



Dr. Eric Gaucher
Associate Professor
School of Biology
310 Ferst Dr.
Atlanta, GA 30332-0230 USA
Tel: 1-404-385-3265

February 25, 2014

To:
CETL Award Committee

Please accept this application in consideration for the CETL Education Partnership Award. I have been fortunate to conduct a number of different outreach activities for K-12 students and the general public since I joined our great institution in 2008. Although these experiences are reward enough, my application humbly seeks institute recognition for these efforts that extends the reach of Georgia Tech's hand into the community.

This application contains a description of the education and public outreach partnership between my group at Georgia Tech and teacher Janetta Greenwood at Dunwoody High School (Atlanta). The following people have provided letters of support on our behalf:

Prof. Terry Snell (Chair, GT School of Biology)
Dr. Jamila Cola (Research Scientist, GT Center for Education, Integrating Science Math and Computing)
Noel Maloof (Principle of Dunwoody High School, Atlanta, GA)

This application also contains examples of the posters presented by Dunwoody High School students that have won 1st Place in Dekalb County Science Fairs in 2012 and 2013, as well as statements from the constituencies associated with the partnership:

A handwritten signature in blue ink, appearing to read "Ryan Randall".

Ms. Ryan Randall (former GT Master's student, current Research Coordinator II in Gaucher lab)

A handwritten signature in blue ink, appearing to read "Janetta Greenwood".

Mrs. Janetta Greenwood (Science Teacher, Dunwoody High School, Atlanta)

A handwritten signature in blue ink, appearing to read "Eric Gaucher".

Eric Gaucher (Associate Professor, School of Biology, Georgia Tech)

Thank you for considering this partnership for a prestigious CETL award.

Sincerely,
Eric Gaucher

Education Partnership Award (Eric Gaucher, Ryan Randall, Jenetta Greenwood)

I have participated in a variety of education and public outreach (EPO) activities since arriving at the Institute in the fall of 2008. The majority of our EPO efforts have focused on research experiences for high school students at Dunwoody High School. This effort consists of two phases each year. For the first phase, conducted during the winter semester, my graduate students and I travel to Dunwoody to guide the research direction of Mrs. Jenetta Greenwood's upperclass Biotechnology class. This class focuses on a STEM theme and is composed of mostly underrepresented minorities and/or female students selected by Mrs. Greenwood. These students conduct scientific laboratory research for the entire semester and do this nearly independently after we spend the first month teaching them experimental techniques. For the second phase, starting in the summer, two or three students are selected to continue independent research in my laboratory at Georgia Tech for the summer. These students come to lab every weekday to conduct experiments on a project of their choosing and often work 8-10 hours per day. The experiments attempt to address a hypothesis that the students use for competition in the National Siemens Competition in Math, Science & Technology.

Although the specific details of the research these students conduct varies from year to year, we made a video of our Dunwoody classroom experience for one of the many years of our partnership that showcases the general science theme and dynamics between Georgia Tech and the students at Dunwoody:

<http://www.youtube.com/watch?v=n5XIrKmk-1g>

For the students selected to conduct independent research in my laboratory, each year they participant in the Siemens competition (highest rank: **Semifinalists**) and the State of Georgia Science Fair (highest rank: **County winners, State Finalists**). This participation highlights the high caliber of research these students conduct and is reflected in their presentations:

2011: Siemens Semifinalists, Dekalb County Science Fair participants

2012: Siemens participants, 1st Place Winner of Dekalb County Science Fair, State of Georgia Science Fair participant

2013: Siemens participants, 1st Place Winner of Dekalb County Science Fair, attending State of Georgia Science Fair in spring 2014

We have also presented our research for the general public at two highly attended venues. The first was for the [Atlanta Science Tavern](#) that focused on how early life on Earth evolved and the other was for the [Science Café @ Atlanta Botanical Gardens](#) that discussed ancient life and how advances in biotechnology help us understand how life adapts.

Radio interview of my graduate student and I about our research and EPO efforts for Georgia Public Broadcasting

<feed://sciencecafe.podbean.com/feed/>

The following is a list of GIFT Teachers and GT SURE students that have been hosted by the Gaucher group. The GIFT program provides K-12 teachers with an opportunity to do an internship during the summer with a professor at Georgia Tech. Each of the GIFT teachers listed below worked full-time in my group over the summer months.

Year	First	Last	Position	School	County	Affiliation
2011	Janetta	Greenwood	Science K-12 Teacher	Dunwoody HS	Dekalb	Gaucher hosted for 2011 astrobio summer camp
	Deanna	Boyd	Science K-12 Teacher	Ronald E. McNair Middle School	Fulton	Gaucher/Williams hosted for 2012 astrobio summer camp
	Aakanksha	Angra	Undergrad PT-SURE Student	Georgia Tech	Fulton	Gaucher hosted for 2011 astrobio summer camp
2012	Janetta	Greenwood	Science K-12 Teacher	Dunwoody HS	Dekalb	Gaucher hosted for 2012 astrobio summer camp
	Claire	Zimmerman	Art K-12 Teacher	Dunwoody HS	Dekalb	Gaucher/Williams hosted for 2012 astrobio summer camp
	Tanya	Mason	Science K-12 Teacher	Arabia Mountain HS	Dekalb	Gaucher/Williams hosted for 2012 astrobio summer camp
	Deanna	Boyd	Science K-12 Teacher	Ronald E. McNair Middle School	Fulton	Gaucher/Williams hosted for 2012 astrobio summer camp
2013	Janetta	Greenwood	Science K-12 Teacher	Dunwoody HS	Dekalb	Gaucher hosted for 2012 NSF GIFT

The eight Dunwoody students I hosted in my laboratory and their current status

Year : Project	First	Last	Position	Grade	College Attended
2011 Summer: Engineering Fluorescent Proteins for Biotechnology	Dionne	McKenzie	Siemens	12th	Georgia Tech
	Kristen	Ingram	Siemens	10th	TBD
2011 Fall	Dionne	McKenzie	Gaucher Intern	12th	Georgia Tech
	Angela	Pham	Gaucher Intern	12th	Georgia State University
2012 Summer: Fluorescent Proteins - A Possible Biological Sunscreen	Penny	Kahn	Siemens	12th	Macalester College
	Kayla	Arroyo	Siemens	12th	Spelman College
	Kristen	Ingram	Siemens	11th	TBD
2012 Fall	Penny	Kahn	Gaucher Intern	12th	Macalester College
	Kayla	Arroyo	Gaucher Intern	12th	Spelman College
2013 Summer: Reestablishing Ancestral Bimolecular Phenotype	Sandra	Amacher	Siemens	12th	Auburn University
	Darsy	Rameriz	Siemens	12th	TBD
2013 Fall	Sandra	Amacher	Gaucher Intern	12th	Auburn University
	Darsy	Rameriz	Gaucher Intern	12th	TBD
	Saakya	Peechara	Gaucher Intern	12th	TBD

Co-teach Applications of Biotechnology class at Dunwoody High School in conjunction with Mrs. Janetta Greenwood.

Year	Class Size	Position	School	Grade
Spring 2012	17 students	Co-Taught Applications of Biotechnology	Dunwoody HS	11-12th
Spring 2013	12 students	Co-Taught Applications of Biotechnology	Dunwoody HS	11-12th

Spring 2014	9 students	Co-Teaching Applications of Biotechnology	Dunwoody HS	11-12th
Spring 2015	25 students	Co-Teaching Applications of Biotechnology	Dunwoody HS	11-12th

These EPO efforts have provided amazing experiences for my career, both professionally and personally. Teaching high school students in the classroom is an exciting experience because students at that age are so eager to absorb, digest and process information as they prepare for the transition to college. And, it is apparent that these students feel special that a Georgia Tech professor comes to guide their lab experiments at school. Unlike college students, these high school students are so vibrant and energetic, and this energy is infectious. My graduate students and I invariably return from our visits to Dunwoody with a rekindled energy for research that is spread among the group. In this sense, our visits to Dunwoody provide a psychological and sociological benefit for my group that is not otherwise possible.

The high school students selected to conduct research in my lab at Georgia Tech represent a balance between self-motivated, precocious students versus students that are less focused but that we feel would benefit from more structure in their lives. I have been fortunate to witness the development of both of these types of students. The former students clearly appreciate the research experience and use it as a stepping-stone to conduct research in college. These students have also been able to highlight their research experiences when applying for (and receiving) scholarships and awards in college.

The latter students also clearly appreciate the experience, but they tend to extract different lessons from the experience. These students learn more lessons about life such as dedication, commitment, and critical-thinking skills that the former students often already possess. Seeing both of these types of students appreciate their experiences is truly rewarding for me (and productive for my group).

Our partnership with Mrs. Greenwood's students at Dunwoody was initiated in 2011, and has taken place for every year thereafter. As we gear up for our 2014 partnership, this will mark the fourth iteration of students, and with each year, our program gets stronger and broader. After each year, we assess the strengths and weaknesses of our program not only among the students but also in consultation with the students after they begin their studies in college and can reflect upon their experiences.

In summary, I am certain that my career is substantially more gratifying because I participate in these education and public outreach activities. I am also certain that these high school students greatly appreciate their experiences, and that the role Georgia Tech plays in the community is expanded by our efforts with these students.

Thank you for your consideration.

Noel L. Maloof
Principal



Michael Thurmond
Superintendent

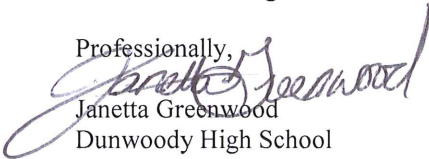
Dunwoody High School
5035 Vermack Drive
Dunwoody, GA 30338-4626
678-874-8502

The Biotechnology Student Research Program is a program designed for 11th and 12th grade students that “transforms” scientific knowledge into practice. Approximately 10-20 students are serviced each year through this collaboration with Dr. Eric Gaucher and Ryan Randall. This partnership addresses the need to increase females and minorities’ in science by providing opportunities to learn science through hands on activities that replicates authentic research taking place at Georgia Tech University. As part of the new statewide initiative of increasing student exposure to STEM based careers and content, the Biotechnology Student Research Program works to provide students with opportunities to intern in Dr. Gaucher’s lab and/or conduct their own research project at Dunwoody High School with guidance, direction and support from Dr. Gaucher and his Research Coordinator, Ryan Randall. Currently the Georgia Department of Education has a new mandate that promotes college and career readiness for all students. The expectation is to ensure that students graduate from high school with both rigorous content knowledge and the ability to apply knowledge gained. The partnership that has been developed with Dr. Gaucher and Ms. Randall fully embraces both of these initiatives.

I met Dr. Gaucher and Ms. Randall in the summer of 2010 as a Georgia Intern Fellowship for Teachers (GIFT) Fellow. Through the GIFT program, I have developed a strong and productive relationship with Dr. Gaucher and Ms. Randall. Over the past four years Dr. Gaucher and Ms. Randall has worked collaboratively with me to 1) Design authentic research based experiments for my high school Biotechnology and Scientific Research classes, 2) Sponsor high school student interns to work in his lab during the summer and fall semesters for high school course credit. 3) Mentor high school student’s SIEMENS and Science Fair Projects. 4) Co-instruct my Scientific Research course by making special appearances to lead lessons and teach content aimed towards their research projects. 5) Provide supplies and resources to my students and classes in order to conduct high level research projects that otherwise would be unaffordable for a typical high school classroom. 6) Create activities and co-instruct a week-long Astrobiology camp for high school students.

Dr. Gaucher’s and Ms. Randall’s work with my students is highlighted by the fact that over the past four years the teams of students that they have mentored were selected as Regional Semi-finalist in the National Siemens competition as well as Regional and State Science Fair Award recipients. Also several students that previously had not considered science as a viable option for a career or college major are currently enrolled in college as science majors and participating in research labs as interns. This is definitely as a result of Dr. Gaucher’s and Ms. Randall’s mentorship and influence. Dr. Gaucher and Ms. Randall’s full support and commitment to decreasing the achievement gap among under-served youth and minorities in science is ever present and highly impressive. They understands the need to expose more females and minorities to STEM based careers and work very hard to ensure that their experiences working in the Gaucher lab or participating in research projects are rewarding, educational, and fun. The various experiences that Dr. Gaucher and Ms. Randall has made possible for my students have enriched their academic performance, curiosity, and exposure to research at a level that has better prepared them for the college as they move forward in their educational quests.

It is my hope that the committee recognizes the impact that Dr. Gaucher and Ms. Randall have had on K-12 education. They are excellent role models to others on how to commit to educational outreach to improve science education in Georgia and enrich the lives of young students by exposing them to research-inspired experiences.

Professionally,

Janetta Greenwood
Dunwoody High School

Ryan Randall Statement for Education Partnership Award

The partnership between Prof. Gaucher, Mrs. Janetta Greenwood, and I has allowed us to implement a year round K-12 outreach program that is ultimately rewarding for all members involved. My primary role in this trifold partnership is to implement the direct connection between our laboratory at Georgia Tech and the K-12 community, as well as the process design for our various outreach activities.

Prof. Gaucher first told me about an exciting outreach opportunity while I was a M.S. thesis research student in his laboratory in the summer of 2011. Mrs. Janetta Greenwood had approached Prof. Gaucher to host two high school students for a Siemens competition research project in our laboratory. Right away, we developed a Siemens research project theme as a spin-off to my own thesis research. I then mentored, supervised, and trained the students in the laboratory for the six weeks that followed.

After the successful implementation and completion of the project, the partnership agreed to push the collaboration further, whereby our lab would offer an internship to selected high school students for the fall semester. In this semester-long internship, I supervised the students and assigned their day-to-day experiments.

In yet again, another successful semester, we again pushed the collaboration even further, to begin what is now a year round effort of spring, summer and fall outreach programs between Dunwoody high school and the Gaucher lab. The spring project is by far the most innovative, whereby Prof. Gaucher and I develop a research project for a senior biotechnology class taught by Mrs. Greenwood. We then travel to Dunwoody high school during the spring period, where I lecture, create lesson plans, bring materials and supplies, and advise the students in their experimental work.

I owe an enormous amount of gratitude to Prof. Gaucher and Mrs. Greenwood for presenting me with the opportunity to reach a broader range of students. Collaborating with the K-12 community at the research level has proven more rewarding than I could have ever imagined. I have been able to introduce my cutting-edge thesis work (work that I am truly passionate about) into the young science community and I have learned new perspectives about research, learning, teaching and mentoring. I have established mentor/mentee relationships with many students outside of our time together. I serve as an advisor and as a confidante to help them in other aspects in their lives, whether it be applying to colleges, looking over their science papers, or supplying letters of support for internship applications after they've graduated high school.

This partnership has also improved my leadership and communication skills and advanced my career. Upon graduating, Prof. Gaucher offered me the position of Research Coordinator II, whereby a large role is to lead the lab's outreach efforts. This partnership has also allowed me to gain leadership skills that help me mentor undergraduate students in the laboratory at Georgia Tech.

Sincerely,



Ryan Randall
Research Coordinator II (Prof. Gaucher Lab)
Georgia Institute of Technology



Dr. Eric Gaucher
Associate Professor
School of Biology
310 Ferst Dr.
Atlanta, GA 30332-0230 USA
Tel: 1-404-385-3265

February 24, 2014

CETL Committee

Dear Selection Committee:

This letter serves to confirm Ms. Ryan Randall's leadership and participation in the education and public outreach partnership that exists between my research group at Georgia Tech and Mrs. Janetta Greenwood's students from Dunwoody High School in Atlanta. Ryan has played an instrumental role in initiating and sustaining this partnership over the years as she has transitioned from graduate student to Research Coordinator II in my group.

Ryan is the glue of our Dunwoody partnership. Her dedication and commitment to helping these high school students is inspiring. Ryan commits a substantial portion of her Spring Semesters for traveling to Dunwoody to teach Mrs. Greenwood's students in the concepts and practices of molecular biology and biotechnology. Ryan teaches using an ideal balance of classroom lecture with hands-on laboratory experiments. I have found over the years that the high school students are typically more comfortable with Ryan (compared to me) because she is closer in age to the students. This closeness helps to remove barriers that otherwise prevent students from fully absorbing the teaching material. Ryan is keenly aware of this and exploits it in order to help the students learn as much information as possible.

During the remainder of the year, Ryan serves as the research advisor for the students that come to my lab to conduct independent research. This requires that Ryan is available and willing to answer questions anytime the high school students need help understanding a concept of their work or to help with experimental protocols and laboratory equipment. These young students learn how to formulate scientific hypotheses with Ryan, how to test their hypotheses and interpret data, how to troubleshoot their results, and how to convey their results to the general public using written reports and scientific posters. These students are often rewarded by placing in county and/or state science fairs.

Ryan displays a great deal of patience with our high school students. Her levelheadedness and command of the research provide a perfect balance for letting students discover on their own yet also subtly steering them down particular paths of learning success. Ryan has committed a great deal of her time and effort into shaping the minds of underrepresented and/or female students in Atlanta. This commitment should be acknowledged, not only for past successes, but also for helping to establish a collaboration that will bear fruit for years to come.

Thank you for your consideration.

Sincerely,

A handwritten signature in blue ink, appearing to read "Eric Gaucher".

Eric Gaucher

Noel L. Maloof
Principal



Michael Thurmond
Superintendent

Dunwoody High School
5035 Vermack Drive
Dunwoody, GA 30338-4626
678-874-8502

January 28, 2014

To Whom It May Concern:

This letter is written to express my strong support of Dr. Eric Gaucher for the Georgia Tech Center for the Enhancement of Teaching and Learning Faculty Award for Academic Outreach. I have had the pleasure of collaborating and observing Dr. Gaucher's outreach activities over the past four years. As a stakeholder in K-12 education, it is refreshing to witness a post-secondary educator dedicate his time and knowledge towards the advancement of science education with our youth outside of the traditional educational setting. As a science teacher, I fully appreciate the importance of presenting science opportunities to our students to help inspire them to pursue science careers.

I met Dr. Gaucher in the summer of 2010 as a Georgia Intern Fellowship for Teachers (GIFT) Fellow. Through the GIFT program, I have developed a strong and productive relationship with Dr. Gaucher and members of his research lab. Over the past four years Dr. Gaucher has worked collaboratively with me to 1) Design authentic research based experiments for my high school Biotechnology and Scientific Research classes, 2) Sponsor high school student interns to work in his lab during the summer and fall semesters for high school course credit. 3) Mentor high school student's SIEMENS and Science Fair Projects. 4) Co-instruct my Scientific Research course by making special appearances to lead lessons and teach content aimed towards their research projects. 5) Provide supplies and resources to my students and classes in order to conduct high level research projects that otherwise would be unaffordable for a typical high school classroom. 6) Create activities and co-instruct a week-long Astrobiology camp for high school students.

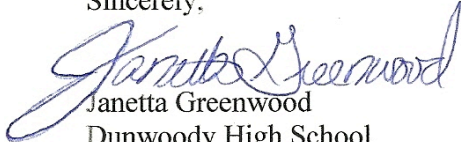
Dr. Gaucher's work with my students is highlighted by the fact that over the past four years the teams of students that he has mentored were selected as Regional Semi-finalist in the National Siemens competition as well as Regional and State Science Fair Award recipients. His full support and commitment to decreasing the achievement gap among under-served youth and minorities in science is ever present and highly impressive. He understands the need to expose more females and minorities to STEM based careers and works very hard to ensure that their experiences working in his lab or participating in research projects are rewarding, educational, and fun. The various experiences that he has made possible for my students have enriched their

"The School Cannot Live Apart From The Community"
www.dekalb.k12.ga.us

academic performance, curiosity, and exposure to research at a level that has better prepared them for the college as they move forward in their educational quests.

It is my hope that the committee recognizes the impact that Dr. Gaucher has had on K-12 education. He is an excellent role model to other professors on how to commit to educational outreach to improve science education in Georgia and enrich the lives of young students by exposing them to research-inspired experiences. Because of his outstanding commitment to educational outreach and to increasing student excitement and engagement in science, I fully endorse Dr. Eric Gaucher's nomination for this award with confidence and enthusiasm.

Sincerely,

A handwritten signature in blue ink that reads "Janetta Greenwood". The signature is fluid and cursive, with the first name being more prominent.

Janetta Greenwood
Dunwoody High School
Biology/Biotechnology Instructor
Teacher Effectiveness District Facilitator

February 3, 2014

CETL Awards Selection Committee

To Whom It May Concern:

It is my honor to support Prof. Eric Gaucher's application in consideration for CETL's Education Partnership Award. As Eric's chair, I am familiar with his outreach program and I have had the opportunity to work with Eric on K-12 activities. Eric is an exemplar faculty member for his outreach efforts and he is a motivation to both junior and senior faculty in the School of Biology.

I first worked with Eric when he served as co-leader of an Astrobiology camp for high school students hosted each summer for one week on GT campus. This camp enrolled 25 students from all over Atlanta and used hands-on experiments to teach students about NASA's past and current space exploration missions. One goal of the camp was to have local high school teachers direct the daily activities of the Astrobiology camp. This required that Eric, Prof. Loren Williams and myself host these GIFT educators prior to the start of each camp so the teachers themselves could learn the experiments. Eric was highly motivated and passionate about directing the high school teachers and making sure they knew all the details of each experiment and how they related to NASA missions. Eric also provided a leadership role by coordinating the efforts of all the high school teachers and the GT undergraduate SURE students that also participated in the camp. Once the GIFT teachers and SURE students were trained, Eric attended the camp every day to give lectures and oversee the general running of the camp. For the most part, things went smoothly in the camp. But when they did not, Eric was quick to assess the situation and modify the program as needed. Eric and his group went above and beyond the call of duty to make sure the high school students extracted as much from the camp as possible, and that the teachers could return to their respective schools and integrate the camp experiments into their own academic curriculums.

I am also familiar with Eric's other outreach activities despite not being directly involved with them. Eric works with Dunwoody science teacher Janetta Greenwood, whom I first met through our Astrobiology camp. Eric has over the years, in essence, ended up adopting Mrs. Greenwood's class in order to give them a more cutting-edge research experience than they would otherwise get using standard high school protocols. Eric devotes a substantial amount of time and effort into his collaboration with the Dunwoody students. In conversations with Eric and Mrs. Greenwood, they both get energetic and rewarding experiences from their partnership.

I cannot think of a more deserving recipient of the CETL's Education Partnership Award than Eric. He has committed more time and effort to K-12 outreach than any other faculty

in my School over the past few years. And because of this, Eric's career seems to be richer and more fulfilling than other faculty that participate less in outreach. Eric's outreach not only benefits him and his students, but also the School of Biology and the Institute as a whole. As one example benefit, I am able to loop his Dunwoody outreach video on the monitors that are displayed throughout the School in order to showcase our activities.

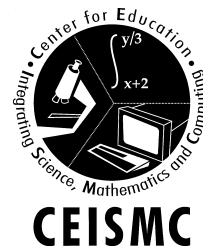
Sincerely,

A handwritten signature in black ink that reads "Terry W. Snell". The signature is written in a cursive style with a prominent flourish at the beginning of the first name.

Terry W. Snell



Center for Education Integrating Science,
Mathematics and Computing
Atlanta, Georgia 30308-1132
PHONE 404-894-0777
FAX 404-894-9675
<http://www.ceismc.gatech.edu>



February 3, 2014

To: CETL Award Committee

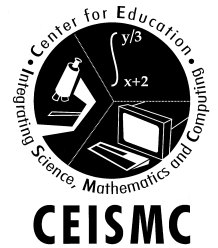
Dear Sir or Madam:

I cannot image anyone more deserving of the Georgia Tech Faculty Award for Academic Outreach than Dr. Eric Gaucher. I am writing this letter in strong support for Prof. Gaucher's collaborative and innovative K-12 outreach programs. I met Eric in 2009 while planning an Astrobiology: Life on the Edge summer camp funded by the GT NASA Astrobiology Institute Center for Ribosomal Origins and Evolution. Along with myself and Prof. Loren Williams in Chemistry (and past recipient of this CETL award), Eric was a co-leader of Georgia Tech's one-week summer research experience for local high school students that ran for four consecutive summers. **He played an instrumental role in developing a problem-based curriculum for the astrobiology camp.** Over the past 5 years, Dr. Gaucher has mentored and trained GIFT teachers and Georgia Tech pre-teaching SURE student while developing curriculum for the summer learning program. **He has also worked to make his research available to the public by making astrobiology educational videos for an online astrobiology short course on the NASA electronic professional development network. He also participated in a PBS video on the Origins of Life.** Dr. Gaucher has always shown a level of passion for teaching and mentoring rarely seen by institute faculty. He was hands-on, patient, and thoughtful with each GIFT teacher and SURE student in his lab. Every teacher or student hosted by his lab would say they had the best summer due to the hands-on mentoring, guidance, lab training, and depth of knowledge gained from their summer experience.

As if the above is not reason enough to recognize Dr. Gaucher for his commitment to training K-12 students, Dr. Gaucher and I **initiated a collaboration between his group at Georgia Tech and Mrs. Janetta Greenwood's Applications of Biotechnology classes at Dunwoody High School in DeKalb County.** Since 2011, Dr. Gaucher and Mrs. Greenwood have worked closely to develop a curriculum that meets numerous Georgia Performance Standards. For part of the year, **Dr. Gaucher and one of his students travel to Dunwoody once a week to assist and co-teach Mrs. Greenwood's biotechnology class.** For the other part of the year, **selected students from Mrs. Greenwood's class conduct science experiments in his lab. He has hosted 14 high school students since 2011. These students are selected based on their academic achievements and diversity. Because of this criteria, he has exposed traditionally underrepresented minorities and women to molecular biology, evolutionary synthetic biology and comparative genomics research. His high school summer researchers have gone on to continue their education at Spelman College, Georgia Tech, Georgia State University, Macalester College, and Auburn University.** Three groups of students have entered into the Siemens Competition and one group became a finalist. They have worked on Engineering Fluorescent Proteins for Biotechnology and Biological Sunscreens, and Reestablishing Ancestral Bimolecular Phenotype. Not only do these students get exposed to science research, they also learn valuable lessons for college such as resolve, critical-thinking, group dynamics, and problem-solving. The level of commitment that



Center for Education Integrating Science,
Mathematics and Computing
Atlanta, Georgia 30308-1132
PHONE 404-894-0777
FAX 404-894-9675
<http://www.ceismc.gatech.edu>



these students display is truly amazing. All of the students that intern in Dr. Gaucher's lab take the MARTA train from Dunwoody to campus each day during the entire summer and at least once a week during the fall semester. This clearly demonstrates the passion that these students have for the research experience in Dr. Gaucher's lab.

Dr. Gaucher has built upon his passion for teaching and expanding astrobiology and evolutionary biology to the public while performing ground-breaking research and instilling the importance of K-12 public outreach to his research group. It is evident that Dr. Gaucher would be a great recipient of the Georgia Tech Faculty Award for Academic Outreach. I hope that this letter conveys in part the recognition that Eric deserves for his dedication to K-12 educational and research experiences. We greatly value his dedicated academic outreach efforts and I hope you will too.

Sincerely,

A handwritten signature in cursive script that reads "Jamila Cola".

Jamila Cola, Ph.D.
Research Scientist II, CEISM

Noel Maloof
Principal



Michael Thurmond
Superintendent

Dunwoody High School
5035 Vermack Road
Dunwoody, GA 30338
678-874-8502

To Whom It May Concern:

I am writing a letter of support for the collaborative educational partnership of Mrs. Janetta Greenwood at Dunwoody High School and Dr. Eric Gaucher at Georgia Tech. I have observed Mrs. Greenwood's student as they embark on research during their second semester Biotechnology course. The students work in collaboration with Dr. Gaucher and Ryan Randall to develop research projects. Dr. Gaucher and Ms. Randall provide hands on guidance and mentor students to conduct authentic research. During the summer and fall semester a select group of these students participate in an internship supported using Dr. Gaucher's laboratory under the supervision of Mrs. Greenwood and Ms. Randall.

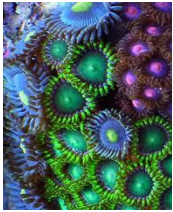
The experience has caused these students to become junior researchers and their laboratory and research skills have expanded beyond that of a high school student. As the principal of Dunwoody High School, I support Mrs. Greenwood's efforts to provide avenues of opportunity that support our STEM grant and increasing the number of students that earn a CCRPI pathway. STEM has been used to encourage teachers to provide their students with opportunities for rigor and self-discovery. This collaborative effort provides this opportunity for an increased number of students each year. With the support of this partnership award more students can benefit from this collaboration.

Dr. Gaucher and Mrs. Greenwood have embraced the vision of the science department to increase the numbers of underrepresented minorities in science. An emphasis at Dunwoody High School is placed on increasing the number of females and ethnic minorities in science. Mrs. Greenwood current initiatives have provided the opportunity for students that were not considering science as a possible career to change their position and are working towards becoming future scientist. Students' under Mrs. Greenwood's and Dr. Gaucher's mentorship have gained research opportunities beyond their expectations both professionally and academically.

It is an honor to fully support the partnership of Mrs. Greenwood and Dr. Gaucher to continue their efforts to increase the number of scientists in the future.

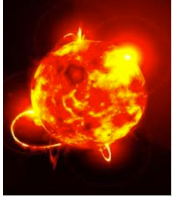
Professionally,


Mr. Noel Maloof



Fluorescent Proteins: A Possible Biological Sunscreen

Penelope C. Kahn, Kayla Ruby Arroyo, and Kristen O. Ingram, Dunwoody High School, Dunwoody, GA
 Dr. Eric Gaucher, Ryan Randall, Georgia Institute of Technology, Atlanta, GA



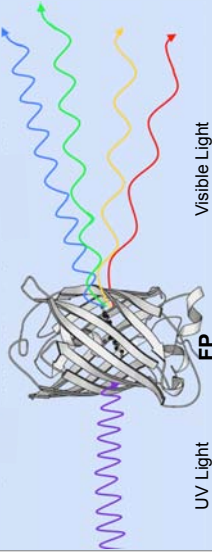
Introduction

Corals and other organisms naturally produce a wide variety of different colored fluorescent proteins (FPs). Despite their abundant destructions in organisms, scientists have not elucidated their biological role.

Theories suggests that FPs possibly function as antioxidants, a source for photosynthesis, or an endogenous 'sunscreen.'

Fluorescent Proteins

FPs are unique in their ability to absorb UV light, and then emit light back out in the visible spectrum.

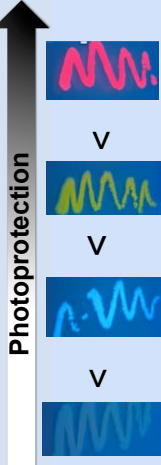


Purpose and Hypothesis

To determine the possible photoprotective properties of a variety of propose FP colors.



To test this, we have inserted FP genes derived from coral into bacteria and exposed the bacteria to damaging UV light.



Methods



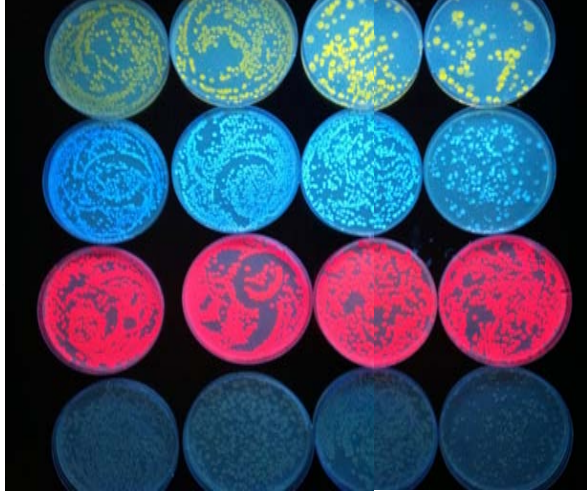
•**Transformation:** FP genes were inserted into competent *E. coli* cells.

•**Protein Induction:** A single colony of *E. coli* harboring a FP gene was cultured and induced.

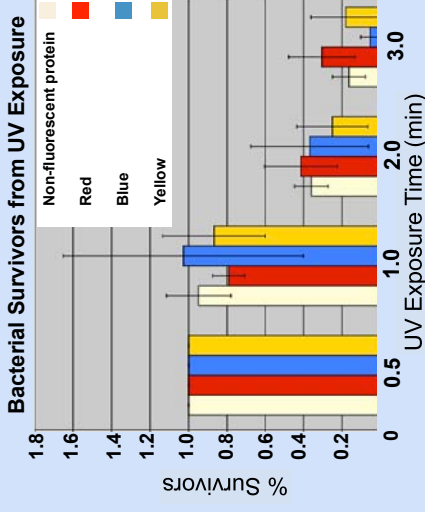


•**UV Exposure:** Pellets of the cultures were exposed to UV at different time intervals and then spread on a culture dish to determine survivability.

Data



Results



* Results are an average of three experimental trials

Conclusion and Future Work

- The red FP shows photoprotective qualities when expressed in *E. coli* cells. *E. coli* containing red FPs have a higher survival rate when compared to a non-fluorescent protein which we assumed to not have photoprotective qualities.
- There is no significant evidence that yellow and blue FPs provide photoprotection.
- Further research of coral fluorescent protein function would include investigating the theories previously stated as well as future exploration of their photoprotective function.

Acknowledgements

This research was made possible using the laboratory of Dr. Eric Gaucher with the supervision of Ryan Randall. This research was sponsored by Georgia Institute of Technology, GIFT, CEISMC, NSF, SIEMENS, and affiliated corporate and academic sponsors.

Reestablishing Ancient Biomolecular Phenotype

Sandra Allison Amacher, Darsy Ramirez, Dunwoody High School
Dr. Eric Gaucher, Georgia Institute of Technology

Introduction

Proteins carry out essentially all of the biomolecular functions of life. Proteins are encoded by DNA and remarkably only about 1-2% of the human genome codes for functional proteins (21,000 genes in total). Of the remaining 98% of the genome, a small percent is composed of fragments of DNA called pseudogenes.

PSEUDOGENES = NON-FUNCTIONAL GENES

Research has shown that pseudogenes were once actually functional, but have since acquired mutations throughout evolutionary history, rendering them to now be nonfunctional. A gene becomes a pseudogene when it is no longer required for an organism's survival.

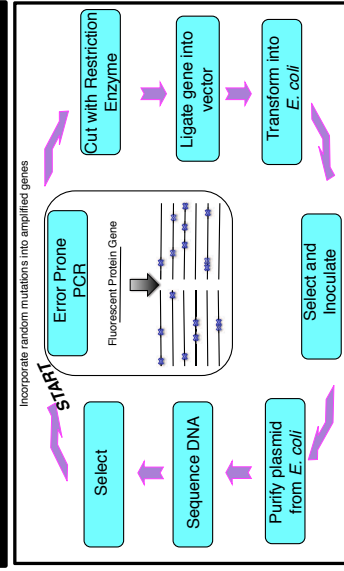
HOW DO PSEUDOGENES EVOLVE TO BECOME FUNCTIONAL AGAIN?

This begs the questions: Can we use pseudogenes as a way to evolve new functionality? Can we reactivate dead pseudogenes? If it is possible to reactivate pseudogenes, it may be incredibly advantageous for humankind's ability to survive in a changing world. For example, our human ancestors used to produce an enzyme that catalyzed vitamin C, but when these ancestors began eating citrus fruits, it was no longer imperative for them to produce Vitamin C. As a result, the gene encoding this enzyme became a pseudogene. BUT, what if one day we needed this gene again? Could we simply turn the gene back on and voila, humans no longer have to eat fruit. This idea has been discussed in the scientific community but, until now, nobody has directly tested this hypothesis.

PURPOSE: Determine how genes evolve in order to restore pseudogene function using green fluorescent protein (GFP) and monomeric red fluorescent protein (mRFP) as model genes.



Methods



Data

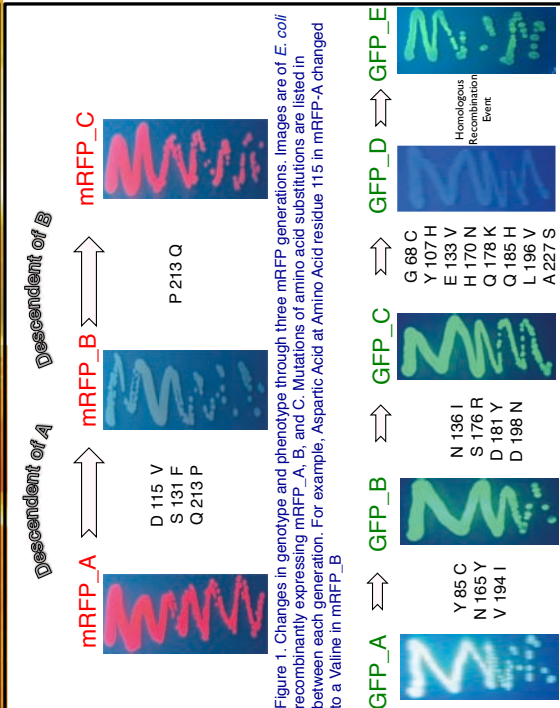


Figure 1. Changes in genotype and phenotype through three mRFP generations. Images are of *E. coli* recombinantly expressing mRFP_A, B, and C. Mutations of amino acid substitutions are listed in between each generation. For example, Aspartic Acid at Amino Acid residue 115 in mRFP-A changed to a Valine in mRFP_B.

Figure 2. Changes in genotype and phenotype through five GFP generations. Images are of *E. coli* recombinantly expressing GFP_A, B, C, D, E1 and E2. Mutations of amino acid substitutions are listed in between each generation.

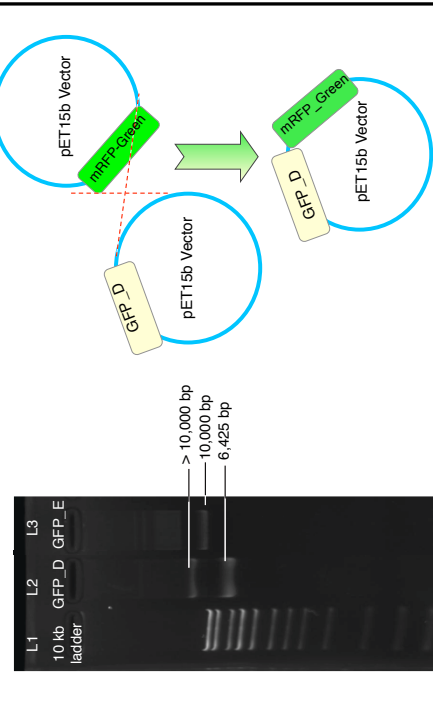


Figure 3. DNA run on 1% TBE agarose Ethidium Bromide Gel. Image contains a 10 kb ladder in Lane 1 (L1) and the purified plasmids of GFP_D (L2), GFP_E (L3). Band at > 10,000 bp represents genomic DNA. Band at 6,425 bp represents pET15B_Vector (at 5,708 bp) with GFP_D (717 bp). Lane 3 containing 10,000 bp band represents a fused mRFP_Green vector with GFP_D vector, resulting from a recombination event.

Discussion

The number of generations and mutations to turn the mRFP and GFP genes on and off were different.

The mRFP gene rapidly lost and regained its function (refer to Figures 1 and 5). mRFP_A acquired three amino acid substitutions, rendering the non-functional protein mRFP_B. The mRFP_B pseudogene regained its ancestral phenotype through one amino acid substitution reversion, P 213 Q.

The GFP gene lost its function through four generations and 15 amino acid substitutions (refer to Figures 2 and 5). A novel mutational event occurred to reestablish green function in GFP_E. Sequence data reveal that the GFP_E and GFP_D genes are identical. This means that GFP_E still contains the nonfunctional GFP_D gene.

So, what gives GFP_E its color? GFP_E contains another fluorescent protein (FP) on its plasmid. This additional FP is a green fluorescing mRFP variant. At some point in the methodology, mRFP_Green was exposed to the GFP lineage and recombinantly combined within the GFP_E generation, evolving into a novel functional plasmid (Refer to Figures 3 and 4).

CONCLUSION
Reestablishing ancient biomolecular phenotypes is accomplished through reversion mutations and through homologous recombination events with surrounding environmental DNA.

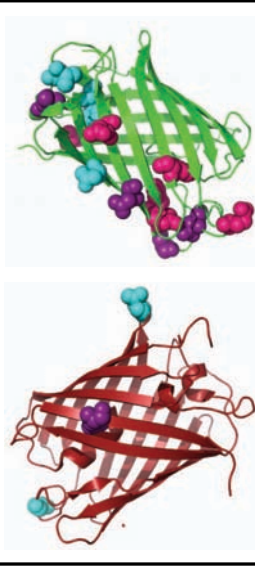


Figure 5. Image on left: mRFP_A protein structure with mutations in B highlighted in light blue and mutation from C in purple. Image on right: GFP_A protein structure with mutations from generation B in light blue, C in purple, and D in fuchsia. Images created on PyMol.

Future Works

There are several further applications in which this research could be applied. One application would be to use the knowledge to gain better understanding of how species evolved. Another continuation would be to try to reactivate human pseudogenes, such as the vitamin C pseudogene. The main priority is to fully understand what is going on with GFP. To understand the specifics of the homologous recombination event.

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