# BIOGENEIUS CHALLENGE

2016 International BioGENEius Finalists



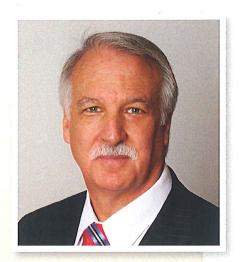




**O** Biotechnology

Engage. Excite. Educate.







June 2016

Dear BioGENEius Attendee,

Each year a group of elite high school students are selected to compete in the BioGENEius Challenge at the BIO International Convention to showcase their innovative research - not just in pursuit of winning top honors, but to propel their ideas onto the international stage in the hopes of providing solutions in healthcare, agricultural, industrial and environmental biotechnology that will transform the way we heal, fuel and feed the world.

These students are part of a generation who are forward thinking, socially minded and dedicated to creating sustainable solutions that may solve some of the most complex problems facing our world today and their world in the future.

The Biotechnology Institute, through the BioGENEius Challenge, creates this stage for these young innovators to present their work, explore career opportunities and experience what it means to be a leader in biotechnology.

It is my distinct honor to welcome this year's BioGENEius students and celebrate their many accomplishments both in and out of the lab. My hope for you these next few days is that you take time enjoy the experience and make new friends. You are all incredibly talented and bright, but it is the connections and community that transform our industry into one of inspiration. Best of luck here at BioGENEius and beyond!

Sincerely,

Dr. Larry Mahan

President

Biotechnology Institute



### **Global Healthcare Sponsor**



Johnson-Johnson

INNOVATION

June 2016

Dear BioGENEius Attendee,

Science and technology are moving at an unprecedented pace, and the opportunities for impact on society is both profound and far reaching. At J&J Innovation, we believe that a great idea and great science can come from anywhere in the world. Supporting and encouraging those ideas and investing in the scientific ecosystem is an important part of our ethos.

That is why we are delighted to be a longtime supporter of the Biotechnology Institute's BioGENEius Competition and of the impressive high school students who compete as part of the program. We are especially delighted to be the signature sponsor of the Global Healthcare Challenge and the Gene Pool Competition. In this challenge, participating high school students present biotechnology based projects that help to advance understanding of - and solutions for – human disease.

In providing support and mentorship for them, and for all the participants in this year's competition, we hope to help foster and encourage the emerging generation of new scientific leaders to continuously come forward with new ideas that can have an impact on improving healthcare all over the world.

Sincerely,

Seema Kumar

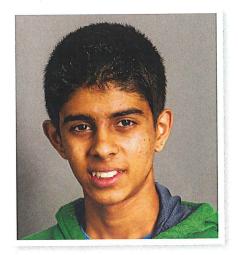
Vice President, Innovation, Global Health and Policy Communications

Johnson & Johnson





# Utkarsh Tandon (UT-karsh TAN-don) | Presentation 1



ARIA: Diabetic Retinopathy Prognosis
via Hypertensive Modeling; ML-based
Morphological Computer Vision for Rapid Ophthalmology

California (Bay Area) Challenge Winner Cupertino High School Cupertino, CA

Sponsor Johnson

### **Description**

This interdisciplinary study develops a novel prognostic for Diabetic Retinopathy (DR) by modeling hypertensive changes at arterial-venous crossings — therefore ultimately discovering new symptoms (venous compression, deflection, and tortuosity) to diagnose and monitor the condition. Additionally, the research develops a low-cost, portable device for rapid DR stage-classification through Random Forest ensembles and morphological computer-vision algorithms.

**Abstract** - Rural regions lack access to trained Ophthalmologists and expensive diagnostic equipment for necessary disease detection through retinal image analysis. The fast-pace progression of the condition causes irreversible retinal scarring if not detected early enough – therefore contributing to the 39 million annual blindness rate worldwide. Due to a potential correlation with Hypertensive Retinopathy this study proposes a novel Blood Pressure Quantification (BPQ) algorithm capable of morphologically modeling AV interactions in order to detect DR onset much earlier than current practices with state of the art 77% prognostic ML model accuracies. The developed PCA derived red lesion sub-classifier and computer-vision feature generation mechanisms seed a stochastic RF module for stage classification of DR images which received 81% cross-validation accuracy (trained from 3,000 retinal images) comparable to human gold-standard of 90%. Fundus biomicroscopy with an aspheric condensing lens attached to a smartphone camera interfaces with the computer vision approach to image retinas with 40 degree FOV's and algorithmically conduct prognostics and stage classification. Full-scale results are returned within minutes compared to the current 6-week screening time therefore facilitating faster treatment and preventing vision loss due to DR on a global scale.



# Laura Fleming (LORE-ah FLEM-ing) | Presentation 3



Valvular Interstitial Cell Activation in Response to Pro-Inflammatory Cytokine Treatment

**Colorado BioGENEius Challenge Winner**Fairview High School
Boulder, CO

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### **Description**

To determine if calcific aortic heart valve disease is an inflammatory disease, I added pro-inflammatory proteins to a culture of heart valve cells. For two cytokines that I tested, there was an inflammatory response that leads to the progression of this disease, indicating that these cytokines could be a drug target for treating this disease.

### **Abstract**

Calcific aortic valve disease is the main heart valve disease in the elderly. The disease is characterized by persistence of myofibroblasts, causing extensive remodeling of the extracellular matrix and stenosis of the aortic valve but its regulatory mechanisms are unclear. Recent studies have suggested that myofibroblast differentiation results from an inflammatory process involving pro-inflammatory cytokines, namely transforming growth factor- $\beta$ 1 (TGF- $\beta$ 1), interleukin-6 (IL-6), and interleukin-1 $\beta$  (IL-1 $\beta$ ). Here I cultured valvular interstitial cells (VICs) on 8-arm PEG-hydrogels with matrix metalloproteinase (MMP) degradable cross-linkers and a pendant adhesive peptide to allow the cells to grow throughout the hydrogel and adhere to it. I then added each cytokine individually to mimic the inflammatory response of VICs. I found that for two methods of quantification, the addition of TGF- $\beta$ 1 and IL-6 increased the measured level of  $\alpha$ -smooth muscle actin ( $\alpha$ -SMA), an indicator of myofibroblast activation. This result supported the hypothesis that these cytokines mediate the actively regulated progression of calcific aortic valve disease. IL-1 $\beta$ , though previously implicated in disease pathogenesis, decreased myofibroblast activation, possibly due to its mediation of apoptosis or its regulatory interdependence with MMP, which was present in the hydrogels. In all control conditions, the majority of VICs had a quiescent or deactivated phenotype, indicating the efficacy of PEG-hydrogels as extracellular matrix mimics. This study illuminated possible pathways towards the pathogenesis of calcific aortic valve disease and supported PEG-hydrogels as viable culture substrates.



# Helen Liu (Hel-lin Loo) | Presentation 4



**Developing a Novel Progranulin-Derived Biologic for Gaucher Disease** 

**Connecticut (At-Large) BioGENEius Challenge Winner** Amity Regional High School Woodbridge, CT

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INNOVATION

### Description

Gaucher Disease is an enzyme deficiency that causes anemia, brittle bones and organ enlargement. A protein that binds and delivers the deficient enzyme to treat GD was discovered. I isolated the part of the protein responsible for binding and engineered a molecule from it to create a novel drug therapy, significantly reducing cost of treatment.

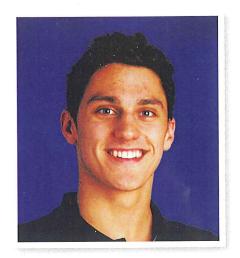
### **Abstract**

Gaucher disease (GD), the most common lysosomal storage disease is caused by mutation of the lysosomal enzyme glucocerebrosidase (GBA). This mutation results in the accumulation of its substrate glucosylceramide, leading to swelled lysosomes. As a result, patients with this disease have enlarged livers, spleens and lymph nodes. The current treatment for this condition is enzyme replacement therapy (ERT); however, ERT has been unsuccessful for some patients and in some cases, adverse effects have been reported.

Furthermore, this treatment is expensive and the cost for each patient is approximately \$350,000/year. Progranulin (PGRN) is a growth factor implicated in various pathophysiological processes, including wound healing, inflammation, and neurodegeneration. It has been shown recently that loss of PGRN resulted in lysosome storage dysfunction in humans and mice. Therefore, this study prompted us to test whether PGRN had therapeutic effects in lysosome storage diseases. The addition of recombinant PGRN prevented GBA aggregation and glucosylceramide accumulation in human fibroblasts from GD patients. We found that PGRN binds directly to the enzyme GBA and was required for the transport of GBA from the nucleus to the lysosome. In particular, we found the essential fragment needed for this binding, a C-terminal fragment (aa 496-593) of PGRN, referred to as Pcgin (PGRN C-terminus for GBA Interaction). Pcgin appears to be the crucial part of PGRN that showed therapeutic effects in GD fibroblasts. These findings demonstrate PGRN as a novel regulator of GBA, which may become a new drug candidate for the treatment of Gaucher disease.



# **Connor Sweeney** (Con-ner Sween-e) | Presentation 5



Role of Arabidopsis thaliana Volatile
Organic Compounds in Intraspecific Communication

**Delaware BioGENEius Challenge Winner** Charter School of Wilmington Wilmington, DE

### **Description**

When wounded to simulate insect herbivory, mustard weed A. thaliana releases chemical signals that other, undamaged A. thaliana plants detect. When these signals are detected, the receiving plants grow larger root systems and change their genetic expressions to adapt to toxic soil. These chemical signals are airborne.

### **Abstract**

When disrupted by stimuli such as foliar herbivory or bacterial infection, plants transfer information via airborne or grounded secretions known as volatile organic compounds (VOCs). The emission of VOCs can induce a response in neighboring plants and can improve plant fitness by alerting nearby plants of an impending threat and prompting them to alter their physiology for defensive purposes. To mitigate additional oncoming herbivore damage, plants already wounded by an herbivore can attract predators that prey on the attacking herbivore, consequently removing a threat before its full damage potential can be realized. In this study, I investigated the role airborne VOCs, released as a result of mechanical wounding, play in intraspecific communication between adjoining Arabidopsis thaliana plants. VOCs released by the wounded plant resulted in more elaborate root development (including longer primary roots and more numerous lateral roots) in neighboring, unwounded plants. Such VOCs also upregulated the Aluminium-activated malate transporter (AtALMT1) responsible for the secretion of L-malic acid. Wounding-induced VOCs therefore induce defense-mechanisms in undamaged, local plants, eliciting a two-pronged preemptive response of more rapid root growth and secretion of malic acid.



# Jilly Cronin (Jil-lee Crow-ninn) | Presentation 7



Effects of Salinity and Temperature on Adsorption of Zinc by E. gracilis

Illinois BioGENEius Challenge Winner
Oak Park and River Forest High School
Oak Park, IL

Description

I tested the ability of Euglena gracilis to adsorb the heavy metal zinc from water when exposed to changing temperature and salinity.

### **Abstract**

Heavy metal pollution is a growing environmental problem, and despite current bioremediation methods, cheaper and more effective methods of removing metals from water are needed. The algae, Euglena gracilis, were grown and given nutrients (fertilizer and carbon dioxide). The algae were then put into tanks of varying salinity and temperature. Zinc was then introduced, and after one hour the amount of zinc left in the tank indicated the amount that was adsorbed by the algae. This was recorded by precipitating the remaining zinc out of the water using 1.0 M sodium hydroxide (NaOH). Low salinity and a temperature of 22°C was more effective at adsorbing heavy metals than high salinity and extremely low or high temperature (p=6.276E-74 based on an ANOVA test). It was confirmed, based on the amount of zinc left in the water after algae was removed, that low salinity and temperature of 22°C constitute the best environment for the algae to adsorb zinc. Future research in this area should work on devising a mechanism for this environment to be put in place when trying to use E. gracilis to remove heavy metals from freshwater.



# Aaron Wills (Air-in Will-z) | Presentation 8



Does Lemna minor have the ability to metabolize and lower the nitrate level in spring water?

**Iowa BioGENEius Challenge Winner** Central Lee High School Donnellson, IA

### Description

My project is about using a common type of duckweed, Lemna minor, to lower the nitrate levels in pond and other water sources. During this project I found that the duckweed was in fact able to lower those levels, but it lowered the levels in such traumatic rates in just ten days.

### **Abstract**

lowa is a farming state, with constant farming comes a heavy use in fertilizers and nitrogen for farming practices. The heavy use of these farming practices creates an increased rate of nitrogen run-off, which has many negative effects on ponds and lakes. Increased nitrogen levels in a pond or lake that can create many problems, but the most commonly know problem for high levels is algal blooms. An algal bloom is when too much nitrogen in the water causes algae to go through their reproduction processes in a faster rate. This project is about how to try and lower those levels, or even keep them from becoming a problem. I hypothesized that Lemna minor will be able to metabolize and lower the nitrate level. I also believe that if the duckweed can metabolize then it will lower the level of nitrates in the spring water to an average amount to maintain the appropriate level in a pond(the EPA level is 10 mg/L). By using 50 petri plates for this experiment and another 10 for the control in my experiment. I first hypothesized that the Lemna minor would metabolize the nitrates that were put into the spring water and the duckweed did so. The second hypothesis was that once the Lemna minor could metabolize the nitrates, and then it would drop the nitrate level needed in ponds. I found that the Lemna minor did lower to a safe level and lowered on an average of 7.2 mg/L in 10 days.



# **Erin Smith** (Eh-rin Smith) | Presentation 9



The Development of a Low-cost, Remote, and Non-Invasive Early Detection System for Parkinson's Disease Using Differences in Spontaneous Facial Expression

Kansas BioGENEius Challenge Winner

Shawnee Mission West High School Overland Park, KS

**Sponsor** 

Johnson-Johnson

**Description** 

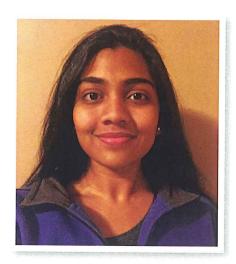
Lack of Parkinson's disease (PD) biomarkers and detection methods limits early intervention and treatment options. This project discovered three differences in facial muscle contractions and expressions that may provide a non-invasive, remote PD monitoring and detection system perfect for those in developing countries and the aging population who are especially vulnerable to PD.

### **Abstract**

Parkinson's disease (PD) is the second most common neurodegenerative disorder in the world. There are no definitive biomarkers or means of detection for PD. Current detection is often inaccurate, while extremely costly and requires a high level of medical infrastructure and expertise. With those in developing countries and the aging population especially vulnerable to the rapid growth of PD, lack of early and accurate detection will pose an increasing challenge for current healthcare systems and limit early intervention and treatment options. PD patients undergo changes in the substantia nigra portion of the brain, the same section where spontaneous facial muscle movements originate. PD patients' expressions are often perceived as "unfelt" or distant. If spontaneous facial movements are indeed affected by PD, this may act as a biomarker and means of objectively detecting and monitoring PD. Facial activity was monitored in response to three ecologically-valid media clips and analyzed by the world's largest spontaneous facial expression machine learning algorithm. Significant differences where discovered between the PD and non-PD group. Overall facial muscle movement was reduced and quantified in PD subjects using the Expression Metric. PD subjects also followed different patterns of responses for the Attention Metric compared to their non-PD counterparts. Further, the muscle movement of the Frontalis (par lateralis) that constitutes Action Unit 2 was void at peak moments in PD subjects. The findings in this study may provide an objective measurement and biomarker for PD, acting as the first step towards a non-invasive, remote PD monitoring and detection system.



# Anantha Sriya Reddy (A-nan-tha Sri-ya Red-ie) | Presentation 10



Application of modular cloning for rapid, site-specific, and stable expression of multi-gene constructs in mammalian cells

Maryland BioGENEius Challenge Winner Poolesville High School Poolesville, MD

Sponsor

Johnson-Johnson

NOITAVONNI

### **Description**

The development of the U2OS cell line was possible by first generating cells that stably express the Cerulean fluorescent protein and an accepter region in the genome. Next, the donor plasmid vector that included a cognate donor region in which researchers can insert their gene of interest was constructed.

### **Abstract**

High-throughput imaging (HTI) is a recent advancement in the study of cellular pathways and molecular mechanisms in both a large number of samples and at the single cell level. One key component of HTI assays is the generation of mammalian cell lines expressing fluorescent proteins, a process that is generally labor-intensive. To address this issue, the goal of this project was to engineer a monoclonal chassis cell-line using a previously published design1. We inserted a BxB1 AttP recombination acceptor DNA sequence within the AAVS1 genomic locus in the U2OS osteosarcoma cell line. Genomic PCR screening was then used to confirm that the BxB1 recombination site was integrated in the desired genomic locus. In addition, the donor plasmid containing the cognate BxB1 AttB site for targeted integration of genes of interest was also generated. After complete development of the monoclonal chassis cell line, we will be able to distribute the product to other researchers and laboratories so that they can investigate their own biological questions of interest using the cell line in parallel with HTI.



# **Carver Nichols** (Car Ver Nickles) | Presentation 12



Predicting Graft Compatibility of Kudzu, Soybeans, and Garden Peas Through Peroxidase Analysis

**North Carolina BioGENEius Challenge** Brevard High School Brevard, NC

### **Description**

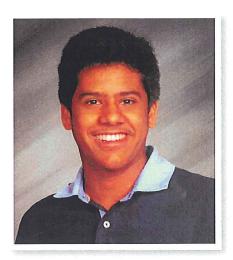
I tried to develop a method to predict whether or not Kudzu, Soybeans, and Garden Peas can be grafted together through Oxidation enzyme profile analysis.

### Abstract ~

An important step forward in progressive agriculture has incorporated the use of grafted vegetables to maximise production efficiency and pest management. Generally, any Herbaceous or soft tissued plant will graft together if these two plants were in the same botanical family. The purpose of this experiment was to investigate whether or not physically similar peroxidase profiles had any correlation with graft compatibility in Fabaceous plants, Pueraria montana, Glycine max, and Pisum sativum. In previous studies, total protein assays were conducted along with histochemical peroxidase assays using guaiacol as an oxidant were performed to then run native gel electrophoresis on tissue extract which were then stained with guaiacol to examine peroxidase profiles. In this study, modified versions of the given methods were used to determine a correlation. All though more testing must be conducted, the preliminary results of both grafting and examination of peroxidase profiles suggest that (Scion) Pisum sativum X (Rootstock) Pueraria montana are incompatible. Preliminary results with (Scion) Glycine max X (Rootstock) Pueraria montana may possibly be compatible. Profiles showed similar physical characteristics and grafts unified, but later died due to mechanical damage.



# **Roy Ghosh** (Roy Go-shh) | Presentation 13



Innovative and Inexpensive Method of Targeting and Killing Circulating Tumor Cells using TRAIL-presenting Liposomes

**Pennsylvania BioGENEius Challenge Winner** Parkland High School Allentown, PA

Sponsor Johnson

### Description

This project aims to destroy circulating tumor cells (which causes cancer to spread) by utilizing lipid-based carriers, adhesive molecules, and a death receptor. Once these carriers adhere to the cancer cells, the death receptor will induce cell death. Using an in vitro device, 77% of cancer cells were killed by the carrier.

### **Abstract**

Circulating tumor cells (CTCs) have a highly characteristic identification and origin in metastatic diseases. Therefore, for the prevention of metastasis in non-hematologic cancers, these rare CTCs must be targeted and killed in patients with high efficiency and low rebounding effects. TRAIL has attracted significant interest because it induces only cancer cell death. However, CTCs' rarity renders all techniques involving metastatic prevention low yielding. This project aims at using liposomal carriers coated with TRAIL and an adhesion molecule to successfully enter the bloodstream, attach to tumor cells, and kill the majority of cancer cells. Two adhesion molecules are utilized: E-selectin (ES) and anti-Epithelial Cell Adhesion Molecule (EP). The lifetime of both liposomes are measured to understand the effectiveness of these carriers in a patient's blood. EP liposomes continually have a higher efficiency and a longer lifetime compared to the short-living ES liposomes. An atomic force microscopy test reveals that TRAIL alone did not have the endurance and strength to kill CTCs. With EP, however, the liposome can sustain the unpredictable stresses of blood, with a rupture force of 8.02E–5 newtons. In the experimental flow tests, two devices are used as microfluidic chips. The wave design chip allows EP liposomes to capture and destroy 77% of all cancer cells in the blood. Based on the high capture efficiency, using these coated liposomes offers an innovative and efficient method in eliminating the majority of cancer cells, slowing the progression of metastasis, and providing supplemental, inexpensive treatment for early-stage and late-stage epithelial cancers.



# Marissa Sumathipala (Mahr-issa Soom-at-ti-pahla) | Presentation





FOXO Transcription Factor: A Novel Therapeutic for Cardiometabolic Disease

**Virginia BioGENEius Challenge Winner** Broad Run High School Ashburn, VA

Sponsor

Johnson Johnson

Jinnovation

### **Description**

This research investigates FOXO transcription factor proteins as a drug target for cardiometabolic disease. Regulating cellular metabolism and essential to longevity, FOXO proteins address the multiple components of cardiometabolic disease by targeting underlying metabolic and cellular pathways. This research found FOXO was a novel, effective drug target for the treatment and prevention of cardiometabolic disease.

### **Abstract**

The risk of cardiovascular disease, the world's leading cause of death, is greatly increased by metabolic syndrome, a combination of hyperlipidemia, hypertension, and type-2-diabetes. A rapidly growing global health challenge across all age groups, cardiometabolic disease affects 25% of adults globally and 10% of children and 50% of adults over 60 in the US. Typically, components of cardiometabolic disease are treated as separate diseases. To more effectively treat cardiometabolic disease, by addressing underlying cellular pathways common to the disease, a novel drug target of FOXO proteins is investigated. FOXO proteins target key metabolic pathways in adipose tissue: lipid metabolism, insulin signaling, autophagy and inhibition of cholesterol biosynthesis and lipid accumulation. FOXO transcription factor was expressed in adipose tissue by crossing two Drosophila transgenic lines, GAL4-driver line with RU486 Gene Switch and FOXO line, and raised on lipogenic diets to induce cardiac and metabolic decline. Abdomens were surgically dissected without damaging beating hearts, and videos were analyzed. Cardiac tissue was fixed, fluorescence-stained, and actin-myofibrils imaged. FOXO-expressing flies on lipogenic diet exhibited therapeutic benefits of reduced cardiac dysfunction: heartrate improved 27%, arrhythmicity 76%, contractility 120% (p<0.05). When expressed prior to lipogenic diet placement, FOXO exhibited preventive benefits: heartrate improved 43%, arrhythmicity 77%, contractility 155% (p<0.05). Structurally, FOXO prevented cardiac hypertrophy and myofibrillar disarray. Successfully reducing mortalities and treating diet-induced arrhythmias, tachycardia, and hypertrophy, FOXO presents a novel drug target for treatment and prevention of cardiometabolic disease.



# Iveta (Iva) Demirova (ih v EH t ah dem ih R oh va) | Presentation 15



Exploring the Development of Antibody-Scaffolded Membrane-Fusion Inhibitors for HIV-1 Therapy

### Sanofi BioGENEius Challenge Canada

New Westminster Secondary School New Westminster, British Columbia, Canada

Sponsor

Johnson Johnson

**Description** 

This project explored the possibility of inserting small, therapeutic peptides into an antibody with the intention of stabilizing them. Specifically tested were reiterations of peptides that inhibit HIV infection by preventing the virus from entering the host cell. Preliminary results predict that two of the antibody-scaffolded drugs will be able to neutralize HIV.

### **Abstract**

Entry inhibitors, one class of existing HIV anti-retroviral therapy (ART) medications, prevent the virus from fusing its membrane with that of the host cell, thus inhibiting viral entry and infection. This project strove to engineer an entry inhibitor targeting the gp41 region of the HIV envelope glycoprotein. Specifically targeted were the exposed helices of the gp41 pre-fusion intermediate that snap together to allow for HIV entry into a cell. With the use of in silico modelling, various reiterations of inhibitor peptide sequences were evaluated based on their ability to conserve binding-active conformation when inserted into an antibody scaffold. PG16, an anti-HIV antibody, was used as the scaffold because of a large, favourable loop that protrudes above the rest of the protein body. A single chain format of PG16 was used because the engineered inhibitor must be small enough to reach its target. Two antibody-inhibitor candidates were identified and have been expressed using Human Embryonic Kidney cells. They will be assayed for binding to gp41 and inhibition of HIV infection. If initial assays are positive, these single chain antibody-scaffolded inhibitors can be further modified to improve their functionality in vitro and in vivo.



# 2016 JUDGING CRITERIA INTERNATIONAL BIOGENEIUS CHALLENGE

### 1. Scientific Merit and Creative Ability

35%

In this section, judges will evaluate the project's overall relevance to the field of biotechnology as well as the originality and creativity demonstrated by the student in proposing and carrying out the project. Does the project show creative problem solving, analysis and interpretation of the data? Judges should also assess the level of science represented by the project, e.g. grade level, university level, etc.

-	Relevance to biotechnology	15%
-	Identify important problems and address solutions	10%
-	Originality and creativity	5%
-	Ingenuity	5%

### 2. Project Execution

35%

Judges should evaluate the project's design as an experiment or a demonstration of an application of biotechnology research. Also assess the scientific research skills shown by the student in carrying out the project. Evaluate the student's results in terms of data collection and analysis and the general validity of the conclusion reached.

	Project design	10%
-	Skill levels demonstrated	10%
_	Validity of conclusion	10%
_	Results: data collection and analysis	5%

### 3. Poster & Oral presentation

30%

The students' visual and oral presentation of their poster design, objectives and conclusion is an important part of the judging process. Assess the poster in terms of its clarity and layout in illustrating the science and techniques involved in the project. Assess the oral presentation in terms of the level of scientific knowledge demonstrated, the student's command of the scientific techniques involved and their ability to explain and defend their conclusions under questioning by the judges.

-	Ability to explain and defend purpose, procedure and conclusion	10%
-	Demonstration of scientific knowledge	10%
-	Command of techniques and skills	5%
-	Poster clarity and layout	5%







Johnny Fells, III New York, NY

Johnny Fells is a recent graduate of Columbia University in New York City with a B.S. in Industrial Engineering and including numerous internship activities with startup companies focused on strategy, consumer engagement, and operational efficiency. Johnny's affiliation with the BioGENEius program is almost as long as his university career! His research interests in high school spanned plant and mammalian biology. Like many BioGENEius finalists, Johnny has been recognized by others as well. In 2008, his plant sciences research in synseed technology, a highly promising tool for the management of certain plants that are difficult to propagate through conventional methods, earned him 1st place at the Georgia Science and Engineering Fair and the National Society of Black Engineers Pre-Collegiate Science Fair.

Additionally, he received 2nd place at the National Organization of the Professional Advancement of Black Chemists and Chemical Engineers Science Fair and was recognized as a finalist at the 2008 Intel ISEF.

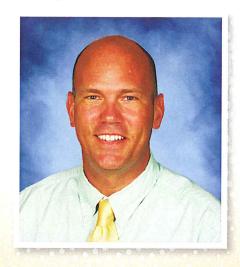
Johnny's interests in agricultural biotechnology led to an expansion of application in 2009, where at BioGENEius, he presented his research related to plants of the genus Scutellaria which constitute one of the common components of Eastern as well as traditional American medicine against various human diseases, including cancer. He discovered that certain leaf extracts from different species of Scutellaria could inhibit the Akt/PKB kinase pathway responsible for cell survival and growth in glioma cells. His work prefaced that of others now investigating novel small molecule derivatives as inhibitors of metastatic growth.

Although he is currently pursuing a career path on "Wall Street", he was indelibly inspired by his science mentors and his participation through BioGENEius at White House Science Fair - meeting President Barak Obama "who urged all students to show the potential of young minds and how the worlds can benefit". Since then, Johnny has dedicated his free time to engage, excite and inspire young researchers in biotechnology by acting as a science fair judge, student mentor, inspirational speaker and even granting special awards (his personal program) for students in less advantaged STEM educational environments. He exemplifies "giving back."

Johnny Fells has shown us that exposure to science has not only a long lasting personal effect, but also one that propagates and can continue to positively affect younger generations — the future leaders in biotechnology. So it is with great pleasure that we recognize Johnny with the **2016 BioGENEius Hall of Fame Award**.







Marc Pedersen
Paulding County High School
Dallas, GA

Marc Pedersen exemplifies the best of STEM teaching nationally from his position at the Paulding County High School in Dallas, Georgia where he covers it all from biotechnology to biology, chemistry, environmental science and AP physics. Marc has been recognized for his inspiring work with students as a 2016 Global Teacher Prize Nominee, a 2015 Presidential Award of Excellence in Science Teaching State Finalist, the 2015 Georgia Teacher of the Year Finalist and numerous Paulding County Teacher of the Year awards.

From Marc's firsthand experience in research spanning molecular biology, behavioral ecology and wildlife conservation, he has provided his students with the opportunity to collaborate with professionals and post-secondary institutions on experiential, graduate level project-based programs that prepare them for college and careers by utilizing technology to investigate real problems within their own county. He has worked collaboratively with Georgia Highlands College, Kennesaw State University, and Georgia Tech to provide them the best chances to explore their potential.

Marc encourages original research leading to publishable outcomes. Through his personal interests, he has exposed his students to mixing state-of-the-art molecular biology and genetic techniques to understand species dominance in invertebrate marine ecology. These efforts are reflected in the success of his students who have placed first in the Paulding Regional Science Fair, third in the Georgia Science and Engineering Fair and participated in the Siemens Math, Science and Technology Competition.

Those who recognize Marc describe him as making biotechnology "alive" for his students — constantly pushing himself to improve and expand on what he does to provide his students with the best of all possibilities for their academic and professional success. His peers recognize this but perhaps it is better summed up by his students: "he is the best teacher!"

So it is an honor to recognize Marc Pedersen with the 2016 BioGENEius Mentor of the Year Award.







### Abraham Lincoln High School San Francisco, CA (accepted by George Cachianes)

We would not have the quality of national talent at the BioGENEius Challenge were it not for the educational infrastructure and administrative dedication to excellence as exemplified by this year's BioSTEM Leader Awardee, Abraham Lincoln High School in San Francisco. Lincoln is a comprehensive public high school in San Francisco serving culturally diverse students from all areas of the city. Lincoln's Biotechnology Academy was founded in 1995. Over the past 20 years it has grown from one section of 30 students to 5 sections with more than 180 students. With a goal to encourage and enable students to pursue a career in science, the program emphasizes the applications, implications, and limitations of biotechnology. The program's success is evidenced by the many of Lincoln's graduates who are now employed by across the 1,800 Biotech companies within San Francisco region.

Since 2007 in particular, Lincoln has collaborated with the University of California San Francisco (UCSF) to enter the international Genetically Engineered Machine (iGEM) competition, held annually at MIT for undergraduates in the field of synthetic biology. In the past eight years, Lincoln has twice placed as a top five finalist and won numerous awards in various categories competing against teams from Stanford, Oxford, Harvard, Princeton, Cambridge, Brown, Cal Tech and over 150 other undergraduate research institutions from around the world.

With the significant support of Lincoln administration, George Cachianes has authored and taught this two-year program at the Biotechnology Academy since its inception. George has leveraged his 15 years of research experience at Columbia University, UCSF, Stanford, and Genentech, Inc. to develop scientifically literate individuals who understand how science, technology and society influence one another. Understanding both the promise and limitations of biotechnology, Lincoln students are able to use this knowledge in their everyday decision making based upon a substantial knowledge of facts, concepts, and process skills. The Biotechnology Academy at Lincoln is one of our leading national examples of STEM excellence, producing our future leaders in biotechnology.