Book of Abstracts

CUNY Research Office

Daler Djuraev; Sonia Orellana; Maria Orellana	Profs. Subhendra Sarkar, Zoya Vinokur	Radiologic Technology	**Soft X- Ray Imaging of Possible Transmetallation among Endogenous Fe(II)/Fe(III) and Mn(I-IV) States due to Thermo-mechanical Stress in Model Carbohydrates**	8
Emma Bjornsen	Prof. Allison Berkoy	Entertainment Technology	**You are Prepared**	8
Gabriel Martinez; Ryan Donnelly	Prof. Jose Martinez	Radiologic Technology	**The Effects and Consequences of Chemical Warfare**	9
Husnain Khan	Prof. Zhou Zhang	Mechanical Engineering Technology	**Force-feedback Design for Robotics Hand**	10
Navdeep Kaur; Safraz Harun; Katie Tam; Robert O'Brien	Prof. Zoya Vinokur	Radiologic Technology	**Open labs Vs. Radiologic Students' Final Practical Grades**	10
Ollana John	Prof. Eric Lobel	Radiologic Technology	**Effectiveness of Collimation in Radiation Protection**	11

Qing Chen	Prof. Ariane Masuda	Mathematics	**Bezier Curves**	12
Ralph Lauren Ocampo; Rohini Mattan; Peber DeJesus	Prof. Zoya Vinokur	Radiologic Technology	**Compare how students performed and attendace before, during and after pandemic waves**	12
Wilna Michel	Prof. Sara Woolley	Communication Design	**Los Pirineos, the mostly true memoirs of Esperancita Gómez**	13

X- Ray Imaging of Local and Global Diffusion of Biominerals Induced by Chemical and Mechanical Stress in Biological Model Systems

Aaliyah Salmon ; Aravis McBroom ; Joanna Syska
Profs. Subhendra Sarkar, Evans Lespinasse

Heavy metal exposures from food and water are common in industrial cities as well as in agro economies initiating multiple health issues. Ex vivo imaging studies on three model tissues (Apple, banana and sweet potatoes with 3 different bulk pH and different proportions of biominerals) are undertaken in our X-ray laboratory to understand x-ray absorption and scattering by various minerals at micromolar concentration range. The results should be applicable to build X-ray absorption models for nanomaterials as well as to understand the role of endogenous (native) biominerals to maintain metallo-protein and carbohydrate structures in live biological systems. In addition the functional role of biological water that are intercalated within the macromolecules in the presence of exogenous heavy metal contaminants from environment are explored by low energy (soft) x rays. We have discovered that sample noise (sample standard deviation) is more sensitive to even minute structural change from heat shock or mechanical damage and can be used to develop biomarkers for trauma or burn patients. Analyzing small changes in sample standard deviation requires reproducibility and standardization. Hence the mammography system was calibrated at various mAs ranges at 29kVp with 16 mAs being the best with reproducibility of intensity fluctuations at 1% across the imaging field compared to 1.7% at 4 mAs that increased to 2 and 2.3% for 16 and 4 mAs respectively at 20kVp.

Fabrication of a Thin Flexible Film Coating Made of Pristine Graphene for Lightning Strike Protection

Aaryan Manoj Nair
Prof. Akm Rahman

Lightning strike protection (LSP) have recently been a newly developing field particularly with the emergence of graphene thin film integration into carbon fiber composite structures. This technology has a widespread application in airplanes, wind turbines, and other instruments which are susceptible to frequent lightning strikes. Electrical discharge of the instrument in a safe manner is vital for the safety of the passengers (in the case of flights) as well as the integrity of the aircraft structures because of their specific mechanical and structural properties, which are essential for their functioning. The purpose of the study is to fabricate graphene thin film coated carbon fiber composite structures for assessment with simulated lightning strikes. This study will look at different methods for incorporating GTF (graphene thin film) into Carbon Fiber Reinforced Plastic and assess the electrical conductivity through methods such as compressive molding, Resin Transfer molding fabrication to achieve highly conductive functionalized nanosized GTFs, integrated with carbon nanotubes (CNTs) and graphene nanoplatelets (GNPs). The method developed must reduce the resistivity of the CFRP and provide a safe discharge outlet for the lightning strikes. In the current study we will develop GTF using GNP impregnated polymers. Electrospinning process will be one of the processes implemented to develop the GTF. The purpose would develop viable methods for the fabrication of graphene thin film material, and simulated testing of lightning strikes.

The energy challenge: moving from fossil fuels to biofuels, hydrogen, and green energy sources

Aneeza Hussain; Afrina Nishat
Prof. Alberto Martinez

The aim of this literature research is to evaluate and identify alternative sources of energy instead of fossil fuels. Fossil fuels like natural gas, oil, and coal are known as nonrenewable resources because they are finite resources that cannot be readily replenished at the same pace as their consumption. The alternatives that will be searched for in this literature review are specifically, biofuels, hydrogen, and green energy sources which are all known as renewable. In some countries, alternative renewable sources include geothermal energy, nuclear energy, solar energy, wind energy, and hydroelectric technologies. Hydroelectricity is the only renewable energy that is reliable. Generally, renewable energy sources generate most of their energy at certain times of the day, and its electricity generation does not match with the peak demand hours. The intermittency of sunshine and wind cannot provide an on-demand power source 24 hours a week. Solar energy and wind are unpredictable. Unlike fossil fuel, green/renewable energy does not appear to be a one size fits all solution. The use of multiple sources is generally required to meet energy needs. Identifying those sources and evaluating their viability is the adjusted purpose of this research project.

Harvesting of Animal Populations

Angie Zumba
Prof. Ariane Masuda

The three main biological processes are birth, death and aging. The objective of this project is to investigate how these processes impact the distribution of the female population overtime. We employ the Leslie Matrix Model, which was developed by demographers in the 1940s, to study the growth of the female portion of a human or animal population. In this model the females are divided into n age classes (intervals) of equal duration. In order to perform matrix calculations, we use SageMath in the CoCalc platform. We consider several initial age distribution vectors and observe how they influence the future female population.

Characterizing Tetrahymena thermophila Calpains Using Computational Tools

Anjalee Rabbani
Prof. Ralph Alcendor

Calpains are a set of calcium-dependent cysteine proteases that are found in almost every type of living organism, except archaebacteria. Calpains share a set of common domains that help with their function as proteases. These domains are also used to classify the various Calpains. For example, in humans there are two classes of Calpains, classical and nonclassical calpain. Classical calpains contain C2L, PEF and CysPc domains while the non-classical calpains do not have C2L and or PEF domains. Calpains have been shown to play important roles in cell death, diabetes and neurological diseases such as Alzheimer's disease. *T. thermophila* is a ciliated protozoan which lives in lakes, ponds, and streams. These eukaryotic cells have two nuclei, a macronucleus and a

micronucleus. The macronucleus is involved in vegetative growth while the micronucleus contains germline information. As a eukaryotic model, *T. thermophila* has been used to study many cellular structures and functions, including histones, cell cycle and cell motility. Although these cells have been studied extensively, they are yet to be exploited to examine the role of calpains. The genome of *T. thermophila* has been sequenced, but information on the thousands of genes in these cells is yet to be assigned. Therefore, the goal of this project was to use computational tools to begin examining the structure and function of TTHERM_00287920, one of *T. thermophila* calpain family members. This gene was selected from about 27 different calpain family members. Multiple alignment was done using tools like Multiple Sequence Comparison by Log-Expectation (MUSCLE), Tree-based consistency objective function for alignment evaluation (T-Coffee) and Multiple Alignment using Fast Fourier Transform (MAFFT). Phylogenetic analysis was done using Phylogeny.Fr and Molecular Evolutionary Genetics Analysis (MEGA). Results from these tools suggest TTHERM_OO287920 is closely related to 7, 10 and 15. To streamline the human calpain that TTHERM_OO287920 is more closely related to, SWISS-MODEL, PHYRE2 and VMD tools were used. Analysis using these tools confirmed TTHERM_00287920 to be more closely related to human calpain 7 compared to the others.

Modeling of Infiltration Through Large Openings in Buildings

Carlanthony Lanton; Syed Ali; Satesh Mahabir; Istvan Zagyi
Prof. Daeho Kang

Infiltration through entrance doors has had a major effect on the calculation of building heating and cooling loads within the thermal environment. It also affects thermal environment and building energy consumption as it causes a significant temperature difference. Various factors affect the estimation of the natural airflow through large openings in buildings and modeling of the natural airflows is thus complicated. Several methods have been developed to accurately predict such natural airflows. This project is to learn the existing methods and compare the accuracy of the predictions as each method has a different approach in modeling the behavior of the unwanted natural airflows. The accuracy of the predictions is very important since it directly affect building energy modeling. Future research on modeling the infiltration rates through large openings is needed to accurately account for the impact of the infiltration on building energy consumptions.

Soft X- Ray Imaging of Possible Transmetallation among Endogenous Fe(II)/Fe(III) and Mn(I-IV) States due to Thermo-mechanical Stress in Model Carbohydrates

Daler Djuraev; Sonia Orellana; Maria Orellana
Profs. Subhendra Sarkar, Zoya Vinokur

Micro contaminants from environmental pollutants or free radicals after brain trauma affect plants and animal species including humans. The ex vivo study of these micro contaminants affecting carbohydrates or protein matrix is undertaken in this project. Our laboratory has designed experiments to demonstrate chelation and transmetallation of native bio metals (endogenous Fe, Mn, Ca, Mg, P for example) in the presence of radiological contrast media added to the carbohydrate matrix. Routine imaging modalities, such as x-ray, MR and CT do not have adequate

resolution or sensitivity for nanomolar bio metal reactions with such exogenous media. However, soft x-rays from Mammographic systems at low keV energies seem to show additional x-ray scatter sources in the bulk matrix away from infused radiological media that could originate from endogenous metals. We have analyzed background standard deviation (x-ray noise) in bulk matrix adjacent to heavy atom infusion sites in such biologically active matrix as a function of time and compared with reference carbohydrate phantoms without heavy atom infusion. Changes in background standard deviations in these systems with time seem to favor transmetallation of added Gadolinium or chelation by added iodine complexes to such mineral rich carbohydrates. Our current work includes observation of these phenomena with heat or mechanical shocks applied to multiple apple and sweet potato species.

You are Prepared

Emma Bjornsen
Prof. Allison Berkoy

In today's age of rapidly expanding technology, people around the globe have resorted to extreme measures to "hack" their bodies through technological implants, ranging from NFC chips in fingers to entire hard drives in thighs. Led by Allison Berkoy, You Are Prepared is an interactive browser-based experience, exploring the similarities and intersections between human and machine self-optimization.

Last semester during the first phase of my contributions, I researched content for examples of human biohacking, as well as training a machine-learning platform on AI image generation. The first core task involved searching for video documentation of experimental biohacking and human augmentation projects from recent years. So far, I have found that humans are looking to self-augmentation as a method of seamlessly integrating technology into their bodies. The second research area involved Playform.io, a machine-learning platform. We ran a few models on Playform's machine-learning software to generate image sets of flowers and animals based on assets we prepared, then compared the original assets to the AI-produced images. This semester, I continued research on human optimization, focusing more narrowly on topics like transhumanism and cyborgism. I dove deeper into learning about the ML programs used in many projects I researched in the fall: namely ml5.js, p5.js, Posenet, and Tensorflow. After observing several hours of projects which used these resources as their structure, I was able to identify common trends throughout the projects: mainly the use of the body to perform functions, like playing phone games and synthesizing music, which are usually limited to the users hands or fingers. My second phase of work for this semester was preparing for pitching to and recruiting volunteers for a playtest of the current You Are Prepared prototype. Having a wide range of volunteers to test the experience and provide feedback is crucial as it will give insight to one main aspect of the interactive experience: the use of the p5 speech library for speech recognition and synthesis, as well as how it functions across platforms, general technical usability, and experience design testing. Another core test we are doing is for accuracy of the machine learning model for skeleton tracking. The final culmination of You Are Prepared will present a code-driven audiovisual experience on human and machine self-optimization.

The Effects and Consequences of Chemical Warfare
Gabriel Martinez; Ryan Donnelly
Prof. Jose Martinez

Our research has the aim to uncover both the consequences and effects of Chemical Warfare on a biological and moral scale We will be investigating the usage of several common chemical weapons throughout history The categories of these weapons will be limited to lung toxicants, tear inducing irritants, and vesicating agents We seek to understand the impact that these weapons have on living organisms, especially on the human body Experiments will include synthesizing a non lethal aerosolized compound and examining its impact on a human, and then compare it to other chemical weapons that are regularly used in combat and in civilian settings.

Force-feedback Design for Robotics Hand
Husnain Khan
Prof. Zhou Zhang

The great challenge for the Virtual Assembly Platform is how to make the users have the in-person feeling with the augmented tools. Hands are the most important organs that are used to provide touch feeling. In a real assembly scenario, the force from the components and tools will be feedback to the brain via the hands. Unfortunately, the virtual assembly failed to mimic the in-person scenarios since it will not provide such kind of feedback. As a result, the users' real identities are lost. Then, the users' slower-progressing wrong habits will prevent them from success in the future. Therefore, it is necessary to design a robotics hand that can provide force feedback. The proposed robotics hand will combine the motion synthesis of the human body, kinematic, dynamics, and computer graphics to reproduce the movement of a hand. Besides, spring, damper, and servo motors are integrated into the hand design. All the components will contribute to the force-feedback. After that, this project will be integrated into the project of "Procedure-Oriented for Engineering Education" to improve users 'immersive feeling when they implement the virtual assembly.

Open labs Vs. Radiologic Students' Final Practical Grades
Navdeep Kaur; Safraz Harun; Katie Tam; Robert O'Brien
Prof. Zoya Vinokur

Open lab facilitated by the Radiologic Technology & Medical Imaging department provides an opportunity to radiologic imaging students outside regular class time to master their radiologic positioning in correspondence to that student's clinical education. This research aims to analyze the correlation between open lab efficiency and its utility in contributing to a student's clinical education and practical performance. We will take a look at previous practical examination performance of imaging students, and it's correlation to the amount of time spent in open lab. A radiographic imaging student's ability to conceptualize positioning via open lab sessions as well as apply them to real life patient care, and medical imaging is essential for that student's imaging development. Through a longitudinal study of previous Radiographic Alumni as well as currently enrolled students, we will analyze the correlation between grades on imaging practical's and time spent in open lab perfecting radiographic positioning to obtain diagnostic image. Distribution of surveys will aid in gauging how medical imaging students find the beneficial aspects of open lab

to their conceptualization of radiographic imaging along with its associated positioning. Students would fill out questionnaires in relation to utilization of open lab based off didactic information and its relation to lab to prepare for practical examinations. Data accumulated is considered to be diagnostically crucial as newly accepted students into the Radiologic Technology and Medical Imaging program at New York City College of Technology have the least amount of exposure to the tools, didactic knowledge, and equipment knowledge as that of a senior student does. Therefore, open lab was developed to give each student additional lab practice, the exposure necessary outside class time in order to perfect positioning, and the ability to utilize as well as manipulate equipment effectively. Open lab enables radiologic imaging students the chance to develop critical thinking skills needed for clinical education, and practical examination. Through a longitudinal study, data analysis can be used to indicate that time spent in open lab can have a direct relationship on a student's performance for lab practicals and clinical rotation.

Effectiveness of Collimation in Radiation Protection
Ollana John
Prof. Eric Lobel

Radiation protection is used to reduce the amount of ionizing radiation exposure that the patient and/or radiographer are exposed to. Collimation is a method of radiation protection that reduces the exposure field size to radiate only the area of interest. The purpose of this investigation is to compare the amount of dose absorbed using a Phillips digital radiography x-ray machine VS a Pascal dosimeter and if the collimation on a larger body part reduces dose at a higher percentage than a smaller body part. In this investigation, the two body parts of interest were the hand and lumbar spine. All technical factors remained the same (40" SID, OID kept at a minimum, AEC used, 80 KVP set for lumbar spine exposures and 52 KVP set for PA hand exposures). Collimation was increased (field size reduced) by 1-inch length and width for each exposure. The expected result is that dose will decrease as collimation is increased. It is important to note that with the Pascal dosimeter, dose will increase since the dosimeter was placed in the collimated field and once collimation increased (field size reduced) and the dosimeter was not in the collimated field, dose decreased as expected, for the most part. Overall dose reading on the DR machine showed that for the lumbar spine dose was reduced by 29% and for the hand dose was reduced by 14%, a 15% difference. Dose was reduced 2x more in the lumbar spine than the hand. Overall dose reading on the Pascal dosimeter showed a 6% dose reduction in the lumbar spine and a 214% increase in dose for the hand. This research is useful in radiation protection practices and confirms that collimating does decrease dose.

Bezier Curves
Qing Chen
Prof. Ariane Masuda

Drawing on a computer using a mouse is quite different than drawing by hand. It can be challenging to use a mouse to even simply trace a line. If the drawing involves several lines and curves, the task becomes more complicated. The goal of this project is to show how to design beautiful artworks using Bézier Curves. A Bézier Curve is a smooth parametric curve produced

by the coordinates of certain points. To draw a specific curve, one needs to select multiple control points positioned in strategic places. By changing these positions, one can draw different curves to produce the desired pattern. We use Krita, which is a professional free and open-source painting program made by artists to create digital art. We demonstrate how the Bézier curve pen tool in Krita can be used to trace over images by selecting the control points. We also explore the mathematics behind Bézier curves.

Compare how students performed and attendace before, during and after pandemic waves
Ralph Lauren Ocampo; Rohini Mattan; Peber DeJesus
Prof. Zoya Vinokur

Covid-19 is a global pandemic that affected many people that includes students from all different parts of the world. In this case, the research would focus on the Radiologic Technology and Medical Imaging program students at New York City College of Technology, who must do hands-on learning in order to accomplish the experience required for the degree. One of the hardest obstacles that radiologic students have to go through are the ones that are unable to be online. One example of those required classes would be the Clinical Rotation. It is mandatory for the radiologic student to go to a required hospital site and complete the necessary hours and competency to get passing grades. The Radiologic Technology and Medical Imaging Radiology is a degree where students must deal with patients and have in-person contact in order to take the best diagnostic medical images. The covid-19 virus was spread to the whole United States and was announced a pandemic beginning in March of 2020. It got to the top peak level of exposure in hospitals within that time. In order to gather the data that would be used in this research, surveys would be sent out to both Juniors and Seniors in the program. which would represent the answers to how the pandemic affected students. Comparisons are going to be made on how students did and attended through the pandemic and after the pandemic between juniors and seniors. Analysis of how Radiology tech students attended school before, throughout, and after the pandemic (when vaccines were out), are going to be further critiqued and explained.

Once the Surveys have been answered the research would create a data and graph that would be analyzed in order to compare the Attendance and Performance in the Year 2020 to the Year 2022 to see if there were any changes that affected the student during those pandemic years. This is continuous research as the Covid-19 Pandemic is still active as of this day.

Los Pirineos, the mostly true memoirs of Esperancita Gómez
Wilna Michel
Prof. Sara Woolley

A Graphic novel is a story or book written in the style of the comic book. A graphic novel can be written in any genre and is mostly expressed in illustration.As an artist and a designer, a graphic novel covers both of those aspects. One must sketch out the illustrations and plan out layout as well as create a story that is reflected in those images. To create a Graphic Novel one must go through all the steps of development : from rough sketches to final piece. I will be discussing the steps from rough sketches to useful digital files. The first step to creating a graphic

novel is to have a plan. For my research project ,I will be looking into the world of production for the creation of the Graphic Novel " Los Pirineos". "Los Pirineos" is a research based piece of fiction created by Sara Woolley that follows the life of a young girl in exile from 1950's Colombia ; and her family's flight to the United States .To begin the creation of the novel one must research the topic and create the story line. Afterwards they must create the illustrations that go along with the storyline. The illustrations are line art and then scanned and prepared for digital editing. Through the use of Adobe Creative Suite the line art is developed in Photoshop and colored digitally. After the images are then placed into the layout of a graphic novel and organized by page. Lastly the text is added and combined to create a printed final piece. This whole process is the role of production assistant. Through this experience I learned about the world of comics publishing from the inside. Learning about proper file preparation for book production,and digital coloring gives one experience and skills needed in the field of design and or illustration.