackensack NJ 07601

The potential of nicotinamide (NAM), vitamin B3, as a therapeutic option in Alzheimer's disease is controversial. NAM is the precursor molecule of nicotinamide adenine dinucleotide (NAD⁺), which is needed for the activation of sirtuin 1 protein (SIRT1). SIRT1 production has been shown to be beneficial in Alzheimer's disease as it results in reduced levels of β-amyloid, possibly by switching the processing of amyloid precursor protein (APP). Interestingly, NAM is said to inhibit the SIRT1 protein, thus not affecting β-amyloid processing, potentially resulting in an opposing effect. However, additional research suggests that NAM promotes the degradation of β-amyloid and Tau protein through autophagy. NAM has also been found effective in the activation of phosphatidylinositol-3-kinase (PI3K-Akt) and MAPK, inducing stress survival signaling pathways, and the transcription factor CREB, which has been shown to result in greater learning and memory capacity in mice. The purpose of this research is to report the effect of NAM in reducing β-amyloid and Tau protein production by treating N2a-695 neuroblastoma, a cell line that produces β-amyloid and Tau, with NAM concentrations of 0, 0.01, 1.25, and 10 mM. Results from ELISA show that β-amyloid levels decreased by 40% at 1.25 mM (p < 0.001) and Tau protein levels decreased by 20% at that concentration (p < 0.01) after treatment with nicotinamide. SIRT1 levels also decreased (p < 0.01) which suggests that NAM is working independently from the SIRT1 pathway to reduce levels of β-amyloid and Tau in this cell line. Autophagy, CREB, MAPK, PI3K-Akt results are pending.

THE ROLES OF STAT5 AND MCL-1 IN THE PROLIFERATION OF K562 CELLS

Grace Kwon, Bergen County Academies

Chronic myelogenous leukemia is characterized by the transformation of myeloid cells, which are found in bone marrow. Myeloid cells are stem cell precursor to the cells that make up the blood, and are greatly important for a healthy circulatory system. This cancer is the most common leukemia affecting adults, and 1 in every 250 people born today will contract this disease. It is controversial as to whether growth factor independence 1 (gfi-1) is a gene that inhibits the survival of leukemia cells, and it is unclear the pathways through which it can affect leukemia cell proliferation. Gfi-1 is believed to induce changes in other protein levels to affect cancer survival. It has been hypothesized that IL-4, a gfi-1 gene upregulator, will significantly inhibit K562 (human immortalized leukemia line) cell proliferation by changing the STAT5, mcl-1 and Bcr-Abl levels. To investigate the hypothesis, k562 cells were introduced to various concentrations of IL-4 (0.5-8 mg/mL, p<0.05) for a range of 24-72 hours. Viable cells were counted using MTS assays, and levels of gfi-1, STAT5, and bcr-abl concentrations will be measured using ELISA procedures. Results are pending.

ALZHEIMER'S AND AMD: THE IRON CONNECTION

Emily Trimm (student), Bergen County Academies, Oral Presentation

In order to compare the role of elevated iron levels in both age-related macular degeneration and Alzheimer's disease, neuroblastoma cells (SH-SY5Y) and retinal pigment epithelial cells (ARPE-19) were cultured to create in-vitro models. Ferric ammonium citrate (FAC) was applied to cell medium in various concentrations in order to increase intracellular free iron levels. Hydrogen peroxide concentrations were applied following a two day incubation period with FAC and both cell viability and apoptosis were measured using cell titer 96 and Annexin V kit respectively. The ability of cells to regulate free iron levels was then inhibited by knocking down the hemochromatosis (HFE) gene. The cells were then treated with free iron and the production of the amyloid beta 42 ($A\beta 42$) protein was measured in both cell lines using an ELISA kit. The presence of $A\beta$ in protein aggregations in the brains of Alzheimer's patients and the retinas of patients with AMD has provided evidence for similar pathways of both diseases. Full results of the experiment are pending, but this research could provide important information regarding the connection between the roles of iron and $A\beta 42$ in both diseases.

THE EFFECTS OF A COMBINATION TREATMENT, BASED ON THE INGREDIENTS OF KIMCHI, ON GASTRIC CANCER CELLS

Ryan Lee (student) Bergen County Academies, Hackensack NJ 07601

Kimchi is known to be a very healthy food in Korea; however, it is believed that pickled foods can have an increased risk of gastric cancer. Despite claims that it increases chances of getting gastric cancer, it is also believed to have anti-cancer effects simultaneously. What this experiment intends to do is to utilize two chemicals found in two of the main ingredients of kimchi: capsaicin from red pepper powder and allicin from garlic. Although past researchers have obtained results that capsaicin and allicin both induce apoptosis in cancer cells, they have never been used in a combined treatment. Therefore, this experiment is designed to compare the effects capsaicin, allicin, and both of them combined have on the cancer cell. A way to deliver the capsaicin and allicin to the cancer cells is by using the emerging, hot-topic technology of nanoparticles to "package" them to the cells that need them. Both chitosan and PLGA nanoparticles will be researched as the possible packing of the chemicals. Nano-structural imaging will be used to image the cancer cells and nano-structural packages in the SEM and in TEM if necessary.

ROLE OF C-MYC AND MAD1 IN YAP1-DOWNREGULATED HaCaT AND MDA-MB-231

Andrea Thomas (student), Bergen County Academies, Hackensack NJ 07601

TEAD protein transcription factors, major components in cancer development, are incapable of initiating transcription without the aide of certain coactivators, one group of these being oncogenes YAP1 and TAZ. YAP1, a downstream effector of the Hippo signaling pathway, along with other TEAD-interacting coactivators, enables the overexpression of proliferative genes such as c-Myc. When adenocarcinoma MDA-MB-231 and human keratinocytes (HaCaT) are transfected with small hairpin RNA through the pGFP-V-RS vector, a knockdown of YAP1 occurs. The role between YAP1 and c-Myc expression is to be investigated in MDA-MB-231 and HaCaT, along with analysis of c-Myc antagonist MAD1 protein levels that takes part in regulation of the cell cycle and tumor reduction. In addition, c-Myc's and MAD1's role in contact inhibition will be investigated, a mechanism regulated by the TEAD transcriptional factors in the Hippo pathway. Here, YAP1 downregulation will lead to specific c-Myc and MAD1 expression levels in MDA-MB-231 that will be in variance to results yielded from HaCaT, which is hypothesized to show decreased cell proliferation and have expression levels possibly affected by the transfection vector. The cell contact inhibition mechanism will also be investigated in order to elucidate the role of c-Myc in this process in MDA-MB-231. MDA-MB-231 and HaCaT cell lines were cultured and subsequently transfected with YAP-13, YAP-21, and YAP-23. Expression levels of c-Myc and MAD-1 were tested through KPL ELISA technique. Contact inhibition will be studied through systematic cell viability assays over a 24, 48, and 72-hour period. Results pending.

BACK TO THE ROOTS: CURCUMIN INDUCED CHEMO-SENSITIZATION OF OVARIAN CANCER CELLS

Kiran Bhutada (student), Bergen County Academies High School

Curcumin, a spice used in various cooking styles, has proven to be a powerful antioxidant, with its ability to lower the risk of multiple types of cancer; Cisplatin is a cytotoxic drug used in cancer chemotherapy. The purpose of this experiment is to determine to what extent curcumin induces chemo-sensitization, specifically Cisplatin, in ovarian cancer cells. In this experiment, *Ovarian cancer cells (SKOV3) will be utilized. In the experiment, cells will be treated with varying curcumin concentrations, (2 μ M – 4 μ M).* The most common treatment for Ovarian cancer is chemotherapy such as Cisplatin, but cells have begun to grow a resistance against the drugs, such as the cell line SKOV3. *To evaluate the efficiency of curcumin on the*

chemo-sensitization, an assay will be conducted to measure the amounts of protein Bcl-1, along with a cell proliferation assay. The hypothesis states that if a dose dependent curcumin concentration is added to Ovarian Cancer cells, then these previously Cisplatin-resistant cells, will uptake the chemotherapy more readily leading to an decrease in the protein Bcl-2 . Results pending.

CONTRACTION AND EXPANSION OF THE MOUSE BLASTOCYST IN VITRO

Caroline Kratka (student), High Technology High School, Lincroft NJ 07738

Blastocyst hatching is a complex process that occurs about five days after fertilization. During the hatching process, the blastocyst will expand, inflate, and contract as it attempts to break from the zona pellucida. In this experiment, time-lapse microscopy was used to analyze the expansions, contractions, inflations, and hatching of mouse blastocysts that had been exposed to varied conditions. The independent variable compared embryos that were freshly ovulated with no changes to the zona, compared to embryos that had the zona subjected to laser assisted hatching or laser zona thinning. The student and her mentor expected to see that the contractions were in some way related to the dynamic process of successful blastocyst hatching. The goal is to determine how the contraction cycles affect these processes, and to use this information to help make earlier predictions on the capability of a blastocyst to hatch normally. The results show that there seems to be no pattern, whether based on amplitude and/or time of contraction, that would indicate whether a blastocyst can successfully hatch. However, an interesting occurrence was that the number of contractions the mouse blastocysts experienced was higher than the total seen in past studies. The conclusion made was that the large number of contractions seen could illustrate a greater amount of suffering with a longer in vitro period, since the embryos used had been flushed from the uterus at an earlier stage than past experiments.

Biochemistry

Room: Hunterdon 116 Moderator: Rebecca Lyddon

Time	Presenters	Title
9:45	Isabella Martin	THE EFFECT OF HEAT SHOCK PROTEINS ON THE CHEMOTHERAPY-INDUCED NEURODEGENERATION OF ASTROCTYES
9:55	Erik Wu	THE SYNTHESIS OF OLEIC ACID CORE SILICA NANOPARTICLES FOR THE SAFE DELIVERY OF ENZYMES
10:05	Justin Yu	MANAGING INFLAMMATION IN CHRONIC LYMPHOCYTIC LEUKEMIA TREATMENT
10:15	Rachel Kaufman	THE UV ABSORPTION OF CHLOROPHYLL COMPARED TO OXYBENZONE, HOMOSALATE, AVOBENZONE AND OCTOCRYLENE
10:25	Adi Melamed	THE ROLE OF ALPHA-SYNUCLEIN ON APOPTOSIS AND OXIDATIVE DNA DAMAGE IN A ROTENONE-INDUCED <i>IN VITRO</i> MODEL OF PARKINSON'S DISEASE
BREAK		
10:35	Arun Kalyanaraman	BIOPHYSICAL MODELS OF PROTEIN EVOLUTION
10:45	Zechariah Brown, Jennifer Zelnick	EXPRESSION AND PURIFICATION OF DHFR MUTANTS
10:50		

THE EFFECT OF HEAT SHOCK PROTEINS ON THE CHEMOTHERAPY-INDUCED NEURODEGENERATION OF ASTROCTYES

Isabella Martin, (student), Bergen County Academies, 07601

Peripheral neuropathy, a severe inflammatory response of the nervous system is a common side effect of certain chemotherapy treatments. Often this prevents doctors from increasing chemotherapeutic dosages as the cancer progresses. Ethoxyquin (EQ), a dog food additive, is thought to significantly lower the neurodegeneration of cells. Ethoxyquin may help to alleviate peripheral neuropathy when added in conjunction with chemotherapy drugs. EQ binds to Hsp90, blocking carrier proteins Ataxin-2 and Sf3b2, increasing neuroprotection. In this study, concentrations of Cisplatin, a chemotherapy drug with known peripheral neuropathy side effects were given to mouse astrocytes, to induce neurodegeneration. Concentrations of EQ were subsequently added, as to reduce this neuronal damage. Additionally, Hsp70, a known natural neural protector was upregulated by adding concentrations of Valproic Acid to damaged cells. The upregulation of Hsp70 helps protect from

stress, aid cells in correcting damage induced by the chemotherapy, as well as revise any incorrect binding or protein folding carried out by Hsp90 and its carrier proteins. The concentration of Cisplatin desired was the LD50. Using an MTS assay, this concentration was determined to be 100 μ M, dissolved in DMSO. Concentrations of EQ dissolved in DMSO used were administered at 0.5, 1, 5, 10, 50, and 100 μ M. Valproic Acid concentrations were determined to be to be effective in the dose range 0.5, 1, 5, 10, 50, and 100 μ M. When given to cells without the addition of Cisplatin, the increased viability of cells treated EQ concentrations were found to be statistically significant at 10, 50, and 100 μ M. Additionally, the increased viability of cells treated with Valproic Acid concentrations proved to be statistically significant at concentrations of 10, 50, and 100 μ M. Next, concentrations of EQ and Valproic Acid were added to chemotherapy-damaged astrocytes. Viability was measured using an MTS assay. With EQ, increased viability was found to be statistically significant at concentrations of 50 and 100 μ M. Combinatorial treatment with Valproic Acid is still pending.

THE SYNTHESIS OF OLEIC ACID CORE SILICA NANOPARTICLES FOR THE SAFE DELIVERY OF ENZYMES

Erik Wu (student), Deok-Yang Kim, Chemistry Department, Academy for the Advancement of Science and Technology (AAST), Hackensack NJ 07601

Silica based nanoparticles have the potential to serve as a novel delivery system, allowing safe transport of therapeutic compounds on the microscopic scale throughout the human body. Silica based nanoparticles were prepared by forming a silica matrix around an oleic acid emulsion. Chymotrypsin enzyme was encapsulated inside. These particles were measured for their breakdown rates of a sample bovine serum albumin solution and the values were compared against an absorbance calibration curve to determine the concentration of albumin protein remaining after set intervals of time. The particles' catabolic process rate can be determined from this. This rate can be assessed to determine the feasibility of this therapy. Oleic acid core silica nanoparticles are important due to their increased reaction activity and enhanced durability, allowing for the breakdown of more compounds in a faster and more stable manner when compared with solid filled nanoparticles. Enzymes can be delivered in a safe and efficient way using this method, allowing for a wider range of cures to be developed. This technology can be applied as a hypothetical treatment for protein related diseases, such as Alzheimer's Disease and Amyloidosis, providing new therapies or safer alternatives to some currently established methods of treatment.

MANAGING INFLAMMATION IN CHRONIC LYMPHOCYTIC LEUKEMIA TREATMENT

Justin Yu (Student), Donna Leonardi, Research Cell Biology Lab, Bergen County Academies, Hackensack NJ 07601

Clinical trials for lenalidomide as a treatment for chronic lymphocytic leukemia (CLL) were halted by the FDA due to safety concerns involving higher death rates. Tumor flare inflammatory reactions occurred in 30% of patients in one study. In patients that did not respond to lenalidomide treatment, IL-6 was significantly increased. In contrast, lenalidomide, approved for use with multiple myeloma, decreases IL-6. In the experiment reported here, natural killer (NK) cells and chronic lymphocytic leukemia cells were treated with lenalidomide and QNZ which inhibits NF- κ B, a transcription factor that enhances transcription of IL-6. A potential new therapeutic option in CLL patients may be to administer lenalidomide and QNZ to treat the cancer while inhibiting NF- κ B which would lead to decreased levels of IL-6. Results of this study demonstrate a statistically significant decrease in IL-6 in a NK and CLL co-culture as compared to treatment with lenalidomide alone ($p < 0.05$). In non-treated co-cultures, there was a statistically significant decrease in viable cells compared to individual culture, indicating cytotoxicity and efficacy as a chemotherapeutic regime ($p < 0.05$). NK cell viability determined through CD56 labelling showed a significant increase when cells were treated with both lenalidomide and QNZ as opposed to lenalidomide alone ($p < 0.05$).

THE UV ABSORPTION OF CHLOROPHYLL COMPARED TO OXYBENZONE, HOMOSALATE, AVOBENZONE AND OCTOCRYLENE

Rachel Kaufman

Ultraviolet (UV) radiation is the most harmful human carcinogen and one of the most prominent being that it radiates from the sun. Exposure to UV radiation can cause sunburn, discoloring of the skin, and can eventually lead to benign and malignant skin tumors. There are two types of UV radiation: UVA and UVB. UVA rays are not absorbed by the ozone layer and can penetrate human skin. UVB rays are partially absorbed by the ozone layer and only affect the surface of the skin. However, most generic sunscreens on the market have been ineffective in blocking both forms of radiation. Most generic sunscreens contain the active ingredients Avobenzene, Octocrylene, Oxybenzone and Homosalate. When these ingredients are combined they are effective in blocking most UV rays, however each has severe side effects and poses a detrimental hazard to health. Chlorophyll holds the potential to as much, if not more, UV radiation as the active ingredients currently

found in sunscreen. To test the efficacy of chlorophyll to block UV radiation, a UV spectrometer was used. Each active ingredient, Chlorophyll, Avobenzone, Octocrylene, Oxybenzone and Homosalate was placed in its own cuvette and placed in a UV spectrometer to determine their range of absorbency. The results portrayed that chlorophyll is comparably effective to the other active ingredients, yet in more concentrated quantities. With its maximum absorption found at 406 nm, it effectively blocks UVA radiation. In future studies chlorophyll should be combined with a UVB filter such as Homosalate or Octocrylene.

THE ROLE OF ALPHA-SYNUCLEIN ON APOPTOSIS AND OXIDATIVE DNA DAMAGE IN A ROTENONE-INDUCED *IN VITRO* MODEL OF PARKINSON'S DISEASE

Adi Melamed (Student), Robert Pergolizzi, Ph.D., Bergen County Academies, Hackensack, NJ 07601

Parkinson's disease (PD) is characterized by the degradation of dopamine-producing cells in the substantia nigra, the accumulation of intraneuronal protein aggregates, such as alpha-synuclein and ubiquitin, and increased levels of apoptosis and oxidative DNA damage. Rotenone, a ketonic compound used as an insecticide, has been shown to induce Parkinson's-like symptoms in murine models *in vivo* as well as Parkinson's-like molecular changes *in vitro* using neuroblastomas. This project serves as a means to investigate the role alpha-synuclein plays in PD's oxidative damage and early apoptosis. Parkinson's-like molecular changes were induced in Be2-M17 neuroblastoma cells through exposure to 5nM rotenone for 24 and 48 hours. In one experiment using Be2-M17 cells, expression of the SNCA gene, which codes for the alpha-synuclein protein, was knocked down using shRNA. In both the experimental and control groups, levels of early apoptosis and oxidative DNA damage were measured at 24 and 48 hour intervals. It was hypothesized that a decrease in levels of both oxidative DNA damage and early apoptic levels would be observed in cells that no longer express the SNCA gene. Using flow cytometry, it was determined that apoptosis levels rose from 1.15% to 2.88% in SNCA-positive rotenone-treated cells from 24 hours to 48 hours. Other experiments are pending. Future research will include a larger variation in rotenone concentration and time intervals to further examine rotenone's effects *in vitro* as well as identify the effectiveness of knocking down the SNCA gene at greater concentrations of rotenone, in an attempt to emulate more severe PD.

BIOPHYSICAL MODELS OF PROTEIN EVOLUTION

Arun Kalyanaraman (student), High Technology High School, Lincroft NJ 07738

Understanding the evolutionary trajectories of populations has been the topic of immense study over the past few decades. At the heart of this investigation lies the ability to characterize the relationship between an organism's fitness and mutations in its genome. This relationship determines the ability of an organism to survive in its environment and is thus vital to the study of population genetics on evolutionary scales. An organism's fitness fundamentally depends on the biophysical properties and molecular interactions of its DNA and proteins. In this study, I develop such a model, focusing on the effect of "folding hotspot" residues in the evolution of new protein function by using an evolutionary model based on the thermodynamics of protein folding and binding. Using a recently-developed numerical algorithm, I calculate specific properties, such as the mean number of amino acid substitutions, of the evolutionary trajectories of proteins in this model. This work helps to advance our understanding of natural evolution as well as the bio-engineering of proteins with novel functions.

EXPRESSION AND PURIFICATION OF DHFR MUTANTS

Zechariah Brown, Jennifer Zelnick,(students), Dr. Nina Goodey

Dihydrofolate reductase, or DHFR, is an enzyme that reduces dihydrofolic acid to tetrahydrofolic acid, using NADPH as electron donor. DHFR catalyzes the reduction of dihydrofolate acid to tetrahydrofolic acid. Found in all organisms, the pharmaceutical need for DHFR is immense. DHFR has a critical role in DNA synthesis and drugs that kill cancer cells. Drugs that inhibit DHFRs from pathogens are antibiotics or antiprotozoal drugs. We expressed and purified *B. stearothermophilus* in DHFR mutants. Our hypothesis was that if we could create these proteins, we can study how specific drugs inhibit it. We focused on site-directed mutagenesis. Site-directed mutagenesis is a molecular biology method that is used to make specific and intentional changes to the DNA sequence of a gene and any gene products. Procedurally we have to design our primer, express our proteins, purify our protein, and then analysis of results. As mentioned, our gel was one of our results. The gel shows us that we have protein. Expression worked. We were also able to determine the purity, concentration, and yield (mg) of our DHFR proteins. This discovery would allow future research teams to study how well specific drugs inhibit DHFR. Since we used *B. stearothermophilus* we can also reason that our research will have applications in not only cancer research, but in disease prevention as well.

Health & Medicine I
Room: Somerset 243 Moderator: Laura Lorentzen

Time	Presenters	Title
9:45	Sara Zhou	EXTENDING LIFETIME OF COAGULATION FACTOR USING VON-WILLEBRAND FACTOR FRAGMENTS
9:55	Eric Kim	LINKING DIABETES TO ALZHEIMER'S DISEASE IN NEUROBLASTOMA CELLS VIA TGFβ1
10:05	Hee-Sung Kim	NOVEL GHRELIN-ACTIVATED MECHANISM IN THE INTESTINES: SOLUTION TO TYPE-2 DIABETES
10:15	Serena Tharakan, Jenna DiRito	NANOPARTICLE-MEDIATED GENE DELIVERY VIA BALLOON ANGIOPLASTY TO SUPPRESS INTIMAL HYPERPLASIA
10:25	Nitza Granados	MONASCIN'S AFFECTS ON AMYLOID BETA PEPTIDE LEVELS BY UP-REGULATION OF PPAR γ AND INSULIN DEGRADING ENZYMES IN SH-SY5Y CELLS.
BREAK		
10:35	Vivian Xu	DOUBLE-TEAMING PARKINSON'S DISEASE WITH RESVERATROL AND COQ10
10:45	Thomas Ferrante	A NOVEL TARGET FOR REDUCING THE ADVERSE EFFECTS OF CHEMOTHERAPY: THE GONADOTROPIN RELEASING HORMONE RECEPTOR
10:55	Bianca Pereira	INHIBITING EEF2K-MEDIATED AUTOPHAGY AND ITS EFFECT ON PANC-1 CELL PROLIFERATION
11:05	Minnie Jeong	INCREASING THE EFFICACY OF GEFITINIB THROUGH β 1 INTEGRIN DOWN-REGULATION IN MDA-MB-231

EXTENDING LIFETIME OF COAGULATION FACTOR USING VON-WILLEBRAND FACTOR FRAGMENTS

Sara Zhou, Adi Melamed (students), Dr. Robert Pergolizzi, Stem Cell Research Laboratory, Bergen County Academies, Hackensack NJ 07601

Hemophilia A is characterized by Factor VIII (FVIII) deficiency, preventing blood coagulation. The current treatment, recombinant FVIII, quickly degrades in the blood, requiring multiple injections weekly. In this study, von Willebrand Factor (vWF) fragments will be used to protect FVIII from degradation, possibly increasing the treatment's lifespan. The purpose of this study is to find the smallest possible fragment of vWF that will effectively protect FVIII. vWF fragments of different lengths will be created by amplifying vWF cDNA fragments with a polyhistidine tag through PCR, and attaching the amplified cDNA to an expression vector. E. coli will be transformed with this expression vector. Chicken egg lysozyme will be used to lyse the E. coli's shell, releasing the proteins inside. After purification by affinity chromatography using a nickel column and removal of the polyhistidine tag using the site-specific protease enterokinase, the vWF fragments will be bound to FVIII. The negative control will be the first 272 amino acids (AA) of mature vWF and the positive control, the first 1300 AA. The vWF-FVIII complexes will be introduced to human serum, and an ELISA will be conducted to measure intact FVIII. The levels of FVIII will indicate the ability of vWF fragments to protect FVIII from degradation. It is hypothesized that a fragment of vWF 272-1300 AA long will be able to protect FVIII in serum.

LINKING DIABETES TO ALZHEIMER'S DISEASE IN NEUROBLASTOMA CELLS VIA TGFβ1

Eric Kim (student), Bergen County Academies, Hackensack NJ 07601

Alzheimer's Disease (AD), the leading cause of dementia in elderly people, is frequently associated with amyloid beta (Abeta) plaques in the brain, and an increased ratio of Abeta42/Abeta40 isomers has been connected with an increased prevalence of these plaques. Type 2 diabetes mellitus (T2D), a failure to properly respond to insulin, has been noted to increase the risk of AD; although this connection is not yet fully understood, TGFβ1, a cytokine that regulates a variety of cellular functions, is suspected to be heavily involved. The purpose of this experiment is to identify the role of TGFβ1 in increasing the Abeta42/Abeta40 ratio in BE2-M17 neuroblastoma cells under T2D conditions. It was hypothesized that if under T2D conditions, the BE2-M17 cells would yield increased Abeta42/Abeta40 ratio and TGFβ1 levels. Additionally, it was hypothesized that they would yield a normal Abeta42/Abeta40 ratio even under T2D conditions if the TGFβ1

signaling pathway is inhibited. The ELISA results for Abeta40 and 42 levels report that variations in glucose and insulin exposure have no significant effect on Abeta40 levels, but decreases glucose, insulin, and insulin-like growth factor 1 levels significantly increases Abeta42 levels. This suggests that a combination of hypoglycemia and hypoinsulinemia increases the risk of AD.

NOVEL GHRELIN-ACTIVATED MECHANISM IN THE INTESTINES: SOLUTION TO TYPE-2 DIABETES

Hee-Sung Kim (student), Bergen County Academies, Hackensack NJ 07601

Ghrelin is a hormone that stimulates hunger (and therefore glucose consumption), and glucagon-like-peptides (GLP-1 and GLP-2) are hormones that regulate insulin production. GLP-1 has a significant role in type-2 diabetes, as it mediates hyperglycemia (high blood glucose concentrations) by inducing insulin production while GLP-2 antagonizes and, therefore, regulates GLP-1 activated insulin-production. These hormones are commonly upregulated during food consumption, implying linkage between these two hormones. However, it has not been reported whether these two hormones are linked. Firstly, the research presented here investigated whether a direct relationship between ghrelin and intestinal GLP-1 secretion existed. Secondly, the research aimed toward investigating the extent of involvement of glucose transporters in this process, specifically GLUT2 and GLUT5. Intestinal NCI-H716 cells, which are able to secrete GLP-1, were treated with ghrelin (0.1 - 100 nM). ELISAs were performed to measure GLP-1, GLUT2, GLUT5, and GLP-2 production caused by ghrelin treatments. Treatment with 0.1 nM and 1.0 nM ghrelin caused a significant increase in GLP-1 secretion by NCI-H716 cells. Treatment with 10 nM and 100 nM ghrelin caused a significant increase in GLUT2. Treatment with 0.1 nM, 1 nM, 10 nM, and 100 nM caused a significant decrease in GLUT5. Finally, treatment with 10 nM and 100 nM ghrelin caused a significant increase in GLP-2. The discovery of this novel pathway, causally linking ghrelin, the glucose transporters, and the glucagon-like peptides, suggests the high potential of ghrelin-based therapies for type-2 diabetes patients.

NANOPARTICLE-MEDIATED GENE DELIVERY VIA BALLOON ANGIOPLASTY TO SUPPRESS INTIMAL HYPERPLASIA

Serena Tharakan (student) Jenna DiRito (student) Robert Pergolizzi, Ph.D. Bergen County Academies Hackensack NJ 07452

In the US alone, 200,000 surgical vascular procedures fail annually, primarily due to restenosis caused by a healing response known as intimal hyperplasia (IH). IH can be attributed to endothelial cell proliferation, narrowing vessel walls through VEGF-A, a gene allowing for the growth of the endothelial cell layer called the intima. Pdx1 is a homeobox whose promoter can induce overexpression of VEGF-A. We hypothesized that genes that interfere with IH, encapsulated in nanoparticles, and coated on a surgical balloon could specifically target the region of interest. shRNA-regulated knockdown of Pdx1 delivered to a rat carotid via PLGA nanoparticles, created via double emulsion method, lowers VEGF-A expression, preventing endothelial growth, neo-intima development and ultimately occlusion. We used TEM to analyze size and quality of the nanoparticles. Glycerol is used to suspend the nanoparticles, allowing adherence on a surgical balloon. The nanoparticle coated surgical construct employed was used to test its efficacy compared to an uncoated and glycerol only coated balloon catheter. Two weeks after we performed the left carotid injury model, we harvested the tissue for histological analysis. We used fluorescence microscopy to detect cells that took up the anti-Pdx1 plasmid, tagged with GFP, to confirm the successful delivery of the contents of the nanoparticles. We used rt-PCR to assess extent of IH and levels of VEGF-A. Significant results ($p < 0.05$) indicated that we have a new, effective treatment for inhibiting intimal hyperplasia, a site specific method of gene delivery, and a newly elucidated pathway between Pdx1 and VEGF-A. While intimal hyperplasia is the initial model, further research will apply the delivery method to various venous and arterial conditions.

MONASCIN'S AFFECTS ON AMYLOID BETA PEPTIDE LEVELS BY UP-REGULATION OF PPAR γ AND INSULIN DEGRADING ENZYMES IN SH-SY5Y CELLS.

Nitza Granados (student), Academy for Medical Science Technology, Bergen County Academies, Hackensack NJ 07601

Excessive accumulation of beta-amyloid peptide (A β) in the brain is a key pathological change in Alzheimer's disease (AD). It has been also found that Insulin-degrading enzyme (IDE) is downregulated in Alzheimer patients. IDE participates in the proteolysis of A β which is theorized to be a significant cause of their disease. Given that PPAR γ can upregulate IDE resulting in degradation of A β (1-42) consequently a PPAR γ agonist should reduce the adverse effects of Alzheimer's disease. Monascin (MS) is an active compound having anti-inflammatory, anti-cancer, antiatherosclerotic, and hypolipidemic effects. MS effects A β due to its hypolipidemic effects and its association as a PPAR γ agonist, indicating that MS can increase IDE expression in the cells by upregulating PPAR γ , leading to decreased A β levels. Human neuroglioma H4 cells will be used to view Monascin's effect on downregulation of the A β produced. ELISAs will be used to quantify the possible change in A β levels due to varying concentrations of MS. The effects of MS on cell viability and lysis will also be evaluated. The data will

be analyzed and compared to a control of untreated neuroblastoma cells. This study is looking at the effects of Monascin on the clearance of A β based on the ideal that MS upregulates both PPAR γ and IDE which consequently downregulates beta-amyloid levels.

DOUBLE-TEAMING PARKINSON'S DISEASE WITH RESVERATROL AND COQ10

Vivian Xu (student), Bergen County Academies, Hackensack NJ 07601

Parkinson's disease is a chronic and progressive neurodegenerative disorder resulting in the loss of dopaminergic neurons and decrease of motor function. The cause of Parkinson's disease is unknown and there is currently no known cure. There are several existing medications, such as levodopa, which replaces dopamine in the brain. However, these are only effective during early stages of treatment and cannot slow or stop the degenerative process. Although the molecular mechanisms are unclear, studies have recognized oxidative stress as an example of a key contributor to the development of Parkinson's disease. A potential way to treat this is through the use of antioxidants, which can be used to inhibit the oxidation of molecules and therefore reduce oxidative stress, and subsequently improve dopamine production. Coenzyme Q10 (CoQ10) and resveratrol are two natural antioxidants that have shown promise individually in Parkinson's research. In this study, parkinsonism was induced in PC-12 pheochromocytoma cells using a set concentration of oxydopamine (6-OHDA), and treated with combinations of concentrations of CoQ10 and resveratrol. ROS fluorescence assays and dopamine ELISAs will be performed to determine oxidative stress and dopamine production in the cells. Results are pending.

A NOVEL TARGET FOR REDUCING THE ADVERSE EFFECTS OF CHEMOTHERAPY: THE GONADOTROPIN RELEASING HORMONE RECEPTOR

Thomas Ferrante, Cell Biology Lab, Bergen County Academies, Hackensack NJ 07601

A problem with chemotherapy is the damage done to healthy tissue. In vitro studies suggest that increasing adhesion to extracellular matrix (EM) components, such as fibronectin, protects healthy cells from the adverse effects of chemotherapy, however potentially rendering cancer cells protected as well. This study investigated the potential use of the Gonadotropin Releasing Hormone Receptor (GnRHR) as a target for increasing EM adhesion in only healthy ovarian tissue, thus providing targeted protection. While healthy ovarian cells express the GnRH receptor, approximately 20% of ovarian cancers are GnRHR-negative. Therefore, the effect of GnRH on both GnRHR-positive and GnRHR-negative cell lines was investigated. Adhesion to fibronectin was measured after pretreatment with GnRH in both OVCAR-3, a GnRHR+ cell line, and SK-OV-3, a GnRHR- cell line. In OVCAR-3 there was statistically significant increase in adhesion to fibronectin ($p < 0.05$), and an increase in the beta1-integrin component of the fibronectin receptors when measured through ELISA ($p < 0.05$). To investigate protection from chemotherapy, cells were pretreated with GnRH, given 2h to adhere to fibronectin, and then treated with cisplatin. Viability was measured after 24h (MTS assay) and increased in the GNRHR + cell line, OVCAR-3, following the same trend as adhesion to fibronectin ($p < 0.05$). In SK-OV-3 survival did not significantly increase from pretreatment with GnRH, demonstrating the efficacy of this method in protecting only GnRHR+ cells ($p < 0.05$). When plated onto plastic, survival did not increase in OVCAR-3 suggesting that protection from cisplatin is mediated by a cellular pathway activated through integrin binding to fibronectin.

INHIBITING eEF2K-MEDIATED AUTOPHAGY AND ITS EFFECT ON PANC-1 CELL PROLIFERATION

Bianca Pereira (student), Donna Leonardi, Research Mentor, Academy for Medical Science Technology, Hackensack NJ 07601

Metabolic adaptation is crucial for cancer cell survival during nutrient deprivation (ND). In cancer cells, ND leads to endoplasmic reticulum stress and induces apoptosis unless adaptive mechanisms are undertaken. This study elucidated a survival mechanism employed by the pancreatic cancer cell line, PANC-1, and evaluated the potential of targeting the adaptive molecule produced during ND. eEF2 kinase, one such protein expressed, has previously been shown to promote survival during ND by inhibiting eEF2 which is responsible for protein elongation, an energy demanding process, and healthy tissue is independent of this mechanism. NH125 is a molecule that inhibits eEF2 kinase and was evaluated as a potential inhibitor of the cancer cell survival mechanism. PANC-1 viability was significantly reduced under ND deprivation and was further reduced under ND and the NH125 inhibitor ($p < 0.05$). Caspase 3/7 also increased over increasing concentrations of NH125 ($p < 0.05$). eEF2 kinase was inhibited across the concentrations of NH125 in dose response fashions ($p < 0.05$). In addition, a significant decrease in autophagy as a function of p62 levels was shown over increasing concentrations of NH125 ($p < 0.05$) demonstrating that eEF2 kinase is essential for inducing autophagy used for PANC-1 cell

survival. Viability after eEF2k inhibition was higher in fibroblasts in comparison to PANC-1 cells ($p < 0.05$). Results regarding combinatory treatment are pending. Thus, this study indicated that eEF2k is a necessary protein produced by PANC-1 cancer cells and it can be targeted to cause an increased apoptotic response by reducing autophagy. This potentiates the effectiveness of using the NH125 inhibitor in combination with stress-inducing drugs in lower doses to lessen the harmful effects on healthy tissue.

INCREASING THE EFFICACY OF GEFITINIB THROUGH β 1 INTEGRIN DOWN-REGULATION IN MDA-MB-231

Minny Jeong (Student), Academy of Medical Science and Technology, Bergen County Academies, Hackensack, NJ 07601

The main objective of this experiment was to increase the efficacy of gefitinib, a selective tyrosine kinase receptor inhibitor and a widely used chemotherapy, by using it in combination with celastrol, a potent antimetastatic agent that targets β 1 integrin. Integrins play an important role in cell signaling by regulating the cell signaling pathways of transmembrane protein kinases such as receptor tyrosine kinases (RTK). Thus, it was hypothesized that β 1 integrin down-regulation would require lower concentrations of gefitinib and would reduce gefitinib resistance in the cells. Mda-mb-231 was cultured and treated with concentrations of celastrol (0.312-1.25 microg/mL) for 24 hours in order to down-regulate the production of β 1 integrin. Cell viability was measured for each concentration and an ELISA was performed to determine the amount of β 1 integrin present. Results are pending. Mda-mb-231 was treated with concentrations of gefitinib (0.5-30 microM). Cell viability was measured and an ELISA was performed to determine the presence of β 1 integrin. Mda-mb-231 was treated with a combination of celastrol and gefitinib, with the most effective concentration of celastrol and the various concentrations of gefitinib. Synergistic/additive effects were examined and the relationship between cell viability and the presence of β 1 integrin was analyzed. Using celastrol to down-regulate β 1 integrin is a practical method; however, in the future, mda-mb-231 will be transfected with mir-29c which perhaps may do a more efficient role of down-regulating β 1 integrin. These results will be compared together to observe which method is more practical and efficient.

Health & Medicine II

Room: Somerset 244 Moderator: Diane Ratner

Time	Presenters	Title
9:45	Rachel Gleyzer	KRAS AS A NOVEL TARGET IN GLIOBLASTOMA MULTIFORME TREATMENT
9:55	Yashaar Hafizka	EFFECTS OF BETA-LAPACHONE ON INTERACTIONS BETWEEN NATURAL KILLER CELLS AND BDCM CELLS.
10:05	Rachael Han	EFFECT OF BERBERINE ON A375 MELANOMA CELLS
10:15	Shin Hye Kim	THE ROLE OF EXOSOME MEDIATED CROSSTALK IN THE INFLAMMATORY RESPONSE OF ASTROCYTES
10:25	Joyce Zhou	INHIBITION OF METASTASIS AND INVASIVENESS IN A2058 MELANOMA CELLS BY MIR-145
Break		
10:35	Arushi Ramani	ASSESSMENT OF CURCUMIN CYTOTOXICITY AND ITS THERAPEUTIC POTENTIAL IN BREAST CANCER
10:45	Nicole J. Kim	FIBROBLAST GROWTH FACTOR-2 AND SYNDECAN-1 AS POTENTIAL BIOMARKERS OF CIRCULATING CD15+/CD30+ CELLS IN POOR OUTCOME HODGKIN LYMPHOMA PATIENTS
10:55	Julie Patel	THE EFFECT OF DOXORUBICIN-LOADED-CURCUMIN-STABILIZED GOLD- NANOPARTICLES ON BREAST CANCER CELLS
11:05	Himani Patel	THE MECHANISMS OF METFORMIN IN MDA-MB-231 TRIPLE NEGATIVE BREAST CANCER
11:15		

KRAS AS A NOVEL TARGET IN GLIOBLASTOMA MULTIFORME TREATMENT

Rachel Gleyzer (student)

Glioblastoma Multiforme (GBM) is the most common brain tumor in adults characterized by aggressiveness, invasiveness and rapid proliferation. Most patients diagnosed survive no longer than a year. GBM's rapidity of proliferation makes it very difficult to eradicate, since it continues growing before, during and after treatment. In GBM, aberrant signaling in the Ras/Raf/MAPK pathway leads to the proliferation and maintenance of the cancer. KRAS is an important gene in this pathway that activates further downstream factors including phosphorylated ERK (phospho-ERK), and finally leads to cell proliferation. This research investigated the effects of KRAS knockdown on proliferation and activity of phospho-ERK, in the GBM cell line Ln229. Small hairpin RNA (shRNA) plasmids with green fluorescent protein (GFP) were used to inhibit KRAS expression *in vitro*. Proliferation was analyzed by comparing percentages of transfected versus non-transfected cells overtime. Phospho-ERK levels were analyzed using an enzyme linked immunosorbent assay (ELISA). Data obtained showed no significant decrease in levels of phospho-ERK after KRAS knockdown. There was also no difference in growth rate in Ln229 cells after KRAS knockdown. This indicates that knockdown of KRAS alone is not sufficient to halt activation of this pathway, which is contrary to the hypothesis. It suggests that there is cooperation between the Ras/Raf/MAPK pathway and other signaling pathways, which must be explored in future research.

EFFECTS OF BETA-LAPACHONE ON INTERACTIONS BETWEEN NATURAL KILLER CELLS AND BDCM CELLS.

Yashaar Hafizka (Student), Donna Leonardi, Research Mentor, Academy for Medical Science Technology, Hackensack NJ 07601

Beta-Lapachone has recently been introduced as a potential cancer treatment. Natural killer (NK) cells are regarded to be the best candidate cells for immunotherapy for cancer patients. In this experiment, the selectivity of beta-lapachone in BDCM (chronic myelogenous leukemia) and NK cells was investigated by determining its effect on cell proliferation through a cell proliferation assay. The data showed that there was no significant change in the proliferation of NK cells after being treated with 0.2 μ M – 1.0 μ M of beta-lapachone. However, there was a significant decrease in BDCM proliferation ($p < 0.05$). This suggests that beta-lapachone is effectively inducing apoptosis in the leukemia cells BDCM, while not significantly affecting the NK cells. Additionally, the mechanism of action of beta-lapachone has not been confirmed although previous studies have shown that beta-lapachone activates SIRT1 in neuroblastoma cells. Data regarding the activation of SIRT1 in the cell lines used in this research is pending. NK cells will be co-cultured with BDCM to determine the cytotoxicity of NK cells towards BDCM. A caspase 3/7 assay will be performed in future research to determine if beta-lapachone is causing a decrease in cell proliferation due to apoptotic mechanisms or cytotoxic death. Data for the activation of NK cells in co-culture with BDCM is also pending. The effect of beta-lapachone on the process of autophagy will also be investigated. Data for cellular metabolism of BDCM and NK cells is pending.

EFFECT OF BERBERINE ON A375 MELANOMA CELLS

Rachael Han (student), Bergen County Academies, Hackensack NJ 07601

Berberine is a plant alkaloid that first appeared in the literature in 1933 as an antimicrobial agent in the treatment of an infection of the eye by trachoma. Since then, the potential of berberine as a therapeutic has grown. Cyclooxygenase-2 (COX-2), an enzyme necessary in the production of prostaglandins and has been shown to be related to certain types of cancer. Although COX-2 is known for being over expressed in non-small cell lung cancer, recent studies have shown that COX-2 is of equally importance in malignant melanoma. COX-2 production has been linked to the activation of pathways that mediate proliferation, angiogenesis, and apoptosis resistance. The goal of this project was to test the effect of berberine, a selective COX-2 inhibitor, on A375 malignant melanoma cells and investigate the process in which berberine reduces proliferation. Cell viability decreased in a dose dependent manner ($p < 0.05$) at concentrations greater than or equal to 0.5 μ M. The activity of COX-2 was determined by measuring the amount of Prostaglandin E2 (PGE2) produced in A375 malignant melanoma cells. The purpose of performing a PGE2 ELISA was to investigate the correlation between the decrease in cell viability and the decrease in the activity of COX-2. ELISA results are pending.

THE ROLE OF EXOSOME MEDIATED CROSSTALK IN THE INFLAMMATORY RESPONSE OF ASTROCYTES

Shin Hye Kim (student), Academy for Advancement in Science and Technology, Hackensack, NJ 07601

Growing evidence indicates that the intercellular interaction between the cancer cells and the surrounding cells in the tumor microenvironment have a significant influence on the cancer's metastatic potential and progression. Exosomes are small membrane vesicles that are secreted by various cell types that carry various proteins, lipids, and miRNAs that could be transferred to other cells in the microenvironment to alter its biochemical composition, signaling pathways, and gene regulation. This intercellular exchange of proteins and nucleic acids by the exosomes within the cancer microenvironment is believed to have an important role as a messenger in the communication to promote cancer progression (Peinado et al., 2012). Tumor-derived exosomes transmit signals to the surrounding cells allows for the recruitment of the surrounding cells that create the "metastatic niche" necessary for the cancer cells to grow and migrate. How the tumor microenvironment supports cancer cells to evade apoptosis and to facilitate metastasis is a fundamental question that still remains to be answered. Data collected thus far suggests that astrocytes proliferate dependent on the increasing amount of tumor derived exosomes present. The dose dependent response to the increasing number of exosomes for the IL-6 levels secreted from the astrocytes is indicative of the inflammation that is occurring due to the presence of exosomes. Further results are pending.

INHIBITION OF METASTASIS AND INVASIVENESS IN A2058 MELANOMA CELLS BY MIR-145

Joyce Zhou (student), Academy for the Advancement of Science and Technology, Bergen County Academies, Hackensack, NJ 07601

Melanoma is the fifth most common type of cancer in females. Because of its highly metastatic and invasive potential, the prognosis of melanoma is poor while viable treatment options are limited in their efficacy. There is growing evidence that microRNAs are aberrantly expressed in many human cancers and are significant contributors to carcinogenesis and cancer progression. MicroRNA-145 (miR-145) is shown to be commonly downregulated in microRNA expression signatures of various human malignancies, consequently becoming a candidate miRNA with prospects as a diagnostic marker or therapeutic target. However, miR-145's mechanism of action or its regulatory effect on target genes and pathways in melanoma remains unclear. This study focused on elucidating the role of miR-145 as a tumor suppressor in invasive A2058 melanoma cells as well as its mechanism of action. It was hypothesized that miR-145 upregulation in A2058 cells will decrease their metastatic and invasive potential. To investigate this hypothesis, A2058 cells were stably transfected with miR-145. ELISAs were used to measure proteins significant in the metastatic and invasive nature of A2058, including MUC1 and MMP11 expression in control and transfected A2058 cells. A collagen I cell invasion assay was used to determine the effect of miR-145 upregulation on A2058 invasiveness. Results are pending. Findings may have major implications in the therapy of melanoma, either alone or in combination with other existing treatment regimens.

ASSESSMENT OF CURCUMIN CYTOTOXICITY AND ITS THERAPEUTIC POTENTIAL IN BREAST CANCER

Arushi Ramani (student), Academy for Medical Science Technology – 200 Hackensack Ave. Hackensack, NJ 07601

The objective of this experiment was to assess the cytotoxicity and therapeutic potential of nano-curcumin in an *in-vitro* breast cancer model. A protocol for the creation of nanoparticles for prostate cancer delivery was modified for this purpose. Curcumin-loaded hydroxypropyl methylcellulose nanoparticles were engineered employing techniques such as sonication, centrifugation, rotary evaporation, and lipholization. The chemistry of these nanoparticles was imaged and analyzed using transmission electron microscopy and Fourier-transform infrared spectroscopy. Next, MDA-MB-231 breast cancer cells were cultured in six-well plates; controls of these cells without the presence of nanoparticles were compared to experimental groups, which contained MDA-MB-231 cells exposed to increasing concentrations of the curcumin nanoformulations. All trials were conducted in triplicate. After these plates were incubated overnight, flow cytometry was used to assess cellular uptake of these nanoparticles. This was determined by examining fluorescence levels in each well, as curcumin possesses a natural fluorescence. Cytotoxicity of curcumin was evaluated by performing a cell count, which dictated the number of cells still living in both the control and the experimental groups. Data from the flow cytometer should show increased fluorescence in cells exposed to curcumin nanoparticles. The cell count should display fewer living cells in the experimental group's wells. Cellulose nanoparticles, then, can be seen as an efficient delivery mechanism the natural diphenol, curcumin. Data should confirm the hypothesized effectiveness of curcumin as a viable breast cancer therapeutic.

FIBROBLAST GROWTH FACTOR-2 AND SYNDECAN-1 AS POTENTIAL BIOMARKERS OF CIRCULATING CD15+/CD30+ CELLS IN POOR OUTCOME HODGKIN LYMPHOMA PATIENTS

Rajendra Gharbaran, Nicole J. Kim (student), Stephen K. Suh, John Theurer Cancer Center Tumor and Genomics Program, Hackensack University Medical Center, Hackensack, NJ 07601

Up to 20 percent of high-risk, unfavorable classical Hodgkin Lymphoma (cHL) cases, which include patients experiencing early relapse and progressive disease development, suffer poor outcomes, and the applicability of existing prognostic measures is limited. To determine more reliable biomarkers of this case of cHL, tumor biopsies and peripheral blood leukocytes of untreated Nodular Sclerosis cHL patients were investigated for consistent biomarkers in predicting patient outcome prior to frontline treatment. 151 candidate biomarkers, determined by bioinformatics data mining, were studied in 10 HL cell lines. Expression of Fibroblast Growth Factor-2 (FGF2) and Syndecan-1 (SDC1) by CD30+ cells from HL patient samples representing good and poor outcomes were analyzed by qRT-PCR, immunohistochemical (IHC), and immunofluorescence analyses. FGF2 and SDC1 expression levels were 245-fold and 91-fold higher, respectively, in poor outcome (PO) samples than in good outcome (GO) samples. FGF2 and SDC1 were over expressed in all HL cell lines, and the over expression was HL-specific. Analysis of chemo-naïve HL blood samples suggested that in the PO group a subset of CD30+ HL cells, significantly over expressing FGF2 and SDC1, had entered the circulation. The results suggest that small subsets of circulating CD30+/CD15+ cells expressing FGF2 and SDC1 indicate identification of NS-cHL patients who will experience poor outcome.

THE EFFECT OF DOXORUBICIN-LOADED-CURCUMIN-STABILIZED GOLD- NANOPARTICLES ON BREAST CANCER CELLS

Julie Patel (student), Stem Cell Research Laboratory, Bergen County Academies, Hackensack NJ 07601

Curcumin has anti-carcinogenic characteristics due to its effect on tumor suppressor pathways, and when used with Doxorubicin, a common chemotherapy drug, it induces a higher apoptotic rate than each aforementioned component would singularly induce on breast cancer cells. Curcumin, a natural phenol, aids with the stabilization and potency of gold nanoparticles. The addition of Doxorubicin into the C-GNPs will be used to measure the efficacy of the DOX C-GNP nanoparticle and its potential for drug-delivery to cancerous cells as the containment of doxorubicin in nanoparticles is known to significantly increase the delivery of the drug to cancerous cells. Three treatments will be analyzed to determine the potential of the DOX C-GNPs. The first treatment consists of free Doxorubicin particles, the second of C-GNPs, and the third of Doxorubicin loaded C-GNPs. The Doxorubicin-loaded C-GNPs are expected to induce apoptosis amongst the breast cancer cells at a higher rate than the aforementioned treatments would on breast cancer cells. The major goal of this project is to determine whether C-GNPs significantly increase the delivery of doxorubicin to the cells, which results in apoptosis, and to identify a differentiating factor attributing to the treatment with the greatest significance. Results are pending.

THE MECHANISMS OF METFORMIN IN MDA-MB-231 TRIPLE NEGATIVE BREAST CANCER

Himani Patel (student), Bergen County Academies, Hackensack NJ 07601

Recent studies have shown that metformin, a drug used by patients with type 2 diabetes, may possess antitumor properties through the activation of AMP-activated protein kinase. However, there are other pathways regulating cellular proliferation, leading to uncertainty regarding its mechanism of action, specifically in breast cancer. In this research, MDA-MB-231 breast cancer cells were targeted with metformin, and processes, such as autophagy and apoptosis, were investigated. An MTS assay and measurement of caspase 3/7 demonstrated that metformin significantly reduced cell proliferation ($p < 0.05$) and induced programmed cell death ($p < 0.05$). The detection of autophagic vacuoles demonstrated that metformin led to a significant increase in autophagy in MDA-MB-231 cells ($p < 0.05$), potentially mediating this cell death. An increase in AMP-activated protein kinase ($p < 0.05$) with mTOR only increasing at the highest concentration ($p < 0.05$) suggested that metformin may induce apoptosis through an mTOR-independent AMPK pathway to autophagy. Furthermore, the inhibition of Akt ($p < 0.05$), a mediator in an alternate pathway regulating cell growth, suggests metformin could also lead to apoptosis through additional mechanisms. The measurement of ERK showed no significant trend demonstrating that it is not contributing to metformin's mechanism of action. The downstream targets of AMPK, such as p27 and p53, may also play a role in metformin's mechanism of action with regard to inducing autophagy. Determining the mechanisms through which metformin decreases cell proliferation and exploiting them may offer a viable treatment for breast cancer.

Environment & Ecology I
Room: Somerset 016 Moderator: Alex Soranno

Time	Presenters	Title
9:45	Elizabeth Brooks	CARCINOGENIC EFFECTS OF CHEMICALS FOUND IN HYDRAULIC FRACTURING FLUID ON SELENASTRUM CAPRICORNUTUM
9:55	Joseph Maggiore	THE USE OF <i>SARGASSUM SP.</i> AS A BIOSORBENT
10:05	Vladyslav Nazarchuk	ANALYSIS OF NITRATE POLLUTION IN MANALAPAN BROOKS
10:15	Samuel Coakley	THE CHANGES IN THE SEDIMENT GRADIENT OVER TIME OF MONMOUTH COUNTY BEACHES POST-HURRICANE SANDY
10:25	Marianna Fleming	THE RELATIONSHIP BETWEEN THE CHANGES IN SAND VOLUMES AND THE BIODIVERSITY INDICES ON VARIOUS BEACHES IN MONMOUTH COUNTY, NJ POST HURRICANE SANDY
BREAK		
10:35	Ryan Badum	THE RELATIONSHIP BETWEEN HURRICANE SANDY AND POPULATIONS OF <i>Carex kobomugi</i> AT THE SANDY HOOK UNIT OF THE GATEWAY NATIONAL RECREATION AREA
10:45	Grace McIlvain	SIZE, ABUNDANCE, BIODIVERSITY AND DISTRIBUTION OF ICHTHYOPLANKTON FOUND IN BARNEGAT BAY, NEW JERSEY FROM MAY 2012 TO OCTOBER 2013
10:55		

CARCINOGENIC EFFECTS OF CHEMICALS FOUND IN HYDRAULIC FRACTURING FLUID ON SELENASTRUM CAPRICORNUTUM

Elizabeth Brooks (student)

The purpose of this experiment is to determine whether some of the chemicals used in hydraulic fracturing fluid are harmful at small dosages in algae cells. The cell line *Selenastrum capricornutum* was cultured according to ATCC protocol and was exposed to five different concentrations (in geometric series) of acetaldehyde, sodium chloride, and citric acid. Three replicates were used for each concentration and six controls were used for each chemical. The protocol from OECD GUIDELINE FOR TESTING OF CHEMICALS "Alga, Growth Inhibition Test" was used throughout the experiment. At the beginning of the experiment 10^4 cells were measured in each flask using a cell counter and were measured again at 24hr, 48hr, and 72hr using the cell counter. At the end of the experiment there should be a significantly smaller number of cells than on day one. After analyzing the data it should show that the amount of cells decreased steadily each day after exposure. The lower concentration should show less of a decrease than the higher concentrations but the decrease should still be significant. The conclusion drawn from this experiment should be that these specific chemicals used in hydraulic fracturing fluid would be harmful to organisms at low concentrations and should not be released into the environment.

THE USE OF *SARGASSUM SP.* AS A BIOSORBENT

Joseph Maggiore (student), Biotechnology High School, Freehold NJ 07728

Throughout the world, there is a constant surplus of chemical pollution ranging from heavy metals to organic compounds. Often times, technologies for the removal of these chemical pollutants are inefficient and expensive. A new process for pollutant removal must be developed is necessary for environmental remedy. One new outlet of research in the field of chemical pollution is the use of seaweed that can act as a biosorption tool. In many studies, *Sargassum sp.* is one biosorption tool that has been proven to succeed in removing some pollutants. In order to fully understand the extent of *Sargassum sp.* biosorption characteristics, solutions of pollutants were exposed to *Sargassum sp.* for different amounts of time. After each simulate pollutant was created, it was tested on *Brassica rapa* for germination and adult stem height. After 5 minutes of exposure, 500µM of pollutant are completely removed. The *B. rapa* trials exhibited that after 5 minutes of *Sargassum sp.* exposure, the treated-pollutant-water performed just as well as H₂O. In conclusion, *Sargassum sp.* was determined to be a sustainable tool to remove toxic chemicals from polluted waters. *Sargassum sp.* offers a cheap, manageable, and efficient removal process for heavy metals.

ANALYSIS OF NITRATE POLLUTION IN MANALAPAN BROOKS

Vladyslav Nazarchuk (student), Michael Roche, High Technology High School, Lincroft, NJ 07738

The question under study was whether there is a significant difference in nitrate content between two local brooks – Weamaconk Creek and Manalapan Brook. This was investigated with the intention of discovering the effect of farming vs. residential fertilizer pollution on the nitrate contents of adjacent water ecosystems. The research hypothesis was that there is a significant difference in nitrate levels between the two selected locations at Weamaconk Creek and Manalapan Brook. To test this hypothesis, a location next to a few farms was selected at Weamaconk Creek, and a location next to a residential area was selected at Manalapan Brook. Water samples from these locations were collected once a week, over a 20-week period. The samples were then tested for nitrate content using a nitrate ion-selective electrode. A two-tailed, paired t-test was conducted with the data, and the p-value was found to be 9.24×10^{-4} , clearly less than the alpha value of 0.05. Thus, it was found that there is a significant difference between the nitrate content at Weamaconk Creek and Manalapan Brook, but that both levels are well below the safety threshold to cause any concern.

THE CHANGES IN THE SEDIMENT GRADIENT OVER TIME OF MONMOUTH COUNTY BEACHES POST-HURRICANE SANDY

Samuel Coakley (student), Marine Academy of Science and Technology

Hurricane Sandy disturbed the sediment gradient of Monmouth County beaches. Hurricane Sandy moved sediment from beaches up to a quarter mile inland in some areas. This had a negative effect on both the coastal towns and the environment. When towns replenish beaches after large storms, they use taxpayer's money, and many buildings were damaged requiring more money to be spent. Ideally, a sediment gradient is present in which the finest sand is furthest from the body of water and the more coarse sand is along the water line. This project analyzes the sediment gradient's change over time after Hurricane Sandy. I went to four different sites in Monmouth County: Gateway National Recreation Area Sandy Hook Unit, Sea Bright, Belmar, and Seven Presidents Oceanfront Park and sampled the sediment at each different beach structure. The sediment was then separated by size using a Ro-Tap sediment shaker. The mass retained in each sieve was then recorded. The frequency of each grain size at different beaches and beach structures was then found as showing that the sediment moved along the beach over time. Hurricane Sandy had a large effect on disrupting the sediment gradient and over time the sediment did move back toward the ideal model.

THE RELATIONSHIP BETWEEN THE CHANGES IN SAND VOLUMES AND THE BIODIVERSITY INDICES ON VARIOUS BEACHES IN MONMOUTH COUNTY, NJ POST HURRICANE SANDY

Marianna Fleming (student) The Marine Academy of Science and Technology

Coastal geomorphology is an important aspect in the tourism industry in New Jersey. The tourism industry brings in almost 40 billion dollars to New Jersey's economy every year, but that number is declining. New Jersey needs to reduce the erosion rate on its beaches to keep the tourism industry thriving. Hurricane sandy caused massive erosion rates and sand displacement across the entire state. The objective of the study was to figure out which beaches had the lowest erosion rate after the storm and why. The variable that was examined was the percent ground cover for the vegetation at each site. Six sites were chosen at different locations in Monmouth County. To collect erosion data, beach profiles were taken using the Emory method. Percent ground cover was calculated using the Braun-Blanquet percent ground cover scale. There is an inverse relationship between the percent ground cover and the amount of eroded sediment in coastal areas.

THE RELATIONSHIP BETWEEN HURRICANE SANDY AND POPULATIONS OF *Carex kobomugi* AT THE SANDY HOOK UNIT OF THE GATEWAY NATIONAL RECREATION AREA

Ryan Badum, Marine Academy of Science and Technology, Highlands NJ 07732

Asiatic Sand Sedge, *Carex kobomugi*, is an invasive species of dune grass that has taken root along the Eastern seaboard of the United States of America. This nonnative grass expedites erosion on the dune system causing them to become more flat and thus leaving coastal communities more susceptible to storm surges. This experiment aimed to find a relationship between the changes in population density of *Carex kobomugi* before and after Hurricane Sandy which made landfall in the fall of 2012. Data for the experiment was collected using a Trimble Geo XT GPS unit to plot both beds of *Carex kobomugi* as well as individual points along the dune system of the Sandy Hook Unit of the Gateway National Recreation Area. The beds mapped were then compared to maps of previous years to determine if there was a significant difference in population size and distribution after the storm. The data shows a general increase in both number of beds and overall area covered of *Carex kobomugi* on the Sandy Hook Unit of the Gateway National Recreation Area. This increase in population means that more

coastal dune environments and communities along the coast are at a greater risk of large-scale erosion and other adverse effects of storm surges.

SIZE, ABUNDANCE, BIODIVERSITY AND DISTRIBUTION OF ICHTHYOPLANKTON FOUND IN BARNEGAT BAY, NEW JERSEY FROM MAY 2012 TO OCTOBER 2013

Grace McIlvain (student)

Estuarine ichthyoplankton are a vital part of the marine ecosystem and a well-known bio indicator. Over the past decade Barnegat Bay in New Jersey has become highly eutrophied due to anthropogenic activity. One of the problems researchers face is the limited amount of data about the baseline health of the bay, which is necessary to measure efficacy of any mitigation or to track long-term changes. The goal of this study was to determine the baseline health of ichthyoplankton in Barnegat Bay and to look for changes in biodiversity, biomass and population structures for the period of May 2012 to October 2013. Biweekly sampling occurred using 500um and 200um bongo net to take a plankton trawl and eleven species of commercially and ecologically important fish were identified and measured using a Shannon wiener biodiversity index. It was found that there was a significantly difference for seasonal variations ($p < .055$). Additionally, biodiversity was statically higher at the inlet of the bay. At the southern end of the bay (with the lowest flushing rate) both biomass and diversity were lower. The study establishes the baseline health of ichthyoplankton in Barnegat Bay and allows for assessment of the future health.

Environment & Ecology II

Room: Somerset 245 Moderator: Dena Restaino

Time	Presenters	Title
9:45	Tracy Wan	THE EFFECTS OF TITANIUM DIOXIDE NANOTUBES ON THE PHOTODEGRADATIONS OF METHYL ORANGE
9:55	William Lin	THE EFFECT OF REFRACTED LIGHT ON ALGAE GROWTH
10:05	Rajaamatangi Pillai	THE EFFECT OF SOIL AMENDED WITH GREEN TEA LEAVES ON THE PRODUCTION OF SPINACH PLANTS
10:15	Nivetha Karthikeyan	THE EFFECT OF MARIGOLD NATURAL PESTICIDES ON CONTROLLING A NEMATODE POPULATION
10:25	Anuja Walke	INDUCTION OF PLANT DEFENSE USING 2, 6 DICHLOROISONICOTINIC ACID ON <i>Curtobacterium flaccumfaciens</i> in MUNG BEANS
BREAK		
10:35	Yewoon Choi	THE REMOVAL OF COPPER (II) IONS IN WATEWATERS USING BIOADSORBENTS
10:45	David Yang	ENCAPSULATION OF PEPPERMINT TEA LEAVES IN ALGINATE BEADS FOR THE REMOVAL OF COPPER (II) IONS FROM CONTAMINATED WATER
10:55	Alon Millet	CELLULOSE BINDING DOMAINS: NOVEL IMPLICATIONS IN AGRICULTURE AND BIOFUEL PRODUCTION

THE EFFECTS OF TITANIUM DIOXIDE NANOTUBES ON THE PHOTODEGRADATIONS OF METHYL ORANGE

Tracy Wan

Decontamination of wastewater, utilization of environment-friendly chemicals, and adaptation of sustainable energy sources are a few of the most prominent issues that green chemistry is trying to deal with. In recent years, there had been an increasing number of applications using photocatalyst such as titanium dioxide nanoparticles (TiO₂ NPs) to treat wastewater. In general, the photocatalysts accelerate the rate of decomposition of organic dyes (e.g. methyl orange) with the help of ultraviolet radiation. However TiO₂NPs has their own limitations, including low separation efficiency and limited quantum efficiency. To further improve the efficiency by increasing the surface area, the structure of TiO₂ NPs is modified into nanotubes (NTs) through electrochemical methods. TiO₂NTs will be imagined using a Scanning Electron Microscope (SEM). The hypothesis is that if TiO₂ NTs are used as photocatalysts instead of TiO₂ NPs to accelerate the photodegradation of

methyl orange, then the efficiency of TiO₂ NTs will be higher than that of TiO₂NPs. TiO₂ NTs may be further used to filter wastewater.

THE EFFECT OF REFRACTED LIGHT ON ALGAE GROWTH

William Lin (student)

The purpose of this experiment was to determine whether there is a significant difference between the amount of algae grown with refracted light and the amount of algae grown without refracted light. This refracted light was proportional to the presence of a refractive medium. The student researcher explored the phenomenon of refractive mediums, such as ice, as potential “magnifying glasses” for algae growth. After culturing algae within growth apparatuses (which allowed for the presence of a refractive medium), algae was sampled using a spectrophotometer. The spectrophotometer provided accurate readings of the change in percent transmittance of the sample, quantifying the growth of the algae. By using a two-tailed, independent t-test, a p-value of 5.60×10^{-3} (0.00560) was obtained. Because the p-value was less than the alpha value of 0.05, the research hypothesis was supported, and it was concluded that there was indeed a significant difference between the amount of algae grown with refracted light and algae grown without refracted light.

THE EFFECT OF SOIL AMENDED WITH GREEN TEA LEAVES ON THE PRODUCTION OF SPINACH PLANTS

Rajaamatangi Pillai (student)

The objective for conducting this experiment was to determine whether amending gardening soil with green tea leaves would increase the above-ground biomass of spinach plants. The alternative hypothesis was that there would be a significant difference between the plants grown in green tea-amended versus non-amended soil. To test this research hypothesis, thirty pots filled with garden soil were acquired. One tea bag with two grams of *Bromley Pure Green Tea* leaves was poured into each of fifteen pots, while the other fifteen pots, serving as the control group, received no tea leaves. After the plants were consistently watered and then harvested forty-six days after they were planted, their roots were removed. Lastly, the above-ground biomass of each plant was measured in grams using a scientific balance. These values were analyzed using a two-tailed, independent t-test. It was determined based on the calculated p-value of 0.543, which was less than the alpha value of 0.05, that there was no significant difference between the above-ground biomass of the spinach plants grown in green tea-amended soil versus non-amended soil. The data failed to reject the null hypothesis and did not support the alternative hypothesis. Although amending the soil with green tea leaves did not significantly increase the above-ground biomass of the spinach plants, external factors and variables which possibly affected plant growth were identified, and improvements of the experiment were considered.

THE EFFECT OF MARIGOLD NATURAL PESTICIDES ON CONTROLLING A NEMATODE POPULATION

Nivetha Karthikeyan (student), Michael T. Roche, Biology Department, High Technology High School, Lincroft NJ 07738

From the days of Rachel Carson’s *Silent Spring*, there has been a search for alternative pesticides in the form of biological control. Under this vein of thinking, an experiment was conducted to test the hypothesis that there will be a significant difference in the number of nematodes exposed to the roots of a suspected natural pesticide, French Dwarf marigolds, versus the number of nematodes unexposed to marigold roots. The experiment was conducted through cultivating nematode cultures in three separate trials consisting of pure medium, half-starch half-soil, and pure soil mediums, respectively. These were selected to balance the survival of the cultures with mimicking real world settings. Populations of cultures were then calculated through human counting of individual nematodes and software counting of nematode pixels in photos. After data analysis, using two-tailed t-tests, it was determined that the population of nematodes within a purely starch culture, with a p-value (0.651) greater than the alpha-value of 0.05, was not significantly affected by the presence of marigold roots. The population of nematodes within a half starch, half soil culture, with a p-value (0.006) less than the alpha-value of 0.05, was significantly affected by the presence of marigold roots. Nematode cultures did not survive in the pure soil culture. Such results suggest that French Dwarf marigolds can, indeed, serve as natural pesticides, depending on the medium in which they are used.

INDUCTION OF PLANT DEFENSE USING 2, 6 DICHLOROISONICOTINIC ACID on *Curtobacterium flaccumfaciens* in MUNG BEANS

Anuja Walke (student), Donna Leonardi, Biology Department, Bergen County Academies, Hackensack NJ 07601

Farmers often lose a large portion of their harvest to plant pathogens. A natural phenomenon exhibited by plants is termed Systemic Acquired Resistance (SAR) and allows a plant to achieve increased resistance to a broad spectrum of pathogens after a first initial infection by one. Synthetic chemicals termed Plant Activators have been created that are able to induce SAR in plants without them first having to be infected. Unlike pesticides, these activators mimic the same biochemical processes that plants exhibit during SAR. In this study, plant activator 2,6 Dichloroisonicotinic acid (INA) is used to observe the efficacy of the activator to reduce the severity of bacterial pathogen *Curtobacterium flaccumfaciens* on mung beans. The mung beans were sprayed with varying concentrations of INA (0-120µg/mL) three days prior to disease inoculation. Severity of the disease was determined by the number of lesions on the two leaves of greatest surface area. Results are pending.

THE REMOVAL OF COPPER (II) IONS IN WATEWATERS USING BIOADSORBENTS

Yewoon Choi (student), Dr. Abel Navarro, Science Department, Borough of Manhattan Community College, Manhattan NY 10007

Recent research has shown biosorption as a “green alternative” for the decontamination of metal pollutants. Biosorption is defined as the process by which non-living biomasses bind to contaminants using the chemical structures on its surface, or active sites. Chemical groups such as carboxyl and hydroxyl groups are have proven to be crucial in the adsorption of metal pollutants such as lead and cadmium. In this experiment, chitosan was used an encapsulating agent for peppermint tealeaves to produce a new hybrid adsorbent. Chitosan derives from chitin, a natural polymer found in seashells, and has also proven its adsorption properties towards metals. Furthermore, peppermint tealeaves, another inexpensive form of biomass, have also shown high affinity towards pollutants. The combination of the tealeaves and chitosan optimized the removal of copper from water and the chitosan was formed into beads. To determine the optimum experimental conditions for the chitosan beads, initial pH, adsorbent dose, initial metal concentration, salinity, and presence of crowding agent were tested to maximize the uptake of copper from solutions in batch experiments at room temperature. The optimum pH level was 6, which falls in the range of natural water of 5-7 and the optimum adsorbent dose and initial metal concentration were 150mg of chitosan of a 180 mg/L copper solution, respectively. The presence of salts such as NaNO₃, CaNO₃, and NaCl, surprisingly increased the adsorption capacity of the adsorbents. Conversely, crowding agent such as polyethylene glycol, showed a small decrease in the adsorption. This adsorption technique will contribute in finding new inexpensive and biodegradable methods for water purification of contaminated wastewaters.

ENCAPSULATION OF PEPPERMINT TEA LEAVES IN ALGINATE BEADS FOR THE REMOVAL OF COPPER (II) IONS FROM CONTAMINATED WATER

David Yang (student), Abel Navarro, Academy for the Advancement of Science and Technology, Hackensack NJ 07601

Copper is one of the most prevalent heavy metals in wastewaters and causes several harms in the environment as well as human health. Conventional techniques to remove copper include activated sludge, chemical precipitation, and reverse osmosis. This research proposes an alternative cost-effective method that utilizes encapsulation of spent peppermint tea leaf into alginate gel bead as a potential adsorbent of copper metal ions from water. Batch experiments were carried out at room temperature to determine experimental conditions that maximize the removal of copper. Results show that pH 6 and an adsorbent mass of 125 mg achieved the maximum adsorption of a 150 ppm Copper solution. The removal capacity of this novel adsorbent decreases under the influence of salts and crowding agents. Finally, the alginate bead/peppermint tea leaf shows adsorptive properties even in the presence of other heavy metals and organic compounds. This study demonstrates that hybridization of different biosorbents is a promising, cost- and time-efficient material for selective heavy metal decontamination at industrial levels.

CELLULOSE BINDING DOMAINS: NOVEL IMPLICATIONS IN AGRICULTURE AND BIOFUEL PRODUCTION

Alon Millet (student), Laboratory of Cellular Biology, Bergen County Academies, Hackensack NJ 07601

Increases in world population have effected resource deficits in both the agricultural and the energy sectors; methods to increase plant biomass would therefore have significant implications in these areas. Cellulose binding domain (CBD), the noncatalytic protein domain of many bacterial and fungal cellulases, has been found to modulate the turgor-driven growth of plants by adsorbing to microcracks in plant cell walls, altering microstructure and enhancing cellulose degradation by

hydrolases, allowing for expansion. This study investigated the effects of CBD (0-0.1 mg/mL) on *V. radiata*, the common mung bean, from an agronomic perspective. CBD was administered hydroponically to *V. radiata* seeds which germinated and were grown for 8d (12h light cycle). Mass, length, material stiffness, and stem diameter increased in a dose-response fashion, suggesting efficacy in increasing the agronomic contributions of the bean ($p < 0.05$). SEM and TEM micrographs verified an altered microstructure. Silver nitrate was administered in countertoxicity trials verifying CBD's potential as a countertoxin ($p < 0.05$). Simulated drought trials found CBD modulated the mass of the plant ($p < 0.05$). A free D-glucose assay demonstrated CBD effected a decrease in free glucose per unit mass at low concentrations but an increase at high concentrations ($p < 0.05$), showing promise in sustainability and cost-efficiency of biofuels. Total free glucose increased 550% at 0.1 mg/mL CBD. Sustained release trials evaluated the delivery of CBD, with material stiffness increasing ($p < 0.05$) compared to single dose administration. This study found that CBD has significant potential as a plant additive in the fields of both agriculture and energy.

Psychology & Behavior
Room Somerset 018 Moderator: TBA

Time	Presenters	Title
9:45	Gillian Covillo	AUDITORY STIMULI IMPACT ON TEENAGE GIRL'S DREAM COGNITION IN REM SLEEP STAGE
9:55	Matthew Kumar	THE EFFECT OF POSITIVE REINFORCEMENT ON THE ACADEMIC PERFORMANCE OF ADOLESCENT MALES AND FEMALES
10:05	Tiffany Chen	THE EFFECT OF COLOR-TINTED ENVIRONMENTS ON GOLDFISH ACTIVITY
10:15	Tiffany Yuen	COMPARISON OF DIFFERENT PERSONALITY TYPES: INTROVERTS AND EXTROVERTS WITH NUMBER OF FRIEND NODES ON FACEBOOK
10:25	Priscilla Wong	ASTIGMATISM ON THE ABILITY TO VIEW MAGIC EYE 3D ILLUSIONS
BREAK		
10:35	Connor O'Leary	OLFACTORY ASPECTS OF PATHOGENIC RESPONSE AND AVOIDANCE IN <i>C.elegans</i>
10:45	Ariana Bhatia	THE CORRELATION BETWEEN UNEMPLOYMENT RATE FLUCTUATION AND STRESS-RELATED MEDICAL DISORDERS
10:50		

AUDITORY STIMULI IMPACT ON TEENAGE GIRL'S DREAM COGNITION IN REM SLEEP STAGE

Gillian Covillo (student), Morristown High School, Mentor: Erin Colfax

Experimental psychology explores learning, memory, and cognition. Many studies in the field of experimental psychology focused on using odor stimuli as a way to enhance or change dreams, but few of these researchers looked into use of auditory stimuli as an alternative. Others showed that auditory stimuli could activate the auditory cortex in dreaming, rarely waking the dreamer. This study looked to reproduce these findings and to determine whether different auditory stimuli, like voice recordings and music, can influence a dream. This investigation used six teenage female participants meeting study specific criteria. Over the three-week study, participants were exposed to various audio stimuli during sleep. Data was collected in participant dream journals and by capturing brain waves via portable electroencephalograms (EEG). The dream journals were then analyzed to see whether auditory stimuli impacted the reported dreams. Descriptive statistics were also analyzed by seeing trends within the data between participants. The Caucasian participants dreamt more during the voice stimuli phase than the African American participants. Also the Caucasian participants also had a longer average time sleeping per night than the other participants. Future research is important to conduct because of the many things we do not know about the sleeping unconscious.

THE EFFECT OF POSITIVE REINFORCEMENT ON THE ACADEMIC PERFORMANCE OF ADOLESCENT MALES AND FEMALES

Matthew Kumar (student)

This experiment examines the effect of positive reinforcement on how well adolescent students answer multiplication questions. While skill in math is important, confidence is also important. When one is told that they are doing better, they become more confident in their abilities to do mental math. This experiment will determine whether or not there is a significant difference in the number of correct answers when positive reinforcement is used versus when there is no

reinforcement. The study measured the amount of multiplication problems subjects answered correctly; first with no reinforcement, then with positive reinforcement. This statistical data analysis revealed that telling subjects that their previous answer are correct, or positive reinforcement, leads to more correct answers to multiplication problems in adolescent students. The p-value of positive reinforcement on the academic performance of adolescents is .00000572, meaning there is a significant difference. The p-value of positive reinforcement on the academic performance of males is 0.000335, meaning, again, there is a significant difference. The p-value of positive reinforcement on the academic performance of females is 0.006056705, again, significant.

THE EFFECT OF COLOR-TINTED ENVIRONMENTS ON GOLDFISH ACTIVITY

Tiffany Chen (student), High Technology High School, Lincroft, NJ 07738

The purpose of this experiment was to determine if there was a significant difference among the mean amounts of goldfish activity in tanks surrounded by clear (control group), red, and blue cellophane. Goldfish activity was recorded in two dimensions, because the equipment needed to record the movement in three dimensions was not available to the student researcher. In every trial, one goldfish was placed in each of the different color-tinted environments. A camera stationed above the tanks filmed the movement of the fish in 5-minute periods. The positions of the fish were recorded in Logger Pro 3.8.6.1. The distances between pairs of adjacent position points were calculated and summed to reach a total linear distance traveled. A total linear distance was calculated for each of the 36 trials (12 per level). When the researcher conducted two-tailed, paired t-tests between the different levels, two of the three p-values obtained were less than the alpha level of 0.05. For these two levels, the data did support the research hypothesis. It was concluded that goldfish in the clear-tinted environment were significantly more active than goldfish in the blue-tinted environment (p-value: 0.000857). Similarly, goldfish in the red-tinted environment were significantly more active than goldfish in the blue-tinted environment (p-value: 0.0204).

COMPARISON OF DIFFERENT PERSONALITY TYPES: INTROVERTS AND EXTROVERTS WITH NUMBER OF FRIEND NODES ON FACEBOOK

Tiffany Yuen (student), High Technology High School, Lincroft, NJ 07738

The purpose of this research experiment was to do a comparison of the different personality types: introverts and extroverts. This was done by comparing their number of friend nodes on Facebook. The alternative hypothesis says that there will be a significant difference between the number of nodes that extroverts have on Facebook and the number of nodes that introverts have on Facebook. This experiment was conducted by surveying a specific high school for subjects between the ages of 14-18 who have Facebook accounts, and then separating those subjects into personality groups of either introverts or extroverts based on their results from a personality test. Those who were concluded to be ambiverts, people having characteristics of both introverts and extroverts, were excluded from the rest of the experiment. The subjects then analyzed their Facebook accounts with the WolframAlpha Facebook analyzer to determine the number of friend nodes each subject has. Based on a conducted two-tailed independent t-test, it can be determined that the p-value of 0.0449 is less than the alpha value of 0.05. This supports that there is a significant difference between the number of nodes that extroverts have on Facebook and the number of nodes that introverts have on Facebook.

ASTIGMATISM ON THE ABILITY TO VIEW MAGIC EYE 3D ILLUSIONS

Priscilla Wong (student), High Technology High School, Lincroft, NJ 07738

The student researcher tried to determine if there was a significant difference between the proportion of people with astigmatism who were able to view the Magic Eye 3D Illusions and the proportion of people without astigmatism who were able to view the Magic Eye 3D Illusions. The question for exploration involved the connections between the eyes and the brain, the workings of autostereograms, and the possible effects of certain vision impairments or conditions on the ability to perceive the 3D images from the autostereograms. Investigating the relationship between astigmatism with associated depth perception problems and the ability to view these autostereograms provided more insight into the question raised. The test incorporated two groups of thirty people each, one group with astigmatism and the other a control group without astigmatism. Each individual was given the same instructions and tips for viewing the illusions and ten minutes to correctly identify the hidden images in two different Magic Eye images. A two proportion z-test was then conducted to analyze the data. The data produced a p-value of about 0.5175, which was greater than the level of significance of 0.05. Therefore, the results supported that there was no significant difference between the proportion of people with astigmatism who were able to view the Magic Eye 3D Illusions and the proportion of people without astigmatism who were able to view the Magic Eye 3D Illusions.

OLFACTORY ASPECTS OF PATHOGENIC RESPONSE AND AVOIDANCE IN *C.elegans*

Connor O'Leary (student), Biotechnology High School: Mentor: Dr. Julie Nowicki

C.elegans are model organisms that are known to possess an olfactory system similar to animals including mammals. This experiment investigates the impact of the olfactory chemosensory system of *C.elegans* in response to pathogenic (*S.marcescens*) and nonpathogenic (*E.coli OP50*) bacteria because bacteria are the main food source for these nematodes. Wild-type (N2) worms were compared to AWB olfactory deficient worms. It was predicted that the AWB olfactory deficient worms couldn't differentiate among pathogenic and nonpathogenic bacteria whereas the wild-type could. The observed results showed that N2 (wildtype) had a positive chemotaxis index to nonpathogenic bacteria that was statistically more than the chemotaxis index to pathogenic bacteria and Luria broth(negative control). The AWB olfactory worms showed no statistical differences among chemotaxis indexes. This supports the hypothesis that the AWB olfactory chemosensory system plays a role in the detection and differentiation of pathogenic versus nonpathogenic bacteria. An additional objective was to determine whether an increased sensitivity to pathogenic bacteria elicited a heightened olfactory response in *C.elegans* promoting them to avoid pathogenic bacteria. Worms with increased pathogen sensitivity were able to avoid pathogenic bacteria more readily than norm sensitivity worms. This supports the hypothesis that an enhanced negative stimuli cause an increase in olfactory sensitivity, pathogen detection, and avoidance.

THE CORRELATION BETWEEN UNEMPLOYMENT RATE FLUCTUATION AND STRESS-RELATED MEDICAL DISORDERS

Ariana Bhatia (student), Freehold Township High School, Freehold Township, NJ 07728

Since the 1990s, unemployment rates in America have been increasing to unsustainable levels. Many articles have stated, without support of statistics, that unemployed people are more likely to be affected by stress-related diseases. When under stress, the human body releases a molecule called neuropeptide Y, causing the accumulation of fat, and produces an insufficient amount of insulin. These altered bodily processes, when under excessive stress can lead to diseases such as obesity, diabetes, and cardiovascular disease. It can thus be inferred that mental stress and resulting from unemployment may lead to medical disorders such as obesity, diabetes, and cardiovascular diseases. The purpose of this study is to determine whether there is a relationship between unemployment rate fluctuation and annual rate of obesity, diabetes, and cardiovascular disease in America. After thoroughly researching, collecting, and analyzing data on unemployment, obesity, diabetes, and cardiovascular disease rate in American working people aged 16-65 over the time period of 1990-2012, a Pearson's Correlation test was conducted between unemployment rate and each of the three medical disorders. With an alpha value of 0.05 and a sample of $n=23$ the Pearson's Correlation test resulted in r values of 0.4140, 0.5485, and 0.6509, all above the critical value of $r=0.4130$, concluding that there is a significant correlation between unemployment rate and stress-related medical disorders amongst working people in America. The results of this unprecedented study can help develop programs for the unemployed to maintain physical activity and decrease stress levels, allow hospitals and medical staff to predict patient traffic, and emphasize the health hazards resulting from unemployment.