# Book of Abstracts

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**Downscaling Methodology for Satellite Land Surface Temperatures Over Urban Environments**

Omotolani Adelekan , Sean Valis , Nadia Sultana, Serigne Mbaye, Naved Khan
Prof. Abdou Rachid Bah

The urban heat island (UHI) is a major environmental and public health issue in big cities. In order to study and better understand the phenomenon, high spatio-temporal land surface temperatures are required. However, there is no satellite that provides LST data with both high spatial and high temporal resolution. In this study, we use a linear regression model to downscale the Geostationary Operational Environmental Satellites – R series (GOES-R) LST data to the spatial resolution of Landsat observations (30 m) over New York City. The GOES-16 delivers land surface temperatures at a spatial resolution of 2 km but at a high frequency of every 5 minutes. On the other hand, Landsat 8 Thermal Infrared Sensor (TIRS) delivers land surface temperatures at higher spatial resolution of 30 m but at a lower frequency of 16 days. The downscaled LST data has spatial resolution of 30 m with a frequency of every 5 min. The downscaled estimates showed a reasonable agreement (-0.09 to 3.30 K) when they were validated against independent Landsat images. The results of this study could be applicable in any urban area in the world.

**Implication of Energy Loss Due to Natural Airflow Through Entrance Doors**

Syed Ali, Adama Barro, Carlanthony Lanton, Satesh Mahabir, Sherene D. Moore, Cathal O'Toole, Matthew X. Quinones, 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. Natural airflow through revolving and other types of entrance doors has impacted building climate, which has attributed to heat loss. It is vital to analyze airflow through entrance openings for a better understanding of air movement, heat dissipation, and building energy consumption. The purpose of this research is to examine scientific literature on infiltration rate, differential pressure, distance of vestibule space, and energy sustainability of entrances; as an essential means in lowering a building's carbon footprint. Some methods that were used in estimating door infiltration rates are qualitative analysis, a pre-experimental design survey, computer simulation and estimation functions, tracer gas measurements, pressure sensors, calculation of air leakages, and the *ASHRAE Standard 90.1*. Studies estimate that infiltration through large openings may take a large percentage of energy consumption in buildings. Future research on entrance infiltration rate is needed to design efficient, high performing vestibule technologies that are beneficial in reducing air infiltration, and

energy costs. These innovations would be beneficial in maintaining indoor occupant comfort and decreasing greenhouse gas emissions that are a contributor to climate change.

**You are Prepared: a Brower-based Interactive Performance using AI and ML**
Emma Bjornsen
Profs. 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.
In the first phase of my contributions, I have been researching content for examples of human biohacking, as well as training a machine-learning platform on AI image generation. The first core task has involved searching for video documentation of biohacking and human augmentation projects from recent years, putting focus on non-medical and more experimental, elective procedures. So far, I have found that humans are looking to self-augmentation as a method of seamlessly integrating technology into their bodies, eliminating the need for a separate or wearable device. The second research area involves Playform.io, a machine-learning platform. We have been training Playform's machine-learning software to generate image sets of flowers and animals based on assets we prepare, then comparing the original assets to the AI-produced images. This training is part of our ongoing image research, and we will conduct further tests to learn more about the particular machine-learning platform that Playform is making more accessible for artists. The final culmination of *You Are Prepared* will present a code-driven audiovisual experience on human and machine self-optimization. Participants will be challenged to a series of body-controlled interactive games stemming from the findings of our ongoing research.

**Search for Naturally Occurring Fe(II) vs Fe(III) Roles in Model Carbohydrate Matrix by Forcing Transmetallation in Mammography**
Sonia Orellana, Maria Orellana, Daler Djuraev
Profs. Subhendra Sarkar, Zoya Vinokur, Lazar Fleysher

We have been working to test possible biometal displacement (particularly iron) from their native bioenvironment by external agents. We used Gadolinium and iodinated radiological contrast media that are known to be environmental toxins and displace metals affecting aquatic species. Using soft mammography X-rays at a low kVp we collected x-ray absorption data from sweet potatoes, bananas, and apples with and without such contrasts. Time series data for several days on these model carbohydrate samples have been recorded and are being analyzed not only to test the metal displacement theory, but also to image the distribution of radiological contrast. Additionally, the heterogeneity of this process could help understand the mechanism of metal

displacement and we feel the standard deviation values in image pixels could be valuable. An extension of this work currently underway is the effect of heat shock and comparing the contrast diffusion pattern to simulate the effects of global warming enhancing metal toxicity on biological tissues including mammals.

**The Ethics and Consequences of Cloning**
Gabriel A. Martinez, Ryan M. Donnelly
Prof. Jose Martinez

Our research topic is the ethics and consequences of plant and animal cloning. Cloning is a widely used agricultural process. It is employed when a plant has desirable traits that people wish to replicate and preserve. Cloning in agriculture is a process that is widely accepted as safe, however, we sought to test that general hypothesis. Is cloning truly a safe process? As part of our research, we conducted both scientific experiments and public opinion surveys, in order to test for possible physical (genetic) consequences, and moral consequences respectively. Our scientific endeavors involved performing actual plant cloning, in which we attempted to clone a mint plant from cuttings. We did this to test for possible genetic abnormalities when performing repeated cloning. Our public opinion surveys sought to observe and detail reasons why the public may be apprehensive towards the idea of cloning, on the grounds of morals, religion, and other reasons. Our analysis and research were performed with the rules and codes regarding ethical research in mind at all times. We ensured that all guidelines were adhered to, to the highest degree possible. Our research into cloning led us to the realization that although humans may have marginal successes in cloning, such as our initial success with our mint clones, we lack the proper knowledge and understanding to produce effective and self-sufficient organisms. Cloning is similar to any type of artform our world has to offer; Easy to learn, near-impossible to master. There will almost always be mishaps, such as in our case, and until our societal knowledge of cloning is advanced significantly, cloning will remain an imperfect art.

**The History of Quadratic Equations**
Harouna Guisse
Prof. Nadia Benakli

The objective of this project is to explore the history of quadratic equations, to have a better understanding of why ancient civilizations (Egyptians, Babylonians, Greeks, Persians…) needed to solve these equations. We will learn about the tools and methods that were used to solve these equations, and how these evolved over time. Furthermore, examples of solutions will be presented by using a geometric approach. Additionally, the relevance and application of these equations in an everyday setting will be discussed.

**Covid-19 Impact on Radiologic Imaging Students Learning**

Safraz Harun, Ralph Lauren Ocampo, Rohini Matan, Navdeep Kaur
Prof. Zoya Vinokur

The spread of COVID-19 has impacted the way in which students learn. Traditionally, information is delivered face-to face. In-person learning provides students the ability to engage, participate, and encourages one-on-one student-teacher interaction. Distanced learning has caused students to transition online due to the unprecedent spread of COVID-19. Classes are conducted via zoom, where students are able to join a class through a zoom meeting ID and password. This research aims to analyze the positive and negative effects of the transition to distanced learning. This change has had effects on every student's ability to learn either positively or negatively. Some students find distanced learning to be rather difficult. Many factors that contribute to the difficulty are things such as the age of the student, how tech-oriented that student is, and the ability to understand concepts via zoom. On the opposite end, many individuals enjoy the experience to learn virtually as it reduces student burnout. The objective of this study is to analyze data gathered by the Radiologic Imaging department at New York City College of Technology on how students feel about this academic transition. We will analyze the Radiographic Imaging departments student's ability to understand concepts via zoom as compared to an in person class. The ability to understand radiographic concepts and apply them in lab and clinic is crucial for the development of that student. Lab practice is a necessity in order to conceptualize topics and apply the material that was given to us to upskill our knowledge. Reducing the spread of COVID-19 is a substantial concern for everyone, but we aim to survey the impact of distanced learning and the change in structure of these students' academics and educational experience.

**Comparative Analysis of 3D Printed Denture Resins with Traditional Denture**

Aneeza Hussain, Caleb Beckwith, Alcha Soumailou
Prof. Gaffar Gailani

The aim of this experiment was to evaluate and identify compression strength between traditionally manufactured acrylic dentures and additive manufacturing resin dentures. Specifically, the dentures produced by Uhler Dental's Reveal line were compared against samples produced on the Formlabs Form 2 SLA, Stereolithography, 3D printer using their Denture Teeth A2 resin to test compression strength to assure they are compatible with the occlusal forces in the oral cavity. Using the ZwickRoell tensile testing machine, it appeared that the acrylic dentures were half as strong as the resin dentures. Then we went ahead and did a comparative analysis under a microscope to see the micro-properties such as the isotropic uniformity in the resin, layer adhesion, and the microstructure of the two different materials; in general, these two materials appear that

resin denture teeth have lesser mean percent porosity values than the acrylic denture teeth. After doing both the compression test and a micro level analysis under the microscope we have determined that the resin denture has the proper strengths and properties to handle the occlusal forces in a human oral cavity.

**Applications of Computer Hardware and Software in Biotechnology**

Noor Samantha Jahan
Prof. Farrukh Zia

Biotechnology and Biomedical Engineering are active and important areas of research. There is an increasing overlap between Computer Hardware and Software Technology and Biotechnology in creating Bio-Sensors and Biotechnology Devices. The main goal of this research project is to explore the use of readily available and affordable Bio-Sensors, combined with low-cost and open-source computer hardware and software in creating useful Biotechnology Devices. Another goal of the research project is to create a low-cost Bio-Sensors based device for the detection and prevention of COVID-19 virus infection.

**Effectiveness of Collimation in Radiation Protection**

Ollana John
Prof. Eric Lobel

Abstract: Radiation protection is used to reduce the amount of ionizing radiation exposure that the patient and/or radiographer are exposed to. One method of radiation protection that is currently used is collimation. Collimation is reducing the exposure field to radiate only the area of interest. It is best practice to increase collimation to reduce patient exposure. The purpose of this investigation is to determine if collimation is effective in reducing the amount of radiation exposure/dose a patient may receive and is collimation necessary based on body part size. In this investigation, two body parts of interest were radiated and observed; the large body part of interest is an adult lumbar spine and the small body part of interest is an adult hand. Multiple x-ray exposures of the hand and lumbar spine were taken using a Phillips Digital Radiography x-ray machine. SID is set at 40 inches for all exposures and OID is kept minimum. Kv is set at 80 for all lumbar spine exposures, and Kv is set at 52 for all hand exposures. The collimation field was increased by 1 inch by length and width with each exposure. For this investigation, radiation dose received for both body parts was measured by using the DR machine. The expected result is that collimation and radiation doses are inversely proportional. As collimation increases, radiation exposure to the patient decreases and it is extremely important to collimate for all body parts but very important for a larger body part to reduce excess radiation. Also, it appears that collimation on a larger part reduces the dose more than a small part by a percentage. This research is useful in radiation protection practices and it confirms that collimating is best practice to reduce patient dose.

Keywords: Collimation; radiation protection; ionizing radiation; exposure; x-ray; protection; scatter; dose.

**Force-feedback Design for Robotics Hand: Bio-based Design and Simulation**
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.

**Development of Functional Composite Material for Lightning Resistance**
Aaryan Nair
Prof. Akm S. 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 be develop viable methods for the fabrication of graphene thin film material, and simulated testing of lightning strikes.

**Mammography and Noise Statistics to Explore Effects of Environmental Metal Toxins on Biologically Active Model Carbohydrate Matrix**

Joanna Syska, Aaliyah Salmon and Aravis McBroom
Profs. Subhendra Sarkar, Evans Lespinasse, and Boris Gelman

We are exploring the effects of radiological organometallic contrasts on native metals in biological tissues, in particular, on fresh bananas and apples as model carbohydrate matrix. The contrasts include Omnipaque (an iodinated CT contrast) as well as Gadavist, and Dotarem (two stable MR contrasts),; all three have organic molecular arms to protect heavy metals from dispersing in live tissue before excretion by kidneys. We used a Hologic mammography system with low kVp, suitable filtration and low photon flux to minimize scattered radiation and record the inherent scatter in the sample due to the lightweight sample biometals and minute quantities of added radiological contrasts as above. Contrast distributions were mapped by low-dose 2D mammographic exposures at specific time intervals for several days. We hypothesize that the transmitted x-rays in pre and post contrast data may show effects from different minerals, e.g. from iron, calcium and magnesium in the model fruits and eventually could help understand potential risks on human tissues from such external contaminants.

**From Pencil Sketch to Digital File**

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.

**Computational Characterization of Calpains in T.Thermophila**

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 animals 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. Although calpains are being studied extensively, one are or cell model that has yet to be studied is in *Tetrahymena thermophila*. *T. thermophila* is a ciliated protozoa 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* family members. This protein was selected from about 27 different calpain family members. Multiple alignment was done using MUSCLE, T-Coffee and MAFFT. Phylogenetic analysis was done using Phylogeny.Fr and MEGA. Protein structure was modeled using SWISS-MODEL and PHYRE2. Preliminary results suggest that TTHERM_00287920 may be similar to human calpain 7 and 15. However, more analysis is needed to confirm which of these two humans Calpains is TTHERM_00287920 more related to.

**Polydimethylsiloxane (PDMS) Degradation Rate Studies**

Kina Wu
Prof. Ozlem Yasar

In recent years, Tissue Engineering is utilized as an alternative approach for the organ transplantation. Success rate of tissue regeneration influenced by the biomaterials, cell sources, growth factors and scaffold fabrication. Design and precise fabrication of scaffolds are required

to support cells to expand and migrate to 3D environment. At the SET Research Laboratory at City Tech, photolithography is used to fabricate the scaffolds. Main components of the photolithography are “photo-curable material” and an “elevator system”. In current scaffold fabrication set-up at SET, only 2D scaffolds are generated due to the lack of an elevator stage. In this research, to carry the scaffold fabrication from 2D to 3D, elevator stage is designed and fabricated. Our preliminary research showcased those scaffolds can be successfully fabricated with the use of elevator system.