CUNY | Research Scholars Program

2020 Virtual Symposium

Monday July 27
Wednesday July 29
Monday August 3

Dear CRSP Community,

Welcome to the sixth annual Research Scholars Program (CRSP) symposium!

CRSP funds year-long research experiences for associate degree students at all seven of CUNY's community colleges and three comprehensive schools. More than 1,300 students have participated in the program over the past six years. At least 850 have graduated and transferred to other CUNY colleges and beyond, including Columbia, the University of Michigan, Cornell, and MIT. Many of the program's alumni are now in graduate programs across the country.

This year has brought many challenges for participants in the program. As the Covid-19 pandemic led CUNY to shut down its colleges, research projects across the University were disrupted. Both students and mentors responded with innovativeness and extraordinary resilience. This year's 143 mentors have informed us that all but eight of the 220 CRSP projects were able to continue in a virtual format. Many directors and mentors used this occasion to provide their students with deep exposure to the scientific literature and to cultivate their scientific writing skills. Other mentors devised simulations of their laboratory research. LaGuardia Community College held a "town hall" in which several mentors answered students' questions about Covid-19 and discussed the vital importance of research during a public health crisis.

As you will see during the symposium, CRSP students responded to the crisis by rolling up their sleeves and getting to work. Despite the challenges of converting from live to virtual environments, they consulted with their mentors, moved forward with their data collection, computations, and literature reviews, and producedthe presentations we will view during the symposium. They have set an example for the next cohort of students.

The New York City Mayor's office funds the program and we are especially grateful to Mayor Bill de Blasio for his generous support.

The success of the program relies on the college directors (see page v). The directors facilitate every aspect of the program. They recruit faculty and students and they organize high quality programming, including workshops on laboratory safety, scientific writing, and public speaking. The program's 143 mentors gve selflessly of their time, spending 400 hours a year guiding their students through research projects.

The symposium's virtual format this year was made possible by many members of the CUNY community. We thank Dr. Regina Santella for serving as the keynote speaker and Dr. Lucia Fuentes for serving as the featured mentor speaker, and Executive Vice Chancellor José Luis Cruz and Associate Vice Chancellor Tamera Schneider for delivering opening and closing remarks, respectively. Members of the Office of Research staff and the CRSP directors volunteered to serve as breakout room hosts: Rimi Dhar, Jessica Fields, Effie MacLachlan, Allyson Sheffield, Imani Rhone, Derek Steele, and Nhi Tran, Shiang-Kwei Wang. A special thank-you to Rimi Dhar for working nights and weekends to help make this symposium possible.

Finally, we thank Dr. Joshua Brumberg, Dean of Sciences at the CUNY Graduate Center, for recruiting doctoral students and postdocs to serve as poster judges. The judges are: George

Annor, Nora Awadallah, Sahana Bhattacharyya, Rezlind Bushati, Antonio Cerrullo, Hungyi Chun, Subir Dhamoonn, Miruma Ghinia-Tegla, Devon Lundine, Devon Lundine, Rilquer Mascarenhas da Silva, Veeshan Narinesingh, Kelechi Ndukwe, Jasmine Pathan, Andriele Silva, and Duistin Zuelke.

Best wishes to the 2019-2020 CRSP cohort as they continue their academic studies and pursue careers in STEM fields and beyond! We look forward to a new cohort of students in the fall.

Best regards,

Ron Nero, Ph.D.
Director
CUNY Research Scholars Program
July 2020

PROGRAM OF EVENTS

Day One: July 27

10:10 am	**Ron Nerio, Ph.D.** Director, CRSP	**Symposium Begins** (please log in at 10:00 am)
10:15 am – 10:30 am	**José Luis Cruz, Ph.D.** Executive Vice Chancellor and University Provost	**Welcome Address**
10:30 am – 11:15 am	**Regina Santella, Ph.D.** Columbia Mailman School of Public Health	**Keynote Address** *Using Biomarkers in Cancer Research: Environmental Exposures and Genetic Susceptibility*
11:15 am – 11:30 am	**Lucia Fuentes, Ph.D.** LaGuardia Community College	**Mentor Address** *In the face of Covid-19 disruption: An opportunity to bridge your research to your community*
11:30 am – 12:00 pm	**Novelette Neill** Medgar Evers College **Ashley Mercado** Queensborough Community College	**Featured Student Presentations** Session 1
12:00 pm – 1:00 pm		**Lunch Break**
1:00 - 1:10 pm	**Ariella Trotsenko** CUNY I-Corps	**NSF Innovation Corps** *How to turn your research into a startup*
1:10 pm – 1:40 pm	**Vishwanauth Persaud** Bronx Community College **Emily Morrissey** Kingsborough Community College	**Featured Student Presentations** Session 2
1:40 pm – 1:50 pm		**Short Break**
1:50 pm – 3:30 pm	**CRSP Students**	**Poster/PowerPoint Presentations** Session 1

Day Two: July 29

1:00 pm to 1:45 pm	**Jose Martin** Guttman Community College **Daniel Orjuela Alejandro Boyaca** Borough of Manhattan Community College **Tetiana Soloviova, Aldona Gjoni, and Amina Shahbaz** New York City College of Technology	**Featured Student Presentations** Session 3
1:45 to 2:00 pm		**Short Break**
2:00 pm to 4:30 pm	**CRSP Students**	**Poster/PowerPoint Presentations** Session 2

Day Three: August 3

1:00 pm to 1:45 pm	**Anastasia Maximenko** Staten Island College **Veronica Martinez Castro** LaGuardia Community College **Francisco Javier Gómez Pérez** Hostos Community College	**Featured Student Presentations** Session 4
1:45 pm to 2:00 pm		**Short Break**
2:00 pm to 4:30 pm	**CRSP Students**	**Poster/Powerpoint Presentations**
5:00 pm to 5:20 pm	**Tamera Schneider, Ph.D.** *Associate Vice Chancellor for Research*	**Closing remarks**
	Ron Nerio *Research Programs Director*	**Announcement of presentation winners**

College CRSP Directors

Borough of Manhattan Community College	Siddharth Ramakrishnan and Venita Andrews
Bronx Community College	Katherine Acevedo-Coppa
College of Staten Island	Alfred Levine and Maria Ivanova
Guttman Community College	Chulsung Kim
Hostos Community College	Reginald Dorcely, Francisco Fernandez, and Amaris Matos
Kingsborough Community College	Homar Barcena, Christina Johnson and Frances Samuel
LaGuardia Community College	Allyson Sheffield
Medgar Evers College	Mohsin Patwary
New York City College of Technology	Hamid Norouzi and Abdou Bah
Queensborough Community College	Shiang-Kwei Wang

Keynote Address

"Using Biomarkers in Cancer Research: Environmental Exposures and Genetic Susceptibility"

Regina Santella
Mailman School of Public Health, Columbia University

Regina M. Santella, PhD, is Professor of Environmental Health Sciences at the Mailman School of Public Health at Columbia University, and Vice Dean for Faculty Affairs. For 18 years she led Columbia's National Institute of Environmental Health Sciences Center for Environmental Health in Northern Manhattan, and currently leads the Center's Integrated Health Sciences Facility Core. She also co-leads the Cancer Population Sciences Program and Biomarkers Shared Resource of the Herbert Irving Comprehensive Cancer Center. She received a BS in Chemistry from Brooklyn College, an MS in Organic Chemistry from the University of Massachusetts and a PhD in Biochemistry from the City University of New York.

Dr. Santella's research is focused on the use of biomarkers of exposure and genetic susceptibility to understand risk for cancer development concentrating on liver and breast cancer. Her laboratory has developed antibodies and immunoassays to a number of carcinogen-DNA and protein adducts and uses these methods to determine exposure to environmental carcinogens. Other assays have been used to understand genetic susceptibility related to DNA repair capacity using phenotyping assays. More recently, her laboratory is investigating the use of epigenetic markers, including DNA methylation and microRNA expression, to identify those at increased risk or as early biomarkers of disease. She has published over 500 papers.

CRSP Mentor Address

"In the Face of Covid-19 Disruption: An Opportunity to Bridge Your Research to Your Community"

Lucia Fuentes, Ph.D.
LaGuardia Community College

Lucia Fuentes, Ph.D., did her undergraduate studies in the University of Geneva in Switzerland, received her MSc in Molecular Biology from the University of Costa Rica and her PhD in Virology from the University of British Columbia, Canada. Her post-doctoral work involved the study of cell-to-cell movement of viruses into embryonic plant tissues. Before joining LaGuardia, Dr. Fuentes taught and developed curriculum for courses in biology and did collaborative research on the mechanisms of macrophage modulation by fungi and bacteria in British Columbia. Over the past eight years and as part of her work in the Natural Sciences Department at LaGuardia, Dr. Fuentes, in collaboration with Dr. Maria Entezari, has investigated mechanisms of immunomodulation in microglia, particularly the dysregulation of phagocytosis in neurodegenerative diseases such as Alzheimer's; together, both professors have co-mentored over twenty students, most of whom have continued their studies in biology or medicine. Dr. Fuentes has always seen the study of science as a gateway for students to widen their understanding of not only the natural world, but of our society as a whole.

Featured Student Oral Presentations

College	Title	Student	Mentor
	Session 1, July 27 11:30 am – 12:00 pm		
Medgar Evers	The Risk Assessment and Exposure of Per-Polyfluoroalkyl Substance within Indoor Environment	Novelette Neil	Jin Shin
QCC	Analysis of Citizen Science Data to Examine Bird Diversity in NYC Parks	Ashley Mercado	Joan Petersen
	Session 2, July 27 1:10 pm – 1:40 pm		
BCC	Is America's Cleanest Water Killing Us?	Vishwanauth Persaud	Dickens St. Hilaire
KBCC	Lunar Ecology: Plant Growth in Lunar and Aguas Zarcas Meteorite Soil	Emily Morissey	Kieren Howard
	Session 3, July 29 1:00 to 1:45 pm		
Guttman	The Application of Solid Acid Catalyst in Biodiesel Production	Jose Martin	Ji Kim
BMCC	Gravity Model: Understanding Columbian International Trade	Daniel Orjuela Alejandro Boyaca	Shruti Sharma
NYCCT	X-Ray Imaging of Godolinium Diffusion and Near Infrared Spectroscopy of Dark Photosynthesis in Metal Iron-Rich Pineapple	Tetiana Soloviova, Aldona Gjoni, and Amina Shahbaz	Subhendra Sarkar, Chen Xu, and Zoya Vinokur
	Session 4, August 3 1:00 to 1:45 pm		
CSI	Applications of Singlet Oxygen in Photodynamic Therapy: Evaluating the Stability of Chlorin e6	Anastasia Maximenko	Alan Lyons
LAGCC	Are Aerosolized Bacteria Being Incorporated nto the Microbiome of Organisms Found Along the Shores of Newtown Creek?	Veronica Martinez Castro	Joby Jacob and Ingrid Veras
Hostos	Structure-Based Characterization of TRPM8 Modulators Using Computer-Aided Molecular Design	Francisco Javier Gómez Pérez	Yoel Rodriguez

Student Presenters

Name (First)	Name (Last)	College	Page Number	Pres. Date	Room Number
Aliff	Abad	New York City College of Technology	58	Jul 29	1
Ahmed	Aboudiwan	LaGuardia Community College	43	July 29	4
Muiz	Agbaje	Hostos Community College	28, 29	Aug 3	2
Ayat	Agha	Borough of Manhattan Community College	10	Jul 29	1
Harry	Aguilar	LaGuardia Community College	49	Aug 3	3
Sakib	Ahmed	Borough of Manhattan Community College	6	Jul 27	1
Muhabbat	Ahmedova	Queensborough Community College	76	Aug 3	3
Momtahina	Akter	College of Staten Island	20	Jul 27	4
Sadia	Akter	LaGuardia Community College	48	Jul 27	3
Saad	Al Bawi	Borough of Manhattan Community College	n/a	Aug 3	2
Sunil	Ale	LaGuardia Community College	50	Jul 29	1
Kathie	Alli	Borough of Manhattan Community College	1	Jul 29	1
Lisbeth	Almonte	Guttman Community College	23	Jul 29	1
Jacquelyn	Apostolo	Queensborough Community College	65	Aug 3	1
Tamara	Areizaga	Queensborough Community College	65	Jul 27	2
Mac-Darlene	Armand	Medgar Evers College	53	Jul 29	1
Malik	Atadzhanov	Kingsborough Community College	34	Aug 3	1
Muhabbat	Axmedova	Queensborough Community College	76	Aug 3	3
Mahamud	Babu	Queensborough Community College	65	Aug 3	1
Nikola	Baci	Queensborough Community College	66	Jul 27	2
Anny	Baez Silfa	New York City College of Technology	59	Jul 27	2
Alpha	Bah	Hostos Community College	29	Aug 3	1
Muhammed	Bajo	Bronx Community College	10	Jul 27	2
Jaweria	Bakar	Kingsborough Community College	37	Aug 3	1
Awa	Barry	Medgar Evers College	53	Jul 29	1
Sultana	Begum	New York City College of Technology	59	Jul 27	2
Zameera	Bhairo	Borough of Manhattan Community College	9	Jul 29	1
Monique	Bisasor	Bronx Community College	13	Aug 3	2
Nathaniel	Boadi Donkor	Borough of Manhattan Community College	11	Jul 29	n/a
Levi	Borevitz	Kingsborough Community College	35	Jul 27	2
Jun Ye	Cai	Kingsborough Community College	35	Aug 3	3
Joanne	Callaghan	Borough of Manhattan Community College	37	n/a	n/a
Brian	Carter	Hostos Community College	32	Aug 3	2
Noel	Castillo	Kingsborough Community College	41	Jul 27	2
Biling	Chen	Queensborough Community College	66	Jul 27	2
Bingfang	Chen	New York City College of Technology	59	Jul 27	1
Ting Ting	Chen	College of Staten Island	16	Aug 3	3
Heesoo	Cho	Queensborough Community College	66	Jul 27	2
Showmik	Chowdhury	New York City College of Technology	59	Jul 29	2

Name (First)	Name (Last)	College	Page Number	Pres. Date	Room Number
Absari	Chowdhury	Bronx Community College	14	Aug 3	2
Michael	Copeland	LaGuardia Community College	45, 51	Jul 27	1
Diego	Cordova	Queensborough Community College	67	Jul 29	2
Nadjet	Cornejal	Borough of Manhattan Community College	2	Jul 29	2
Shepherd	Coron	Borough of Manhattan Community College	2	Jul 27	2
Karen	Correa	College of Staten Island	20	Jul 27	4
Monique	Correa	LaGuardia Community College	20	Aug 3	2
Helena	Crentsil	Medgar Evers College	54	Jul 27	1
Gearoff	Cruz Rodriguez	Borough of Manhattan Community College	n/a	Aug	3
Chang	Cui	Queensborough Community College	67	Jul 29	2
Daniel	De Jesus	Medgar Evers College	50	n/a	n/a
Erichel	Dela Cruz	LaGuardia Community College	44	Jul 29	2
Maria	DeLeon	New York City College of Technology	59	Jul 27	1
Krissy	Dellacave	College of Staten Island	20	Jul 29	4
Alexandra	Diaz	College of Staten Island	20	Jul 29	4
Ruth	Dorcely	Guttman Community College	24	Aug 3	2
Ousman	Dukuray	Guttman Community College	23	Aug 3	2
Andre	Dunkley	LaGuardia Community College	51	Jul 27	2
Gilford	Duversaint	New York City College of Technology	55	Aug 3	2
Adebayo	Efunnuga	Borough of Manhattan Community College	4	Aug 3	2
Borelle	Fabrice	Borough of Manhattan Community College	9	Jul 29	2
Marven	Fam	College of Staten Island	20	Jul 27	4
Fernando	Fernandez	Borough of Manhattan Community College	11	Jul 27	n/a
Alex	Fiero	College of Staten Island	21	Aug 3	2
Nell	Flores	Queensborough Community College	68	Aug 3	2
Vania	Fulton	LaGuardia Community College	49	Jul 27	n/a
Yeremi	Garcia	Guttman Community College	22	Jul 27	1
Oumdath	Gbadamassi	Hostos Community College	28	Aug 3	1
Circe	Gedeon	Queensborough Community College	68	Jul 29	2
Edmond	George	College of Staten Island	15	Jul 29	4
Aldona	Gjoni	New York City College of Technology	63	Jul 27	3
Francisco Javier	Gómez Pérez	Hostos Community College	29	Aug 3	1
Georgina	Gooden	Medgar Evers College	55	Jul 27	1
Brettania	Gordon	Queensborough Community College	69	Jul 27	1
Reem	Gouda	College of Staten Island	17	Aug 3	3
Yanqiu	Guo	Queensborough Community College	69	Jul 29	2
Emely	Gutierrez	Queensborough Community College	70	Jul 29	1
Victor	Halabani	Kingsborough Community College	41	Aug 3	3
Bahashanda	Hananiyaev	Kingsborough Community College	36	Aug 3	2
Rawan	Hanini	Kingsborough Community College	33	Jul 27	1
Fahameda	Hassan	New York City College of Technology	61	Jul 27	2
Kyaw Zaw	Hein	Borough of Manhattan Community College	5	Aug 3	n/a
Kleyris	Heras	Guttman Community College	25	Jul 29	2
Sophia	How	Queensborough Community College	70	Jul 27	1

Name (First)	Name (Last)	College	Page Number	Pres. Date	Room Number
Hongzhong	Hu	LaGuardia Community College	50	Jul 29	1
Aneeza	Hussain	New York City College of Technology	60	Aug 3	1
Asifa	Ijaz	Kingsborough Community College	41	Aug 3	3
Clarissa	Intriago	Guttman Community College	78	Jul 29	1
Tamara	Ariezaga	Queensborough Community College		Aug 3	3
Iryna	Ivanyuk	Kingsborough Community College	n/a	Jul 29	1
Yrfrat	Jahan	Bronx Community College	13	Jul 29	2
Ethabanie	Jean Francois	Medgar Evers College	56	Jul 27	3
Travis	Jenne	LaGuardia Community College	48	Aug 3	1
Weida	Jiang	Borough of Manhattan Community College	3	Jul 27	1
Inoussa	Kabore	Hostos Community College	27	Jul 29	2
Aser	Kalkoumdo	Hostos Community College	30	Jul 27	3
Mehnoor	Khan	College of Staten Island	18	Aug 3	3
Md Reduanul	Karim	LaGuardia Community College	46	Aug 3	1
Mustapha	Kobeyssi	College of Staten Island	18	Jul 29	4
Xavier	Koudougou	Hostos Community College	30	Jul 27	3
Samuel	Krichavets	College of Staten Island	18	Aug 3	3
Joan Beatrice	Ladaban	New York City College of Technology2	60	Jul 29	3
Stephanie	Landazuri	Queensborough Community College	70	Jul 27	3
Mary	Lee	New York City College of Technology	60	Jul 27	2
Steven	Li	New York City College of Technology	62	Jul 29	3
Jiaqian	Liu	Borough of Manhattan Community College	4	Jul 29	3
Oneil	Mahoney	Borough of Manhattan Community College	10	Aug 3	2
Tania	Makki	LaGuardia Community College	45	Aug 3	n/a
Altrim	Mamuti	Borough of Manhattan Community College	2	Jul 29	2
Aaryan	Manoj Nair	New York City College of Technology	62	Aug 3	3
Jose	Martin	Guttman Community College	22	Jul 27	2
Reynaldo	Martinez	Hostos Community College	32	Jul 29	3
Scarlet	Martínez Cardoze	Hostos Community College	30	Jul 29	3
Veronica	Martinez Castro	LaGuardia Community College	49, 51	Jul 27	1
Leulaye	Maskal	LaGuardia Community College	43	Jul 29	3
Habiba	Masoud	Bronx Community College	12	Jul 29	3
David	Mastalerz	New York City College of Technology	64	Jul 27	3
Anastasia	Maximenko	College of Staten Island	17	Aug 3	3
Masum	Mazid	Kingsborough Community College	38	Jul 27	2
Sylvester	Meadows	Hostos Community College	28	Aug 3	1
Claudia	Mello	Borough of Manhattan Community College	2	Jul 29	
Jassiel	Mena	Hostos Community College	28	Aug 3	n/a
Ashley	Mercado	Queensborough Community College	70	Jul 27	2
Natallie	Mercier	Hostos Community College	28	Aug 3	2
Ebube	Michael	Borough of Manhattan Community College	7	Aug 3	1
Anna	Mikheyeva	Hostos Community College	27	Aug 3	1
Anna	Miller	Borough of Manhattan Community College	5	Aug 3	1

Name (First)	Name (Last)	College	Page Number	Pres. Date	Room Number
Daniel	Minyety	LaGuardia Community College	n/a	Jul 29	3
Emily	Morrissey	Kingsborough Community College	40	Jul 27	1
Natalie	Mosseri	Kingsborough Community College	39	Jul 29	1
Hebatallah	Mostafa	LaGuardia Community College	78	Jul 27	2
Agata	Movsisyan	Kingsborough Community College	40	Jul 27	2
Somaya	Nasher	Hostos Community College	31	Jul 27	1
Victoria	Negron	Guttman Community College	22	Aug 3	1
Novelette	Neil	Medgar Evers College	56	Jul 27	2
Kimberly	Nelsen	LaGuardia Community College	44	Jul 27	2
Haoyu	Niu	Queensborough Community College	72	Jul 29	3
Konstantin	Novichenko	College of Staten Island	21	Aug 3	3
Kingsley	Odae	Hostos Community College	26	Jul 27	2
Onyinyechi W.	Obineche	Hosts Community College	30	Jul 29	2
Danielle	Ohana	College of Staten Island	18	Aug 3	3
Albert	Oladipupo	Medgar Evers College	53	n/a	n/a
Joshua	Olatunji	Queensborough Community College	72	Jul 29	4
Jose	Olivera	Kingsborough Community College	38	Aug 3	3
Elizabeth	Oppong Darkwa	Bronx Community College	12	Jul 29	4
Elena	Oprea	Kingsborough Community College	33	Jul 27	4
Daniel	Orjuela Boyaca	Borough of Manhattan Community College	8	Jul 29	4
Baowend	Ouedraogo	Hostos Community College	28	Jul 27	3
Rassambnewende	Ouedraogo	Hostos Community College	28	Aug 3	1
Qi	Pan	Queensborough Community College	72	Jul 29	4
Bielka	Pena	Hostos Community College	26	Jul 27	4
Estafania	Peralta	Hostos Community College	31	Jul 29	4
Vishwanauth	Persaud	Bronx Community College	13	Jul 29	4
Laura	Pessoa	LaGuardia Community College	49	Aug 3	n/a
Li Kuan	Phang	LaGuardia Community College	47	Jul 27	4
Zheyong	Piao	Queensborough Community College	73	Jul 29	4
Jonathan	Pinkhasov	Kingsborough Community College	41, 42	Aug 3	3
Megan	Pirtle	Queensborough Community College	73	Jul 27	4
Steven	Piller	Kingsborough Community College	42	Jul 27	3
Jason	Polanco	Hostos Community College	26	Jul 27	4
Ziqi	Polimeros	Borough of Manhattan Community College	9	Jul 29	1
Michelle	Puma	College of Staten Island	15	Jul 27	4
Britney	Puma	Guttman Community College	25	Aug 3	1
Shaheer	Qureshi	Borough of Manhattan Community College	3	Jul 27	4
Mohigul	Rahimova	Medgar Evers College	57	Jul 29	4
Destiny	Ramirez	Kingsborough Community College	38	Jul 27	4
Sarah	Rivera	Bronx Community College	7	Jul 29	3
Yvonne	Rodriguez	Queensborough Community College	73	Aug 3	1
Maria Paula	Rodriguez Wilches	LaGuardia Community College	47	Jul 29	4

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Paola	Rojas	Guttman Community College	24	Jul 29	4
Gul	Rukh	Kingsborough Community College	41	Aug 3	3
Stuti	Sangar	Queensborough Community College	74	n/a	n/a
Arantxa	Saint Surin	Medgar Evers College	57	Jul 29	1
Jahmet	Saltus	Queensborough Community College	72	n/a	n/a
Jose	Sánchez Diaz	Hostos Community College	27	Jul 29	2
Gabriela	Santacruz Betancourt	LaGuardia Community College	45	Aug 3	1
Isabela	Santacruz Betancourt	LaGuardia Community College	43	Aug 3	1
Isra	Saqib	Kingsborough Community College	41	Aug 3	3
Epiphanie	Sawadogo	Hostos Community College	26	Jul 27	4
Mohamadou	Sawadogo	Borough of Manhattan Community College	9	Jul 27	4
Mohamed	Sayibou	Bronx Community College	7	Aug 3	3
Dayhana	Segura Del Orbe	Hostos Community College	31	Jul 29	4
Amina	Shahbaz	New York City College of Technology	62	Jul 27	3
Arouje	Shaikh	College of Staten Island	19	Jul 27	4
Harpreet	Singh	Queensborough Community College	75	Jul 29	4
Inderjit	Singh	Bronx Community College	14	Jul 29	1
Christian	Singleton	LaGuardia Community College	43	Jul 29	4
Shatema	Small	Kingsborough Community College	39	Jul 27	4
Angelika	Sobolewska	Kingsborough Community College	35	Jul 27	3
Tetiana	Soloviova	New York City College of Technology	62	Jul 27	3
Briana	Soto	College of Staten Island	19	Aug 3	3
Anna	Steto	LaGuardia Community College	43	Jul 27	3
Holta	Stojku	Kingsborough Community College	40	Jul 27	3
Gloria	Suero	Borough of Manhattan Community College	1	Aug 3	1
Renee	Sumner	Medgar Evers College	58	Aug 3	3
Ryan	Sumner	Medgar Evers College	58	Jul 29	4
Pamela	Tabaquin	Queensborough Community College	75	Jul 29	1
Ali	Taha	LaGuardia Community Collwege	43	Jul 29	4
Borelle Fabrice	Tene Moukam	Borough of Manhattan Community College	9	July 29	2
Abigail	Teye	Borough of Manhattan Community College	11	Jul 27	n/a
Farida	Tijani	Guttman Community College	24	Aug 3	1
Kara	Timrick	LaGuardia Community College	52	Aug 3	3
Kamellea	Torres	College of Staten Island	16	Aug 3	3
Olaya	Torres	College of Staten Island	16	Aug 3	3
Oumou	Traore	Hostos Community College	30	Jul 27	3
Suleyman	Turac	New York City College of Technology	63	Jul 29	n/a
Feruza	Turobova	Queensborough Community College	76	Aug 3	3
Kalu Dike	Udensi	Queensborough Community College	76	n/a	n/a
Reem	Ulay	Borough of Manhattan Community College	10	Jul 27	3
Valentine	Uwechue	Queensborough Community College	76	Aug 3	3

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Shaylin	Venitelli	New York City College of Technology	64	Jul 27	3
Mariana	Vasilita	Kingsborough Community College	34	Jul 27	1
Amy	Velasco	Queensborough Community College	77	Jul 27	3
Mikaila	Valley	Queensborough Community College	68	July 29	2
Orlando	Villalba	Guttman Community College	25	n/a	n/a
Michael	Walker	Borough of Manhattan Community College	8	Jul 29	1
Marwah	Wilson	LaGuardia Community College	46	Aug 3	3
Charles	Wong	Queensborough Community College	77	Jul 27	3
Kelvin	Wu	Borough of Manhattan Community College	6	Jul 29	1
Bin	Yang	Borough of Manhattan Community College	6	Jul 29	n/a
Joonsuk	Yang	Borough of Manhattan Community College	9	Jul 29	1
Yani Acham	Yaou Zakari	New York City College of Technology	64	Aug 3	1
Dmitri	Yeboah	Hostos Community College	28	Aug 3	1
Wesam	Yousri	LaGuardia Community College	48, 49	Jul 27	3
Jonnathan	Zuna Largo	Kingsborough Community College	36	Jul 27	1

Faculty Mentors

Borough of Manhattan Community College

The role of attention in visual perception

Gloria Suero

Mentor: Professor Marjan Persuh
Borough of Manhattan Community College

The role of visual attention in perception has long been controversial. The primary goal of our project is to determine whether attention moderates visual perception. We developed a method for measuring attention and perception simultaneously. We modified the multiple object tracking paradigm, in which observers are asked to remember and track continuously moving objects. This paradigm has been used successfully to manipulate the availability of attentional resources. We used open source tool PsychoPy to program pilot experiment, in which observers tracked target items in the presence of moving distractors. We found that at lower speeds, the accuracy was nearly at the ceiling for almost all participants. At a medium speed, the accuracy dropped to approximately eighty percent. At the fastest rotation rate, accuracy was near guessing, averaging around fifty-five percent for most participants. The results of our pilot experiment indicate that the higher the rate of rotation, the more difficult the task becomes, which indicates that task requires more attentional resources. We are currently developing a visual perception task, which will directly measure visual experience of participants. Once the visual perception task is completed, it will be combined with multiple object tracking task. This design will allow us to determine whether increasing demand on attentional resources affects visual perception.

The Effects of Auditory Stimulation on Cognition

Kathleen (Kathie) Alli

Mentor: Professor David Caicedo
Borough of Manhattan Community College

In studies conducted to learn about the effects of musical distraction on cognitive task performance, the findings have demonstrated the idea of music improving cognitive performance (Cockerton, Moore, & Norman, 1997). A descriptive exploratory study done on isochronic tones for the treatment of anxiety showed that when oscillators in the brain match rhythmically with an external stimulus, it demonstrated effective for cognitive functioning, whether in stand-alone or in multiple approach treatment (Ray, 2017). The purpose of my experimental study aimed to determine whether the isochronic tones are still effective while being played with selected genres of music without words. More specifically, cognitive tasks can be enhanced through the auditory stimulation of the isochronic tones, making certain types of music helpful in cognitive tasks such as memory. First, we established a baseline test score of the number of recalled responses for each participant. Then a subsequent memory test was taken under the same conditions as the first but with a randomly applied independent variable (I.V.) of the isochronic tone. What I attempted to find was whether there was an effect on test scores on the subsequent test, based on the administration of the I.V. Many students, when engaged in complex cognitive processing, such as studying for a test or completing homework assignments, listen to music to alleviate the emotional effects of stress. Since this is a common practice, it would be beneficial for researchers and college students alike to understand the role that music can play on cognitive performance.

Antiviral Activity of Psidium guajava Against Herpes Simplex Type 1

Nadjet Cornejal and Claudia Melo

Mentors: Professors Jose Fernandez Romero and Adolfina Koroch
Borough of Manhattan Community College

Guava (Psidium guajava) is a small tree from the Myrtaceae family native to Central and South America. Scientists have suggested that chemicals isolated from the guava plant can have antimicrobial and anti-inflammatory properties. We performed preliminary studies to determine if a guava leaves extract has antiviral activity against herpes simplex type 1 (HSV-1). For this purpose, the XTT colorimetric assay was used to estimate cytotoxicity (toxicity in cells) while the plaque-reduction assay was used to test the anti-HSV-1 activity. Our results suggest that we have a selective antiviral activity with a therapeutic index higher than 750. This result warrants further evaluation of the potential use of this extract to treat HSV-1 infections.

The Effect of Triclosan on the Development of Lytechinus variegatus Embryos

Nadjet Cornejal & Altrim Mamuti

Mentor: Professor Lalitha Jayant
Borough of Manhattan Community College

This project aims at investigating the effects of triclosan on the development of the sea urchin Lytechinus variegatus embryos. Gametes of L. variegatus were extracted from spawned adult urchins using potassium chloride (KCl) and in vitro fertilization was carefully performed. Fertilized gametes were treated with triclosan at nominal concentrations (1, 5, 10, and 20 µM) allowing for embryogenesis to take place. Viability and development of embryos were analyzed using a light microscope. Embryos were counted using a hand drawn grid. Results indicate that embryos exposed to high triclosan concentrations (>5 µM) displayed low viability and arrested development at early stages of embryogenesis. Results of this project suggest that higher concentrations of triclosan might have potential deleterious effects on embryonic development of L. variegatus. Future results will focus on studying the exact cause of the abnormal development of these embryos at high concentrations of triclosan. Effect of triclosan on the rate of fertilization will also be looked into.

Defining the Antibacterial Capabilities of Xylopia aethiopica Aqueous Fruit Extracts

Shepherd Coron

Mentor: Professor Christine Priano
Borough of Manhattan Community College

Xylopia aethiopica is an aromatic tree found across wide areas of Africa and its fruit is commonly used in traditional medicines. It was previously shown that an aqueous X. aethiopica fruit extract completely inhibited the growth of gram-positive Bacillus subtilis but had only minimal effect on growth of gram-negative Escherichia coli. Because inhibition of B. subtilis was complete, it was hypothesized that dilutions of the extract would also confer antibacterial activity against gram-positive bacteria. Experiments were performed to find the minimum concentration needed for inhibition. An aqueous extract of the X. aethiopica fruit was prepared in distilled water by boiling, centrifugation, and sterile filtration. The extract was then serially diluted with LB broth and liquid cultures of E. coli and B. subtilis were prepared with the appropriate controls. Growth of the bacterial cultures was monitored for eight hours by measuring optical density. Results showed that the X. aethiopica extract inhibited growth of B. subtilis at the initial concentration and at a 2-fold dilution, but it did not inhibit growth at lower concentrations. It was concluded that the active components of the X. aethiopica extract need to be present in relatively high concentrations for maximal effect. Further experiments will include investigating the types of phenolic compounds present in these plant extracts that might be responsible for bacterial inhibition.

Identification of such compounds might be useful in developing medicinal alternatives to common antibiotics for the treatment of bacterial infection and disease.

An Assistive Human-Robot System With Multiple Social Robots for Autistic Children

Weida Jiang

Mentor: Professor Mohammad Azhar
Borough of Manhattan Community College

Autism Spectrum Disorder(ASD) is a lifelong developmental disability characterized by difficulty in social interaction, repetitive behaviors, both verbal and nonverbal communication. According to a recent Centers for Disease Control (CDC) And Prevention report, about 1 in 54 children in the United States will be affected by ASD in 2020. The biggest challenge we have faced is the difficulty of establishing effective communication with autistic children; moreover, treatment for autism requires a long period of time. Recently, researchers have deployed humanoid robots to assist autistic children and overcome their mental disorder. Current robots can provide curiosity and more likely to increase the interest in autistic children to participate. Hence, we hypothesize that multiple robots may be deployed as an essential therapeutic tool to improve autistic children's social interaction and collaborative skills. In our research, we designed a human-robot interaction solution using two different assistive robots namely NAO Humanoid Robot and Cozmo Robot. We developed several social interactions and collaborative scenarios to help autistic children engage in regular communication to improve their social skills as well as collaborative skills. For instance, children can use their voice or click the mobile app that we developed to control the movement of the robot to complete the specified assigned tasks to improve their conversation and cooperation. We integrated IBM Watson Assistant Library to analyze the children's voice input and give correct feedback and encouragement. This project will also develop an intelligent web interface dashboard to collect applicable data extracted from the robot and mobile human-robot interaction software for therapists and parents, which can help them monitor and understand the children with autism.

Fractal dimension in butterflies' wings: a novel approach to understand phylogenetic relationship

Shaheer Qureshi

Mentor: Professor Johannes Familton
Borough of Manhattan Community College

The geometrical complexity in the wings of various, taxonomically different butterflies can help us to understand the possible evolutionary relationship by analyzing their fractal dimensions. The fractal dimension of the wing patterns of the Monarch and its mimicry specie Viceroy has been well documented before however the fractal dimension of wing patterns of the Black Swallowtail and Pipevine Swallowtail remains unknown. Here, we investigate the wing patterns of local butterflies and their mimic specie: The Monarch and it's mimic the Viceroy, and the Black Swallowtail and it's mimic the Pipevine Swallowtail. Using MatLab, the complexity of their wing patterns is quantified by their fractional dimension and then calculated through the box-counting method. Preliminary results indicate the fractal dimension of the wing patterns of the Monarch and its mimicry speciee Viceroy are closely related. This can give us some insight into the evolutionary relationship of the Monarch and its mimicry specie Viceroy and can help us to determine the phylogenetic relationship with the less investigated specie Black Swallowtail and its mimic the Pipevine Swallowtail by comparing their fractal dimensions.

Automation and the Future of Work: Costs and Benefits

Jiaqian Liu

Mentor: Professor Christine Farias
Borough of Manhattan Community College

As the development of automation improves the quality of some parts of our lives, it raises the concerns that it could impact many jobs as well. Many jobs in the agricultural, services, and manufacturing sectors are expected to be gradually replaced by automation and robotics. Moreover, low-education and low-skilled workers are facing increasing risks of unemployment. Studies show that 43 percent of jobs in manufacturing, 40 percent of jobs in retail, 38 percent of jobs in telemarketing, 37 percent of jobs in data entry in the US alone are at risk of being replaced by automation. What can people do to face the challenges that automation brings in the future? To answer this question my presentation will attempt to examine the composition of jobs, the automation potential, costs and benefits of automation and possible future job displacement in various occupations due to automation. My research is based on studies and reports from McKinsey Global Institute, International Labor Organization, U.S. Bureau of Labor Statistics, Business Insider, and other sources. My analysis will explore and analyze the positive and negative impacts on the future of work and will make recommendations for the United States economy.

Elimination of Organosulfur Compounds from Model Fuels with Biological Wastes: Tackling the Acid Rain

Adebayo Efunnuga

Mentor: Professor Abel Navarro
Borough of Manhattan Community College

The prevalence of organosulfur compounds compounds in fuels has been an important concern since the XIX century as an environmental risk due to the increase of greenhouse gases in the atmosphere and accentuation of acid rain. This project evaluates the potential of solid waste such as fruit peels as adsorbents for the removal dibenzothiophene (DBT). The adsorption on the fruit peels of orange (OG), lime (LM) and pineapple (PN) was investigated in a batch and continuous-flow systems with synthetic fuels (gasoline and diesel) as a function of type of adsorbent, adsorbent dosage, initial concentration of DBT and column experiments. DBT adsorption follows this trend in gasoline: LM (12.3%) > PN (8.8%) > OG (6.9%) with 50mg, 125mg, and 50mg, respectively. On the other hand, the adsorption of DBT in diesel followed the trend: LM (14.6%) > OG (4.2%) > PN (3.5%) with 50mg, 75mg, and 75mg, respectively. Instrumental analyses propose a polar-drive mechanism by the interaction of carboxyl and hydroxyl groups of the adsorbent and the sulfur atom of DBT. Thermal analysis also suggest that these materials have good thermal and mechanical properties. Column experiments indicate that this approach can be used in continuous-flow system for the treatment of larger volumes of fuels. This work highlights the potential use of fruit peels for the elimination of organosulfur compounds from model fuels as a low-cost and environmentally friendly purification technique.

The Antioxidant Capacity and Total Phenolic Content of Minthostacys verticillata

Anna Miller

Mentor: Professor Adolfina Koroch
Borough of Manhattan Community College

Minthostachys verticillata, otherwise known as peperina, is constrained to Argentina and other neighboring South American countries. Peperina is traditionally consumed as a tea infusion. Peperina has been used as an herbal home remedy for ages, and has been known to alleviate dyspeptic problems, excessive sweating, and inflammation in the stomach of patients. Medicinal properties and traditional uses of plants are associated with the accumulation of chemical compounds in their tissues as total phenolics, and essential oils. The objective of this study is to determine the total phenolic content and assess the antioxidant capacity of commercial samples of leaves. Total Equivalent Antioxidant Capacity (TEAC) and phenolic content of five independent commercial samples were extracted with boiling water for fifteen minutes. Results show variation among different extracts. Sample "Suquia," extracted the highest amount of phenolics, and sample “Jumala,” exhibited the highest amount of antioxidants. Samples "Brochero," and "Jumala" have similar antioxidant capacities and total phenolic contents to one another. Samples with high content of phenolics, show high antioxidant capacity, indicating that there might be a correlation between the antioxidant capacity and phenolic compounds. These results may explain the traditional uses of infusions of peperina.

Role of graphic features in the comprehension of the submicroscopic matter: a qualitative study

Kyaw Zaw Hein

Mentors: Professor Daniel Torres Rangel
Borough of Manhattan Community College

Graphical elements in the form of arrows, textual labels, and particle arrangement are pillars of the symbolism representing the molecular structure of matter in science education. These graphic aids are commonplace in educational diagrams for the teaching and learning of science, having the potential to either reinforce learning of molecular phenomena or to generate alternative conceptions that impede understanding. Still, there is lack of insight into the role that graphic elements play in the understanding of submicroscopic matter, which is a crosscutting concept in the sciences. This pilot study uses a qualitative design with data transformation to gain insight into the role of graphic elements supporting the interpretation of submicroscopic diagrams. We first collected qualitative evidence from 45 college students in the form of verbal diagram interpretations, in order to explore their thinking in terms of graphic usage, to then quantify patterns of graphic usage that compare the characteristics of the different graphic elements supporting comprehension. We found that the thinking of most participants reflected the use of graphic elements with textual or visual formats such as chemical labels or intra-particulate connections, whereas fewer participants used elements with functional or structural connotation such as arrows or particle compactness for comprehension, and just a few participants stressed the use of inter-particulate connections. Qualitative patterns of graphic usage revealed differences in the format and connotative characteristics of the graphic elements used for comprehension. Implications of these findings for increasing submicroscopic understanding, in the context of three-dimensional learning and scientific teaching, are discussed.

Exploring Virtual Environments by Visually Impaired Using a Mixed Reality Cane Without Visual Feedback

Kelvin Wu and Bin Yang

Mentors: Professor Hao Tang
Borough of Manhattan Community College

Finding a way to overcome blindness has been one of humanity's greatest challenges. Recently studies by Cornell and Microsoft research introduced a new technology which utilizes a desktop Virtual Reality (VR) device and a special controller to simulate how a B/VIP uses a white cane to explore their surroundings. Inspired by them, we developed an iOS mobile application, making VR more accessible to B/VIP users. The app allows the users to explore and navigate 3D virtual maps by using their smartphones as a white cane. Using Virtual and Augmented Reality, the app provides users auditory feedback as well as haptic, vibrotactile feedback whenever the virtual cane comes in contact with objects in the virtual environment. This design allows B/VIP users to physically explore and navigate in a virtual world, with an enhanced immersive VR experience. As of now, we mainly focus on how effective this software is in recreating the real world feel in order to determine the feasibility of using this technology as well as how to improve it and overcome the limitations that come with this kind of technology. During the pandemic, we have developed a remote collaboration feature to allow the B/VIP users to test the app at home.

Piezoresistivity in Carbon Microfiber Enhanced Flexible Foams

Sakib Ahmed

Mentor: Professor Mahmoud Ardebili
Borough of Manhattan Community College

The study of carbon fiber-reinforced composites is an area of strong interest in materials science due to the enhanced mechanical, physical and electrical properties of these composites. Piezoresistivity has been observed in different fiber-reinforced composites of polymer matrices which provides the grounds for developing load sensors for various applications. Many applications require flexibility as much as functionality, for example, to develop pressure-sensitive bandages. We have developed an in-situ process to reinforce flexible polyurethane foams with short carbon fibers. We use commercially available FlexFoam-iT!® flexible casting foam. The samples are prepared in a custom designed 3D-printed mold. Different designs of electrodes were also studied and implemented for resistance measurement. The resistance of each sample is measured using a four-probe system under cyclic compression loading. The results of these studies suggest a strong correlation between the pressure applied and the relative resistivity changes of the samples. The finite elements simulation package COMSOL Multiphysics was used to analyze the piezoresistivity of such a carbon fiber-reinforced sample. Since the sample does not have uniform dispersion of the fibers, a parametric study is being conducted to achieve an appropriate conductivity value for the sample in the simulation. The next step of the research will be to set up a simulation for the sample under static loading. The simulations will help us predict the behavior of the carbon fiber-reinforced foams, and the results can be used towards creating calibrated load sensors.

Potential Biological Activity of Commercial Samples of Vernonia amygdalina Plant Extracts

Ebube Michael

Mentor: Professor Adolfina Koroch
Borough of Manhattan Community College

The role of medicinal plants in the inhibition and prevention of oxidative stress-related diseases is an area of growing interest. The remarkable ability of these plants to cause decline in the rate of formation of Reactive Oxygen Species (ROS)—both in vivo and vitro—has been linked to the presence of a group of phytochemicals, known as polyphenols. This study aims to investigate the potential antioxidant capacity of Vernonia amygdalina. Vernonia amygdalina is a plant that originates from tropical west Africa; it bears the common name Bitter leaf, and as the name implies, virtually every part of the plant is known to possess a distinct bitterness in it. In traditional medicine, this plant is widely applied in the treatment of illnesses ranging from diabetes and hypertension to several bacterial, parasitic, and viral infections.
The main objective of this study is to measure and analyze the antioxidant activity associated with V. amygdalina. This has been achieved through the quantification of phenolic compounds present in commercial samples of the plant.
Plant extracts were prepared by grounding dry leaves, dissolved in water, and then boiled for 15 minutes. Total phenolic content was quantified using the Folin-Ciocalteu method and antioxidant activity was quantified using the ABTS radical scavenging assay. Extracts exhibited high total phenolic content and high antioxidant activity. High correlation between total phenolic content and antioxidant activity was observed. These data obtained for total phenolic content and antioxidant activity of V. amydalina supports its traditional and medicinal uses across west Africa.

Geophysical Survey of Fort No.8 and Review of Similar Literature

Sarah Rivera and Mohamed Sayibou

Mentor: Professor Sheldon Skaggs
Bronx Community College

Ground Penetrating Radar (GPR) has been used in diverse fields such as archeology, hydrology, environmental site characterization, and many other studies. It can be used to detect subsurface objects, changes in material properties, voids, and cracks. Our project area selection was a Revolutionary War fortification established by British in 1776 known as Fort No. 8 now on Bronx Community College campus. We conducted GPR surveys on the area and the surveys revealed multiple anomalies. Our primary goal was to “ground-truth” the anomalies identified by the GPR survey. Using the GPR machine, we were able to determine that there might be remnants of an old British Fort under a hill on Bronx Community College. At the end of gathering and analyzing our data, we learned how pairing GPR data and events in history can bring a whole new understanding of what we know. After our work in geological sciences using GPR machine and the Radan7 program now we have developed skills in wider arrays of the sciences. Learning more about history through science was fascinating, and the history was so close to home and so interesting to study. Due to coronavirus, we only have limited data and the remaining of information will be about selected articles talking about GPR and Revolutionary War sites which were similar to our project. These articles were similar to what we could have got from the field work on campus.

Gravity Model: Understanding Colombian International Trade

Daniel A. Orjuela Boyaca

Mentor: Professor Shruti Sharma
Borough of Manhattan Community College

We are interested in understanding determinants of Colombia's international trading patterns, and if these were impacted by important economic and political events. We use the "gravity-model" approach to examine how the Gross Domestic Product and distance between trading partners of Colombia impact its trade. We collected data on 179 of trading partners from the World Bank for the years 2002-2018. In 2014 the Colombian government signed a peace treaty with the Revolutionary Armed Forces which was expected to have a positive impact on the economy, however, this coincided with the oil crisis in 2014 which was especially a shock to Colombia's international trade. When we analyzed the summary statistics, we find a drop in GDP, and also a decline in exports and imports from 2014-2016. In terms of our model, we checked if these events impacted the relationship between the independent variables (GDP/distance) and our main variables of interest-exports and imports. Our multivariate regressions show that there is a positive and significant impact of GDP of the trade partner on Colombia's trade, and a negative and significant impact of geographical distance on Colombia's trade. For each percentage point increase in GDP of the trading partner, Colombia's exports increase by 1.62% and imports increase by 1.68%. We find that these relationships are not impacted (weakened or strengthened) by the events of 2014. In future work, we hope to expand our model by including more variables to better capture the impact of these political and economic events on Colombia's trade.

Compression Test Correlation of 3D Printed Structures Using Finite Element Modelling

Michael Walker

Mentor: Professor Mahmoud Ardebili
Borough of Manhattan Community College

The development of fused deposition modeling (3D printing) using thermoplastics, has led to many opportunities for structural and mechanical research that did not exist before the development of this technology. Due to the printing process, though, structural anisotropy is introduced into the printed structure. Additionally, performing this basic research comes at a high cost in both time and materials.

The goal of this research is to correlate the laboratory obtained compression and impact test results of 3D printed objects with the results generated using computer-based finite element modeling (FEM) of these structures. Doing so allows for improvements in the time and materials efficiency for future research.

Several structures, from solid cubes to tetrahedrally linked cubic lattices were printed using acrylonitrile butadiene styrene (ABS) filament. These objects were tested using compressive loads in a laboratory. For the solid cubes, testing continued beyond the ultimate strength of the ABS material until a permanent distortion of approximately 16mm (or ~42%) was achieved. Testing for the tetrahedral lattices continued to the point of failure by fracture. Finite Element Models were generated from the SolidWorks 2017 part file used to create the printed structure and simulated in Abaqus CAE v6.4.15 using boundary conditions to replicate the laboratory test conditions.

Although a general correlation was found, the anisotropic behavior of 3D-printed materials leads to a variance between computed and observed results. Some of these variances are easily corrected while others are less so. However, the use of FEM modeling has shown promise in making early determinations regarding the suitability of physically testing complex structures, thereby increasing efficiency in time and material utilization during the research process.

Identification and Characterization of Marine Bacteria Associated with Sea Urchin Lytechinus variegatus

Joonsuk Yang and Zameena Bhairo

Mentor: Professor Lalitha Jayant
Borough of Manhattan Community College

A diversity of bacteria share symbiotic relationships with sessile marine invertebrates. These dependent microbiotas are potential producers of known and novel secondary metabolites. This study focuses on identifying and characterizing bacterial flora that exist on the tests and orifices of the sea urchin species, Lytechinus variegatus. The external surfaces of sea urchins were swabbed and plated onto marine agar plates for bacterial isolation. Fourteen of the initial samples were chosen for identification and characterization. The bacterial samples selected were gram negative rods, oxidase positive, did not ferment sucrose and had no antibacterial properties. The Kirby-Bauer tests revealed that the bacterial samples are resistant to common and rare antibiotics used in medicine. Some of the isolated bacteria harbor endogenous cryptic plasmids of approximately 20 Kbp. One of the isolated bacteria was agarolytic in nature. Only a few bacteria were active when cultured on starch and cellulose plates. Chromosomal DNA of all the samples were isolated, and the bacterial genome was subjected to 500bp conserved 16S rRNA PCR. Purified PCR products were subjected to forward and reverse sequencing reactions. Current biochemical analysis determines the bacterial strains to be of the genera Idiomarina and Pseudoalteromonas. Future studies involve analyzing the raw DNA sequencing data using the bioinformatics software QIIME for further taxonomic assignment, phylogenetic reconstruction, and diversity analysis and visualization. Additional antimicrobial assays and biochemical tests will determine potential antimicrobial properties against other microorganisms, as well as notable biochemical activities.

Analysis of Engineering frameworks

Mohamadou Sawadogo

Mentor: Professor Rafael Niyazov
Borough of Manhattan Community College

The ultimate purpose of this research is to determine the how elements of Engineering frameworks react right before collapsing. During the experiments, different masses were loaded to the truss system, and data were collected. The member that has the highest internal force was removed and replace by an adjustable solid element. Then, after collection of data, the elements that were replaced by the adjustable solid element were completely removed, and the experiment were run again. After that, data were compared. After comparison, we observed that the internal force of the removed element was redistributed to the remaining elements of the truss. All those experiments were first done on a 3D module of the truss then on a 2D to confirm the result. The breakthrough of this research was the finding of correlation between the internal forces of the truss, and the elongation of the most stress element.

Machine Learning: Building a Convolution Neural Network to Recognize Functions

Borelle Fabrice, Tene Moukam, and Ziqi Polimeros

Mentor: Professor Chris McCarthy
Borough of Manhattan Community College

Machine Learning (ML) is the most successful and widely implemented branch of Artificial Intelligence. ML is used in a variety of applications such as cybersecurity, image recognition, computer vision, robotics, self-driving cars, drug discovery, data analysis, and finance. We are building and training a ML convolution neural network to distinguish images of mathematical graphs. We used Python, which is the most commonly used computer language for ML. Our neural net is capable of distinguishing straight lines, parabolas, and

trigonometric functions with high accuracy. The key is to have a wide range of correctly labeled training images, each drawn slightly different. We used a combination of computer rendered and hand-drawn images of functions. Ideally, the more people submitting the hand-drawn pictures, the better. With those images, we trained our neural network to identify the specific type of function. We then added regression functionality to create a computer application that can "see" an image of a function, determine which type of function it is, and then plot the best fitting version of that function type. For example, you can input a hand-drawn image of a parabola, the application will recognize if it is concave up or down, and then superimposed on the hand-drawn image, the parabola which best fits the hand-drawn image.

Accelerating the Development of Estrogenic Predictive Models Utilizing Large Scale Chemical Databases

Oneil Mahoney

Mentors: Professors Lauren Wickstrom and Emilio Gallicchio
Borough of Manhattan Community College and Brooklyn College

Estrogenic chemicals in the environment have generated public concerns over potential carcinogenic effects and other endocrine-dependent outcomes. Xenoestrogens are synthetic compounds that simulate the effect of estrogen and interfere with the process of estrogen binding to the estrogen receptor (ER). Experimental studies have identified various xenoestrogens for their potential role in cancer development. However, these studies do not always focus on molecular and structural aspects of the binding process of xenoestrogens to the ER. In addition, assays have demonstrated that many xenoestrogens bind weakly to the ER in vitro; yet it is often unknown whether the compounds mimic the magnitude of the estrogen's response in vivo. Our goal is to address this gap of knowledge and to learn more about the endocrine disruption and risk through novel computational modeling techniques. As a first step, we developed a chemical database of ~200 potential xenoestrogens in order to facilitate the development of an accurate ER ligand binding model. We constructed this database with entries that include physical properties, ER binding data and structural notations for each compound. This informative tool will not only serve as an interface for analysis, but it will be also used in conjunction with the Frontera supercomputing network to construct predictive computational models for determining the estrogenic properties of molecules based on their chemical structures, interactions with the ER, and calculated binding thermodynamic quantities.

Adsorption of Heavy Metals Using Chemically-Modified Tea Leaves

Reem Ulay

Mentor: Professor Abel Navarro
Borough of Manhattan Community College

Copper is perhaps the most prevalent heavy metal used in the manufacturing industries, from food additives to metal-mechanic factories. Common methodologies to remove copper are expensive and produce undesired substances that need to be taken care of. A good decontaminating candidate should be environment-friendly, inexpensive, and capable of eliminating low concentration of the metal. This can be achieved by chemically-modifying known adsorbents to enhance their adsorption properties. This work suggests the use of a chemically-modified spent tea leaves of chamomile, peppermint and green tea under their thiolated, sulfonated and carboxylated forms as candidates for the removal of copper from solutions. Batch experiments were carried out to maximize the adsorption of copper (II) ions. Effects such as acidity, salinity, adsorbent dose, metal concentration, and presence of surfactant were explored. Experimental data shows that the maximum adsorption is reached at neutral pH. The results indicate that Cu(II) can be removed

up to 53%, 22% and 19% with the thiolated, carboxylated and sulfonated adsorbents, respectively. The maximum adsorption of copper on TPM (53%) is achieved with 150mg and decreases with the presence of salts, and surfactants. Conversely, sulfonated and carboxylated adsorbent show a better adsorption in the presence of surfactants. Time dependent experiments show that adsorption is reached in less than 25 min for TCM and 5 min for SCM. Instrumental analyses were used to determine the presence of active functional groups, thermal resistance, and scanning electron microscopy; indicating that both adsorbents are promising cost-efficient materials for the selective recovery and treatment of metal ions from wastewaters. Finally, columns were prepared with these adsorbents to explore their application in scaled-up processes, with very positive results. A long-term goal involves the recycling of the exhausted adsorbent and/or their use in the preparation of biofuels due to changes in materials' structures.

Potential Biological Activity of Litchi chinensis

Ayat Agha

Mentor: Professors Brian Rafferty and Adolfina Koroch
Borough of Manhattan Community College

Over many years, alternative medicinal plants have been used to treat various sicknesses. Litchi chinensis, also known as Lychee, is a fruit of the soapberry family. Native to Eastern India, Southeast Asia, and China, the fruit used to treat the common cold, kidney problems, and to help fight viruses. In recent studies, lychee has shown positive affects in treat liver injury and intestinal barrier dysfunction. The fruit is known to contain high antioxidants levels (□-carotene, Vitamin C, epicatechin, rutin) with anti-inflammatory and anti-cancerous properties. The objective of this study is to prepare extracts from fruit's coat, pulp, and seeds then evaluate their potential antioxidant and total phenolic capacity. Each part of the fruit was dried and ground to a fine powder. The powders were placed in boiling water for 15 minutes creating extracts. Total phenolic content was determined using the Folin-Ciocalteu method. The antioxidant levels were determined using the ABTS radical scavenging assay. The highest content of phenolics and antioxidant capacity were found in the coat of the fruit. In future research, the extracts from the fruit will be applied to human cell lines from both the oral cavity and the intestinal tract. We will determine at what concentration are the extracts considered cytotoxic to the cells. This will be monitored though MTT proliferation assay and LDH leakage assay. Once a viable concentration is found, we will expose our cells to begin testing the anti-inflammatory properties. We expect the coat to remain consistent in reporting high levels of anti-inflammatory properties as well.

Bronx Community College

Isolation of human DNA and PCR amplification of an Alu Insertion site for DNA fingerprinting

Muhammed Bajo, Nathaniel Boadi Donkor, Fernando Fernandez, and Abigail Teye

Mentor: Professor Rujin Tian
Bronx Community College

95% of human genome is made of introns, or non-coding DNA. Alu, a DNA sequence about 300 base pairs long, has been randomly inserted into the introns of human genome over millions of years, therefore our introns often vary in their size and sequence among individuals. The purpose of this study is to examine and compare the insertion patterns of Alu in the introns of chromosome 8 (Ch8) among several individuals. First, we isolated our own DNA from a simple saline mouthwash. Then we applied PCR to amplify Alu on Ch8. Since we each have two copies of Ch8: one maternal allele and one paternal allele, the possible versions or genotypes of Alu insertions in

Ch8 are Alu +/+ (both alleles have the insertion), Alu+/- (one allele has the insertion), or Alu(-/-) (both alleles lack the insertion). Lastly, we analyzed our PCR fragments with gel electrophoresis and determined our Alu genotypes. This project offers the unique opportunity to analyze a sample of our own DNA and an improved understanding of PCR-based DNA fingerprinting and ancestry.

DNA Barcoding; A Powerful Tool for Documenting Biodiversity and Enhancing Science Education

Habiba Masoud

Mentor: Adijat Adebola
Bronx Community College

Taxonomy is a system that is used to identify, name and classify living organisms. It encompasses identifying and characterizing organisms based on observing differences in the morphology, the developmental processes, behavior, habitat and evolution of living things and using this information to arrange organisms into specific groups or taxa. Classical taxonomy as it is practiced today involves having extensive knowledge and training about the particular group of organisms you're studying and is very labor intensive. In recent years, DNA Barcoding has been used as a molecular biology tool to identify and describe old and novel species. This technique can be used with classical taxonomy techniques to rapidly and accurately identify and distinguish between living species. This presentation provides a description of the DNA barcoding technique and describes how it is used to identify plant and animal species. The presentation will also briefly describe how DNA barcoding can be used in the classroom to increase student understanding and interest in science.

Anti-cancer Effects of Quercetin

Elizabeth Oppong Darkwa

Mentor: Professor Rajendra Gharbaran
Bronx Community College

Flavonoids, compounds naturally occurring in several plants including fruits, vegetables and medicinal herbs, have attracted much attention for their role in the treatment of human ailments, including cancer. In this study, laboratory experiments showed that quercetin reduces cell growth of Hodgkin's lymphoma cell lines, KMH2 and L428 in a dose (0, 20, 40, 80 uM)- dependent manner, after 72 hours of treatment. In addition, I learnt from this research that certain foods contains a higher amount of quercetin. These foods are Chocolate dark 25.00mg/100ml, Black Elderberry 42.00mg/100g Fw, Champagne 8.50e-03mg/100ml, black crowberry wine 6.67e-03mg/100ml (Jak and Jak, 2015). Further literature research showed that quercetin has repressed the proliferation of cancers such as gastric cancer, breast cancer, thyroid cancer, pancreatic and lung cancer (Vafadar, Shabaninejad and Monahedpour, 2020). Consuming certain foods rich in quercetin may reduce the risk of certain cancers. Also, the growth-limiting effects of quercetin on Hodgkin's lymphoma suggest that this flavonoid may also help reduce risk of this disease, but further research is needed.

Investigation of Discrete Contamination of Rain and Primary Supplied Water in and around the State of New York, and Resulting Effects on the Surrounding Domain

Vishwanauth Persaud

Mentor: Professor Dickens Saint-Hilaire
Bronx Community College

The conducted research experiment was carried out with the intended aim of determining the amount of contamination of rain and primary supplied water in and around the state of New York. The main influence behind this research was due to the poor quality of water that is provided in third world countries, such as where my mentor and self hail from. With the rise of industrialization, the amount of air pollution is on the rise, which in turn would inevitability also affect the source of water, such as from the atmosphere. Although this experiment is considered a prolonged one, which would require continuous testing to arrive at a proper and adequate conclusion, it is a necessary research needed to be carried out.

The Study of Scattering Reducer for Water Based Liquid Scintillators

Monique Bisasor

Mentor: Professors Sunej Hans
Bronx Community College

A neutrino is a neutral, weak, ghost-like subatomic particle with almost no mass that can pass through matter without any interactions. Even though neutrinos go undetected, they are one of the most abundant particles in the universe. Because they are so small, they are almost impossible to detect. They require a large detection medium such as tons of water, liquid scintillators, or noble gases to detect a signal from neutrino. There are few organic based liquid scintillators that could be used to detect neutrino. My project focuses on the reduction of scattering on absorption spectra in the Water-Based Liquid Scintillators. Water-Based Liquid Scintillators (WBLS) were developed by mixing scintillating benzene based organic solvent, water, and surfactants. Water is the major component of this type of scintillator, as a result this unique detection medium is cost-effective and environmentally friendly. The use of a water-based liquid scintillator with low energy radioactive background could improve sensitivity for neutrino detection. The purpose of this project is to work on a water based liquid scintillator and find a suitable scattering reducer that provides sensitivity for a wide range of particle interaction. Each detector requires good light yield and optimum optical properties, but it is a big challenge for WBLS. The light yield is compromised due to the lower loading of benzene based liquid scintillator to the WBLS and the optical properties are not meeting the need of the experiment as there is scattering in absorbance spectra due to mixing of water and organic solvent. A part of my project depends on finding the suitable scattering agents to improve the optical properties. Analysis of the samples was done using Ultraviolet-Visible Spectroscopy and Fluorometer. The results showed lower scattering of the WBLS system, but further experimentation is needed to further improve the optical properties.

Symmetric at a Point on the Unit Circle, but Not on the Entire Circle

Yrfrat Jahan

Mentors: Professor Yunchun Hu
Bronx Community College

A circle endomorphism is an orientation-preserving degree two covering map of the unit circle. We study a circle endomorphism which preserves Lebesque measure and is uniformly quasisymmetric. Then we construct the conjugacy h between two circle endomorphisms. We will show the h is symmetric at a specific point, but it is not symmetric on the whole circle. This project will prove this

statement by providing calculation and geometric argument.

Analyzing the Security Aspects of Internet of Things (IoT) Using Ethical Hacking

Inderjit Singh

Mentor: Professor Syed Rashid Zaidi
Bronx Community College

The world is getting more connected each day. The present era witnessed more transformations and innovations than some past centuries together. These transformations, figured in the form of globalization, digital innovations, the constant use of cloud systems, and the construction of the Internet of Things, the concept has led society into a dilemma. On one side, the human being can take advantage of a more connected world by talking with relatives, storing files online, and traveling faster from one place to another. But as the amount of data online increases in size, so does the risk of attacks to sensitive information. This latter reason demands actions such as social awareness about cyber criminality and the implementation of corporate and governmental measures of protection. This paper will examine the security aspects of the Internet of Things (IoT) using Ethical Hacking techniques and strategies to improve the security of the devices/equipment that connect to the Internet.

An Exploration of the Synthesis of Iron (Fe2+, Fe 3+) Liquid Scintillator and Light Yield Quenching Study

Absari Chowdhury

Mentor: Professor Sunej Hans
Bronx Community College

There are many national and international projects are funded by department of energy to study the neutrinos the smallest particle coming from Sun or generated from nuclear power plants. Neutrinos are tiniest particles not known to have any mass for long time since their interactions with matter is unnoticeable. Big detectors filled with organometallic compounds are needed to study the neutrinos since their interaction is very small with the matter. The purpose of this study I to work on the synthesis of the Iron loaded liquid scintillators and light yield quenching study. I have performed few reactions with Fe2+ and Fe3+ compounds to complex with organic ligand but there is further study need to complete this part of the project. I also had prepared series of samples to study the quenching of light yield on the samples. In this experiment, the study is also about liquid scintillators. In the past and present, Organic liquid scintillators are used in many neutrino physics experiments. In particular for low energy neutrinos when original time and energy information are required, liquid scintillators have several advantages compared to other technologies. Several metals loaded scintillators of the past suffered from chemical and optical instabilities, limiting the performance of these neutrino detectors. Recent techniques providing metal loaded scintillators that can be used under stable conditions for many years even in ton scale experiments. Metal loaded organic liquid scintillators (LS) have been used in neutrino detectors from the first neutrino experiment. Mostly neutrino experiments have counted on the advantages of the LS technology. The advantages of such a detector type are amongst others high purity, low energy threshold, detector homogeneity, flexible handling, scalability to large volumes and

rather low cost. Both of these projects need further experimentation to complete the study.

College of Staten Island

Enhanced Water Collection From Air Using Hybrid-Hydrophobic Surfaces

Edmond George

Mentors: Professors Alan Lyons, Illya Nayshevsky and QianFeng Xu
College of Staten Island

Water is very essential to life. Harvesting water from the air can supply water for communities in excessively dry environments. Hydrophilic surfaces, which attract water, allow water to condense on the surface in fair amounts. Hydrophobic surfaces, which repel water, allow water to slide off and so be removed from surfaces easily. A combination of a hydrophobic surface with hydrophilic features allows the best utilization of both hydrophobic and hydrophilic properties. This project is aimed at quantifying the amount of water that can be harvested from hybrid hydrophobic-hydrophilic surfaces.

Hydrophobic surfaces were produced and are composed of a fluoropolymer coating on photovoltaic cover glass. Hydrophilic features were produced by mechanically removing the fluoropolymer coating leaving exposed hydrophilic glass. Surface properties were analyzed by measuring water contact angle, water sliding (slip) angle, and contact angle hysteresis (CAH). The water collection properties of the surfaces were analyzed by exposing the surfaces to a controlled humid environment inside a laboratory condensation chamber, and weighing the amount of water that condensed and slid off from surface. Bare (uncoated) glass, and a glass with a continuous hydrophobic coating were used as controls. The amount of water harvested over ~24 hours for each type of surface will be presented.

The Role of Vascular Endothelial Growth Factor in Spinal Cord Injury

Michelle Puma

Mentor: Professors Sreyashi Samaddar and Zaghloul Ahmed
College of Staten Island

Trans-spinal direct current stimulation (tsDCS) is a neuro-modulatory technique, extensively used to positively effect spinal plasticity and motor function in Spinal Cord injured patients. Spinal cord Injury (SCI) is a condition that affects physiological, psychological, emotional, social, economic, and sexual aspects of a patient's life. Scientists around the globe are working towards deciphering a remedy that might be able to impart a better quality of life to these patients. The objective of this study is to understand the effect of tsDCS on the expression a specific growth factor, vascular endothelial growth factor (VEGF). Through various literature review findings, research studies demonstrate the methodology and significance of VEGF along with tsDCS on motor function recovery. Particularly, how tsDCS regulates the increase of VEGF. Furthermore, Cathodal tsDCS, a stimulation that inhibits neuronal activity, results of overexpression of VEGF in non-injured and injured animals. VEGF, a potent angiogenic factor, also plays a significant role in bone formation, hematopoiesis, wound healing, development, neural migration, and neuroprotection. As a result, increase of VEGF is witnessed in ventral motor neurons. Analyzing this growth factor may help us in developing future therapeutic measures for spinal cord injured patients.

Are microplastics a problem in beach sediments? A pilot study of Lemon Creek Beach, Staten Island

Ting Ting Chen

Mentor: Professor Jane Alexander
College of Staten Island

Microplastics are small pieces of plastic that are less than 5mm in diameter. These plastic particles originated from plastic packaging materials such as plastic bottles, plastic bags, personal care products, and fishing lines and nets. These small pieces of plastics that are washed into the sea have had a great impact on marine life because many of these microplastics are consumed by marine organisms and work their way up the food chain. We consume fish and other marine organisms, which means we are consuming the microplastics too. This project assesses the impacts of this global issue at a local level by determining how much microplastic is present at Lemon Creek Beach, Staten Island, and describing shapes and colors of the fragments. Samples were collected from the top 5 cm of the beach sand at the high tide line using a sediment corer. We then took back the samples we collected from the beach to the lab and dried the sediments to prepare for sieving. Samples were sieved for 15 minutes to split them into 4 size fractions (< 300 μm, 300 μm – 1 mm, 1 – 5 mm and everything > 5 mm). Many samples contained organic matter, so we removed it using hydrogen peroxide. We separated the microplastics from the beach sediment by performing a density separation using a saturated NaCl solution. The microplastics float and the sediments sink, with the smaller size fractions needing a longer settling time than the larger ones. We then vacuumed the supernatant and filtered it to collect any floating material on the filter. We examined the filters for microplastic particles using a binocular microscope. The microplastic particles collected will be counted, photographed and described, to determine the extent of the problem at Lemon Creek Beach.

Expression of glucose transporter, Insulin receptor and their role in bioenergetics

Olaya Torres and Kamelea Torres

Mentor: Professor Abdeslem Elidrissi
College of Staten Island

We have shown that taurine supplementation increased islet size in the pancreas and insulin production by β cells. These changes in pancreatic function are responsible for the increased resistance to glucose challenges in taurine-fed mice. Control mice showed a significant increase in plasma glucose concentration 30 min after glucose injection with a gradual decrease thereafter. By 120min, mice were slightly hypoglycemic relative to baseline. In contrast, taurine-fed mice showed a drastically different response to glucose injection. There was a delayed peak of plasma glucose at 60 min post-injection and the plasma glucose in these mice was significantly lower than controls at all times measured ($p < 0.001$). These data were reproduced in avian. Insulin is primarily a metabolic hormone functioning on muscle, fat, and liver via activation of the IR receptor. Insulin also functions on other non-metabolic tissues such as the brain. Once insulin is secreted it crosses the blood-brain barrier by a transporter-mediated saturable mechanism. The IR is widely expressed in the brain at various levels. This regional specify implicates insulin, through activation of its receptor, in various brain functions that are mediated by these brain structures. In this study, we propose to examine the levels of insulin receptors (IR) expression in the pancreas and brain in controls and taurine-fed pigeons. In mice, we found a significant increase in IR expression in all brain regions and the pancreas compared to controls. Here, we propose to investigate the expression pattern of IR and how it is affected by taurine in the avian model. Interestingly, changes in the expression levels of insulin receptors were associated with changes in the expression levels of glucose transporter (Glut 4) in neurons. We suggest that circulating levels of insulin regulate the expression levels of insulin receptors in the brain

that in turn regulate neuronal bioenergetics through regulation of the expression of Glut4.

Electrophysiological and biochemical characterization of neuronal excitability in fragile X mice

Reem Gouda

Mentor: Professor Abdeslem Elidrissi
College of Staten Island

In this study, we examined the fragile x mouse model, fmr1 KO mouse to characterize the excitability of neuronal circuits using the stretch reflex as a model. The FMR1 KO exhibited an enhanced stretch reflex response characterized by an increase in both muscle tension and electromyogram amplitude. The enhanced stretch response was mediated both at the level of CNS and muscle. FMR1 KO mice showed enhanced muscle tension under isoflurane anesthetic. At the level of the muscle, we found histological alterations characterized by changes in the distribution of connective tissue and diameter size of muscle fibers. Furthermore, FMR1 KO muscle displayed ultrastructural modification characterized by longer and thinner sarcomeres. These histological alterations in myofibril and extracellular components of the muscle could explain the exaggerated response of the stretch reflex that is due to the passive properties of the muscle. Immunofluorescence of the spinal cord showed enhanced immunoreactivity in both glutamic acid decarboxylase and choline acetyltransferase and a decreased expression of both GABAA and glycine receptor in the taurine deficient mice compared to controls. Disruptions of the cholinergic, GABAergic and glycinergic systems in the spinal cord may be contributing to the enhance reflex due to changes in excitability and inhibitory functioning. In this study, we propose to further characterize neuronal excitability in fmr1 mice by looking at neurotransmitter receptor expression in the brain and the functional consequences of altered expression of these receptors by measuring neuronal excitability electrophysiologically.

Applications of Singlet Oxygen in Photodynamic Therapy: Evaluating the stability of Chlorin e6

Anastasia Maximenko

Mentor: Professor Alan Lyons and QianFeng Xu
College of Staten Island

Photodynamic Therapy (PDT) uses light, a photo-sensitizer, and molecular oxygen to form an excited state of oxygen, known as singlet oxygen to cause cell death and kill microbial cells. PDT is a minimally invasive technique because the lifetime of the excited state is less than 10 microseconds before it decays back to the molecular oxygen ground state. However, it can be used to treat various malignant cancers, macular degeneration, psoriasis, actinic keratosis, and periodontal disease. Chlorin e6, a hydrophobic photo-sensitizer (PS), can be derived from algae and is used in several countries for PDT; it was selected for this project because of its low cost and high efficiency in the generation of singlet oxygen. The purpose of this study is to evaluate the stability of chlorin e6 when exposed to the excitation wavelength. The study will use a high intensity LED (Cree Semiconductors, peak output at 664 nm) to irradiate the sample and UV-vis absorption spectroscopy to analyze the absorption maxima of the molecule that occur at 405 nm and 658 nm. A series of concentrations of chlorine e6 in aqueous PBS buffer solution will be studied as a function of irradiation time. A Beer's Law calibration plot was used to quantify the concentration of chlorin e6 in solution. The degradation of chlorin e6 vs time and the decomposition rates in the dark vs during exposure to the red LED will be presented.

Late Onset Ataxia in the Fragile X Mouse

Mustapha Kobeyssi

Mentor: Professor Abdeslem El Idrissi
College of Staten Island

Fragile X syndrome is a genetic condition that is due to a trinucleotide CGG expansion in the premutation alleles along the promotor region of the FMR1 gene. Fragile X associated Tremor/ ataxia syndrome, which is caused by these triplet expansions, is considered a neurodegenerative disorder affecting males with late onset (ages > 50 yrs). FMRP is an mRNA binding protein and has been shown to play a role as a transporter of mRNA. Therefore, the absence of FMRP causes improper shuttling of mRNA which leads to abnormal brain development. In this study, we examined histogenesis and pattern of connectivity of the principle cells of the cerebellum; Purkinje cells. The importance of Purkinje cells in the cerebellum is due to their ability to act as a resistance modulator during a high volume of incoming signals from proprioceptors, basal ganglia and other areas of the brain. Thus, alteration in synaptic connectivity of Purkinje cells with other cells of the cerebellum will lead to alteration in motor movement and Ataxia-like symptom.
Since ataxia is a neurodegenerative disorder characterized by abnormal locomotor activity, we hypothesize that abnormal synaptic connectivity in cerebral and cerebellar structures in the fmr1 Ko mice brains may lead to late onset ataxia and other cognitive deficits in these mice.
We found that fmr1 Ko mice, like human with fragile X syndrome show late onset ataxia. Ataxia in fmr1 Ko mice was evaluated using DigiGait equipment which quantifies forelimb and hindlimb coordination as the mice walk on a treadmill. Synaptic connectivity was measured electrophysiological from the brain of fmr1 Ko mice as an indication of the pattern of neuronal firing. Finally, we evaluated histogenesis of the cerebellum by examining the arborization of the dendritic tree of Purkinje cell using immunohistochemistry and biochemical markers of Purkinje cells.
In conclusion, we found that fmr1 Ko mice demonstrate altered electrophysiological, biochemical and histological properties that we suggest are responsible for the later onset ataxia observe in these mice. These alterations are mediated by the transcriptional dysregulation due to the lack FMRP.

Testing the Thermal Stability by Using Singlet Oxygen

Mehnoor Khan, Danielle Ohana, and Samuel Krichavets

Mentor: Professors Alan Lyons and QianFeng Xu
College of Staten Island

Singlet oxygen (1O2) is an excited state of oxygen, which has real world applications. One of the benefits of singlet oxygen is its ability to kill bacteria. Currently, it is being studied by dental professionals to eradicate bacteria that is linked to periodontal diseases. The existing approach uses a sensitizer that is directly applied to the periodontal pocket and limits the delivery span to about 3 mm. This is a concern, as some pocket depths reach 8-10 mm. The advancement of a device with the capability to deliver highly localized singlet oxygen at these depths would be a major improvement over current periodontitis treatments.
Singlet oxygen is produced when a laser diode emits light at a wavelength of 664 nm onto a superhydrophobic sample that is coated with a photosensitizer. This illuminates the sensitizer particles that then react with proximate oxygen gas. In this study, the thermal stability and photostability of samples were tested. The sample used is coated with a solution of Chlorin e6 (Ce6) dissolved in dimethyl sulfoxide (DMSO). Thermal stability was tested by heating the sample at 60°C for varying times, as well as testing a control group, which was not exposed to any heat. Photostability was tested by photobleaching the samples, which entails placing a sample in an empty cuvette and exposing it to an LED light for 30 minutes. After exposing the samples to these accelerated conditions, they were placed in a uric acid trapping solution to quantify the amount of singlet oxygen generated by the surface. Rates were determined using UV- Vis spectroscopy. Preliminary results are reported.

TGFb Pathway Gene Expression Patterns in Non-small cell lung carcinoma and in Glioblastoma Multiforme

Briana Soto

Mentor: Professor Nancy LiuSullivan
College of Staten Island

Glioblastoma multiforme, GBM, is categorized as the most aggressive form of glioma found along the central nervous system. While gliomas approximately make up 80% of all malignant brain tumors, GBM is responsible for approximately half of all primary brain and CNS cancers. This form of cancer targets more men than women and increases in tumor frequency with age as well. Once diagnosed, patients will typically receive a poor medical prognosis with an average survival rate of 12 to 18 months. Invasive ductal carcinoma, IDC, is one of the most common forms of breast cancer diagnosed in women. Non-small cell lung cancer, NSCLC, is one of the most common types of lung cancer. It arises from the epithelial cells in the lung of the central bronchi and to the terminal alveoli. The most common cause of NSCLC is attributed to smoking, but the cancer can also be found in individuals who have no history of smoking. NSCLC will be diagnosed in approximately, 80-85% of all diagnosed lung cancers, rendering it a fairly common lung cancer type. At stage IV, NSCLC will become difficult to treat by standard cancer treatments. The gene expression patterns of both cancers will be studied. According to the pattern of the gene expression, the studies will help to determine which set of gene can potentially be used in order to develop novel drug treatments. Over expressed genes would become the ideal candidate for such treatment.

Selective Attention and Emotion Recognition in College Students Assessed with the AQ and RAADS-14

Arouje Shaikh

Mentor: Preofssor Bertram O. Ploog
College of Staten Island

Emotion and facial recognition are crucial aspects of social interaction. The ability to comprehend one's facial features related to emotions is a crucial social skill that allows people to communicate upon a deeper meaning. The current research topic is the ability of individuals with ASD to accurately recognize emotions in facial expressions. Many individuals with ASD are known to have deficits in emotion recognition but these deficits are still only poorly understood. In the present study, a pre- and post-test and a training phase were implemented to show the effect of training on attention to compound stimuli, especially photos of emotional facial expression. Participants were expected to show longer response times with emotional stimuli than with non-emotional stimuli because of the increased complexity of emotional stimuli. It was further expected that participants who score low (i.e., less "autistic") on the AQ and RAADS-14 would be more accurate in responding to all stimuli than participants who score high especially with the emotional stimuli. Finally, we hope that this discrepancy is reduced (with evidence in the post-tests) due to training. These results are important because they suggest an effective intervention to increase emotion recognition in individuals with ASD with the subsequent improvements in social skills.

Interaction of Different Tau Mutations In Vitro

Marven Fam and Momtahina Akter

Mentor: Professors Alejandra Alonso and Viktoriya Morozova
College of Staten Island

Tau is a microtubule-associated protein (MAP). Tau is required because it assists in sustaining the microtubules in the neural axons in the CNS. Tau is a phosphoprotein and the degree of phosphorylation is important for the normal functions of tau. When tau is hyperphosphorylated, it can't bind to tubulin and stabilize the microtubules. Furthermore, abnormal and hyperphosphorylated tau binds to normal tau and segregates it from the microtubules. Thus, it results in a microtubule disruption and death of the neuron. Normally, tau contains 3 moles of phosphate per mole of protein. However, in an Alzheimer's disease patient, tau protein gets hyperphosphorylated, which results in containing 7-10 moles of phosphate per mole of protein. Previously we had shown that hyperphosphorylation of tau at Ser 199, Thr 212, Thr 231, and Ser 262 with R406W mutation is sufficient to induce pathological conformation of tau similar to one found in Alzheimer's Disease patients. Alzheimer's disease is a progressive disease that contains numerous manifestations, such as destroying the memories of an individual and other neurological functions.
This research was developed to examine the interactions between various tau mutations. For this specific project we want to tag four tau protein constructs with red fluorescent tag (DsRed). There are four tau construct, such as wild type (wt), tau hyperphosphorylated at Ser 199, Thr 212, Thr 231, and Ser 262 (P-Tau); tau with R406W mutation (R406W) and tau pseudo-phosphorylated at Ser 199, Thr 212, Thr 231, and Ser 262 with R406W mutation (PH-Tau) tagged with green fluorescent protein (GFP). To accomplish our objective we want to cut tau genes out of vectors containing GFP and insert them into the vectors containing DsRed. The successful execution of tau constructs tagged with DsRed will allow us to observe the interactions between two different tau mutants.

The Structure, Meaning and Pronunciation of What-Marked Yes/No Questions in New York City English

Karen Correa

Mentor: Professor Jason Bishop
The College of Staten Island

In this study we examine what we refer to as What-marked Yes/No questions (WH-YN) in the New York City variety of English. Examples of WH-YNs are shown in (1) and (2):
(1) What am I? Chopped liver?
(2) What are we? George Washington?
It is clear that WH-YNs are not genuine questions; rather than genuine requests for information, they are rhetorical, which is readily seen when comparing (1) and (2) with the genuine WH-questions in (3) and (4), respectively:
(3) What am I?
(4) What are we?

In the present study, we outline results of an analysis of WH-YNs based on a corpus of popular media. We describe how WH-YNs are distinct from standard WH-questions not only in terms of meaning, but also their syntactic structure, use, and pronunciation.

Effects of Autistic Traits on Acoustic Measures of Vowel Realization

Krissy Dellecave and Alexandra Diaz

Mentor: Professor Jason Bishop
College of Staten Island

Previous research has shown that some measures of speech production and speech perception vary systematically in relation to autistic traits. For example, speakers with more autistic-like personality traits, as estimated by measures such as

the Broad Autism Phenotype Questionnaire, show a decreased use of context in speech perception and complex patterns of vowel-to-consonant interactions in speech production. The present study extends the discussion to differences in vowel production. We test the hypothesis that the acoustic clarity of speakers' vowels is systematically related, in part, to their autistic traits. A large group of native speakers of American English produced words containing four peripheral vowels. Two acoustic measures of vowel dispersion (a measure of acoustic clarity) show that measures of autistic traits predict vowel dispersion in a subset of the speakers. We discuss the implications of the findings for the role of autistic traits in speech and communication.

A Research Game that Models Collaboration between Autistic Players

Konstantin Novichenko

Mentor: Professor: Deborah Sturm
College of Staten Island

We extended a two-player research game that is designed to study the collaborative and emotion recognition abilities of players on the autism spectrum. The video game has 2 phases – first, the players independently assemble a digital puzzle using gestures. Then players communicate in-person to agree on the appropriate emotion for the context. Animations before each scene communicate the context (for example bullying). The players collaboratively select the appropriate emotion of the protagonist (for example sadness). We expected that when an expert player models behavior, a novice player will learn game mechanics and will communicate more as the game progresses. Preliminary observations show that modeling of game play by peers with stronger social skills is effective in improving collaboration. Each testing session consisted of five levels. During the first three levels, the modeler used exaggerated gestures and initiated a discussion about the appropriate emotion to select. After the first three levels until the end of the game session, the modeler stopped exaggerating gestures and didn't initiate a conversation to observe whether the novice player would model initiating collaboration. We conducted a series of sessions with 14 typically developing players and 7 players on the autism spectrum. Six out of 14 of the typically developing participants and 5 out of 7 of the participants on the autism spectrum stated that expert peer modeling improved their understanding of gameplay and helped them to communicate and collaborate more. Moreover, after analyzing video sessions, we concluded that 8 out of 14 of the typically developing participants and 6 out of 7 of the participants on the autism spectrum adopted the modeled behavior and initiated conversations.

Are microplastics a problem in beach sediments? A continuing study of South Beach, Staten Island

Alex Fiero

Mentor: Professor Jane Alexander
College of Staten Island

Microplastics are small pieces of plastic that pollute the environment. To be defined as a micro plastic they must be a particle smaller than 5mm. They can be manufactured this size or formed from the breakdown of larger plastics, so their shape and color vary. Microbeads and nurdles are example of manufactured microplastics and are often improperly disposed of and end up in our oceans. Microfibers are thread like fibers that tend to come off synthetic clothes, the shedding of plastic microfibers can occur just from washing clothes and potentially be dispersed into the environment. There is concern for marine life considering microplastic is a harmful pollutant and potentially be toxic when ingested. This is a potential hazard for humans as well, since it is contaminating our commercial fish groups that are eaten regularly. The purpose of this research is to determine the quantity and nature of the microplastics in sand samples that were collected along South Beach. Our samples were separated based on grain size to measure the concentration of microplastic found at each size, so each sample was separated into three different size groups, 1-5mm, 300 µm -1mm and <300 µm. A density separation is performed on each sample, but in earlier separations, organic matter would be collected

along with the suspected microplastic particles. To prevent this from happening in later separations we started treating each of the fine subsamples with hydrogen peroxide to dissolve any organic material that may have been mistaken for a plastic. The density separation was performed using a NaCl saturated solution, the solution was mixed with a sample and allowed to rest, sediment sank to the bottom of the beaker and any plastic particle was suspended on top of the solution. The top of the solution is then vacuumed, isolated and filtered through a glass fiber filter. Any microplastic particles are collected on the filter disk and are noted based on what subset they came from. In several filters you will see noticeable microplastics, such as clusters of fibers that are black and silver as well as a few clear plastic particles in one sample, and a few plastic fibers which are silver or opaque and a small red fiber in another. For microfibers their color has been mostly silver and clear but there are various colors in our collection such as red, blue, and black and for microfiber beads their colors are light brown to opaque, their shapes vary from smooth pearls to fragmented textured chunks. Further samples are currently being processed and should allow for an analysis of any variations in geographical distribution along the beach.

Guttman Community College

The Application of Solid Acid Catalyst in Biodiesel Production

Jose Martin

Mentor: Professor Ji Kim
Guttman Community College

Biodiesel is renewable fuel that comes from vegetable oil, animal fats and recycled restaurant greases. In this research we used brown grease which is used to describe the FOG materials (fat, oil, and grease) collected in wastewater treatment plants. The brown grease we have been using was collected from the Wastewater Treatment Plant in Torrington Connecticut, and it was filtered to remove any solid residues, and then removed water via Dean-Stark distillation. Previously our research showed the 100 % conversion of brown grease to biodiesel with mixing methanol and catalytic amounts of sulfuric acid in 3.0 hours refluxing. However, sulfuric acid is nonrenewable, corrosive, we have been employing reusable solid catalyst, Amberlyst. The preliminary data showed that addition of 10% of Amberlyst converting brown grease to biodiesel 97 ~100%. We have been investigating the lifetime of solid catalysts by testing how many times the solid catalyst could be reusable before it loses its function.

The Characterization and the Application of Fluorescent Carbon Dots

Yeremi Garcia and Victoria Negron

Mentor: Professor Jihyun Kim

Carbon Nano materials or carbon dots (c-dots) are highly useful biocompatible nanomaterials that can be derived from biomasses, and present as highly florescent. The research conducted within our group focuses on deriving c-dots from the acid whey byproduct of Greek yogurt. The average size of the c-dots is 20 nanometers. We have found that the fluorescence intensity is greater using solid catalyst of Amberlyst- H with an optimal reaction time of 105 minutes than using sulfuric acid with an optimal reaction time of 90 minutes. The fluorescence intensity and absorbance were measured against quinine sulfate to measure quantum yield.

Gutalexa Virtual Assistant

Ousman Dukuray

Mentor: Professor Jinzhong Niu
Guttman Community College

Our project aims to build a virtual information hub, essentially an Amazon Alexa skill, for Guttman Community College of CUNY, helping students and employees find information they need using their voices. This virtual assistant can be used in the Alexa app on a smartphone or on a physical Alexa device like Amazon Echo. Voice assistants like Alexa, Siri, Google Assistant, and Cortana have become an essential part of the ever-growing era of technological advancement. In a fast-paced world with a high expectation for efficiency, we believe this project would help better serve information seekers at our college.

More specifically, our Amazon Alexa skill allows interactions with community members and provides information regarding the college. For example, a new student could ask "Alexa, where is the Financial Aid Office?" and would receive an answer saying, "The Financial Aid Office is located on the third floor right across from the elevator.". Indeed, our Alexa skill can answer questions regarding faculty members, programs, offices, academic services, events on the academic calendar, news about the college, etc. To achieve this mission, we collect, parse, and integrate information from various sources, either automatically through APIs or even manually, including the college directory, the academic calendar, the college event portal, the news feed of our college website, and FAQs from our library and other services and offices. We implement the Alexa skill using Java, host it on Amazon Lambda (a serverless computing platform), and put structured knowledge on Amazon DynamoDB (a NoSQL database service).

Our project is open-source and hosted on Github. We believe that our efforts not only benefit our own community but also can provide guidance on how to provide information in a more effective way in a college setting and shed lights on how to manage and organize domain knowledge effectively.

Determination of Vitamin C Using Spectrophotometry Method

Lisbeth Almonte

Mentor: Professor Chulsung Kim
Guttman Community College

Vitamin C is an essential nutritional component that needs to be taken from foods and dietary supplements. The human body, unlike animals, is not capable of producing it. Its primary benefits include reducing the risks against immune system deficiencies, cardiovascular disease, prenatal health problems, eye disease, and even skin wrinkling. To determine vitamin C in various samples, two conventional methods, such as Titration and Spectrophotometry, have been adopted. Spectrophotometry, more frequently used over the method Titration, is a fast-instrumental method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through a sample solution. One of the standard color development agents for vitamin C determination is the Phenanthroline and Ferric ion complex, assuming the color-developing reagent responds to vitamin C in the solution immediately. This study investigated the effects of the reaction periods between vitamin C and the phenanthroline-Fe reagent on absorbance stability. The 1,000 mg/L of vitamin C stock solution was prepared to prepare three standard solutions that reacted with the color developed reagent, and the absorbance was measured at 510 nm as a function of time up to 20 hours. Experimental observation indicates that as the reaction period increased, the absorbance increased while the linearity between absorbance and concentration dropped. To increase the accuracy of the vitamin C analysis in the solution, the color development period should be consistent for samples and standards. Based on the experiments performed in this study, it is recommended to set between 10 -20 minutes of the color development period.

The Number of Antioxidants in Various Fruits

Paola Rojas

Mentor: Professor Chulsung Kim
Guttman Community College

Antioxidants can protect against cell damage that causes oxidative stress. They are very beneficial and prevent having diseases. This study explores the amount of antioxidants in various citrus fruit peels and vegetables, such as beet, lemon, lime, grapefruit, orange, cauliflower, tangerine, and brussel sprout. Samples were air-dried, followed by ground, and sieved to collect uniform particle sizes. The TEAC method was adopted to determine the amount of antioxidant capacity. According to experimental results, all citrus fruit peels and vegetables studied in this research can be resources for the antioxidants. Among the samples, tangerine showed the highest antioxidant capacity with 74.61 umole Trolox/g sample. The lowest antioxidant capacity was observed in the beet sample with 11.23 umole Trolox /g sample.

Palm Oil Plantation in Ecuador

Farida Tijani

Mentor: Professor Derek Tesser
Guttman Community College

Land cover degradation and change is a significant issue impacting tropical ecosystems. The rapid development of agriculture in tropical regions results in deforestation and biodiversity loss, but agricultural expansion is difficult to monitor from satellite remote sensing due to persistent cloud cover in tropical regions. In the Chocó biodiversity hotspot of Ecuador, deforestation over the past 30 years is driven primary by the conversion of land to Oil Palm monocultures with unknown impacts on biodiversity and ecosystem services. Complex topography and persistent cloud cover limit the utility of traditional survey methods to map the land cover and land use history in this region. Synthetic Aperture Radar (SAR) is an active microwave observation system that produces its own energy and measures the returned backscatter of objects on Earth's surface. Backscatter is a function of the surface geometry and moisture and operates independently of clouds. SAR provides a method to study land cover degradation and agricultural expansion in tropical ecoregions like the Chocó to investigate change over time.

We analyzed PALSAR radar imagery to investigate differences in backscatter between mature and young oil palm fields. QGIS software was utilized in the analysis to create area polygons of mature and young oil palm fields and extract pixels for zonal statistics, guided by ground survey collections. We calculated the backscatter statistics (mean and standard deviation) for young and mature oil palm fields to determine if these regions are distinguishable in radar imagery. We observed different mean backscatter results mature palm and young palm fields in the radar imagery (mature -6.5 dB; young -7.2 dB) demonstrating the utility of SAR to distinguish tropical land cover classes. Future work will incorporate a longer radar time series to investigate tropical degradation over time.

The Total Amount of Soluble Antioxidants in Various Vegetables

Ruth Dorcely

Mentor: Professor Chulsung Kim
Guttman Community College

Over the years' individual's interest in antioxidants of various edible items has drastically increased due to its positive health benefits. Antioxidants are substances capable of defending the human body from a detrimental large chain of free radicals. The chemicals with an odd number of electrons, known as free radicals, roam the body deteriorating cells and causing cancer by binding to DNA, RNA, or proteins. These destructive compounds are neutralized by antioxidants. Many vegetables and fruits have been studied as potential sources for the antioxidants. Some examples of vegetables and fruits with high antioxidant capacity include mango,

blueberry, and red cabbages. In this research, the number of water-soluble antioxidants in various Brassicaceae vegetables such as cauliflower, cabbage, kale, bok choy, broccoli, and brussels sprouts will be studied. The Trolox Equivalent Antioxidant Capacity (TEAC) spectrophotometry method using ABTS radical positive ion as a simulated free radical will be used to determine the amount of soluble antioxidant. has been adapted in the study of antioxidant activity throughout vegetables. This whole presentation has been on the basis and articulation of my research, and its purpose and the process for when the research will be performed under a safe environment.

Identifying Traffickers: Sex Traffickers Data Collection

Britney Puma

Mentor: Professor Dalvin Hill
Guttman Community College

Over the years, we have seen a disheartening increase in the number of human trafficking cases. With this increase, we have also witnessed the revolution of technology. Technology like every other facet of life, has its positive and negative characteristics. This paper aims to view the impact of technology if not used appropriately, as a counterproductive tool in the fight against human trafficking.

The role of technology in eradicating human trafficking will be analyzed. Additionally, various aspects of technology will be assessed to determine effectiveness in the pursuit of significantly reducing the number of human trafficking cases. The research process consists of reviewing sources from organizations such as Safe Horizon, Thorn: Digital Defenders of Children, and Polaris. An overview of human trafficking established laws serves as a major backbone and fuels the proposed idea of implementing functions within a database in the Dru Sjodin National Sex Offender Public Website. The database was found to have numerous U.S. states that did not provide geographical coordinates, which hinders users from using a search functionality within the database.

Hyflex

Kleyris Heras & Orlando Villalba

Mentor: Professor Dalvin Hill
Guttman Community College

A pandemic is known to disrupt many if not all sectors around the world. The educational sector, like any other sector is not exempt from the disruption caused by a pandemic. The Covid-19 pandemic has forced institutions to consider and/or re-consider the way in which they offer services to its stakeholders. Many students, parents, teachers, and staff were forced to find creative solutions to ensure teaching and learning continued.

For years, schools have delivered educational services using an in-person modality in a brick and mortar setting. In recent years, we have seen varying modalities emerge, ranging from in-person, online, hybrid, and most recently Hyflex. Each modality presents its positive and challenging attributes. This paper aims to provide a comparison of the various modalities which are used to educate students. Emphasis will be placed on Hyflex, a modality in which students have the option to attend an in-person class, take their entire class online, or a combination of both modalities, based on student preference. Hyflex is the most promising modality, and will be the central topic of this paper.

Hostos Community College

GPR-based Subsurface Object Detection and Reconstruction Using Random Motion and DepthNet

Bielka Pena, Jasson Polanco and Epiphanie Sawadogo

Mentor: Professors Biao Jiang and Jinglun Feng
Hostos Community College

Ground Penetrating Radar (GPR) is one of the most important non-destructive evaluation (NDE) devices to detect the subsurface objects (i.e. rebars, utility pipes) and reveal the underground scene. One of the biggest challenges in GPR based inspection is the subsurface targets reconstruction. In order to address this issue, this paper presents a 3D GPR migration and dielectric prediction system to detect and reconstruct underground targets. This system is composed of three modules: 1) visual inertial fusion (VIF) module to generate the pose information of GPR device, 2) deep neural network module (i.e., DepthNet) which detects B-scan of GPR image, extracts hyperbola features to remove the noise in B-scan data and predicts dielectric to determine the depth of the objects, 3) 3D GPR migration module which synchronizes the pose information with GPR scan data processed by DepthNet to reconstruct and visualize the 3D underground targets. Our proposed DepthNet processes the GPR data by removing the noise in B-scan image as well as predicting depth of subsurface objects. For DepthNet model training and testing, we collect the real GPR data in the concrete test pit at Geophysical Survey System Inc. (GSSI) and create the synthetic GPR data by using gprMax3.0 simulator. The dataset we create includes 350 labeled GPR images. The DepthNet achieves an average accuracy of 92.64% for B-scan feature detection and an 0.112 average error for underground target depth prediction. In addition, the experimental results verify that our proposed method improve the migration accuracy and performance in generating 3D GPR image compared with the traditional migration methods.

Investigating the Decline of Elephants' population in United States Zoos

Kingsley Odae

Mentor: Professor Moise Koffi
Hostos Community College

Elephants are the largest warm-blooded land mammals and they play an important role in the balance of our eco-system. However, their population dropped significantly by 54% between 1969 and 1979 due to various reasons such as, poaching, and human-elephant conflicts. Studies showed that over the past 5 decades, 390 elephants died in Association of Zoos & Aquariums (AZA)-accredited zoos in the United States. It is hypothesized that the rapid decline of the elephant population in the US is mainly related to poor animal welfare and zoo maintenance. The purpose of this research is to identify the major causes of elephant mortality and predict their survival in American zoos. This research is conducted utilizing secondary data collected from reports, zoo websites, and publications, which are analyzed using excel and Statistical Package for the Social Sciences (SPSS). According to preliminary results, an average of 79 elephants died in US zoos in the last two decades, among which one-third was due to infant mortality and 70% at an average age of 39, with an increasing rate of 30%. Our data indicate a quadratic growth of elephants' death rate in US zoos, which is mainly caused by poor animal treatment and loneliness. Still, further studies on elephants' behavior in their natural habitat are required to ensure their well-being and survival in US zoos.

Impact of population growth on climate change - Statistical analysis of the forecast data

Anna Mikheyeva

Mentor: Professor Alexander Vaninsky
Hostos Community College

Some studies suggest that the widespread population growth is threatening the Earth's atmosphere which requires immediate action, while other studies point out that there is no imminent danger because it is unlikely that the population will grow too fast and become unsustainable. This research investigates the possibility of unmanageable population growth that might have a negative impact on the level of CO2 emissions and the Earth's climate. It is an interdisciplinary research that bridges calculus and statistics to arrive at conclusions about environmental studies. Two corresponding hypotheses were considered: linear or exponential population growth. Actual and prospective data on the population from 1960 to 2100 was collected from the internet and analyzed. The Cauchy characteristic functional equation and the paired t-test were used to make inferences about the population growth, keeping in mind its possible negative impact on climate change. The paired t-test was applied to determine which scenario was more probable, and which of the two opposite viewpoints was more likely to be correct. Based on the p-value, it was revealed that the linear hypothesis prevailed in the period of 1960-2060. However, after that, in the period of 2080-2100, the likelihood of the exponential growth began increasing sharply, and both hypotheses became almost equally likely. We conclude that there is time to prepare and minimize the negative impact of unmanageable population growth.

A New Model of Harvesting Fish Population

José A. Sánchez Diaz and Inoussa Kabore

Mentor: Professor Tanvir Prince
Hostos Community College

In a recent United Nation survey, more than 200 million people depend on fishing as their source of food and income. However, uncontrolled fishing practice can threaten the security of marine life, drastically effecting the ecosystem. For example, the collapse of cod fish in Newfoundland in the early 1900 is one of such dramatic effects of overfishing. It is important to find a balance between economic needs and ecological consideration. Various mathematical models have been established for this purpose, in particular, the well-studied harvesting model, known as the "Schaefer model". Nevertheless, none of the models deal directly with those particular fish population which reproduce at a certain time of the year, and that time is typically constant throughout their life cycle. In this research, we propose a fish harvesting model which will best fit the particular species of fish that obey this specific behavior of reproduction mentioned before. This model is mainly applicable to those types of fish population which reproduce twice a year and continue throughout their life-cycle. Many types of species of fish follow such cyclic behavior of reproduction. The model, which assumes the minimum and the maximum fraction of harvesting, guarantees the survival of the species, and at the same time optimizes harvesting. The model is analyzed both graphically and algebraically.

Exploring the Activation Mechanisms of Phospholipase Enzymes

Natallie Mercier and Muiz Agbaje

Mentor: Professor Anna Manukyan
Hostos Community College

Phospholipases are enzymes that act to catalyze the hydrolysis of phospholipids and act abundantly when near the cell membrane. Molecular Dynamics simulations (MD) technique and an implicit membrane model enable us to understand what triggers the activation of these enzymes near the membrane. The purpose of this research project was to understand the mechanism of activation of secretory phospholipase (sPLA2) upon membrane binding. For structure and trajectory analysis and visualization, Visual Molecular Dynamics (VMD) software was used. VMD allowed us to monitor the time-dependent conformational changes of the molecular structure of a protein as well as various representations of static structures. Our simulations have accurately predicted experimentally obtained membrane-bound conformation, penetration depths, and membrane-anchoring residue. We have used X-ray crystal structure as starting coordinates for our simulations and have constructed several initial structures of phospholipase enzymes. Then, we have tested their stability in the membrane environment using molecular modeling software. Lastly, we have obtained structural data from various databases, and compared our results with the published experimental data.

Mono Color Vs Multicolor

Baowend Ouedraogo

Mentor: Dr. Tanvir Prince
Hostos Community College

An image is a 2-D representation of an object. We will be focus on 2 dimensional photographs. Photography allows us to capture, save, and re-visualize things we want. In fact, there are two type of image which are the mono color images and the multicolor images. A mono color image is an image which has one dominating color and the multicolor has proportionally many different colors. For this experiment, we are going to photograph random mono and multicolor pictures at different places and different focal length, then compare them base on their size and the zoom. The purpose of comparing these pictures, is to understand how the color and the zoom can affect the size of a picture.

Language and the Progress of a 'Peoples' Project

Oumdath Gbadamassi, Sylvester Meadows, Jassiel Mena, Rassambnewende Ouedraogo, and Demitri Yeboah

Mentor: Professor Lang Damaris-Lois
Hostos Community College

The language of colonizers continues to be used in post colonized countries. The use of colonized language as the primary language may impact the development of a country adversely. It is unknown, however, the extent to which native and colonized languages may be influencing productivity in education and economy in post colonized countries. Additionally, although bilingualism is prevalent in post colonized countries, the fluency, comprehension, and written aspect of native and colonized languages may vary greatly among and between individuals in these countries. Exploring the impact of the immigrant experience in a language in relation to education is unknown. The 'normative' question of interest in this study was to explore whether the use of colonized language as

the primary language in post colonized countries, may impact the education and economy of a country and its people. We hypothesized that the use of colonized language instead of native language in countries negatively impacts the economic and educational state of post colonized countries country. To test this hypothesis, data has been gathered and continues to be gathered to perform a 'retrospective' impact evaluation design. Data analysis will be performed using a regression discontinuity design; difference-in-difference method with a complementary approach. We predict that if a country adapts the use of native language as a primary language instead of colonized language, then the economic and educational status will not be impacted negatively.

Exploring the Activation Mechanisms of Phospholipase Enzymes

Natallie Mercier and Muiz Agbaje

Mentor: Professor Anna Manukyan
Hostos Community College

The aim of this research project is to understand the mechanism of activation of secretory phospholipase (sPLA2) upon membrane binding. These phospholipases are enzymes that act to catalyze the hydrolysis of phospholipids and act abundantly when near the cell membrane. In order to gain an understanding of what triggers the activation of these enzymes near the membrane, we have used Molecular Dynamics simulations (MD) technique and an implicit membrane model. For structure and trajectory analysis and visualization, Visual Molecular Dynamics (VMD) software was used. VMD allows us to monitor the time-dependent conformational changes of the molecular structure of a protein as well as various representations of static structures. Our simulations have accurately predicted experimentally obtained membrane-bound conformation, penetration depths, and membrane-anchoring residue. We have used X-ray crystal structure as starting coordinates for our simulations and have constructed several initial structures of phospholipase enzymes. Then, we have tested their stability in the membrane environment using molecular modeling software. Lastly, we have obtained structural data from various databases, and compared our results with the published experimental data.

Structure-Based Characterization of TRPM8 Modulators using Computer-Aided Molecular Design

Francisco Javier Gómez Pérez and Alpha Bah

Mentor: Professor Yoel Rodríguez
Hostos Community College

The Transient Receptor Potential Melastatin 8 (TRPM8) is a Ca2+ permeable ion channel, activated by nonpainful cold, membrane depolarization and cooling agents as menthol or icillin. TRPM8 works as a thermoregulator and its agonists and antagonists can modulate TRPM8 with implications on different diseases including inflammation and cancer. It has been shown that agonists activate TRPM8, with the help of the membrane lipid phosphatidylinositol 4,5-bisphosphate (PIP2), but also antagonists can modulate the biological function of TRPM8. It is also believe that both agonists and antagonists can be used for the same therapeutic indications. Recently, several TRMP8 modulators have been reported in the literature. However, the molecular basis for their interaction with TRPM8 is still poorly understood. Towards this end, we have used computer-aided molecular design to reveal such molecular basis for their interaction with TRPM8. Specifically, we used structure-based molecular docking of these reported ligands (57) against two known TRPM8 cryo–electron microscopy structures (PDB IDs: 6NR3 and 6O6R) using FRED-3.2.02. The Chemguass4 scoring function was used to rank the ligands. The ligand poses are being inspected, analyzed visually and clustered based on their similarity to determine common interaction patterns that help us to decipher the molecular basis of their interaction with TRPM8. This study, conducted in collaboration with Dr. Mercedes Martín-Martínez and Dr. Rosario González-Muñiz at the Medicinal Chemistry Institute-CSIC, Madrid, Spain, could

guide the design and development of more potent TRPM8 modulators, which could be used for the treatment of several diseases including cancer.

Structure-Based Virtual Screening to Identify Small-Molecule Modulators of KChIP2 for Cardiovascular Diseases

Scarlet Martínez Cardoze and Onyinyechi Winner Obineche

Mentor: Yoel Rodríguez
Hostos Community College

Potassium Channel Interacting Proteins (KChIPs) belong to a family of small Ca2+-binding cytosolic proteins consisting of four isoforms, KChIP1-4. Different to KChIP1|3|4, which are primarily expressed in brain, KChIP2 is also expressed in heart. KChIP2 has been shown to be a key regulator of cardiac excitability and arrythmia suscetibility as well as involved in atrial fibrillation (AF) and, therefore, in stroke, systemic embolism and heart failure. AF is the most common arrhythmia diagnosed in clinical practice and is predicted to affect 6-12 million people in USA by 2050. KChIP2 has been reported to have implications in these diseases through modulating voltage-gated K+ channels, Ca2+ channels and Na+ channels. It has also been shown that KChIP2 stops working properly during heart disease. Hence, small-molecule KChIP2 activators capable of restoring proper levels of fully working KChIP2 protein to the heart cells are of great interest. To this end, structure-based high-throughput virtual screening of a commercially available small molecules database (eMolecules ~4 million compounds) against homology models of KChIP2 built using the available structures of DREAM/KChIP3 and KChIP1 (PDB IDs: 2JUL and 2I2R) was performed using FRED-3.2.0.2. The Chemguass4 scoring function was used to rank the ligands. The top-ranked molecules were inspected, analyzed visually and clustered based on scaffold similarity. The best candidates compounds (~50) were prioritized to purchase and experimentally tested in Dr. Marta Gutierrez-Rodríguez and Dr. Mercedes Martín-Martínez at the Medicinal Chemistry Institute-CSIC, Madrid, Spain. These small molecule activators could eventually lead to new treatments for heart disease and arrhythmias.

Redistricting in New York

Oumou Dili Traore, Aser. L. S. Kalkoumdo, and Xavier. R. Koudougou

Mentor: Professors Lauren Wolf
Hostos Community College

Twenty first century's redistricting methods and laws gave place to the prevalence of a practice called Gerrymandering. "Gerrymandering" is a term used to qualify legislators' manipulation of districts' boundaries to give unfair advantages to specific parties. The practice obstructs the democratic process by allowing politicians to choose their electors instead of the opposite, thus leading to the election of non-representative governors. And no real representatives for New York's majority minority districts most likely translates to no laws ameliorating minorities' condition.

In this research we attempt to detect anomalies in four successive New York congressional elections using the Efficiency Gap model, established by McGhee and Stephanopoulos, to highlight the impact of Gerrymandering on election outcomes.

First, we calculated the efficiency gap in the Democratic and Republican votes (percentage of votes each party wasted due to districting) in the 27 districts of New York for the congressional elections of 2012, 2014, 2016 and 2018, using data from the Boards of Election. Then we analyzed voter's ratio in the listed years' Congressional elections and compared their outcomes. Finally, we studied the ethnicity repartition in New York to locate districts with the highest percentage of minorities.

The comparison of voter ratios revealed that after 2012, similar voter ratios in NY districts were leading to different number of elected representatives highlighting the strong impact of redistricting on the elections and the nature of elected representatives. The computation of the efficiency gap formula revealed that districts with

the highest percentage of minorities had the highest Democratic efficiency gap, revealing that Democratic votes' impact were demeaned in the most Democratic area. In view of the result, we figured the existence of a potential link between Gerrymandering and the lack of minority representatives in some New York districts.

Discovery of Small Molecules Targeting the SUZ12(VEFS) - EZH2(SANT2) Protein-Protein Interaction with Computational Methods

Dayhana Segura Del Orbe and Estefania Peralta

Mentors: Professor Yoel Rodríguez
Hostos Community College

Polycomb group (PcG) proteins play an important role in control of gene transcriptional silencing, which in turn regulates lineage pathways during development and differentiation. Two main PcG are known, Polycomb repressive complex 1 (PRC1) and 2 (PRC2). PRC1 compacts chromatin and PRC2 catalyzes the di- and trimethylation of histone H3 lysine 27 (H3K27Me3) to silence gene expression. PRC2 consists of four core subunits —EZH2, EED, SUZ12, and RBBP4— where EZH2 is the catalytic subunit and minimally requires EED and SUZ12 for catalysis. Dysregulation of PRC2 function is largely linked to human diseases, including cancer. It has been reported that two different □-helical bundles of SUZ12(VEFS) domain comprising residues 590–603 and 652–669 (PRC2 complex; PDB ID 6C23) play a critical role in PRC2 proper assembling and function through their interaction with EZH2. Thus, our collaborator Dr. Guillermo Gerona-Navarro designed a stapled peptide mimicking one of these □-helical bundles of SUZ12(VEFS) showing selectivity for H3K27Me3 inhibition (i.e., inhibition of PRC2 catalytic activity) by disrupting the protein-protein interaction (PPI) between the VEFS domain of SUZ12 and the catalytic subunit EZH2. However, to the best of our knowledge, small-molecule inhibitors of the SUZ12(VEFS)-EZH2(SANT2) PPI have not been described yet. Thus, here, we aim to identify high binding affinity small molecules capable of modulating such SUZ12(VEFS)-EZH2(SANT2) PPI. To this aim, we used structure-based high-throughput virtual screening of a commercially available small molecules database (eMolecules ~4 million compounds) against the cryo-electron microscopy structure of the complete human PRC2 complex (6C23) utilizing OEDOCKING-3.2.0.2 and FRED-3.2.0.2 programs. The screened molecules were ranked using the Chemguass4 scoring function. The ~50 highest-ranked molecules are being selected to be experimentally tested in Dr. Gerona-Navarro's laboratory at Brooklyn College of CUNY. Insights from this study will contribute to understand the particular role of EZH2 in different epigenetic processes.

Therapeutic Use of Stem Cells in Diabetes Mellitus

Somaya Nasher

Mentors: Professor Chowdhury Soheli
Hostos Community College

Diabetes mellitus is a chronic metabolic disease characterized by impaired insulin secretion and variable degrees of peripheral insulin resistance leading to hyperglycemia. About 10% of people are suffering from Diabetes Mellitus (DM) worldwide. So far, the treatment options and the medications have not changed much. Although, recently, there is a stem cell-based approach to treat DM patients. Stem cells can derive from mesenchyme, bone marrow, umbilical cord, and progenitor cells from different organs. However, there is not enough review study available where one can get ideas about the treatment outcome of stem cells on type 1 and type 2 DM. Our study based on other research of stem cell therapy on DM might help understand the outcome of the disease treatment. We investigated several articles where type 1 and type 2 diabetes patients were treated with mostly bone marrow-derived autologous hematopoietic stem cells. The injection is mostly IV or very close to the pancreatic duct. Patients were followed for six months to four years after therapy to establish an apparent treatment efficacy. Our small-scale review

shows that stem cell transplant is working on Type I diabetic patients. For type 2 diabetes, we need further studies.

Molecular mechanism of Trf2 - telomeric DNA interaction in Ustilago maydis

Reynaldo Martinez

Mentor: Professor Olga Steinberg-Neifach and Neal F. Lue
Hostos Community College

Telomeres are nucleoprotein complexes located at the ends of eukaryotic chromosomes. Regulation of telomere maintenance by the telomere-associated proteins is important for genome stability, and its disruption may lead to premature ageing and cancer. Telomere-associated proteins often interact with DNA repair factors to promote genome stability. UmTrf2 is a protein discovered in a fungus Ustilago maydis. Based on genome sequence analysis of UmTrf2, its similarity to the telomere-binding protein HsTrf1, the presence of DNA-binding Myb and protein-protein interaction TRFH domains, UmTrf2 is presumed to be a telomere-associated protein. Both the Myb and the TRFH domains in UmTrh2 have a number of insertions not found in other telomere-binding proteins.

The goal of this research project is to investigate mechanisms of the UmTrf2 - telomere DNA binding, specifically whether dimerization is required for UmTrf2-DNA interaction, and whether Myb domains insertions affect this interaction. If UmTrf2 resembles previously analyzed telomere binding proteins, then its binding to telomeres should be sequence-specific and require homo-dimerization.

We plan to express three UmTrf2 recombinant proteins: 1) with both the TRFH and Myb domains intact, 2) without the TRFH domain, 3) with the Myb domain from which insertions were deleted. Proteins will be purified by column chromatography, and the identity of proteins will be verified by Western Blot Analysis. Protein-DNA binding will be assessed by Electrophoretic Mobility Shift Assay (EMSA).

We hypothesize that protein-DNA interaction will be negatively affected by the loss of TRFH domain, but deletion of the Myb domain insertions will not affect the affinity or specificity of the interaction.

The outcomes of the project will contribute to further elucidation of the DNA-binding mechanisms of telomere-associated proteins and the interplay between DNA repair factors and telomere-associated proteins.

5G and the Harmful Affects that it may have on Society

Brian Carter

Mentor: Professor AJ Stachelek
Hostos Community College

Worldwide, many researchers have raised the issue of the possible harm considering the increased use and cumulative effect of RF (Hardell, Carlberg and Hansson, 2009). This is a concern regarding children; because of thinner skulls and developing brains, they may be more susceptible to cellular damage. Several countries have issued warnings about cell phone use for children, but the United States has not. According to the U.S. Government Accountability Office (GAO), scientific research has not demonstrated adverse human health effects of exposure to RF energy from mobile phone use, but research is ongoing that may increase understanding of any possible effects. In addition, officials from the Food and Drug Administration (FDA) and the National Institutes of Health (NIH), conclusions about the scientific research. Ongoing research examining the health effects of RF energy exposure is funded and supported by federal agencies, international organizations, and the mobile phone industry.

My goal is to provide the solution. My Cohort and I managed to research specific radiation details I have received in which I divided the details of my findings and came to a conclusion about the harmful effects. The studies are very different and the total number of studies are surprisingly low. The reactions occur both in vivo and vitro and affect all biological endpoints studied. There does not seem to be a consistent relationship between intensity (power density), exposure time, or

frequency, and the effects of the exposure. On the other hand, strikingly, higher power densities do not cause more frequent responses, since the percentage of responses in most frequency groups is already at 70%. Children are increasingly using cell phones. Family package deals make it easy for parents to obtain phones for their children, and the phones provide parents with the comfort to easy access to their children. However, cell phones emit radio frequency (RF) radiation (Butcher and the committee on Appropriations, 2010). While the government has deemed RF radiation to be safe, there is no significant research to make this claim.

Kingsborough Community College

First Language Attrition Across Three Different Generations

Rawan Hanini

Mentor: Professor Laura Spinu
Kingsborough Community College

This study explores the phenomenon of language attrition. Specifically, we investigate the properties of consonant production (with a focus on a typologically rare category of consonants called geminates) across three groups of speakers of Palestinian Arabic: monolinguals (i.e. native speakers born in Palestine who have lived there their entire life, n=5), late bilinguals (i.e. speakers born in Palestine who emigrated to the US during their teens, n=6), and heritage speakers (i.e. speakers of Palestinian descent, born in the US and who speak both English and Arabic in their daily lives, n=7). All speakers were in their mid-20s. The participants were tested using a delayed word repetition task. The stimuli comprised 60 bi-syllabic Arabic minimal and near-minimal pairs including long (geminate) and short consonants (e.g., sadaq 'he said the truth' vs. sad:aq 'approved'). We controlled for stress and syllabic position. Distractors were also included. The analysis consisted of manually aligning the target consonants, extracting the mean consonant duration and comparing it across groups. The findings were consistent with previous work (Alkhudidi et al. 2018) and revealed shorter consonant durations in the generations of Arabic-English bilinguals living in the United States, with heritage speakers (second generation, born in the US) producing significantly shorter geminates compared to monolinguals from Palestine. The transition is gradual, with the first generation of immigrants not differing significantly from either the monolinguals or the heritage speakers. Consonant properties such as voicing and place of articulation had an effect on duration, generally in the direction predicted by Markedness Theory (Greenberg 1966, Yavas 2008). Our study adds to the body of work examining the attrition of a typologically marked contrast in an understudied bilingual community across different generations.

Competition of PARN and HuR for p53 mRNA Regulation during DNA Damage

Elena Oprea

Mentor: Professor Devany Emral
Kingsborough Community College

The TP53 gene provides instructions for making a protein called tumor protein p53. The p53 stops the formation of tumors and plays a crucial role in inhibition of tumor growth and retention of genetic stability. Defective p53 could allow abnormal cells to proliferate resulting in cancer. It is essential to understand the major steps of gene expression, and methods of regulation. Gene expression is a process by which the instructions in our DNA are converted into a functional product, such as proteins. Exist many ways in which gene expression is regulated in the cell, this project will focus particularly on regulation of p53 expression at mRNA processing step, specifically by two mRNA binding proteins: Poly(A)-specific ribonuclease (PARN) and Human Antigen R (HuR). PARN is a key deadenylase involved in regulating gene expression in mammals. Deadenylation plays a crucial role in the control of mRNAs steady state levels and therefore gene

expression in various cellular conditions. HuR is an RNA-binding protein too, associated with numerous transcripts, coding and noncoding, stability, and translation. HuR has an effect on mRNA stability, it has been implicated in cellular events including proliferation, senescence, differentiation, apoptosis, and the stress and immune responses. Both PARN and HuR are attaching within 3' end of the mRNA. The effects of HuR and PARN are opposite. PARN wants to destroy the mRNA and HuR stabilize it. This research will explore the relationship between HuR and PARN. Finding the competition between HuR and PARN could be used for advantage of the cancer treatment.

Strategies in Second Dialect Learning: A Study of how Monolinguals and Bilinguals learn Epenthesis in S-clusters

Mariana Vasilita

Mentor: Professor Laura Spinu
Kingsborough Community College

Bilingualism has been linked with improved function regarding certain aspects of linguistic processing, e.g. manipulating language in terms of discrete units, novel word acquisition, and learning unfamiliar sound patterns in novel accents. Recent experimental work with non-native contrasts suggests that bilinguals have enhanced phonetic learning and speech perception abilities compared to monolinguals. We investigate phonetic learning skills in monolinguals (n=30) and early, simultaneous bilinguals (n=31). The subjects were trained and tested on an artificial accent of English. One the features distinguishing the novel accent from the standard variety was the presence of vocalic epenthesis in the voiceless s-clusters [sp, st, sk]. For example, words such as 'spy' or 'school' were pronounced as 'suh-py' [səpaj] and 'suh-cool' [səkul]. A total of 760 target items were evaluated manually. A score of 1 was assigned for each token produced with an epenthetic vowel between s and the following consonant, otherwise the score was 0. Early bilinguals outperformed the monolinguals on the acquisition of this pattern. Acoustic analyses are underway to assess the differences between the two groups' productions, such as quality, duration, and placement of the epenthetic vowel, as preliminary observations revealed a high number of long-distance phenomena such as [spəhaj] or [spəʔaj].

Analysis of the Caffeine in Regular Coffee Using the UV/Visible Spectrophotometer and the Standard Addition Method

Malik Atadzhanov

Mentor: Professor Aleksandr Gorbenko
Kingsborough Community College

Coffee is a natural product, during its growth, it synthesizes a variety of alkaloids that chemically resemble the structure of caffeine. These related compounds create a complex mixture in its matrix obscuring the caffeine from being directly analyzed with the external standards method. To avoid these matrix effects, the international food industry ubiquitously uses High-Performance Liquid Chromatography (HPLC) to separate the caffeine from its related compounds. The HPLC technique is very effective at resolving the mixtures into its pure components (substances) and it enables the external standards method to be easily applied. However, this instrument requires a great deal of preparation prior to the analysis and, during its operation, it consumes large quantities of highly toxic organic solvents. To save time and to avoid hazardous waste disposal expenditures, UV/Vis Spectrophotometer and the Standard Addition Method will be developed to rapidly detect and quantitate the levels of caffeine in coffee to assess their relative "strength".

There's a Storm Coming: Could Superstorm Sandy serve as an Indicator of Future Storms & Climate Trends?

Angelika Sobolewska

Mentor: Professor Santina Benincasa
Kingsborough Community College

While Hurricane Sandy happened in 2012, it is still evident across the east coast, especially the tri-state area. This Is due to the fact that we've never truly experienced a storm so prevalent before. However, in recent years it has become more and more apparent, that the Hurricane turned Superstorm Sandy (Due to its force), will eventually become a more common place. Places such as Florida, have been dealt the brunt of this. There appears to be a correlation between our current climate trends and the increase in natural disasters. Using Geographic Information Systems (GIS) data and imagery that was collected from NOAA as well as recent climate data, this study will prove that there is a correlation between the two as well as provide predictions for what the future holds.

3D Homology Modeling of a Ribonuclease J1/J2 in the MRSA Staphylococcus aureus Sp.

Levi Borevitz

Mentor: Professor Dmitry Y. Brogun
Kingsborough Community College

Patients infected with drug-resistant bacteria are becoming less susceptible to the presently available antibiotic treatments The Beta-lactamase protein family causes antibiotic-resistance in various bacterial infections one of which is Methicillin-Resistant Staphylococcus aureus. Ribonuclease J1/J2 is a conserved enzyme in Staphylococcus aureus from the Metallo-beta-lactamase superfamily. It is composed of a b-lactamase core domain, and a b-CASP and C-terminal domain. Previously we have identified the strain V605 of Staphylococcus aureus, containing a ribonuclease J1/J2 with a single nucleotide polymorphism causing a mutation and the subsequent substitution of a Cysteine (C) instead of Arginine (R) at the 220th amino acid position within the protein sequence. To understand how this mutation changes the conformational structure of the enzyme, we performed homology modeling. We used BLAST to identify the solved crystal structure of ribonuclease J1/J2 from Bacillus subtilis with a 67% identity match. We then used Modeller [1] to produce a structure of the ribonuclease J1/J2 enzyme for both Staphylococcus aureus strains USA300 and V605. To see how the mutation affects the folding and the tertiary structure we compared the two structures using the FATCAT algorithm [2]. We found that the main differences are in the C-terminal domain. Knowing the 3D structure of the enzyme is the first step to the development of the potential medication so that we can counteract the drug-resistance in a timely manner.

Chemical Analysis of Amaranth Growth with Aguas Zarcas Carbonaceous Chondrite

Jun Ye Cai

Mentor: Professor Kieren Howard
Kingsborough Community College

In April 2019, a shower of carbonaceous chondrite meteorites fell on Earth into the Aguas Zarcas district of Costa Rica. The meteorite fragments come from a single asteroid in the carbonaceous chondrite (CM) class, being further classified in the Mighei group. The CM chondrites are predominately made up of clay like minerals called phyllosilicates and can be described as mud balls from space. The goal of this experiment is to test the hypothesis that plant growth is possible in regolith composed of the Aguas Zarcas CM chondrite and simulated CM material. If CM provides a fertile medium, then the implications for astrobiology are significant. Indigenous regolith on the moon and mars is known to lack organic and other critical compounds required for plant growth, such as reactive forms of nitrogen (Wamelink, et. al, 2014).

Along with growing the plants, various chemical analysis techniques including X-ray Diffraction (XRD), Infrared Spectrometry (IR), Mass Spectrometry – Gas Chromatography (MS-GC) and litmus pH paper would be used to measure the trajectory of the plant growth in conjunction with the CM. The MS-GC involves demineralization with hydrofluoric acid (HF) that called for proper safety protocol in the laboratory setting before the extraction step. Fragments of carbonaceous chondrites are likely to exist on surfaces of the Moon and Mars and by demonstrating the possibility of plant growth with CM can be precursor to human habitation in space. IR did not detect organic functional groups, so the MS-GC was needed. pH of CM was in the range of ideal amaranth growth pH. Findings indicate the ideal growth of amaranth would likely involve a mixture of CM soil with Martian or Lunar soil as the CM has a higher presence of sulfur which could potentially be toxic to the plant.

The Source of Boron that Contaminates the Groundwater in the Newark Basin, Eastern USA

Jonnathan Zuna

Mentor: Professor Larbi Rddad
Kingsborough Community College

The Newark Basin was formed during the Triassic period and subsequently filled with Triassic-Jurassic rocks. Diabase intruded these rocks and induced their metamorphism, leading to the precipitation of pyrite, chalcopyrite, and calcite. In the studied area, groundwater is contaminated with boron, with concentrations exceeding the children health advisory of 2,000 µg/L, set by the U.S. Environmental Protection Agency (USEPA). High levels of boron in the water pose health risks such as infertility and fetus developmental issues. Given the cluster of elevated occurrences of boron in the studied area, we hypothesize that the diabase intrusions and the associated mineralization are possible sources of boron. On the basis of LA-ICP-MS analysis, previous studies showed that sulfides are not the source of Boron (Ailing, 2019) and that calcite may have contributed to the contamination of groundwater (Zuna, 2019). The current study focuses on the diabase itself to find out whether diabase intrusions are a source of boron. The analysis of boron in diabase samples using the PGNAA method shows relatively high concentrations of boron ranging from 23.9 to 35.6 ppm. Given that diabase contains B-bearing minerals such datolite, which are known to contain substantial amounts of boron, it can be inferred that the boron is concentrated in B-bearing minerals. It can thus be concluded that the diabase is a source of the boron that contaminates the groundwater in the Newark basin. The identification of the diabase as a source of boron would enable the government to restrict the construction of houses near the diabase intrusions in the Newark basin.

Annotation of the Multi-Drug Resistance Genes in Staphylococcus aureus species

Bahashanda Hananiyaev

Mentor: Professor Dmitry Y. Brogun
Kingsborough Community College

Staphylococcus aureus is a gram-positive bacteria resistant to antibiotics [1]. It is the most common bacteria found in hospitals worldwide [2]. The bacteria are prone to a rapid rate of the mutations on the DNA level, thus it acquires the resistance to the new antibiotics. Once it infects a human host, it can cause problems such as skin infections, pneumonia, meningitis, and it can be lethal to humans [2]. Health professionals need to take a quick decision to administer proper antibiotics to a patient, however because of the adaptable nature of the infection, the doctors are unable to treat their patients unless they have enough information about the strain. In this study, we are annotating and identifying orthologous genes in 161 Staphylococcus aureus genomes. We are using the genome of Staphylococcus aureus strain, USA300, a strain of community-associated methicillin-resistant Staphylococcus aureus, as our reference. It is necessary to annotate the Methicillin-

Resistant Staphylococcus aureus (MRSA) genomes and other pathogens to develop proper and effective treatments against infections from particular strains.

Plant Growth on Mars

Iryna Ivanyuk

Mentor: Kieren Howard
Kingsborough Community College

We will study the Aguas Zarcas meteorite, which belongs to the Mighei type (CM) group of carbonaceous chondrites. These meteorites are composed of clay like minerals and contain organic components. We seek to test the hypothesis that addition of carbonaceous chondrite material can fertilize sterile simulated Mars regolith. Our experiments will attempt to grow seeds in soil which is a mixture of carbonaceous chondrite, simulated Mars 'soil' and inert perlite (to reduce the volume of meteorite and regolith used). Growth experiments will be performed under a full spectrum LED grow light. The mineralogy of the meteorite and stimulant will be characterized by X-ray diffraction (XRD). It will be significant if our results show the successful growth of a plant. It will provide a potential future means to grow plants or even grow food the surface of Mars, because clay meteorites (fertilizer) can be found on the surface of Mars or delivered to its surface by space missions. This could be an important step towards Martian colonization.

Teasing apart intonation and segmental information in the perception of foreign-accented English by native speakers

Jaweria Bakar

Mentor: Professor Laura Spinu
Kingsborough Community College

Various studies [1] have found that people with a foreign accent are rated less favorably along subjective scales (e.g., intelligent vs. dull or kind vs. unkind) than speakers without a foreign accent [2, 4, 3]. In a pilot study, we have found that out of five different accents in English, speakers with Russian and Arabic accents obtained consistently lower scores. While these findings may be partially explained by negative representations of the language in the media and pop culture [1], the question arises to what extent linguistic factors such as intonation or segmental properties also play a part? To address this question, we recorded English sentences spoken by native speakers of Russian and Italian (n=4). We created three sets, as follows:
(1) naturally pronounced.
(2) Intonation only (sentences filtered such that only aspects pertaining to intonation were preserved without any linguistic content present).
(3) Segmental information (sentences preserved aspects of foreign pronunciation in terms of consonants and vowels, but the prosodic aspects (e.g., segmental length, intonation) resembled native English production). Sentences spoken by English natives served as a baseline.

A perceptual experiment was set up using PsychoPy. Twenty-six native speakers of English listened to each sentence and rated the speaker in terms of pleasantness, honesty, self- confidence, and expressiveness on a 1-5 Likert scale. Mean scores for each variable were computed in order to determine the effect of language, sentence type, and gender. Our study thus adds to the body of work on foreign accent perception and the mechanisms underlying listeners' reactions.

Electronic Equivalent to Natural Neural Networks

Jose Olivera

Mentor: Professor John Mikalopas
Kingsborough Community College

The memristor is the most recently proposed (1971) and produced (2010) of the four basic two-terminal independent circuit elements (resistor, capacitor, inductor, and memristor). It is a nonlinear electrical component where the magnetic flux is related to the amount of electric charge passed through the device. Memristors can be programmed to have different resistant states which allow storing information as resistance scales. Memristors enable memory and processing in the same device and can be used to construct novel and innovative memory circuits. These memristor memory circuits can produce the results associated with traditional logic circuits and can also mimic results associate with bio-neuro-memory. The main purpose of this project is to find novel ways to use memristors. We will simulate memristor memory circuits with already-established designs, as well as propose new ones.

Determination of DNA quality following DNA extraction using PCR amplification of the Tubulin gene from Saintpaulia ionantha

Destiny Ramirez

Mentor: Professor Farshad Tamari
Kingsborough Community College

There are numerous ways to extract DNA from a plant species. One commonly used by scientists is DNA extraction following the Doyle and Doyle (1990) method. Of late, the Edward's method has been used more frequently. Doyle and Doyle methodology uses organic compounds for extraction and the presence of phenols in the final eluate can be an issue for the downstream application that follows, such as the Polymerase Chain Reaction (PCR). The Edward's method uses inorganic compounds and has been shown to provide high quality DNA which can be used for PCR. We hypothesize that the Edward's method will also yield good quality DNA in other angiosperm plant species, such as Saintpaulia ionantha. This species is commonly known as the African Violet. S. ionantha is a perennial horticultural flowering plant, often appearing in a variety of shades of violet. This species has five petals that are bilaterally symmetrical and are soft to the touch. They are native to Eastern Africa and are able to thrive in low light conditions. We extracted DNA from a few plants of this species. We used the DNA extracts to PCR amplify α-Tubulin from each sample. Our results seem to indicate that the Edward's method used for extraction of DNA from S. ionantha, as a second angiosperm species tested, also provides high quality DNA appropriate for PCR.

Plasmonic crystals excitations at Terahertz frequencies

Masum Mazid

Mentor: Professor Gregory Aizin
Kingsborough Community College

There is a phenomenon known as the Dyakonov Shur instability effect.This effect consists in amplification of the plasma waves exited in the DC current biased plasmonic cavity with asymmetric boundary conditions. This effect is amplified when plasmonic cavities are arranged into a periodic structure called a plasmonic crystal. These crystals are important because when plasma waves are excited they produce electromagnetic waves with frequencies in the terahertz range.

This structure can be realized in a MOSFET, where the boundary conditions can be readily controlled. Here, the electrons will be localized in a well, sort of an electron pit so that electrons can move in two directions only. Numerical analysis shows that Dyakonov-Shur instability is achievable in this structure.This can be accomplished by manipulating gate voltages and boundaries.

The implications of the study are primarily in scanning technology. X-rays use frequencies that can be harmful to the person because they penetrate and cause ionization and therefore can cause cancers or mistakes in the DNA coding such that these tests are used sparingly. Terahertz frequencies are penetrating but are at a frequency that does not cause ionization. Furthermore, there is evidence that it can be used in telecommunication to higher levels of synchronization between devices, especially in fields such as nanotechnology.

Teaching stress to L1 speakers of tone languages: a gamified approach

Natalie Mosseri

Mentor: Professor Laura Spinu
Kingsborough Community College

Few studies examined how paralinguistic information varies across languages and its acquisition by non-native speakers. Among these, some have found that speakers of tone languages use far less F0-related cues when producing verbal expressions of emotions compared to stress language speakers (Annoli et al. 2008, Chong et al. 2015). We propose a new method of teaching intonation to help native speakers of tone languages acquire the expression of emotion in English.

We tested 12 ESL speakers. While most of these natively speak a tone language, we also included speakers of non-tone languages due to recruiting difficulties arising from the Covid-19 situation. A trained native English speaker produced stimuli with sad, angry, and happy content, as well as context-neutral sentences. The experimental procedure consisted of three stages: baseline, training (imitation), and testing. Half of the participants (the control group) responded to sentences bearing natural, non-exaggerated intonation. The second half listened to an exaggerated version of those same statements. The procedure utilized a gamified approach whereby the sentences were cued by appropriate smiley faces. Our method combines some of the latest trends reported in the literature: gamification, exaggerated (Motherese-like) intonation, and imitation.

The analysis included two scoring methods. The first was a visual scoring process where the participants' pitch contours were compared against the model's using the Praat software (Boersma & Weenink 2018). The second method was a perceptual one where the scorers' listened to the participants' recordings and indicated the emotion they perceived for each one.

Our results show that participants who responded to the exaggerated version received more accurate and consistent perceptual ratings. We also found that anger was the most difficult emotion for participants to imitate and for scorers to recognize, possibly due to cultural standards. Our study adds to the body of work on second language acquisition and pedagogy.

Comparing Beer Yeast Strains Using Polymerase Chain Reaction and Restriction Digest

Shatema Small

Mentor: Professor Elizabeth Mulligan
Kingsborough Community College

Comparing Beer Yeast Strains Using Polymerase Chain Reaction and Restriction Digest S. Small and E. Mulligan Saccharomyces cerevisiae is the microorganism responsible for fermenting wine and ale style beers while Saccharomyces pastorianus is responsible for fermenting lager style beers. Brewers found that different yeast strains are key to the development of certain distinctive scent and flavor compounds. This led to selection of yeast for certain flavor profiles and created different yeast strains. In this study, we will look at the genetic expressions of different yeast strains using Polymerase Chain Reaction (PCR) to amplify the Internal Transcribed Spacer (ITS) region and the 5.8S rRNA gene followed by restriction digest by CfoI, HaeIII, and HinfI to differentiate strains of commercial brewing yeasts. We hypothesize that the different strains will have different patterns of cutting after restriction digest. We will analyze yeast from the WYeast catalog. If is

successful we will also look at some yeast samples from bottle conditioned (still containing live yeast) ccommercially available beers to see if we can identify the strain.

Lunar Ecology: Plant growth in Lunar and Aguas Zarcas Meteorite Soil

Emily Morrissey

Mentor: Professor Kieren Howard
Kingsborough Community College

This paper reviews the process and product of planting seeds in a simulated Lunar regolith-carbonaceous chondrite meteorite mix. Due to the increasing threat of climate change, many people have begun to speculate on whether or not colonizing other celestial bodies would be a sustainable course of action. One complication is the capacity for crop growth in extra-terrestrial soil [1]. This experiment was performed to investigate if carbonaceous chondrites can be added as a fertilizer into lunar regolith to improve its fertility. This experiment will also explore if as generations pass, if the regolith will become more nutrient rich. To answer these questions, we compared Amaranth seed growth in 3 types of soil. These seeds were grown under a 2000W Full Spectrum LED light with LMS-1. Lunar Mare simulate was mixed with inert perlite, at a 1:1 ratio by volume, and used as the initial soil. The Aquas Zarcas meteorite was dissolved in distilled water and used as a fertilizer. The experiment produced 80 percent successful growth, with successful being defined as a sprouted seed that produces a secondary set of leaves. We also examined the minerology of the soil using X-ray diffraction [2]. Atmosphere and gravity are not accounted for in our experiment. Due to the Novel Corona Virus, this experiment was not completed. However, using the information from X-ray Diffraction, models were produced that indicated favorable growing conditions for the Amaranth plants. However, the experiment would have to be performed in full to gain a higher level of certainty.

Comparison of Protein Content in Petunia hybrida: Comparing Flower Reproductive and Non-Reproductive Organs

Agata Movsisyan

Mentors: Professor Farshad Tamari
Kingsborough Community College

A developmental comparison of protein content in Petunia hybrida was achieved by selecting flower buds of different stages of maturation. Both reproductive and non-reproductive tissues were used in the comparison beginning from four days prior to anthesis (flower opening). To achieve this, P. hybrida plants were purchased, protein samples were extracted and quantified using a standard Bradford assay, and the comparison was made using Microsoft Excel. The results indicate that whereas for the non-reproductive tissue the protein concentration decreases steadily throughout development, for reproductive tissues protein concentrations increase steadily until one day before anthesis.

Shirley Chisholm State Park Brooklyn, New York Economic and Environmental Sustainability through Land Use Practices

Holta Stojku

Mentor: Professor Luz Martin Del Campo
Kingsborough Community College

1Shirley Chisholm State Park is a unique 407-acre park that opened to the public in July 2, 2019 under Governor Andrew Cuomo's $1.4 billion "Vital Brooklyn" initiative. 2Built on top of the Pennsylvania Avenue and Fountain Avenue landfills in Jamaica Bay, Brooklyn, the park holds environmental and economic significance because of its transformation from decades (1956 to 1983) of toxic land-use, to a park that serves the community as well as the environment. The new state park includes 10 miles of trails for hiking and biking,

kayaking, picnic areas, educational facilities, an amphitheater and more.

The purpose of my research is the study of the environmental and economic benefits of the Shirley Chisholm State Park utilizing the National Park Service (NPS) economic output measurement and by studying and comparing different stages of the land-use affecting water, flora and fauna. Data was collected from Census and U.S Environmental Protection Agency, and it was entered and complied with Excel. This research will first demonstrate how land-use holds hidden economic values and environmental sustainability importance. Second, it will illustrate how transforming landfills to community state parks are economic and environmentally sustainable. Third, it will aim to evaluate the social impact such initiatives have in areas of marginalized communities.

Qualitative Assessment of Pig's Blood Metabolites Using 1H-NMR Spectroscopy

Noel Castilo

Mentor: Professor Homar Barcena
Kingsborough Community College

Metabolomics research ascertains the presence of key metabolites that can serve as indicators of biological processes within an organism and has far-reaching implications as a diagnostic tool in the medical field, forensics, drug testing, and so on. Here, we use proton Nuclear Magnetic Resonance (NMR) spectroscopy to distinguish between compounds found in the blood. The NMR takes advantage of the spin properties of protons within biological molecules and their interactions with radio waves to obtain spectroscopic data of the mixture.A protein precipitation method was used to extract blood metabolites. It was found that water suppression methods were necessary to produce NMR spectra that are useful for metabolomic analysis. Multiple water suppression methods were performed in order to demonstrate consistency and confidence in the methodology. The possibility of ascertaining key metabolites was attempted through overlaying/ superimposing of spectroscopic data. In the future, spiking methods could give more definitive results.
Re-emergent zoonotic diseases as well as new infectious diseases such as COVID-19, highlight the relevance of this research. Thus, testing animals and tracking the evolution or movement of diseases from their wildlife reservoirs, specifically those with infectious agents that have the potential to jump between animals to humans, could give understanding on how pandemics develop.

Identifying Nematode Population and Demography to Determine their Importance in Soil to Predict Floral Health

Victor Halabani, Asifa Ijaz, Jonathan Pinkhasov, Gul Rukh and Isra Saqib

Mentor: Professors David Michaelson and Marie McGovern
Kingsborough Community College

Historically, agriculture always placed an emphasis on the physical and chemical aspects of plant growth while the biological aspects were neglected. Soil, much like the human body depends on a symbiotic relationship with all the organisms it houses. With technology, the world understands the importance of that neglected aspect from utilizing Bacillus thuringiensis found in soil to kill pests, to discovering the importance of annelids such as earthworms for floral health and composting. Scientists and farmers alike are realizing how important it is to understand these biological interactions between crops climate soil and living organisms in sustaining agriculture.

Nematodes are classified within the diverse animal phylum Nematoda. They inhabit a broad range of soil and aquatic environments. More than 15,000 species and 2,200 genera of nematodes have been described. Both Nematodes and Annelids have harmful and beneficial species. Various authorities distinguish among 16 to 20 different orders within this phylum. Only about 10 of these orders regularly occur in soil, and four orders (Rhabditida, Tylenchida, Aphelenchida, and Dorylaimida) are particularly common in soil.

Plant-parasitic nematodes are well known and studied. However many free living nematodes have not been studied. Therefore there is a high probability that most soil habitats will contain undescribed species of free-living nematodes that are necessary to floral health. Identification of these groups is difficult, due to high morphological variability. To address this issue, DNA Barcoding was performed using ribosomal markers as they are highly conserved sequences to identify nematode species found within soil samples collected from the Brooklyn Botanical Garden. Our study seeks to underline that soil containing a variety of identified nematodes will yield efficient floral health and growth. This study will also analyze soil samples modified to have a higher concentration of specific species of nematode to compare floral health and growth rates.

Developed a successful novel protocol to induce spawning of American eel (Anguilla rostrata) for Meeting Market Demand & Conservation

Jonathan Pinkhasov

Mentor: Professor Sarwar Jahangir
Kingsborough Community College

American eel (Anguilla rostrata) is a catadromous fish. From eggs, they develop as leptocephalus in the sea, moving along the Gulf Stream, till they reach the West Atlantic coasts and freshwaters as elvers and yellow eels. Once they sexually mature, eventually they migrate back to the Sargasso Sea to spawn and die. Due to destruction of its natural habitats by barriers, its migration has been affected drastically. In addition, decline in European and Japanese eel increased the demand for American eel dramatically leading to overfishing. The global demand for baby American eels continues to sky-rocket its price to about $2800/pound in 2017. Today, American eel is considered to be an endangered species by U.S. Fish & Wildlife, and IUCN since 2014. Much about the biology of the American eel is still unknown, yielding questions that need to be answered in order to meet market demand and support conservation efforts.

Spawning and raising American eel in vitro will help the US aquaculture produce American eel in captivity. This will help meet market demands, increase employment and reduce pressure on its wild population and sustain them. While Japanese eel, Anguilla japonica, was spawned and raised in vitro up to second generation, American eel needs to be spawned and raised in captivity. This is similar to restoring wild turkey of North America (Meleagris gallopavo) with successful indoor farming.

Our project aims to test and analyze two scenarios to enhance understanding of eel biology. The first, being to reaffirm successful induced spawning American eel in-vitro using a novel combination of gonadotropin hormone, dopamine antagonist, metoclopramide, oestradiol-17β, and pheromone. The second will induce spermatogenesis using testosterone in sexually immature eels to yield males. This will be modified to experiment on females to test the theory of “Gender Bending”, converting a known female into a male.

Metagenomic Analysis of Multi-Drug-Resistant Genes in Staphylococcus aureus Blastoff.V1 revision → Blastoff.V2 (work in progress)

Stephen Piller

Mentor: Professor Dmitry Y. Brogun
Kingsborough Community College

Physicians need to make quick decisions to administer proper antibiotics to a patient, due to the adaptable nature of the bacteria, Physicians are unable to treat their patients until they have enough information about the strain. Methicillin-Resistant Staphylococcus aureus (MRSA) genomes and other pathogens must be annotated to develop treatments against infections from particular strains. We are manually annotating and identifying orthologous genes in 161 MRSA

genomes. We are using the genome of MRSA strain, USA300, a strain of community-associated MRSA, as our reference [2]. Manual Gene Annotation (MGA) is a very involved and error-prone process. In order to automate gene annotation our research team has written the Blast-off algorithm, using Python and Linux/Unix environments. Further development is required on the prototype since it requires that the user perform a combination of downloading and sorting of data-sets, then transcribing into a web browser to upload annotation files iteratively. We rewrote the file manipulation and data preparation part of the program into bash programming language in a Unix environment. Thus,we are improving the annotation workflow and actively eliminating human interaction. Currently we are continuing to improve the Blast-OFF algorithm by combining the data preparation, file-handling, and web interaction bash scripts with container technology to further streamline the workflow. Finally, a comparative analysis of the results from the manual gene annotation versus the Blast-off algorithm results for accuracy is on the way. Currently testing developed data preparation bash scripts.

LaGuardia Community College

Solar Panels for the Lunar Base

Leulaye Maskal, Christian Singleton, Ahmed Aboudiwan, Ali Taha

Mentor: Professor Malgorzata Marciniak
LaGuardia Community College

The motivation behind this research lies in the well-spread news about USA and China's plans to build bases on the moon within the next 10 years. In this research, we create a mathematical model of efficiency for geometrical solar panels, as well as discuss which locations on the moon may be suitable for placing a non-tracing solar power plant. We consider the North Pole, the Equator and additional locations; and analyze the accumulation of illumination over an 18.6-year period that represents the lunar cycle. The simulation for geometrical panels is based on the etendue, with the panel being the diaphragm and a selected segment of the sky being the source. However, the etendue needs to be modified due to the properties of solar energy. The selected segment of the sky is crafted with careful analysis of the motion of the moon. The difficulty of the model comes from the fact that the motion of the sun on the moon's sky is subject to change in its speed and direction, which is created by the moon's libration. In addition, we discuss the change of luminosity of the sun's light due to the varied distance between the moon and the sun. The simulation was performed using MATLAB and Mathematica.

Design of Selective Dopamine Receptor Agents to Address Substance Abuse and Addiction

Isabela Santacruz

Mentor: Professor Ian Alberts
LaGuardia Community College

The development of medications for treating disorders such as substance abuse and drug addiction is a key issue of societal importance. Dopamine receptors are well-known as the targets for such disorders. We aim to progress the design of selective drug leads to specific members of the dopamine receptor family in order to treat the above neuropsychiatric disorders, while minimizing undesirable side-effects.
The ligands explored in this work were based on the scaffold of the commercial dopamine receptor agent, 1-phenylbenzazepine. Our research plan involved utilizing 1-phenylbenzazepine as a template and conducting structural manipulations at substituent branch points to generate highly active, selective dopamine receptor agents. The main objective was to design ligands that are tightly binding to the dopamine 1 receptor (D1R) with a poor binding affinity towards the dopamine 5 receptor (D5R) in order to produce safer, more potent drugs.
Two scientific programs were used in this work; Autodock, an automated docking tool, designed to predict how drug candidates bind to a receptor of known 3D structure and Schrõdinger's Maestro for visualization of the protein-ligand complexes in order

to identify key interactions. The generated ligands will be docked to the binding domains of D1R and D5R to determine the corresponding binding affinities towards each receptor and identify the most tightly binding, selective compounds. The best results achieved from our computational protocol will be the subject of biological assays to test their activity towards the target receptors by our collaborator at Hunter College, Dr. Wayne Harding.

Investigation of efficacy of inhibition of different compounds against Mycobacteria

Anna Steto

Mentor: Richa Gupta
LaGuardia Community College

The discovery of new drug targets and development of new drugs against deadly diseases is imperative for global health. In recent years, biomedical researchers are facing a challenge of trying to find different ways to treat infectious diseases caused by bacteria because they are becoming resistant to various currently used antibiotics. Spread of antibiotic resistance is a serious threat to world health and developing new antibiotic regimes can help to minimize this. Tuberculosis is a very contagious disease caused by Mycobacterium tuberculosis, which mainly infects human lungs but can also affect other organs of the body. The disease is spread mostly when someone who has untreated tuberculosis sneezes or coughs, and the pathogenic bacteria are released in the surrounding air in the form of aerosols that get inhaled by other people. Over 10-million people get infected by this disease annually and there is an increasing risk of acquiring tuberculosis in people with diseases such as cancer and HIV-AIDS. The currently administered drugs against tuberculosis target the bacterial cell wall metabolism, DNA replication or transcription machinery. However, there is a serious problem of emergence of drug-resistant strains of mycobacteria world-wide. To address this issue, we have to discover new ways to inhibit mycobacteria. In our project, we have characterized and compared the inhibition potential of different compounds on mycobacterial growth and survival. The interesting results will be presented.

RecO Involvement in the DNA repair mechanisms of Mycobacteria

Erichel Dela Cruz

Mentor: Professor Richa Gupta
LaGuardia Community College

DNA is constantly under threat from intracellular and environmental factors that damage its chemical structure. In living organisms, it is known that the most lethal kind of DNA damage is DNA double-strand breaks (DSBs). Organisms constantly evolve their mechanisms to repair DNA damage, and without the repair mechanisms biological processes will be at halt and may cause further damage to the cells. Mycobacteria, which include both pathogenic and non-pathogenic species, employ three distinct repair mechanisms to ensure survival in the wake of DSBs, namely, Homologous recombination (HR), Nonhomologous end joining (NHEJ), and Single-strand annealing (SSA). Of the multitude of proteins involved in mycobacterial DSB repair that recognize damage and co-ordinate repair processes, our recent studies have indicated that RecO protein plays a very important role. When RecO protein is removed from mycobacteria in the ΔrecO deletion strain, the bacterial chromosome becomes more susceptible to DNA damage as cellular DSB repair by both HR and SSA mechanisms gets abrogated. However, the exact molecular function of RecO in these homology-dependent repair mechanisms remained unclear. In this project, we have identified DNA-binding and zinc-binding domains of this protein and targeted them to make chromosomal mutants of recO that would be deficient in HR and SSA. We infer that these domains are pertinent for the role of RecO in HR and SSA, and our findings could help in the identification of a new drug-target against mycobacteria.

Identify Genes Functioning with Linker Histone H1 in Regulating Blood Tumor Formation Caused by Hyperactive JAK/STAT Signaling

Kimberly Nelsen

Mentor: Professor Na Xu
LaGuardia Community College

We have shown previously that the interaction between STAT and H1 suppresses blood tumor formation induced by hyperactive JAK/STAT signaling. Although 61 gene products were identified which interact with H1 in vivo, the manner in which these 61 genes affect H1-mediated tumor suppression and heterochromatin formation was not determined. Our present research aims to single out and identify novel genes which function with H1 in vivo in mediating heterochromatin formation and suppressing blood tumor formation caused by hyperactive JAK/STAT signaling. The method we will use to identify these novel genes is by conducting a second mis-expression genetic screen, using the previously identified 41 enhancers and 20 suppressors of H1 depletion- mediated lethality phenotype. We expect our research will reveal a network of signaling pathways and proteins that may function together with the linker histone H1 in regulating multiple biological events. In addition, our research findings will provide a foundation for future studies in understanding mechanisms of the blood tumor formation caused by hyperactive JAK/STAT signaling.

How Much is Too Much? Antioxidants Modification of Immune System

Tania Makki, Michael Copeland, and Gabriela Santacruz Betancourt

Mentor: Professor Tonya Hendrix
LaGuardia Community College

Antioxidants are molecules responsible for protecting other molecules from the chemical process called oxidation, which leads to the destruction of vital molecules in our cells such as proteins and DNA. Moreover, an overdose in antioxidants can lead to negative effects on our health that can damage the immune system.
The ideal model organism used in this work was the Drosophila Melanogaster, known as the Fruit Flies, which is a type of insect commonly used as an organism for genetic researchers. Including their life cycle, a sequence of events that consist of the changes in life by following the growth, maturation, and death of an organism.
The Drosophila Melanogaster life cycle includes four stages: eggs, larvae, pupa, and adult. However, the duration of these stages may differ in different hosts and ecological conditions. This was used to understand how would levels of antioxidants affect their life cycle.

Drosophila Innate Immune System… A flying History

Tania Makki, Michael Copeland, and Gabriella Santacruz Betancourt

Mentor: Professor Tonya Hendrix
Laguardia Community College

Researchers have seen that both humans and Drosophila (fruit fly) deploy a protein that plays a critical role in their immune responses to invading bacteria. The discovery gives scientists evolutionary insight and a model organism to explore ways to boost the human immune system and create infection-fighting medicines. In order to have a better understanding of how the Immune system of Drosophila functions, and find ways to improve human race, the CRSP scholars program gave us the opportunity to study “The effects of Antioxidants levels of Drosophila”. This research enables us to study how drosophila get effected and respond to different levels of antioxidants. In order to analyze the different effects on Drosophila life cycle and survival, the main focus is to study how does the Drosophila Immune system functions. The immune system rests on two major pillars: the innate, general immune system and the adaptive, specialized immune system. Both systems work closely together

and take on different tasks. The Drosophila however has an innate immune system, which means that Drosophila will have the same immune response to any intruder or pathogen and will not differentiate between one another. Their Immune system also occurs by the same defense mechanisms. The identification of these post-transcriptional regulatory mechanisms and the annotation of most Drosophila immunity genes have derived from functional genomic studies using "model" pathogens, intact animals and cell lines.

Thiol Substituted Water Soluble Phthalocyanines For Photodynamic Therapy

Md Reduanul Karim and Mosammat Rina Akter

Mentor: Professor Sunaina Singh
LaGuardia Community College

Phthalocyanines (Pcs) and their diamagnetic metallated complexes, for example, Zn(II), Al(III), Ga(III), can be efficient photosensitizers for photodynamic therapeutics (PDT) because they can photosensitize the formation of singlet oxygen. Singlet oxygen is formed upon energy transfer from the triplet excited state of the dye to ground state triplet oxygen. Since red light penetrates deeper into tissues, Pcs can be more efficient PDT agents than the well studied porphyrins because the electronic bands of Pcs in the red special region are about two orders of magnitude stronger than the porphyrins. Zinc metallophthalocyanines are of interest because of their high triplet quantum yield and long triplet lifetimes. Significant research directed at improving the selectivity of the Pcs toward malignant tissues has resulted in limited success because of poor solubility in physiological fluids. Since the red light penetrates deeper into tissues, Pcs can be efficient PDT agents. In order to evaluate the effect of substitution on the efficacy of phthalocyanines, a few of thiol substituted water-soluble phthalocyanines were prepared by reaction of the commercially available hexadecafluorophthalocyaninatozinc(II) by controlled nucleophilic substitution of the peripheral fluoro groups in the presence of potassium carbonate in dry dimethylsulfoxide (DMSO).

Diabetes Mellitus & Alzheimer's Disease…Are ketones the cure?

Marwah Wilson

Mentor: Professor Lucia Fuentes
LaGuardia Community College

With previous clinical studies linking Diabetes Mellitus to Alzheimer's Disease (AD), evidence suggests that brain homeostasis depends on the stabilization of blood glucose. AD, a neurodegenerative disease of the central nervous system distinguished by the accumulation of insoluble proteins in the brain, results, in part, from the incapacitation of microglia to perform their phagocytic activities. This change in function is also associated with microglia presenting a pro-inflammatory phenotype, which interestingly, is also characteristic of phagocytes of diabetic patients. Previously we determined that BV2 cells (immortal mouse microglia cell line) grown under hyperglycemic conditions showed significant increases in Nitric Oxide (NO)-a proinflammatory molecule- production, accompanied by reduced phagocytic activity, when compared to cells grown in normal or hypoglycemic conditions. Control of hyperglycemia is thus a key goal for the reduction of diabetes-associated diseases such as AD, among others. Several investigators have proposed the introduction to a ketogenic diet, high in fats and proteins and low in carbohydrates, as a way to reduce hyperglycemia in diabetes type II patients, without the use of drugs. The diet mimics a state of glucose starvation, where cells rely on ketones, resulting from ketogenic metabolic pathways, as a source of energy. Ketones (such as β-hydroxybutyrate) are not only an efficient source of energy, they are also known to downregulate transcription of pro-inflammatory genes by inhibiting histone deacetylases as well as improving

glucose tolerance. We propose to examine the effect of ketone bodies on the production of proinflammatory molecules and oxidative stress in BV2 cells. We hypothesize that the addition of ketone bodies to LPS-treated cells will downregulate production of oxidative stress markers (ROS/NO/proinflammatory molecules). To model the experiment, techniques will include TUNEL assays and western blot detection methods to examine mitochondrial and protein activity. Proposed experiments may indicate that implementing ketogenic diets to diabetic patients may reduce their probability of developing neurological disorders such as Alzheimer's disease, with the added advantage of controlling diabetes.

Probing the molecular orbitals of collagens with supercomputers to achieve molecular stability

Li Kuan Phang

Mentor: Professor Midas Tsai
LaGuardia Community College

Amino acid residue mutations in collagens can cause genetic brittle skeleton, bone or skin disease like osteogenesis imperfecta and probing the most stabilized glycine-based structure could potentially reverse the mutation effect.
While collagen peptides are complex structures that usually make up 25 – 30% of the proteins in a mammal body, these triple helices polypeptides are mostly found in fibrous tissue such as skin, muscles, ligaments, tendons and bones. Collagen peptides are repetitive sets of three sequential amino acids. From the Protein Data Bank (PDB,) we selected a specific pattern, PPG (P as proline; G as glycerin.) Later, we altered the pattern and hypothesized three other combinations, AAG (A as alanine,) GGG and azaG azaGG (azaG as aza-Glycine.)
Today's computer technology can optimize molecules by virtually testing the structures prior to benchwork testing. Using Gaussian 5 software, we inspected four different collagen structures in their triple helices forms and distorted strands. Finally, we compared the hydrogen bonding energies of all combinations and forms. Because azaG donates an extra hydrogen bond to its acceptor that gives rise to collagen stability, it revealed that azaG azaGG is the most optimized pattern.
Therefore, we concluded that the presence of azaG in the collagen sequence enhances structure stability that could benefit biological-relevant research. Because hydroxyproline (Hyp) is another most common Y-position amino acids and compromises almost 14% of mammalian collagen, for future work, we plan to substitute azaG with Hyp. We will perform same procedures to explore more collagen stability possibilities.

Another link between Diabetes Mellitus and Alzheimer's Disease: Ketone Bodies derived from Ketogenic Diets upregulate phagocytosis of microglia while reducing free radical production

Maria Paula Rodriguez Wilches

Mentor: Professor Lucia Fuentes
LaGuardia Community College

Diabetes Mellitus (DM) has been linked to Alzheimer's Disease (AD) by growing indirect and direct evidence showing the detrimental effect of fluctuations in blood glucose on brain homeostasis. AD is a neurodegenerative disease characterized by the accumulation of insoluble proteins in the brain, which result, in part, from the deficiency of microglia to perform their functions as the professional phagocytes of the Central Nervous System. Previously, we determined that growth under hyperglycemic conditions downregulated phagocytosis in BV2 cells, an immortal mouse microglia cell line. Hyperglycemia is a hallmark of uncontrolled DM, and is accompanied by the inability of the cells of diabetics to use glucose as a main source of energy, provoking the cells in the brain to use ketone bodies as their main source of energy . Ketone bodies are known to be more fuel efficient than glucose and generate less reactive

oxygen species and free radicals when metabolized. Based on our research into the literature on this topic, we hypothesize that microglia grown in hypoglycemic media supplemented with ketone bodies will increase phagocytic indexes when compared to cells grown under hyperglycemic conditions. We also hypothesize that in cells pre-treated with LPS, ketones will lower production of NO2 without interfering with the upregulation of phagocytosis we have previously observed when BV2 cells are exposed to LPS. We propose to examine the effect of treatments with different concentrations of ketone bodies, both in the presence and absence of LPS, on the phagocytic activity of BV2 cells. Following different treatments, zymosan, a yeast derived particle, or latex spheres will be added to the cells and, following a brief incubation period, cells will be fixed, stained and particles ingested will be counted using light or fluorescent microscopy. We propose to set up experiments to examine this model which, if confirmed, could open possibilities for prevention of AD in diabetics, by promoting ketogenic diets and reducing hyperglycemia while promoting better function of microglia.

Elucidating the function of Dysferlin in cultured coelomocytes from the sea star, Patiria miniata

Wesam Yousri and Sadia Akter

Mentor: Professors Ingrid Veras and Thomas Onorato
LaGuardia Community College.

Dysferlin is a calcium-binding transmembrane protein involved in membrane fusion and membrane repair that belongs to the Ferlin family of proteins. Ferlin proteins function in various biological processes in several organisms. For example, dysferlin is essential for normal endocytosis during oogenesis and for embryogenesis in the sea star, Patiria miniata, and it has been shown to regulate cell adhesion in human monocytes (one type of white blood cell). Therefore, we had previously examined dysferlin expression in sea star coelomocytes ("white blood cells" of sea stars) and have found that cultured coelomocytes express dysferlin protein, which appears to be enriched at the cortex of certain coelomocytes. We intended to continue investigating dysferlin protein expression in cultured coelomocytes. This research project aims to 1) examine dysferlin protein expression in sub populations of coelomocytes and 2) elucidate the function dysferlin in sea star immune cells. Here we outline the proposed experimental that were to be conducted to address the aims of this research project.

Comparing a Theoretical and Simulated Cantilever Beam

Travis Jenne

Mentor: Professor Yves Ngabonziza
Laguardia Community College

Comparing the theoretical and simulated maximum stress and displacement of a 1060 Aluminum cantilever beam under a concentrated load. The theoretical results were calculated mathematically and the simulated results were found using Solidworks. Solidworks is a computer modeling aided design program used to test objects under various conditions without having to spend money on creating a prototype. I tested a 550mm long, 12.7mm high, and 63.5mm thick aluminum beam with a fixed end on one side and a 4.53 kilogram weight placed on the other side. This was tested at two different temperatures, 0 and 250 degrees celsius. At 0 degrees celsius the simulated and theoretical maximum displacement were 3.256mm and 3.27mm respectively. For a difference of 0.014mm. And at 250 degrees celsius the simulated and theoretical maximum displacement were 3.321mm and 3.86mm. For a difference of 0.539mm. The results of the max stress were not as uniform. At 0 degrees celsius the maximum stress simulated was 8.731x10^7 N/m^2 and theoretically was 14.31811x10^6 N/m^2. For a massive difference of 72.991890 x 10^6 N/m^2. For 250 degrees celsius the maximum stress simulated was 8.147x10^8 N/m^2 and theoretically was 15.16x10^6 N/m^2. Which had an even larger variance of 79.954x10^7. Which leads me to doubt the results of my simulated results for the stress of the beam.

Aerosolization remediation of a polluted waterway: friend or foe?

Harry Aguilar, Veronica Martinez, Vania Fulton and Wesam Yousri

Mentor: Professors Ingrid Veras, Olga Calderon, and Joby Jacob
LaGuardia Community College

Newtown Creek has been the subject to anthropogenic pollution and has been designated a superfund waterway. In an effort to combat the pollution in the Creek, NYC's Department of Environmental Protection has installed aeration systems in order to oxygenate the water and increase survival rates of aquatic organisms in the creek. There have been community concerns about the potential for pathogenic bacteria from the Creek to be aerosolized as the result of this process. In order to determine if bacteria is being aerosolized, samples were collected from eight different locations along the creek while the aerators were running. Bacterial genomic DNA was isolated from the samples. Next generation sequencing was used to determine the small subunit ribosomal RNA for the variable regions of V3 and V4. Acinetobacter, Bacillus, Carnobacterium, Halomonas, Pseudoalteromonas, Psychrobacter, and Vibrio, represented a larger proportion of bacteria collected from aerosols and grown in the lab whereas they represented a much smaller proportion of the OTUs isolated from the water; where Stenotrophomonas was overwhelmingly represented.

Data Visualization of COVID 19 Statistics

Monique Correa

Mentor: Professor Na Xu
LaGuardia Community College

Coronavirus Disease 2019, also known as COVID-19 is a disease caused by a virus known as SARS-COV-2. Despite SARS-COV-2 startlingly high R0 number (the average number of new infections initiated by an individual) information on this virus remains elusive. We are implementing data from NYC Department of Health and Open Datas' COVID-19 statistics and cross referencing it with other data points then visualizing it in an easily understood format for the public.
Using JavaScript, G Suite and ArcGIS, data points and correlations are displayed as interactive charts or geographic maps that can be accessed on our webpage,https://storage.googleapis.com/big_mac/index.html. End users will be able to use the interactive features and filters to customize data, for example, current positive cases, number of deaths and hospitalizations and create other reports instead of searching for information across different sources.

Effects of Toll-like Receptor Signaling Pathways on Microglial Morphological, Phagocytic and Inflammatory Response

Laura Pessoa

Mentor: Professor Lucia Fuentes
LaGuardia Community College

Microglia, the professional phagocytes of the Central Nervous System (CNS), are known to be critically involved in the initiation and development of Alzheimer's Disease (AD). In AD, the microglia are constantly activated, meaning their Pathogen Recognition Receptors (PRRs) are exposed to molecules known as Danger or Pathogen Associated Molecular Patterns (DAMPs and PAMPs). The chronic neuroinflammation resulting from this exposure further aggravates the immune cells by promoting the passage of bacteria, fungi and viruses across the blood-brain-barrier (BBB). The initial increase in phagocytic function is quickly suppressed, causing the characteristic accumulation of neurotoxic amyloid beta (Aβ) plaques. A family of PRRs involved in this overactive immune response, are the Toll-like receptors (TLRs). In this study, we propose an experimental design to determine the signaling pathway(s) involved in the

changes seen in AD, thus narrowing the biological target for therapeutic treatments. Different Toll Like Receptors, including TLRs 1/2, 2/6, 3, 4, 5, 7/8, and 9, will be stimulated with agonists Pam3CSK4, MALP-2, Poly I:C, LPS, Flagellin, Loxoribine and CpG ODN, respectively, and their effects on phagocytic activity, cell morphology and production of pro-inflammatory molecules will be measured in BV2 cells. Results will be analyzed to determine whether common signal transduction pathways characterize the responses of the cells. We hypothesize that TLRs using the MyD88 pathway will provoke a stimulatory response, including increase in phagocytosis and in production of pro-inflammatory markers, while TLRs that do not use the MyD88 pathway will present opposite effects. These results could give insight into possible targets for modulating microglial phagocytic and pro-inflammatory activities.

Visualizing the Pulsars Detected by Fermi Large Area Telescope

Daniel DeJesus

Mentor: Professor Joshua Tan
La Guardia Community College

A neutron star is a rapidly spinning stellar remnant with a spin period ranging from milliseconds to many seconds. As neutron stars spin, they emit beams of electromagnetic radiation including radio and gamma rays and are observed by astronomers as pulsating sources known as “pulsars”. The Fermi Large Area Telescope (LAT) has been used to observe pulsars in gamma-ray wavelengths to complement observations made by radio telescopes. In this work, I identify pulsars that were detected by Fermi-LAT to determine their properties and distinguish them from undetected pulsars. I used the Python packages Numpy, Matplotlib, Astropy, Scipy, Gammapy, and Psrqpy to create data visualization products that allowed close scrutiny of the properties of these objects. I conclude that the pulsars identified by Fermi are fast spinning and generally above a specific threshold clearly visible in a plot of pulsar period derivatives versus spin periods. Different surveys were sensitive to different pulsar populations with young pulsars’ locations concentrated along the plane of the galaxy and recycled or millisecond pulsars more uniformly distributed throughout the celestial sphere. This work made use of the Fermi-LAT All Sky Survey and Australian Telescope National Facility Pulsar Catalog.

Parabolic Iteration

Hongzhong Hu

Mentor: Professor Tao Chen
LaGuardia Community College

How virus spread is similar function iteration. The understanding of parabolic iteration should shed light on virus spread model. In particular, there should be only two cases of parabolic maps on the real line;
1. Convergent: all points converge to a point or a cycle.
2. Lost: the orbit of any point is everywhere on the real line. Mathematically, it is dense on the real line.

Modeling the Output Power of Solar Panels with Machine Learning

Sunil Ale

Mentor: Professor Malgorzata Marciniak
LaGuardia Community College

An existing research conducted at the University of Tsukuba used a crystalline silicon based solar panel to create a model of output power as a function of temperature and irradiance. They combined an existing model for current at maximum power point and another existing model for voltage at maximum power point to generate a new model for output power. Our research uses this model for output power and data collected from previous CRSP students Andrea Martinez and Abel Asfaw in 2019. The data was collected from the roof of LaGuardia M-Building. AHQST 100W polycrystalline solar panel,

pyranometer, and LabQuest Sensor were used to measure and calculate the surface temperature of the solar panel, output voltage, output current, output power, and irradiance. The data was plugged into the theoretical model to generate expected output power and the model was then modified using constants to generate the best fit model for our data. Python libraries: pandas and matplotlib were used to analyze and visualize the model-generated and measured data. We also used the python library sci-kit learn to generate another model: a machine learning model for output power. However, due to the limited amount of data available to us, the output data might not be as reliable even though we have seen positive results with this model. Regardless of the kind of model we might decide to go with, our overarching goal is to produce a generalized model for output power of solar panels, which can hopefully be used for estimating output power from solar panels at any other locations on the earth and even in the space for future researches and works.

Are aerosolized bacteria being incorporated into the microbiome of organisms found along the shores of Newtown Creek?

Veronica Martínez Castro

Mentor: Professors Ingrid Veras, Olga Calderon, and Joby Jacob
LaGuardia Community College.

Newtown Creek is a superfund site and one of the most polluted water bodies in the United States. The New York City Department of Environmental Protection (DEP), under a consent order from the State Department of Environmental Conservation (DEC) installed an aeration system in Newtown Creek to remediate low dissolved oxygen (DO) levels in the water. This system can, however, aerosolize bacteria, which can then travel to upland areas and become part of the microbiome of organisms that inhabit the shore. This could be potentially dangerous for the health of the communities living in the areas surrounding the creek, as certain species of bacteria are opportunistic pathogens. To assess whether aerosolized bacteria are being incorporated into the microbiome of organisms living along the shore of the creek, we collected and sampled ants from this area to use as model organisms. It is expected that the insects' microbiome will include bacteria that have been isolated from the aerosols, like those of Alcaligenes, Acinetobacter, Bacillus, Psychrobacter and Vibrio genera which contain species known to be pathogenic to humans.

Circadian Rhythms and Immune System Function in Drosophila Melanogaster

Michael Copeland

Mentor: Professor Tonya Hendrix
LaGuardia Community College

Since the genes that produce circadian rhythms are highly conserved, scientists are seeking to discover all of their effects on phenotype as the field of chronobiology expands. It follows, then that Drosophila melanogaster continues to be used as a model system in which to investigate the wide-ranging influence of clock genes. We wish to understand the effects of circadian state on the immune functions of haemocytes function in Drosophila. This review will cover out current knowledge in this field, the direction of our research and implications of our future data for other organisms.

HIV Phosphorylation Site Investigation Using MALDI-LTQ

Andre D. Dunkley

Mentor: Professors Kevin Mark and Pratikkumar Rathod
LaGuardia Community College

As an initial step in developing a cure for HIV, certain phosphorylation sites have been identified as candidates for investigation. Phosphorylation is a dominant form of post-translational modification of proteins, involved in numerous biochemical

processes such as signal transduction, activation, and deactivation of proteins. Phosphorylation in HIV-1 predominantly occurs at the amino acids serine, threonine and tyrosine, and preliminary data indicate that there are 11 potential sites. Investigating these sites may provide insight into how to reduce the efficacy and propagation, and possibly develop future treatments and/or cures for human carriers.

Sites were computed by bioinformatics software (eg.NetPhosK, KinasePhos and GPS), using the sequenced genomes for HIV-1 clades, Vif. In-vitro kinase assay of Vif peptides. Out of the 11 sites, the 4 that show potential were validated using Protein Kinase C (alpha and beta), Protein Kinase C (alpha), Protein Kinase A and CDK2/CyclinA. In all, our preliminary data on Vpu, Vif and Vpr, three of the smaller HIV proteins covering about 12% of the total number of HIV amino acid residues, generates the prediction of at least 4 novel sites. This indicates that our method is capable of detecting phosphorylation sites that have not been characterized yet.

Thus far, a peptide sequence of a p24 HIV-1 protein has been phosphorylated by a specific enzyme and analyzed by Matrix-Assisted Laser Desorption Ionization Linear Trap Quadrupole (MALDI-LTQ). Later, the study was expanded to the entire p24 protein level, where phosphorylation was measured to be in a phosphorylated-to-unphosphorylated ratio of 1:1000. The goal of this study is to identify potential phosphorylation sites of p24 on the peptide level to compare the results with both the bioinformatics and p24 whole protein phosphorylation data. Extrapolating to the whole HIV proteome suggests that there are up to 30 to 40 novel phosphorylation sites in HIV.

Stress Analysis of 3D Modeled Small-scale Wind Turbine Blade

Kara Timrick

Mentor: Professors Malgorzata Marciniak, Jessie Oehrlein,Vladimir Przhebelskiy and Marina Nechayeva
LaGuardia Community College

Wind turbine blades interact with wind initiating the conversion of kinetic energy possessed by the wind into useful power. For safe power generation, wind turbine blades must sustain all loads acting on them during operation. Former CRSP researchers optimized the geometry of a small-scale wind turbine blade to maximize the power coefficient. No attempt has been made to analyze the structural integrity of the blade. This project focuses on stress analysis of the optimized blade. Blade Element Momentum (BEM) theory was used to calculate aerodynamic loads acting on the blade. Centrifugal and gravitational loads were calculated using equations derived in similar studies. A 3D model of the blade was constructed in Solidworks 2018. The blade was assigned modified ABS plastic material properties and the calculated loads were applied elementwise. A nonlinear static finite element analysis (FEA) was conducted in Solidworks Simulation Premium to visualize how the blade responds to the loads. Initial results show a high degree of blade deformation upon loading. The tip of the blade deformed vertically by 0.26 meters, while the length of the blade is only 0.3 meters. Additionally, the indicated stress levels exceeded the yield strength of the blade material in approximately 15% of the model. The large deformation and surpassing of yield strength indicate blade failure. Future studies should focus on collecting experimental data as FEA involves numerical approximations that may not represent reality. Furthermore, researchers might consider using a stronger blade material rather than modified ABS plastic to reduce deformation and stress levels.

Medgar Evers College

Blocking Lysine Acetylation-Directed Epigenetic Mechanisms Abrogate the Growth of Prostate Cancer Cells

Albert Oladipupo

Mentor: Professor Carolle Bolnet
Medgar Evers College

Acetylation of aminoacid lysine by histone acetyltransferases (HAT) creates acetylated-lysine (AcK) moiety on chromatin and chromatin-associated proteins to regulate nuclear signaling and gene transcription. These Kac sites serve as a docking site for bromodomain-containing proteins. Dysregulation of this acetylation-mediated molecular processes leads to development of many cancers including Prostate Cancer (PCa). Therefore, blocking acetylation-mediated events could prevent the growth of PCa.

CREB-binding protein (CBP) is the master coactivator that activates gene transcription through site-specific acetylation of lysine residues on chromatin by its HAT domain. One of the members of BET family, the Bromodomain 4 protein (BRD4) is recruited to the Kac site upon CBP-mediated acetylation. Literature suggests that inhibition of CBP HAT activity and BRD4 functions abrogate the growth of melanoma cells.

CBP is a coactivator of Androgen Receptor that directs the progression of PCa. We previously demonstrated that acetylation plays a pivotal role in development of PCa. Thus, here, we hypothesize that inhibiting CBP HAT and BRD4 will block the growth of PCa cells. Towards this goal, we tested the effects of CM354 and JQ1 which are inhibitors of CBP HAT and BRD4 in blocking the growth of cancer cells The study demonstrates that CM354 and JQ1 can indeed induce abrogation of PC3 cells proliferation.

Respiratory virus shedding in exhaled breath and efficacy of face masks by Leung et al (2020) Nature Medicine

Mac-Darlene Armand

Mentors: Professors William Carr
Medgar Evers College

The main focus of this recently published study was to identify if surgical face masks can protect people from viruses transmitted through exhaled breath and coughs. In order to know if the face masks are effective, samples of droplets and aerosols were collected to detect respiratory viruses. Real-time polymerase chain reaction (RT-PCR) was used to detect viruses (Coronavirus, Influenza virus and Rhinovirus) and the G-II bioaerosol collecting device was used to collect droplets and aerosols from people with and without face masks. Nasal and throat swab samples were collected to confirm viral infection. 3,363 people were screened from two different studies. Of 246 individuals, who were enrolled, 122 provided exhaled breath samples without wearing a face mask and 124 participants were wearing a face mask. All of the participants were infected with either the Coronavirus, Influenza virus and Rhinovirus. The results indicated that surgical face masks could prevent transmission of human coronaviruses and influenza viruses from symptomatic individuals. This study indicated that surgical masks could efficaciously reduce the transmission of influenza virus particles into the environment in respiratory droplets, but not in aerosols The outcome of this study indicated that people should wear masks even if they do not show symptoms. Not everyone who are infected with these viruses showed symptoms. Therefore, face masks should be worn at all times when in public. Although hand hygiene and use of face masks, primarily targeting contact and respiratory droplet transmission, have been suggested as important mitigation strategies against influenza virus transmission, little is known about the relative importance of these modes in the transmission of other common respiratory viruses. face coverings are recommended as a simple barrier to help prevent

respiratory droplets from traveling into the air and onto other people when the person wearing the face masks coughs, sneezes, talks.

Using the creation of multiple choice questions with H5P Technology for learning critical thinking skills in Biology

Awa Barry

Mentors: William Carr
Medgar Evers College

Current studies have demonstrated that active learning or learning by doing has a more significant impact on learning outcomes than reading or watching videos. With the development of H5P tools, an open-source, online technology (www.h5p.org), faculty, and even undergraduate students can create interactive exercises that promote formative learning. We hypothesized that when students create multiple choice questions using H5P Technology, they will improve their knowledge of course content and develop critical thinking skills. To test this, we identified two learning outcomes that were most challenging for MEC students in General Biology: 1) identify the attributes of molecules with carbonyl group and 2) the essential organelles present only in plant cells, not animal cells. We gave the students a pre-test based on these topics. Then, we told them to develop two digital assessments as multiple-choice questions using H5P. We instructed them to provide feedback for each response to explain why a correct answer was correct and why an incorrect answer was incorrect. Afterward, we gave them a post-test in which they were asked to provide subjective feedback on their use of H5P tools. We recorded all responses, compared pre and post-test scores, and quantified the students' feedback. We used Mann-Whitney paired statistical tests in Prism software for data analysis. The results showed that the assessment scores tended to increase after the H5P activity (n=14, p=0.07, mean= 65% for the pre-test vs. 88% for the post-test). Statistically, there was no significant difference between the pre and post-test scores. Still, there was a tendency of higher scores in the post-test. Based on their subjective impressions, a majority (70%) of the students reported that their confidence increased in explaining course-content (n=36). This project's outcomes suggested that an H5P platform is a versatile tool for building student confidence in explaining the content in biological sciences.

Studies on anti-cancer properties and on Clove Oil

Helena Crentsil

Mentor: Professors Ijaz Ahmed and Alam Nur-E-Kamal
Medgar Evers College

Research over the last decade has been done to show that micro nutrients in fruits, spices, and vegetables reduce cancer. Clove essential oil is mostly used by Indians as flavoring and spice proving to cure common cold, cough and cancer tumors. Eugenol one of the primary components in clove oil consist 81.1 % of the oil. It is used as antiseptic, antibacterial and analgesic agent in traditional medicine. Oil extract derived from clove bud (Syzygium aromatics) have been used in prior research to demonstrate the anti-proliferative effects of on several cancer cell lines. This research project is to study on clove oil extract for cytotoxic effects against cancer cell lines.

Method: Using Tween 20 and Tween 80, a standard titration technique was used to prepare the microemulsions. A test for stability under extreme stress condition was conducted through centrifugation for stability. Further studies for characterization was carried out using dynamic light scattering (DLS). Inhibition of cell proliferation was assessed using MTT [3-(4,5-dimethylthiazol-2-you)-2,5-diphenyltetrazolium bromide] as a vital assay. HTh7 (Thyroid cancer cell line) and HeK-293 (non-tumorigenic) cell Line was assessed for anticancer activity.

Results: The MTT test revealed that the formulation expressed cytotoxicity against thyroid cell lines. Further research revealed that apoptotic cell found in clove bud oil is mainly responsible for cell death when stained with V-FITC.

Conclusion: Oil extract of clove was found to have a strong anti-cancer activity. Since this spice has been in use for thousands of year without any known side effect. The clove oil extract may be used as potential therapy for cancer.

Automatic programming through machine learning and the role it will play in the Health field

Gilford Duversaint

Mentor: Professor Rosa Zavala- Gutierrez
Medgar Evers College

Computer programs and software have become an integral part of everyday life everywhere in the world especially in developed countries. As the programming and devices become more powerful and complex, they will have an even more pervasive hold on our lives Computer programs will be able to do things that we thought were only achieved by humans: recognizing what's in a picture, telling when someone's getting mad or sad, summarizing documents, dealing with economies, and the more relevant role of diagnosing and treating patients. Almost all of the improvements in software are and will be driven by breakthroughs in artificial intelligence — the software's growing ability to understand complex nuances if the world. In fact, it is believed that programming will reach a stage where those who have not devoted the years to studying computer science, will be able to program computers with minimal technical knowledge. For example, a doctor can write a computer program to formulate a diet plan, or a specific medication regimen for an individual just by expressing what he/she desires as outcomes. The purpose of this project is to learn the basics of machine learning through a hands-on health care related experiment, and then survey the current state of automatic programming and what the promise of machine learning is for the field.

The Antibacterial properties and effectiveness of Clove Oil

Georgina Gooden

Mentor: Professors Ijaz Ahmed and Alam Nur-e-Kamal
Medgar Evers College

Background. Despite conflicting opinions, herbs and essential oils (EOs) have been found to have a significant number of applications in human life. One of these applications is the treatment of the multi-drug resistant Streptococcus Suis with the essential oil from the medicinal plan, Syzygium Aromaticum to reduce its associated risk. The purpose of this study is to determine the composition and effectiveness of Clove Oil as a natural antibacterial treatment of this pathogen. This project is aimed to evaluate the clove EOs, as potential alternative to synthetic compounds, by summarizing the known most-active EOs with antimicrobial properties.
Experiment and Results. The results showed that Eugenol was the major active ingredient found in Syzygium Aromaticum (Clove oil), 97.76%. Scanning Electron Microscope showed that a 15-minute exposure to clove oil resulted in morphological damage such as cell membrane and cell wall lysis, and deformed shape. This was maximized at a concentration of 15% (v/v) of clove oil at pH 4 for all MDR S. Suis isolates, but had minimum inhibitory effect at concentration of 5% (v/v). Limited EOs shows promise as an antimicrobial agent, especially in Gram-positive bacteria. Agents belonging to the highly volatile phenolic, aromatic, and alcohol group seemed to be the most effective. Clove EO destroys the cellular membranes and walls of the microorganism and inhibit proper synthesis of DNA and proteins.
Conclusion. Clove oil extract has been demonstrated to kill both gram positive and negative bacteria. Further studies need to be conducted to discover which oils are most effective and whether a combination of oil increases the potency of the oils for treatment.

Using Fruit Flies to Better Understand Disease Treatment in Humans

Ethabanie Jean Francois

Mentors: Professor Chiyedza Small
Medgar Evers College

Drosophila melanogaster, also known as the fruit fly, is a well-studied organism that has been used as a genetic model for several human diseases such as Parkinson's disease and Alzheimer's disease. About 60% of the Drosophila genome is homologous to the human genome, making it an accessible, cheap, and a well-researched system to use for biomedical research purposes. The fruit's fly developmental pathways, which include JAK-STAT, Toll, and Notch, amongst others, are well characterized, and its' cadre of mutations allow for the study of dysregulations of genes that lead to disease in humans as well as drug testing. The physiologic and molecular advantages of the fruit fly make it eligible in the study of complex pathways involved in the study of cancer. Over the last decade, Drosophila melanogaster had become a successful model in studying cancer evolution in fruit flies that possess epithelial tumors. My project focuses on better-understanding tumor development in Drosophila hematopoiesis and seeks to understand how the fly can be used to study several plants used in ethnomedicine. Drosophila hematopoiesis occurs in the lymph gland and gives rise to three blood cell types: plasmatocytes, crystal cells, and lamellocytes. Dys-regulation of these cells can lead to melanotic tumors in the fly. In this research, we incorporate the study of plants used in ethnomedicine, a sub-field of medical anthropology to better understand their effects in a model system of inflammation and cell proliferation. Can the study of medicinal plants in Drosophila lead to the discovery of new or alternative medicines?

The Risk Assessment and Exposure of Per- Polyfluoroalkyl Substance within Indoor Environment

Novelette Neil

Mentor: Professor Jin Shin
Medgar Evers College

Perfluoroalkyl Substances (PFASs) such as PFOS (Peruorooctane Sulfonate) and PFOA (Perfluorooctanoic Acid), sometimes it is called “forever chemicals,” have recently drawn exceptional attention due to their persistence, global ubiquity and their harmful effect on our human body including birth defects, hepatic, transcriptional effects, endocrine description, and neurodevelopmental toxicities. A few studies reported a high level of PFASs concentration in human blood and urine. PFASs are present in various consumer goods, including carpets, leather, apparel, textiles, paper and packaging, coatings, rubber, and plastics, etc.. The primary exposure pathways of PFASs are well identified by the ingestion of food, drinking water, and dust inhalation, but still, knowledge of human exposure and its assessment is not explicit, although many studies were currently ongoing last decade. From the literature review, we found the most commonly detected PFASs were Perfluorooctylsulfonate(PFOS), perfluorohexane sulfonate (PFHxS), and Perfluorooctanoic acid (PFOA) from an indoor residential home, these chemicals covers almost more than 70% of total PFASs in the dust at the residential home. This study aims to establish the risk and estimate the exact exposure amount of PFAS and what is most dominant PFASs within indoors as humans spend most of their time, including children’s rooms, dust in offices, and products that humans used daily at their home.

Photosynthetic Bioconjugates based on Graphene Oxide Investigated by Joliot-type Spectroscopy

Mohigul Rahimova

Mentor: Professor Michele Vittadello
Medgar Evers College

Photosynthesis is the process through which algae, cyanobacteria, and plants convert light into chemical energy. Photosystem I (PSI) is one of the protein complexes that catalyze the process. PSI, a reaction center found in thylakoid membranes, is the site of a primary charge separation event and electron translocation across the membrane. This phenomenon takes place at the P_{700} domain following light irradiation. The operation of PSI resembles that of a photodiode and has been a source of inspiration for researchers in their attempts to assemble artificial photoconversion devices. Graphene oxide (GO) is a bidimensional nanomaterial based on carbon, that has been shown to stabilize proteins in the form of bioconjugates. Our research group has pioneered the immobilization of PSI on GO-based supports. In this study, we have assembled a model system consisting of GO derivatives functionalized with Nickel nitrilotriacetic groups in suspension (GO-NiNTA). GO-NiNTA was coordinated to Histidine-tagged PSI core complexes (PSI CCs), yielding GO-NiNTA-PSI bioconjugates. To assess the functional integrity of PSI on the surface, we conducted Joliot-type spectroscopy measurements (JTS) on GO-NiNTA-PSI in comparison with PSI CCs. JTS allowed us to measure the effect of redox donor concentration (i.e. DCPIP) and light irradiance in terms of absorbance differentials vs. time. Sodium ascorbate or vitamin C (VC) assured the re-reduction of DCPIP and methyl viologen (MV) was used as a final electron acceptor. The spectral analysis was conducted based on a kinetic model describing the oxidation of P_{700} in terms of four-time constants, τ_1, τ_2, $\tau_{hv,}$ and τ_D. We determined that PSI on the surface of GO presents slower kinetics than free PSI in suspension and that GO plays the role of electroactive redox support.

Hair Dye Products and their Effects on Human Health

Arantxa Saint Surin

Mentor: Professor Harsha Rajapakse
Medgar Evers College

Hair dye products are increasingly becoming popular among both men and women in the cosmetics industry to enhance their beauty. In this literature search, different hair dye products that are in use and their effects were studied. Current knowledge on changes in these effects on African American women's hair was also studied. Although all three types; permanent, semi-permanent and temporary hair dyes are equally used, permanent hair dyes were found to be the most dangerous due to high chemical content that can cause more damage to the hair shaft. Moreover, some hair dyes including semi-permanent, temporary hair dye and henna, a herbal hair color were found to be safer than the others. Among many commonly found chemicals in hair dye products, ammonia and hydrogen peroxide were found to be the most damaging. Several studies showed that African American women's hair tend to get damaged more easily with hair dye products than other women, and a possible connection with breast cancer. However, it was not clear if this difference was due to the specific texture of the hair or higher than average chemical content in products specifically manufactured for African American hair type.

Kinetics of Cyclopentane Hydrate formation In the presence of Gemini Surfactants

Renee Sumner

Mentor: Professor Oluwaseun Salako
Medgar Evers College

This work studies the impact of two Gemini surfactants (Dowfax C6L and Dowfax 2A1) on the kinetics of Cyclopentane (CP) hydrate formation in a high-pressure reactor. Both surfactants used in this study have an anionic head group and hydrophobic tail group. Dowfax 2A1 has two anionic head group and twelve-carbon chain hydrophobic tail group. Dowfax C6L has two anionic head group and a six-carbon chain hydrophobic tail group. Specifically, we want to investigate the role of hydrophobic tail group of surfactants on CP hydrate formation kinetics. For this research, we used bulk phase surfactant concentration of 100ppm and 600 ppm. Our preliminary results show the importance of the surfactant hydrophobic tail group to the kinetics of CP hydrate formation.

Synthesis of Diacylglycerol-Lactones Using Microwave Assisted 1,3 Dipolar Cycloaddition Reactions

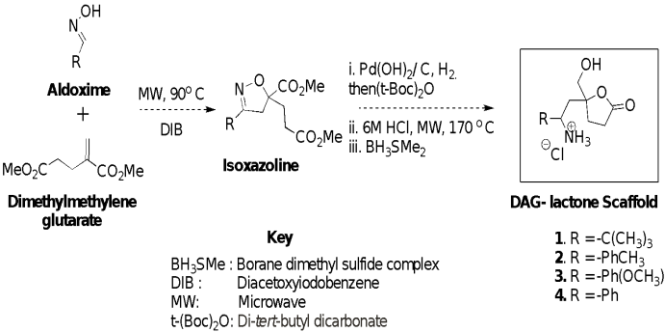
Ryan Sumner

Mentor: Professor Richard W. Denton
Medgar Evers College

Uncontrolled cell division that results in abnormal cell production is known as cancer. This results in unregulated cell proliferation that invades normal tissues and organs thus spreading throughout the body. It is known that Protein Kinase C (PKC) activity is implied in the proliferation of cells. Different strategies are formulated in drug development of PKC inhibitors such as ATP, small molecule and protein substrate binding pocket inhibitors, and biological modulators of PKC to treat anti-proliferation action.

PKC is also a cellular receptor for phorbol esters. These compounds were found to activate PKC and cause induction of apoptosis in specific prostate cancer cells. Another type of compounds called diacylglycerol-lactones (DAG) are also found to activate PKC very and are highly potent. Hence, the preparation of more potent DAG lactones is of high priority to cancer treatment.

In this project a new class of DAG lactones will be prepared using the microwave assisted 1,3 dipolar cycloaddition reaction between an aldoximes and dimethylmethylene glutarate. The resulting isoxazolines will be reduced to give the corresponding 1,3-aminols, then transformed to DAG-lactone scaffolds (**1-4**) according to the reaction scheme below.



New York City College of Technology

Mainstream Media Coverage of those Developments, and the Future of Motherhood

Aliff Abad

Mentor: Professor Katherine Gregory
The New York City College of Technology

How do the media interpret reproductive interventions that involve genetic testing? When a scientist performed the first known genetic editing on twins, Lulu and Nana, he ignored ethical considerations of

CRISPR use. This project provides a content analysis of digital articles in popular science and newspapers. Our interpretation of these articles suggests that there is a lack of critical interpretation of the ethical implication of the procedure and towards future genetic developments. While the public is curious about the repercussions of genetic editing, not enough focus has been applied to the ethics of conducting such a procedure.

Roboqueen 3D

Anny Baez

Mentor: Professor Farrukh Zia
New York City College of Technology

Roboqueen is a persistent research project in the Department of Computer Engineering Technology. It is being designed as a full body interactive robotic mannequin in response to the needs of the fashion technology industry by using inexpensive cardboard slices and aluminum frames for the body and low cost open source hardware devices such as Raspberry Pi, Arduino and servo motors for head and arm movement. In the current phase of the project Roboqueen's circuits and hardware components are improved and updated with the help of 3D printed circuits, integrated circuits, and sensors. Currently, the cardboard hands are being replaced with 3D printed fingers and wrist to add functionality that previously did not exist. Servo motors connected to Arduinos hidden in the forearm are used to move the fingers and pick up and hold objects in the hand.

3D Printed Computer Circuits

Sultana Begum

Mentor: Professors Ohbong Kwon and Farrukh Zia
New York City College of Technology

3D printing technology has rapidly become a mature technology due to the availability of low-cost 3D printers based on open source designs and components. A wide variety of 3D print materials are now available with many different physical and electrical properties. 3D printing encompasses many types of technologies and materials as it is being used in a wide variety of industries. This research project has explored novel and innovative ways to use 3D printing technology to create electronic computer circuits, sub-systems, and devices by using a combination of conducting and non-conducting materials and components. These 3D printed computer circuits have a range of applications in creating systems such as IoT (Internet of Things) devices, toys, bio-sensors such as the motion sensor, wearable tech garments using Light Emitting Diodes (LED) and jewelry such as wrist bands and rings embedded with LEDs.

Talk and Roll Bot- mind controller

BingFang Chen

Mentor: Professor Farrukh Zia
New York City College of Technology

Talk and Roll Bot is a mobile robot project which combines computer hardware, computer software, mechanical, electrical, data communication and networking subsystems to create a working prototype of a computer controlled robot system. In the current phase of the research project, background research is done to learn to use the Electroencephalogram (EEG) measurements of brain waves to control the robot. A modified Mindflex game controller is connected to Arduino and brain activity data is passed on to Processing code running on a PC in order to track and record brain wave patterns. The electrical activity of the brain will be used to control the DC motors in Talk and Roll Bot.

Mapping a Space Filling Curve from the Cantor Ternary set onto the unit square continuously.

Showmik K. Chowdhury

Mentor: Professor Satyanand Singh
New York City College of Technology

In this study, we will discuss a Space-Filling Curve that maps the Cantor ternary set to completely fill the unit square. We extended our work over the last three semesters, which began with everywhere continuous functions that are nowhere differentiable to generating the cantor set and creating fractals. Our work culminates with the fascinating set created by cantor and we will show by using I. J. Schoenberg's groundbreaking curve which was published in the "*Bulletin of the American Mathematical Society*", 1938 by filling in the details in his example to illustrate how to map the Cantor set onto the unit square. In this example we illustrate how a continuous curve takes points from the Cantor ternary set and passes through every point in the unit square. We will begin by defining a truncated tent function f on the interval [0,2] and periodically extend it with period 2. We will then define two functions x(t) and y(t) on the unit interval [0,1] as the sums of infinite series which are dependent on f. We will establish the continuity of x(t) and y(t) and show that for any point (a,b) on or in the unit square, we can find a corresponding t_(a,b) in [0,1] such that x(t_(a,b)= a and y(t_(a,b)= b. We will make use of binary expansions, properties of the Cantor ternary set and mathematical analysis to illustrate the work. The Space -Filling curve is not a bijection and it has infinite length. It maps the Cantor ternary set which occupies zero space, in other words the Cantor ternary set has measure zero, but possess the cardinality of the continuum.

Characterization of Staphylococcus Pasteuri isolates derived from human atherosclerosis plaque

Maria De Leon

Mentors: Professors Niolufar Haque and Nasreen Haque
New York City College of Technology

Atherosclerosis has long been associated with a chronic inflammatory disease that affects mainly large and medium-sized arteries. It is defined as the building block of atherosclerotic plaque that consists of a well-defined structure of lipids, necrotic cores, calcified regions, immune cells, endothelial cells, inflamed smooth muscle cells, and foam cells. Atherosclerosis can lead to serious problems, including heart attack, stroke, or even death. In addition, infections have been long associated with atherosclerosis. Microbiomes in the atherosclerosis plaque were discovered by pathogenic bacteria *Staphylococcus Pasteuri* (Haque et. al. 2019). *S.pasteuri* has been isolated from several sources along with vegetables, goat milk, naturally fermented Italian sausages, vacuum-packed lamprey, drinking water supplies, human vomit, urine, and blood.
It was found that *S. Pasteur* contains genes of auxin. The basic understanding of plant growth is through auxin distribution. It is produced by the seed of the fruit or plant. It is known as a plant hormone that helps plants to easily adapt to their surroundings, and to their growth. One type of auxin, arising from nature is indole-3-acetic acid (IAA), is predominantly biosynthesized from tryptophan. Tryptophan is an essential aromatic amino acid that the body cannot synthesize. Auxin helps the plants to proliferate, however, it is toxic to plants. At high concentration auxins are used as herbicides. An infamous example is "Agent Orange" used for defoliation during the Vietnam War. But later it was found that it caused cancer, along with many other diseases and was also linked to several birth defects. This consequently had a devastating effect on humans. We hypothesize that considering IAA is biosynthesized by an essential amino acid tryptophan, that it can stimulate the auxin production and since *S.pasteuri* contains an auxin

(IAA) genes, manifests the activation to form atherosclerotic plaque. The purpose of this study is to investigate the role of auxin activation in *S.pasteuri* derived from human atherosclerotic plaque. The subsequent effect on smooth muscle cells, auxin (IAA) aids the plants to proliferate, it is possible that it might be the cause of the activation process. Smooth muscle cell (SMC) proliferation and migration is a hallmark of atherosclerosis. My aim is to establish the production of auxin from *S. Pasteur* isolates from plaques.

Additive vs. Subtractive Manufacturing in Dental Laboratory Technology

Aneeza Hussain

Mentor: Professor Daniel Alter
New York City College of Technology

Have you seen technicians using milling and 3d printing machines yet? The development of computer-aided manufacturing and the medical application of this industrial technology have provided an alternative way of fabricating oral and facial prostheses. This narrative review aims to evaluate the different streams of computer-aided manufacturing in dental technology. To date, there are two streams: the subtractive and the additive approaches. The differences reside in the processing protocols, materials used, and their respective accuracy. In general, there is a tendency for the subtractive method to provide more homogeneous objects with acceptable accuracy that may be more suitable for the production of intraoral prostheses where high occlusal forces are anticipated. Additive manufacturing methods have the ability to produce large workpieces with significant surface variation and competitive accuracy. Such advantages make them ideal for the fabrication of facial prostheses.

Machine Learning Application in Physical Computing

Joan Beatrice Ladaban

Mentor: Professor Farrukh Zia
New York City College of Technology

Machine learning and physical computing are important areas of research. This project involves the use of machine learning and physical computing to control an autonomous robot. Machine Learning refers to writing code that learns from data and improves its performance and is a topic related to Software Engineering. Physical computing refers to writing code to interact with the physical environment by using sensors and physical devices. This is a topic related to Hardware Engineering and where one can use open source hardware such as Arduino and Raspberry Pi. This research project combines the Software and Hardware aspects into one working system. In the current phase of the project a voice command recognition app is used on a mobile device to control an Arduino based smart car through Bluetooth wireless connection.

Title: COVID-19 Impact on Radiology Students' Distance Learning

Mary Lee and Fahameda Hassan

Mentor: Professor Zoya Vinokur
College: New York City College of Technology

Distance learning (DL) is a teaching tool that offers education to students remotely in various locations (Ruiz, 2006). The increase in distance learning education is evident in all types of educational programs including those in Radiologic Sciences. DL education programs are expected to comply with all standards just as traditional programs are (Aaron, 2015). With a traditional class setting, knowledge is taught at a given time and day, which is structured in terms of course development and attendance. It does not factor in the domestic and familial

responsibilities of the students outside the classroom walls. What happens when a pandemic creates a widespread stoppage of human movement and changes in-classroom teaching to distance learning. How do students adapt? Can they adapt? How do educators teach when the classroom shrinks to the size of a computer monitor? What happens to the clinical, hands-on portion of the education? Many questions arise when a traditional university classroom setting moves abruptly to distance learning. With the distribution of surveys, we hope to analyze how students coped with DL, its evolution and efficiency of course material distribution over the remaining Spring 2020 semester.

Augmented Reality Gaming: Harnessing Real and Virtual Environments with Game Interactions

Steven Li

Mentor: Professor Benito Mendoza
New York City College of Technology

Augmented Reality or AR for short is a type of technology that shows and place 3D objects or pictures made by computers into the real world through digital devices such as phone or computers. AR is an example of how technology advances. More importantly, AR is slowly becoming a technology that is transforming society, it is changing the way people design and create, and it can improve the way people live. A simple example of how this technology can be used is to improve the way how people use a map on the phone. Some people may have a hard time reading the map in 2D. However, if the map is combined with AR then people can get to their destination by following a line or arrow displayed in the real world, avoiding constantly look at their phone. The goal of my project is to make a 3D character move and interact with the surrounding environment. The movement of the character will be controlled by the user and should be able to detect the ground and other objects and surfaces. The character should be able to move around objects and/or jump, fall, and climb to other surfaces . The challenge of this project resides in the fact that normally AR is only able show objects into the environment but is not able to interact with them. This project aims to improve AR making virtual characters interact with other objects both real and virtual.

Fly Ash Based Geopolymer for High Temperature and High Compressive Strength Applications in Aggressive Environment

Aaryan Manoj Nair

Mentor: Professor AKM S Rahman
New York City College of Technology

Geopolymers are the results of geosynthetic reactions between aluminosilicates and strong bases. This results in chemical bonds between aluminum (Al), Silicon (Si)and oxygen (O) composing polymer rings in tetrahedral coordination. These bonds give them widespread useful applications such as high heat bearing ceramics, and base construction material whilst being far more environmentally conscious. The purpose of the experiment is to examine the effect of Silicon Carbide whisker and inorganic glass particles on thermal and mechanical properties of Geopolymers. This study will help understand the effect of various compositions and concentrations of SiO2 in mechanical strength. In this experiment, the major source of Aluminosilicate material to make the geopolymer paste was fly ash, potassium hydroxide, Potassium silicate, Glass silica and water. A variety of concentrations of Silicon Carbide Whisker and glass particles will be added into geopolymer paste in order to evaluate their performance specifically on compressive strength and thermal conductivity. These are essential properties of cementing materials in energy or heat extraction process. Therefore, the material under investigation has potential for geothermal energy extraction and subterranean structures.

Monitoring the transport of minerals and nutrients in a plant model by using x-ray imaging. Biophysical modeling

Tetiana Soloviova, Amina Shahbaz and Aldona Gjoni

Mentors: Professors Subhendra Sarkar and Chen Xu
New York City College of Technology

Our current research demonstrates the movement of nutrients in live biological tissues as measured by x-ray absorption of a premixed dental paste. Metapex is an iodine-based, antibacterial paste with calcium hydroxide. In this study, its radiopaque properties are useful to visualize the dynamic transport and phase mixing of minerals in plant tissues using a temporal recording of x-ray images from perfused live plant tissue (weakly acidic, pH approx. 6-7). Fruits with strong and weak acidity (strawberries, pH 3.0-3.5, and bananas, pH 6.5) were selected as references without dynamic fluid uptake to compare the diffusion and resorption of perfusing Metapex at equilibrium in reference fruits with dynamic phases as in plants. Plants chosen were weakly acidic pH level (6-7), such as cucumber and sweet pepper, same as that of bananas. NOMAD Pro2 dental machine and a digital plate Sirona were used for imaging. The iodine paste was diluted to minimize the rejection reaction in plant tissue. The x-rays were taken immediately, hourly, and weekly. Results showed phase mixing with complex diffusion and resorption pattern that could be modeled by quantifying Calcium filtering capability, multicomponent transport, and random transport models. Correlation with observed growth rates of reference plant stems without Metapex perfusion, as well as ones with mechanically induced injuries, may be useful to understand the development and repair mechanisms of normal and injured human tissues.

Voice Controlled Self-Driving Car

Suleyman Turac

Mentor: Professor Benito Mendoza, PhD
New York City College of Technology

Voice recognition have became one of the most commonly used computational structures used in our daily lives. Speech recognition develops methodologies enabled by recognition and translation of spoken language into commands. In the last few years we have seen interest to speech recognition by companies like Amazon and Google, which uses the technology to make our lives easier. Home assistant Alexa have been the prime example of this technology, in 2019 Amazon sold more than 100 million devices with Alexa Assistant pre-installed on it. As speech recognition is an advanced subfield of computer science it can be very useful when combined with another sophisticated subfields like Machine Learning And Deep Learning. Since Self-driving cars technology is one of the hottest areas of research and business, we can allow drivers and passengers to give commands by voice. In the last few years, we have seen an enormous evolution in the area with cars from Uber, Tesla, Waymo; what seemed like a science-fiction, some years before, now seems more like something which is soon to become part and parcel of life. Different technological advancements, in both hardware (LIDAR sensors, cameras, GPS, ultrasonic sensors) and software (advanced algorithms for fusion and analysis of data in real time, making the autopilot functionality) are making Self-driving cars are now a reality. For the later, Artificial Intelligence, and in particular two its subfields Machine Learning and Deep Learning have contributed to developing the latest generation of algorithms for the five essential steps to form the self-driving pipeline Localization, Perception, Prediction, Planning, and Control. Although this technology sounds relatively sophisticated, it is not far out of reach for the general public. Recently, platforms such as Amazon DeepRacer or DonkeyCar.com are available to the public. These platforms allow to build and train scale model cars 1/10th or 1/18th. These small, toy-

like cars have a mounted camera and an onboard computer module. The computer module runs self-driving pilot algorithms, neural network, trained by the user, which can drive itself along a track. These platforms provide developers with the opportunity to go hands-on with advanced techniques used on training real self-driving cars, such as reinforcement learning. However, the cost of the hardware goes from $300 to $400, depending on how much assembly is required. Our research focuses on building a student affordable platform for scale model voice controlled self-driving cars that are powered by solar panels. The goal of this project is to explore current developments of Open Source hardware and software to build a low-cost platform consisting of the car chassis/framework, sensors, solar panels and software for the autopilot. Our research will allow other students with low budget to enter into the world of Deep Learning, self-driving cars, and autonomous cars racing competitions.

Non-Destructive Testing of Concrete

Shaylin Venitelli and David Mastalerz

Mentor: Professor Navid Allahverdi
New York City College of Technology

Concrete has been in use for over 5000 years with the process of combining limestone and volcanic rock to build many of the world's architectural marvels, such as the Colosseum, and the Pantheon. When considering how these long lasting structures of ingenuity have stood the test of time, the concept of sustainability and durability are introduced. The modern day construction industry utilizes Non-Destructive Testing (NDT) in order to assess the strength of existing structures and how their integrity has deteriorated with time. The American Society of Civil Engineers (ASCE) has provided the industry with valuable assessments of the current state of infrastructure throughout the United States. With an unsatisfactory grade of D+, most of the infrastructure is reaching the end of its service lifespan with high risk of failure. It is important for the industry to address these concerns and work towards investments in maintenance, durability, and sustainability. The Schmidt Hammer is one such device that measures the elastic properties, in our case concrete, through the rebound resistance that the tested material exerts back on the hammer. Along with laboratory testing, the use of digital technology and 3D modeling can provide extraordinary means of inspection that otherwise would be difficult to analyze manually in person.Our primary research focused towards literature review and the area of digital non-destructive testing by means of 3D modeling. Another area of our research tested the accuracy of physical non-destructive testing results compared with the results obtained from destructive techniques. These areas are imperative, especially in the world today, to provide the tools in which the construction industry can focus on efficiency and productivity of a material’s lifespan for future projects.

Electrical Engineering Technology

An Internet of Things Application Based on MQTT Protocol

Yani Acham Yaou Zakari

Mentor: Professor Xinzhou Wei
New York City College of Technology

The Internet of Things (IoT) refers to a vast number of “things” that are connected to the internet so they can share data with other things. ThingsBoard is an open-source IoT platform that enables rapid development, management and scaling of IoT projects. With ThingsBoard, we can collect and visualize data from devices and assets. We also can analyze incoming telemetry and trigger alarms in our system. MQTT is a publish-subscribe-based messaging protocol used in the internet of Things. It works on top of the TCP/IP protocol, and is designed for connections with remote locations where a "small code footprint" is required or the network bandwidth is limited. The goal is to provide a protocol, which is bandwidth-efficient and uses little battery power. So, it’s the perfect solution for

Internet of Things applications. In our research project, we adopt the MQTT protocol with an open source platform, Thingboard, to collect real time data and display them in real time with user design dashboard.

Queensborough Community College

Child Emigration & Material Culture: A Sociological Analysis of Horatio Alger, Jr.'s Young Adult Novels

Jacquelyn Rose Apostolo

Mentor: Professor Amy Traver
Queensborough Community College

This research relates the Children's Aid Society's (CAS) 19th-century child emigration program to themes of young-adult mobility in Horatio Alger Jr.'s novels, which, through a "rags-to-riches" narrative, describe poor vagrant boys' transformations into virtuous, middle-class citizens during the Gilded Age. To do so, it integrates contemporary sociological theories on the "culture of migration" with data from a qualitative content analysis of 26 novels from four of Alger's book series. With additional CUNY Research Scholars Program (CRSP) summer support, this research will grow to include an additional series of four Alger novels, as well as primary-source data from the CAS, to highlight the manner in which cultural products/media helped to bolster the child-emigration schemes of New York City institutions during the late 1800's.

Identification of the molecular targets of SARS-CoV-2

Tamara Areizaga

Mentor: Professor Monica Trujillo
Queensborough Community College

Wuhan China was the origin of a viral outbreak in early 2020 which led to a global pandemic. A novel corona virus, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is responsible for the coronavirus disease COVID-19 and it has infected over 2.5 million people worldwide. New York City became the epicenter of SARS-CoV-2 in March 2019 and spread at an alarming rate forcing strict measures to contain the spread. In 2003 there was another coronavirus that caused the severe acute respiratory syndrome (SARS-CoV) outbreak. SARS-CoV-2 is a single stranded RNA virus believed to have originated from bats and has similar infectious method as SARS-CoV. Though SARS-CoV and SARS-CoV-2 have great similarity in some conserved proteins, little is known about SARS-CoV-2. In order to understand how the virus hijacks the host during infection, scientists are working to detect the SARS-CoV-2 molecular targets *in-vitro* and to identify an animal model for the virus. This review summarizes: 1- advances into the understanding of the molecular targets of SARS-Covid-19 and 2- the characteristics of a ferret model that can potentially be used to test different vaccines.

Urban Noise

Mahamud Babu

Mentor: Professor Kimberly Riegel
Queensborough Community College

Loud noise is a problem that has been shown to affect individual people's mental and emotional health. To address this issue on a larger scale, we need to gather data from the community capturing not only sound but people's reactions to those sounds. Gathering useful data on this topic will require surveying a lot of people from various environments. In order to make this data collection manageable, this study designed a mobile application for people to record

sounds in their environment, and take a brief survey of their experience with that sound. The app designed during this study is called Auditive. Auditive will allow users to record a 30 second sound on the app and then complete a survey on their experience with the sound. Auditive has been released for beta testing on the app store. Sound data is being collected by the researchers to ensure a smooth user experience and accuracy of sound measurements.

Wireless Transmission of GPS Data to Arduino Microcontroller

Nikola Baci

Mentor: Professor Raul Armendariz
Queensborough Community College

Cosmic rays are high energy particles that come from stars and accelerate in supernovae explosions, from regions around black holes, and from active galaxies. A cosmic ray that enters the Earth's atmosphere creates secondary particles, mainly muons that come to the surface in the form of showers. The team is working to create a muon detector that will count the muon shower rate, measure the energy of these showers, and store the data on a cloud platform. Data is collected for parameters such as shower location on earth, UTC time, and atmospheric temperature and pressure, which helps to better analyze and understand the nature of cosmic rays. We are using an Arduino Atmega 2560, which is an open-source single-board microcontroller, to receive muon information from a DAQ circuit, and UTC time from a GPS antenna/receiver. The GPS information will be transmitted wirelessly through a radio frequency network using two XBee modules, and ensure the Arduino program works as efficiently as possible. Xbees support the 802.15.4 protocol. We are designing the system to enable transmission of two pieces of information: the GPS PPS (1 pulse per second) which is a digital signal, and the NMEA sentence which contains the physical GPS UTC timing data.

Synthesis of polysubstituted pyrroles

Biling Chen

Mentor: Professor Sasan Karimi
Queensborough Community College

Pyrrole, a heterocyclic compound, is found in many marine natural products that exhibit biological activities. We became interested in synthesizing several medicinally active pyrroles that have antimicrobial, antifungal, anti-inflammatory, and antitubercular activities. Though there are many syntheses available to prepare pyrroles, our synthetic method is unique and has not been previously reported. Our methodology involves treatment of nitrodienes in the presence of a Molybdenum (Mo) catalyst. Using this approach, we have prepared a number of medicinally active pyrroles such as the antimicrobial pentabromopseudilin, the anti-inflammatory bimetopyrol, and antitubercular agents. Several antitubercular agents we have synthesized are new and will be tested for their biological activities.

Structural study of iron in magnetic thin films prepared by sol-gel method

Heesoo Cho

Mentor: Professor Sunil Dehipawala
Queensborough Community College

Most devices used in nanotechnology rely on very small magnets. Sol-gel technique can be used to prepare micro-scale magnets. We were investigating iron-containing magnetic films prepared by sol-gel method. Preparation begins with mixing solutions and then let the solution turns to gels. Drying the gel yields is a transparent solid magnetic sample. The thickness was controlled by the area of the container and sample volume. Dried samples were annealed to different temperatures to test the stability. Any significant change in the microstructure of iron is investigated. Extended X-ray absorption Fine

Structure spectroscopy (EXAFS) is a valuable tool to determine the amount of iron present in a particular sample and atomic structure around the iron atom. Preliminary studies indicated that iron is present in two forms, elemental iron, and iron-oxygen compound. The main edge energy position is consistent with Fe3+ and pre-edge intensity provides a fraction of elemental iron present in samples.

Military Experience and Immigration Status: Impact on Educational Perceptions and Career Aspirations

Diego A. Cordova

Mentor: Professor Anissa Moody
Queensborough Community College

Longstanding research has documented the multiple challenges to the upward mobility of immigrants to the U.S., including educational and vocational barriers. The impact of these barriers is complex and intersecting, shaping the socioeconomic and psychological lives of families and individuals. To date, no research has explored the degree to which military service influences the professional trajectories of immigrant students. The current study will focus on the relationship between veteran identity, immigration status and career choices. Results will inform the following questions: Does one's immigration experiences or veteran identity influence years of education, academic discipline, vocational roles and tasks, and type of post-secondary education? Though numerous data sources have documented the impact of recent immigration policy changes to student enrollment at post-secondary institutions, there are limited descriptive studies exploring college retention and career choices as a function of immigration status. At the same time, thirteen percent of military veterans are of immigrant origin yet there is a lack of information regarding the confluence of military service and immigration status in relation to vocational goals or educational outlooks. This study will build this body of research by asking if a student's immigration status and military experience influence their perception of educational barriers, and their career paths.

Synthesis of N-2-hydroxyethyltrichloroacetamide: Possible precursor to polyurethane

Chang Cui

Mentor: Professor Jun H. Shin
Queensborough Community College

Polyurethane is a polymer that is composed of many units of organic urethane. It was first prepared in 1937 by Dr. Otto Bayer. Polyurethanes are a stiff plastic material with every day use including: at home, on holiday, in offices, and for sport and leisure activities. In comparison to other plastic materials, polyurethanes are superior in their durability, transparency, weatherability and flexibility. Therefore, polyurethanes are used in the manufacture of high-resilience foam seating, rigid foam insulation panels, microcellular foam seals and gaskets spray foam, durable elastomeric wheels and tires, automotive suspension, condoms and so on. Furthermore, it has been reported that polyurethanes are nontoxic to humans compared to many other plastics, and they are easily recyclable.

Polyurethanes are prepared from polyesters, glycols, and diisocyanates which have a sequence of NNOO unit. However, the polyurethane which may be produced from the reaction of hexachloroacetone (HCA) and aminoalcohol has a sequence of NONO unit. Therefore, this different sequence unit of polyurethane may give different properties from the typical polyurethanes, and will lead to new plastic materials.

This research focuses on synthesizing the N-2-hydroxyethyltrichloroacetamide, which is a precursor to the new type of polyurethane. The reaction of HCA and 2-aminoethanol gave N-2-hydroxyethyltrichloroacetamide with a white solid in high yield. The compound was further reacted with another HCA to produce the corresponding

trichloroacetate derivative, $Cl_3CC(O)NHCH_2CH_2OC(O)CCl_3$ at room temperature. Both compounds have been characterized, and desirable crystals of the latter compound was obtained to determine the molecular structure. The latter compound will be further reacted with 2-aminoethanol to synthesize polyurethane which is new type of polyurethane with NONO sequence unit.

Comparison of Two Satellite Soil Moisture Data On Long Island Region

Nell Flores

Mentor: Professor Dugwon Seo
Queensborough Community College

Pictures taken with low quality cameras lead to low quality photos, but pictures taken with high quality cameras lead to high quality photos. Most people have a phone and they could test this statement out by asking a stranger to photograph them. The same line of thinking be applied to scientific instrumentation, and more specifically satellites collecting water moisture data from the Earth. The purpose of our project is to compare two Satellites, SMOS and SMAP, and their data to see how newer high-quality instruments lead to better data. The first comparison can be done by looking at the specifications of the satellites. Vital information including the resolution and period can be found on government websites. The satellite with the higher resolution and lower period will obtain higher quality images. To prove our prediction, we first download the data from each satellite via their respective government websites. Python will be used to open each data set and to create visualizations of their data. Data sets will be based on two days out of the year in two different weather seasons. Data from these two days will be averaged from their respective day since each day has multiple data sets. Images will be created from these data sets to represent a map with varying hues. We will obtain images from the years that the satellites were simultaneously operating. The images will be placed on a timeline and will show the difference between the two satellites data quality.

High Impact Practices in the Mathematics Classroom

Circe Gedeon and Makaila Valley

Mentors: Professor Maria Mercedes Franco and Professor Rommel Robertson
Queensborough Community College

Coined by George Kuh, the term High-Impact Practices (HIPs) refers to pedagogical practices known to promote student engagement, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, and attainment of educational goals. Conducted primarily at baccalaureate granting institutions, these studies have shown a profound impact of HIPs on traditionally underserved students. Community colleges have much to gain if able to replicate the benefits of HIPs observed at four-year colleges and universities. The purpose of this research project is to collect, digitalize, organize, and analyze data from sections of mathematics courses taught at Queensborough with or without the use of HIPs and to attempt to capture and compare the student experience in these varied settings.
More concretely, this study is looking at 50 sections of mathematics courses taught between 2005 and 2017 by one instructor (the Principal Investigator in the study). In about half of these courses, the instructor integrated one or more HIPs (Writing Intensive Courses, Academic Service Learning, Common Read, or Undergraduate Research). Aspects of the student experience that are being examined relate to student participation (attendance, withdraw rates) and satisfaction with the course (student evaluations) and student learning outcomes (e.g. final grades, proficiency on final exam questions/topics covered on both traditional and HIP courses). Preliminary results suggest that students find HIP courses more challenging yet more engaging than regular, non-HIP courses.

Identification of genes regulated by SC03855

Brettania Gordon

Mentor: Professor Monica Trujillo
Queensborough Community College

Streptomyces are bacteria characterized by a complex developmental cycle with an intricated signaling network not fully understood yet. Proteases are enzymes that catalyze the cleavage of peptide bonds in proteins. These enzymes are mostly located in the cytoplasm, but intramembrane proteases also exist. Rhomboids are a group of intermembrane proteases conserved among all kingdoms of life. However, the role of bacterial rhomboid proteases is mostly unknown. We are interested in understanding the role of rhomboids in streptomyces. Specifically, our work is aimed to understand the role of SCO3855. This putative rhomboid protease was identified by our group using bioinformatics tools. SCO3855 is highly conserved in *streptomyces* and our goal is to characterize its participation in the physiology of *streptomyces coelicolor*, the model organism for streptomyces. We have constructed an overexpression strain that has SCO3855 under a constitutive promoter and the corresponding control. The comparison of both the overexpression and the control strains will allow us to shed light into the role of the *S. coelicolor* rhomboid gene. We are using RNA-Seq to identify which genes are differently expressed when we have an extra copy of SCO3855. Based on the data to be obtained from RNA-Seq and after doing the sequence analysis we would identify the differently expressed genes. Characterization of the differently expressed genes would allow us to propose a role for SCO3855 in the developmental cycle of *S. coelicolor*.

Bayesian Phylogenetic Inference of Stochastic Block Model on Random Graphs

Yanqiu Guo

Mentor: Professor Wenjian Liu
Queensborough Community College, CUNY

This project involves a classification problem on a deep network, by considering a broadcasting process on an infinite communication tree, where information is transmitted from the root of the tree to all the vertices with certain probability of error. The information reconstruction problem on an infinite tree, is to collect and analyze massive data samples at the *n*th level of the tree to identify whether there is non-vanishing information of the root, as *n* goes to infinity. Its connection to the clustering problem in the setting of the stochastic block model, which has wide applications in machine learning and data mining, has been well established. We have extended the classical works of phase transition of this SBM reconstructability on the Ising model and the Potts model, by studying a general symmetric model which incorporates the characteristics of both Ising and Potts through different in-community and out-community transition and transversion probabilities. Then this project has established the exact conditions for the non-tightness of the reconstruction bound. Furthermore, the corresponding information reconstruction problem in molecular phylogenetics has been explored, by means of the refined analysis of moment recursion on a weighted version of the magnetization, concentration investigation and in-depth investigation on the resulting nonlinear second order dynamical system. Finally this research have applied the numerical analysis and MATLAB to simulate the signal propagation on random graphs and evaluate the sampling efficiency of phylogenetic reconstruction.

Analysis of College Student's Knowledge Concerning Sexual Violence

Emely Gutierrez

Mentor: Professor Celia Sporer
Queensborough Community College

Rape myths are fictitious beliefs concerning sexual violence that promote victim blaming and contribute to excusing the offender (Rollero & Tartagila, 2018). Knowledge and awareness are crucial in combating rape myths. Attitudes toward gender also contribute to attitudes supportive of rape myths (Rosenthal et., 1995). This study was conducted to determine the knowledge and attitudes of students from Queensborough Community College concerning sexual misconduct and rape myths, including support resource availability. Participants filled out a survey developed for this study containing multiple choice and short response questions focused on sexual assault, rape myths, gender attitudes and resource availability. Preliminary results suggest that there is a difference in attitude toward sexual assault between same sex and different sex assaults, as well as an overall gender component in the attitude and perception of scenario of sexual assault and support of rape myths. The preliminary results further suggest that most students at QCC are somewhat familiar with the basic policy regarding sexual misbehavior in the college but are barely knowledgeable of the consequences of committing such act. Preliminary results have also revealed that most respondents believe sexual assault occurs occasionally on campus. The result of this study highlights some positive aspect of the dissemination of information on the topic of sexual assault, but also strongly suggest that gender roles, belief about relationship and rape myths continue to persist and must be addressed.

Determination of the Ionization Constant of Weak Carboxylic Acids via Freezing Point Depression Measurements

Sophia How

Mentor: Professor Paris Svoronos
Queensborough Community College

Freezing point depression is a colligative property that is directly related only to the number, but not the nature, of particles (ions and molecules) in solution. The ions of molecules in solution are partially separated in a weak acid; therefore, the ratio of the molecules is not one to one. For the first time, the ionization constant of a weak carboxylic acid is determined in a non-traditional method that does not require the titration of the acid with a standardized base solution. The ions of the carboxylic acid are not completely separated because it is a weak acid that the ions are partially ratio. This project uses freezing point depression measurements to calculate this physical property via the Van't Hoff factor as long as the Ka value is above 10^{-3}. The ionized portion of the solute is measured through a derived equation that corresponds to the freezing point depression temperature. The measured equilibrium constant Ka values of various carboxylic acids were determined at various concentrations: 0.100 M, 0.050 M, 0.025 M, and 0.010 M. The experiment is fast, uses extremely low concentrations of the solute, and the results are easily reproducible without leaving too much waste.

Examining the relationship between STAT 3 and estrogen receptor in osteoclast function and development

Stephanie Landazuri

Mentor: Professor Andrew Nguyen
Queensborough Community College

Menopausal women commonly experience low levels of estrogen due to a decrease in ovarian

activities. Several studies have shown that menopausal women are at risk of developing osteoporosis suggesting that low levels of estrogen causing bones to become weak and less dense. As osteoporosis is known to be caused by an increase of osteoclastic activity in the bones, the relationship between osteoclasts and estrogen however is not clearly defined. We have recently shown that female mice with Signal Transducer and Activator of Transcription 3 (STAT3) deleted from osteoclasts exhibit weaker bones compared to litter mate control. This suggests that STAT3 may be involved in the signal pathway between estrogen and osteoclast development and/or their activities. One hypothesis is that the decrease in estrogen disrupts the STAT3 signaling pathway resulting in an increase in osteoclast activity or cell survival. We exploit the idea and analyze the effects due to the loss of STAT3 in the pre-osteoclastic RAW264.7 cell line. The CRISPR-Cas 9 system was used to knock out the *stat3* gene followed by the Real-Time Quantitative PCR analysis to confirm that the loss of STAT3 expression. To determine osteoclast activity and survival we treated the control and knock out cell with alendronate and estradiol. Alendronate is a bisphosphonate that has been used to treat osteoporosis patients by slowing down the osteoclastic activity in bones. Wild type and STAT3knock-out RAW264.7 cells were treated either with alendronate or 17β estradiol to determine the number of cell death or apoptosis. We assessed apoptotic cells using flow cytometry and FITC-antibody specific to the annexin V. Our preliminary data showed that RAW264.7 cells deleted of STAT3 treated with alendronate and estradiol exhibit an increase in cell death suggesting that normal function of STAT3 is to protect osteoclasts from the estrogen induced apoptosis.

Analysis of Citizen Science Data to Examine Bird Diversity in NYC Parks

Ashley Mercado

Mentor: Professor Joan Petersen
Queensborough Community College

The purpose of my project is to build a wildlife database of bird species in New York City parks by mining data from the eBird citizen science project. eBird is a compilation of bird sightings from birdwatchers worldwide that researchers can use to leverage data for bird conservation, habitat protection, restoration, and environmental education. The database may also reveal observation patterns of rare, threatened, and endangered birds in particular areas, which can help determine the decline or recovery of species. My analysis of this information included filtering and sorting eBird data from each borough by location. I also compared these locations to existing Parks' properties to detect possible data gaps and generated lists of species documented in each of these parks to develop diversity indices.

Preliminary sorting and analysis of the eBird Manhattan borough data have revealed that six NYC Parks properties lacked eBird survey information. Among surveyed parks, there was a distinct observation data bias between large and small parks. Further analysis showed that Central Park had both the highest number of species surveyed (339) and the most individual observations (795,578) between 1980 and 2017. The five most common birds in all Manhattan parks, according to the dataset, are the House Sparrow, Northern Cardinal, European Starling, American Robin, and the Blue Jay. Data regarding the state-listed endangered Peregrine Falcon revealed that sightings in borough parks have increased, especially between 1995 and 2017, corresponding to New York agencies' consistent conservation efforts. This type of information can be used to inform Parks' conservation and land management personnel regarding regulatory processes across all agencies. Awareness of bird biodiversity, patterns, and presence within city parks can improve how their habitats are maintained and protected, particularly for species of greatest conservation need.

Design of Power Amplifier to Control Rotation of a Servo Motor

Haoyu Niu

Mentor: Professor Huixin Wu
Queensborough Community College

Servo motors are widely applied in devices controlled by electronic signals, and are widely used in the field of robotics. The servo motor has its advantages that provide the angle of rotation according to the received Pulse Width Modulation (PMW). It also has the ability to generate a high torque that can hold certain Newtons without changing the angle. To produce proper rotation, an important chip (555 Timer) in design circuits is used to control how long the PMW lasts, so that the servo motor will rotate the expected angle. The purpose of this project is to use two servo motors to control the movement of the fingers of a prosthetic hand under working frequency (50 Hz) of the servo motors. In other words, to change the duty cycles (below 50%), so that it can control the movements of the fingers of the prosthetic hand without changing the operating frequency of the servo motors. Therefore, the result of the research project will contribute to make a comparison with other similar applications in real life, especially in circuits that require the operation of a motor, such as in the field of robotics.

PREDICTING THE ORIGIN OF BLACK HOLE SEEDS USING COSMOLOGICAL SIMULATIONS

Joshua Olatunji and Jahmel Saltus

Mentor: Professor Jillian Bellovary
Queensborough Community College

This study aims to understand the formation of Massive Black Holes (MBHs), with masses up to billions of times the mass of our Sun, starting from the first seeds formed at the early stages of the Universe and over cosmic time. The formation of MBHs and their evolution is still a matter of debate. This study is based on three theoretical scenarios to give solid groundings to the formation of MBHs. These scenarios are understood by using an N-body + smoothed particle hydrodynamics simulation, a computer-simulated version of our Universe, starting from the Big Bang until the present day.

The simulation contains many galaxies, which cover a wide range of masses, star formation rates, and properties that match galaxies observed in the real Universe. Using python, we analyze the generated data, specific to physical quantities (location, formation time, merger rate, and mass) of MBHs. Carefully observing changes in growth and activity of the BHs with time, a conclusion can then be drawn on which scenario is valid. This study will also make predictions for the rate of gravitational waves, where each of the three scenarios, as mentioned earlier, will have a peculiar gravitational wave signal.

Heavy Metal Absorption by Plants and Role of Iron in Soils Using X-ray Absorption Spectroscopy

Qi Pan

Faculty Mentor: Professor Sunil Dehipawala
Queensborough Community College

Extended X-ray Absorption Spectroscopy (EXAFS) and X-ray Absorption Near Edge Structure (XANES) was used to study heavy metal absorption by plants grown in soils with various chemical environments. A selected plant was grown in soils containing metals such as lead, arsenic and iron. The aim of this study is to investigate role of iron in the absorption of other heavy metals into plants. Plant tissue samples were collected in regular intervals. Samples were dried and grounded to fine powder form. Selected samples were mounted in identical holders with same mass. The amount of metals and their bonding properties were investigated using synchrotron X-ray absorption spectroscopy. The main absorption edge position of the absorption spectrum changes with the electronic environment or oxidation state of the iron. The peak height is

proportional to amount of metals present in samples. Preliminary studies indicate presence of more arsenic in plants grown with Fe^{3+} than plants grown with Fe^{2+} containing soil.

Optimized Imidazolium Based Ionic Liquid- Single-Walled Carbon Nanotubes Mixtures for Energy Storage Applications

Zheyong Piao

Mentor: Professor Tirandai Hemraj-Benny and Professor Sharon Lall-Ramnarine
Queensborough Community College

The advancement of new energy storage devices with high energy density and high-power density is much needed. In comparison to traditional batteries, supercapacitors are superior due to their higher power density and longer life cycles. However, for supercapacitors to be more widely used in practical applications, more effective electrodes and electrolytes are necessary. Single-walled carbon nanotube electrodes have shown great promise as efficient electrodes due to their high surface area. Also, due to ionic liquids' wide electrochemical windows, they can serve as excellent electrolytes in energy storage devices. In this study, the specific interactions between single-walled carbon nanotubes (SWCNTs) and ionic liquids (ILs) of imidazolium cations coupled with bis(trifluoromethylsulfonyl)amide (NTf_2^-) anion were investigated to contribute to the development of optimal electrodes and electrolytes for energy storage devices. The SWCNT-IL mixtures, containing 2 wt % and 5 wt % SWCNTs, were prepared by an ultrasonic vibration method. The interactions between the ILs and the SWCNTs were analyzed by UV-Visible and Mid-IR spectroscopy. Results indicated that there were strong interactions between the ILs and the SWCNTs, which facilitated the de-bundling of the SWCNTs.
Increased ionic conductivities were observed for ionic liquids composites containing the SWCNTs. This work was supported in part by the U.S. Department of Energy, Office of Basic Energy Sciences, Division of Chemical Sciences, Geosciences, and Biosciences under contract DE-SC0012704.

Porous microspheres of polyaniline and its derivatives prepared from single surfactant W/O/W double emulsions

Megan Pirtle

Mentor: Professor David Sarno
Queensborough Community College

This study focused on preparing porous microspheres of polyaniline (PANI) and several of its mono- and di-substituted derivatives. These materials are conducting polymers that exhibit properties of both plastics and metals, including processability and electrical conductivity. Porous microspheres are obtained by a water-in-oil-in-water (W/O/W) double emulsion method in which one liquid is dispersed in another liquid to create double layered liquid droplets. In our system, the double emulsion is generated by the rapid addition of excess ammonium hydroxide to an acidic dispersion containing the preformed polymer and an amphiphilic monomer such as *o*-toluidine. The monomer is soluble in acidic solutions, but spontaneously forms immiscible droplets (the "oil") in sufficiently alkaline solution. The polymer dissolves in the monomer droplets to form the spheres, and water droplets trapped in the viscous polymer matrix form the pores. The monomer serves as a single small molecular surfactant that stabilizes both the oil-water and water-oil interfaces of the double emulsion. This is rare among W/O/W systems, which typically require multiple surfactants and stabilizers. FTIR and NMR spectroscopy confirm the presence of the monomer in the polymer spheres and its absence in non-spherical particles. SEM images reveal that the initially granular polymers can be nearly fully converted into discrete porous spheres. This method has been applied to polyaniline, poly(*o*-toluidine), poly(*m*-toluidine), poly(2,5-dimethylaniline) and poly(3,5-dimethylaniline). Each material has been optimized to produce the most discrete porous spheres with the

narrowest size distribution by varying the amount of dispersed polymer and dissolved monomer. Potential applications, enhanced by the pH and redox-active properties of these polymers include microreactors for reactions in confined spaces, supporting materials for catalysis, and encapsulants for loading and triggered release for drug delivery.

The Lost Year: The Impact of COVID-19 Non-Traditional Commencements on High School Graduates' Academic Motivation and Post-formal Goals

Yvonne Rodriguez

Mentor: Professor Anissa Moody
Queensborough Community College
SIRP Faculty Advisor: Professor Jody Resko.

Over 3 million American students graduate from high school each year (nces.ed.cov). This year, social distancing guidelines, in response to the COVID-19 pandemic, have impacted commencement ceremonies and other final year rituals. These major milestones are now being conducted via virtual modalities, informal gatherings, or have been non-existent. Commencement rituals are well-documented in the literature as developmental assets supporting academic motivation and self-esteem (Klepfer, 2015). With a sudden change in traditions and the current challenges of distance learning, it is hypothesized that a lack of formal commencement will decrease academic motivation and negatively impact post-formal educational goals. Through exploratory research the goals of this study include (1) describing the experiences of high school graduates in the COVID cohort of 2020, (2) describing the effects of non-traditional commencement ceremonies to high school graduates, (3) identifying the impact of COVID-19 to post-formal education, and (4) addressing the gaps in the literature regarding educational rituals and developmental markers. The proposed study will utilize a survey design method. Participants will respond to a detailed demographic questionnaire that assesses commencement experiences, responses to COVID-19, formal academic motivation measure, and post-formal goals. The sample population will be inclusive of high school graduates of 2020, with the exclusion of high school dropouts and those who completed a GED.

Experiences With COVID-19 in NYC

Stuti Sangar

Mentor: Professor Larisa Honey
Queensborough Community College

The world is enduring through one of the most mentally and physically pain inflicting events in history. This pandemic has taken a toll on the lives of every human being on this planet. People have changed their perspectives, eating habits, sleeping habits, opinions, thoughts, and lifestyles. The purpose for this study was to understand how the livelihoods of people have changed because of this pandemic. We used methods of observation and interaction with people on their views and reactions to the coronavirus pandemic and see how they accustomed themselves to the "New Norm" of wearing masks and distancing themselves from one another; along with researching how some areas of New York City have been affected by the virus. To get the results, we conducted interviews with essential workers, family members, friends, COVID positive patients, COVID negative patients; observed people from different areas of New York City and took notes twice to thrice a week, sent out an open ended survey in which people would be able to answer questions regarding the situations they have been dealing with, and collected data online to see the rate of deaths and positive cases throughout the City. The results varied from people leaning towards their emotional selves or fighting and being resilient. People's daily journals were another way to check how the coronavirus was changing people's mindsets about life and existence.

Microwave synthesis of composites of polyaniline nanofibers and ruthenium nanoparticles.

Harpreet Singh

Mentor: Professor David M. Sarno
Queensborough Community College

Polyaniline (PANI) is a conducting polymer, a material that exhibits properties of both plastics and metals. These "synthetic metals," which are processable and electrically conductive, can be easily prepared as nanoscale fibers. Due to their high surface area-to-volume ratio, they have been applied as sensor components and catalyst supports. We are developing a method to prepare hybrid materials composed of ruthenium nanoparticles (Ru-NPs) and polyaniline nanofibers (PANI-NFs). These will be deployed as catalysts for the degradation of the toxic azo dye congo red, a model compound that is representative of a variety of industrial pollutants. $RuCl_3$ or RuI_3 is dissolved in an aqueous dispersion containing pre-formed PANI-NFs for overnight adsorption of Ru^{3+}. The solution is then microwave irradiated at 150°C in the presence of the reducing agent $NaBH_4$ to produce the metallic Ru nanoparticles. The PANI-NFs serve as a high surface area scaffold that disperses the Ru-NPs and minimizes their aggregation. Morphology and elemental composition is characterized by SEM and EDS, respectively. The current efforts of the research focus on optimizing the deposition of the Ru-NPs by varying irradiation time and reactant concentrations. Our ultimate goal is to study the catalytic properties of these hybrid materials.

Entrapment of Photosystem I within a Polyaniline Matrix on Carbon Paper for Photocurrent Generation

Pamela Joy Tabaquin[1]

Mentors: Dr. David E. Cliffel[2], Dr. G. Kane Jennings[2], Dr. Christopher Stachurski[2], Dr. Dilek Dervishogullari[2], and Dr. Kody Wolfe[2]

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Photosystem I (PSI) is a membrane bound protein complex found in plants which helps drive photosynthesis. Due to its abundance in nature and high quantum efficiency, PSI is a prime candidate for use in biohybrid solar cells. To date, several PSI bioelectrodes have been successfully fabricated using a variety of different electrode materials and host matrices, such as conductive polymers like polyaniline (pAni). pAni has been polymerized on metallic electrodes in the past; however, carbon paper (CP) substrates can also been utilized for pAni polymerization. Electrochemically polymerizing aniline in the presence of PSI onto low-cost, high-surface area CP, enabled the production of PSI-pAni-CP electrodes which showed enhanced photocurrent generation. The hydrophobic CP was first pretreated then characterized using contact angle and cyclic voltammetry. Using the pretreated CP as electrodes, PSI-containing pAni films were electrochemically deposited and tested in photoelectrochemical cells. It was found that electrodes prepared in the presence of PSI enhanced the observed photocurrent by a factor of 2 over non-PSI containing electrodes. By investigating different mediator systems and optimizing deposition conditions, photocurrent generation can be further improved to develop high-performing PSI-pAni-CP bioelectrodes for biohybrid solar cells.

Synthesis of X-Shape Molecules as Electron Acceptors in Organic Solar Cells

Feruza Turobova and Muhabbat Ahmedova

Mentor: Professor Sujun Wei
Queensborough Community College

Compared to traditional silicon solar cell, organic solar cell (OSC) has advantages of being flexible, cheap and light-weighted. However its light-to-electricity conversion efficiency is not as good as silicon counterpart. Therefore there're tremendous interests to further improve OSC's efficiency. Within OSC, it typically contains donor and acceptor materials. The C_{60} fullerene based acceptor readily accepts electrons from a wide range of donor materials and exhibits high electron mobility. However, fullerene is not an ideal material due to its weak absorption and very deep LUMO level. Therefore there is a clear need for alternative acceptor materials. We propose to synthesize X-shape molecules as electron acceptors via strain and Hückel aromaticity as the driving forces. The molecule's bottom half is a fluorene unit, and the top half is a fused heterocyclic ring. Both motifs are twisted along a central double bond. We have synthesized first two targets in four synthetic steps. These red compounds show intense green fluorescence. Their structures were preliminarily confirmed by H-NMR and C-NMR. With ~500mg of these compounds each in hand, further investigations such as fluorescence quantum yield and testing them in an organic solar cell as acceptors are set to go.

Construction of a SCO3855 inactive mutant

Kalu Dike Udensi

Mentor: Professor Monica Trujillo
Queensborough Community College

Rhomboid proteases are intercellular membranes present in all living organisms. The role of bacterial rhomboids are yet to be determined. Preliminary results from predecessors suggest that rhomboid proteases from *Streptomyces coelicolor* (SCO3855) could be implicated in the activation of one of the systems for bacterial protein secretion, the twin-arginine proteins translocation system. The final goal of this project is to characterize the enzymatic activity of SCO3855. For this a negative control for comparison with the active enzyme is needed. This research aims at creating a SCO3855 inactive mutant as a negative control by substitution of an active residue site on SCO3855 enzyme using site directed mutagenesis. The targeted active residue site is known to be critical to enzymatic activity hence substitution of that amino acid is needed to create an inactive mutant. Site directed mutagenesis was used to create the putative inactive mutant. Restriction analysis on resulting SCO3855 mutant confirmed a successful experiment. The known substrate for SCO3855, TatA from *Providencia. stuartii*, the active purified SCO3855 and the inactive mutant presented here would be used to develop the assays for characterizing the enzymatic activity of SCO3855.

Phylogenetic and expression analysis of *tbx3* gene

Valentine Uwechue

Mentor: Professor Sushma Teegala
College: Queensborough Community College

A significant event during embryogenesis is a process called gastrulation during which the three germ layers - ectoderm, mesoderm, and the endoderm are established. T-box family of proteins play a crucial role in patterning the germ layers. T-box protein, Tbx3 has been shown to be essential during development and is an important player in oncogenesis: it is overexpressed in several cancers, contributes to tumor formation and can drive the proliferation of cancer cells. In humans, having one functional copy of TBX3 is believed to cause an autosomal dominant condition called Ulnar mammary syndrome (UMS), which is defined by defects of the upper extremities that include hypoplastic or missing ulna. In the development of the mouse, Tbx3 expression begins in the inner cell mass of the blastocyst and then appears in the

extraembryonic mesoderm during gastrulation. Tbx3 plays key roles in both the establishment and maintenance of pluripotency in embryonic stem cells and can inhibit differentiation of progenitor cells. Previous studies also suggest that tbx3 is expressed in the frog, Xenopus laevis, during early germ layer development. We propose to further study the role of Tbx3 across species using phylogenetic analysis. Tbx3 has been implicated in a variety of developmental contexts, however the mechanism by which it functions during development remains unclear. Using Bioinformatics and Molecular Biology techniques, I studied the mechanism by which tbx3 functions using tools like BLAST, alignment of protein sequences, protein modeling, and designing phylogenetic trees. The results indicate that Tbx3 is very highly conserved across many species. The results also identified a DNA binding domain in Tbx3 that might be crucial for its functionality across various species. Mutations of this particular domain will help delineate the mechanism by which the protein functions in-vivo.

Smart Fashion

Amy Velasco

Mentor: Professor Huixin Wu
Queensborough Community College

"Smart Fashion" project consists of a circuit design, incorporated in a bracelet or ring, which can detect the heart rate of a person and obtain an output reading. The circuit was designed to detect the heart rate in different categories (age range) of people and under different condition. Age group was classified as young adulthood (15 to 30 years old), adult (31 to 40 years old), middle age (41 to 60 years old), and older adulthood (61 years and older). Smart Fashion also worked for groups of people in different conditions, such as physical activity, exercise, and exposure to low temperature. With this information, the circuit showed the user's heart rate through colors that was represented by Light Emitting Diodes, LEDs. In other words, depending on the color of the LED, it showed the condition of the heart rate in which the participant was. Consequently, allowing the participant to normalize her/his heart.

Determination of the Concentration of Antioxidants in Commercial Beverages Using the Folin Ciocalteau Microspectrophotometric Method

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Oxidative stress is the process that results from the accumulation of harmful moieties called free radicals, which can lead to diseases such as, but not limited to, skin cancer. Antioxidants are compounds that the human body uses to help prevent or delay cell damage caused by oxidative stress. They are found in many naturally occurring fruits and vegetables and are often consumed in beverages such as teas, coffees, and juices. In this study, the total amount of antioxidants in a commercial beverage is calculated via the oxidative Folin Ciocalteau method and microphotospectrophotometric measurements using the Beer-Lambert's law. The standard reference compound is gallic acid which is commonly used in the wine industry. Regular caffeinated vs. decaffeinated samples of the same brand will be compared and case studies will be presented. The difficulties and limitations associated with this procedure will be highlighted with an emphasis on the reproducibility of the reaction and the limited amount of waste material produced.

Temperature Effect on Electrical Circuit Response

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Temperature change affects how electricity flows through an electrical circuit by changing the speed at which electrons travel. There are many simulation softwares that can be used to determine the effect of temperature on electrical circuit response, namely Solidworks, Matlab, Multisim to mention a few. In this research, Multisim was first used to design and analyze the RLC circuit and to see how the temperature will affect the voltage and power of the three components; three temperatures were analyzed (0, 25, and 50 degrees) and the results showed the effect of temperature change on the circuit elements' response . The next phase will be to design and analyze more complicated circuit such as integrated circuits to see the effect of temperature change on the circuit output.

Reducing Math Anxiety in the Classroom using a Mindfulness and Growth Mindset Approach (MAGMA)

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Math anxiety is a debilitating problem that affects many community college students. This anxiety is characterized as an overwhelming feeling of helplessness and panic that many students have concerning their ability to solve mathematical problems. According to the literature, math anxiety inhibits learning, and could lead to loss of interest in math classes, poor exam grades, withdrawals from courses mid-semester, poor or failing course grades, and loss of interest in STEM disciplines. Therefore, math anxiety is a social justice concern, and addressing this psychological issue in the classroom would help to promote equity in the classroom for vulnerable students. Studies have shown that psychological interventions involving principles of mindfulness and growth mindset greatly contribute to academic success in students. The current research, an extension of a successful pilot-tested study in a statistics course (Samuel & Warner, 2019), is the first to implement a combined mindfulness and growth mindset intervention in various STEM courses (e.g. Statistics, Quantitative Reasoning, Macroeconomics). Preliminary results from the mixed methods research reveal a substantial reduction in overall math anxiety in the intervention group compared to the control group. Additionally, significant math anxiety reduction was found in female, and in first-year student subgroups. The Mindfulness and Growth Mindset Approach (MAGMA) appears to offer an inexpensive, effective approach to producing more academic resilient students. Future research will explore using the MAGMA as an intervention to address reading and writing anxiety.