



**Book of Posters**

**CUNY Research scholars Program (CRSP) & Louis Stokes  
Alliances for Minority Participation (LSAMP) – Fall 2022**



# HOW WILL CLIMATE CHANGE AFFECT THE FUTURE

Author: Ashanti Belone - Healthcare Communications Department

Mentor: Professor Farrukh Zia - Computer Engineering Technology Department



## ABSTRACT

Climate Change has played a massive role in the habitat of us earth dwellers and the animals that co-exists with us. I believe that essentially climate change plays a massive role because this can dictate whether or not the earth is habitable and if a need for evacuation is necessary. Many might believe that climate change only refers to the rising temperature but that's just the icing on the cake. Earth is a system that is very much connected, this means that changes in one area will set off a chain reaction allowing these changes to happen in many other regions. It is our job to protect our home and maintain the organisms living in it by being mindful of the types of things we use because they can change the continents of the gases we breathe and as stated above it can lead to earth being inhabitable for all.

## INTRODUCTION

By Definition, Climate change refers to the long term shifts in Temperature and weather patterns.

These shifts may be natural, such as through variations in the solar cycle. since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas. Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures. Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for garbage are a major source of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main emitters.

## LITERATURE REVIEW

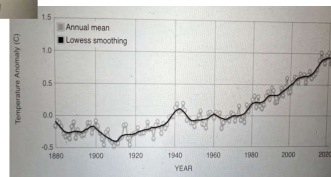
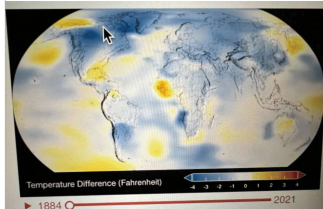
What are the causes of the climate change that we are facing? Just to name a few: As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Nearly all land areas are seeing more hot days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average. Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses.

## RESEARCH METHODOLOGY

The first thing i did during this research is to find out what was being done over the years to slow climate change and also how can we reverse some of these Climate change effects without taking away necessary actions needed for human and animal survival. Research shows that improvement to energy efficiency and vehicle fuel economy , increases in wind and solar power , biofuel from organic wastes, setting a price on carbon and protecting forests are all potent ways to reduce the amount of carbon dioxide and other gases trapping heat on the planet.

## DATA ANALYSIS

Take a look at the rate at which climate change has increased throughout the years.



## RESULTS

According to IPCC - Increased heat waves, droughts and floods are already exceeding plants' and animals' tolerance thresholds, driving mass mortalities in species such as trees and corals. These weather extremes are occurring simultaneously, causing cascading impacts that are increasingly difficult to manage. They have exposed millions of people to acute food and water insecurity, especially in Africa, Asia, Central and South America, on Small Islands and in the Arctic. To avoid mounting loss of life, biodiversity and infrastructure, ambitious, accelerated action is required to adapt to climate change, at the same time as making rapid, deep cuts in greenhouse gas emissions. So far, progress on adaptation is uneven and there are increasing gaps between action taken and what is needed to deal with the increasing risks, the new report finds. These gaps are largest among lower-income populations.

## CONCLUSION

To conclude ,climate change interacts with global trends such as unsustainable use of natural resources, growing urbanization, social inequalities, losses and damages from extreme events and a pandemic, jeopardizing future development.

What we really need is governments, the private sector, civil society – working together to prioritize risk reduction, as well as equity and justice, in decision-making and investment. These investments could range from solar panel usages , reusing compost , cutting back on tree removal, protecting our forests and many more potentially this can help us to all maintain life on earth because the planet is truly in grave danger.

## REFERENCES

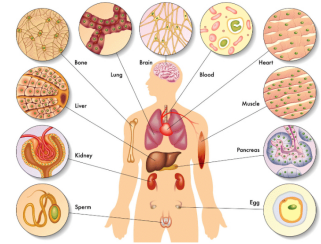
<https://www.cdc.gov/climateandhealth/default.htm><https://www.cdc.gov/climateandhealth/default.htm>

# Animal Research & Mother Cells

Mother cells have enormous potential for use in modern medicine. Also known as stem cells, or master cells, these have the ability to imitate or become other types of cells, whether muscle, brain, bone, blood, etc. This is incredibly useful because if a big enough breakthrough is made to better understand and control these cells, humans could build artificial tissue or organs from scratch using human stem cells or the patient's own stem cells, thus avoiding the risk of rejection by the body towards this new organ or limb, not to mention the fact that if we manage to apply this change to our own genetics, the human being would extend his quality of life to such an extent that a person born with this capacity would be and it would work like a 40 year old person, actually being 80. The role of animals in this is basically experimentation and testing technology to better manipulate these cells and see what things are safe and what are not. Pigs, rats and rabbits are the best candidates to be used in the name of science because their similarities to humans would be able to give us a more biological idea of what the process would be like and what we could and could not replace with new cells.

## What Are Stem Cells?

Stem cells are undifferentiated cells with the capacity to both differentiate and multiply into the 200 cells types that form a human being.



## Research Questions

1. What is your position on experiments with animals and organic tissues for medical purposes?
2. Do you think that this type of research should be better financed to accelerate its development for the benefit of the human race?
3. What is your position on the use of genetic engineering and the use of mother cells to correct birth defects?
4. The development of mother cells for the regeneration of muscle and bone tissues in mammals would mean the use/sacrifice of animals and other living beings for testing. What is your opinion regarding this dilemma?

## Ongoing Survey's QR code



## Data Analysis

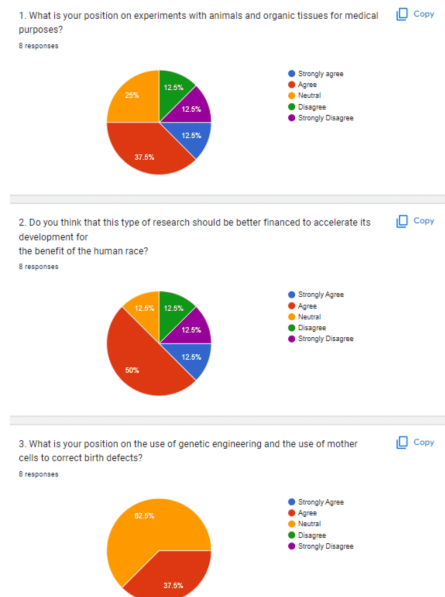
According to the survey results, it shows that the majority are in agreement regarding the research of stem cells for medicinal use in humans, but some others demonstrate neutrality on the subject.

# I ❤️ Stem Cell Research

## Conclusion

This is definitely a complicated topic but it is also very interesting since the answers given by the people in the survey are clear despite the fact that not all respondents study majors related to medicine. The survey will continue to collect data that will be saved and used in future projects.

# Thank you!





# City Prime: A Heteromorphism Robot

Iqra Khan

Prof. Xiaohai Li

Robotics & Intelligent Systems Lab

[www.citytechrobotics.org](http://www.citytechrobotics.org)

Department of Computer Engineering Technology

## ABSTRACT

In this research project we will design and develop a heteromorphism robot that can reform its structure and locomotion mechanism between a ground rover and a humanoid robot depending on the environment, terrain and desired tasks. Our project will create a novel robotics platform that may lead to new application opportunities of robotics in disaster response, service, education and other related fields.

In this project, we will first design and build a humanoid robot, then create additional morphism and locomotion mechanism design, add and integrate additional components to enable heteromorphism. We will program the robot to perform various tasks including changing from a ground rover form to a humanoid form. As the first half of the project, we are working toward the finish of the design and development of the humanoid features of the robot by this semester.

## INTRODUCTION

The motivation for this project is a robot built by a former research student at City Tech Robotics Lab. The robot consists of twenty servos present in the joints of the robot to induce movement. A network controller and program were developed to control the robot

## Methodology / Results

So far in our project, we have done extensive research on new generations of servos that we will use in the robot. We are searching and selecting and we will use servos that have the best balance of torque rating, no load speed, signal response speed, and power consumption. Testing platform and procedure are under design for testing the motor's tech characteristics. These servos are imperative to robotic motion.

Stall Torque	1.5 [Nm] (at 12 [V], 1.5 [A])
No Load Speed	59 [rev/min] (at 12V)
Baud Rate	7,843 [bps] ~ [Mbps]
Feedback	Position, Temperature, Load, Input Voltage



Figure 2: DYNAMIXEL 12A Servo

We also examined the workings of a li-po battery. Li-po batteries need to be stored at about 3.7V per cell to prevent them from puffing up or getting permanently damaged.

Figure 3: Puffed Up Li-Po battery vs. Non-Puffed Up Battery

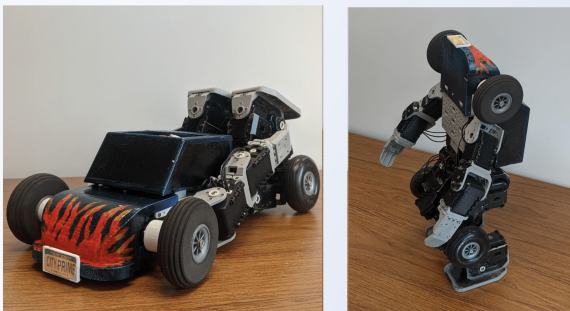


Figure 1: Heteromorphism Robot: Can alter between humanoid and ground rover form

## CONCLUSION

The project is still in its initial stage. We are still working on developing the robotic design and the humanoid features of the robot.

## REFERENCES

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# The Impacts of Climate Change

Author: Junxi Chen

Mentor: Prof. Ann Ngana Mundeke

## Abstract

Climate change is long-term shifts in temperatures and weather patterns by human actions. However, Climate Change has brought significant changes in the world. This Research Project points out to the main factors that cause climate change. The impacts of Climate Change are numerous including economic impacts, social impacts, and environmental. This project focuses on the environmental impacts of climate change.

## Hypothesis

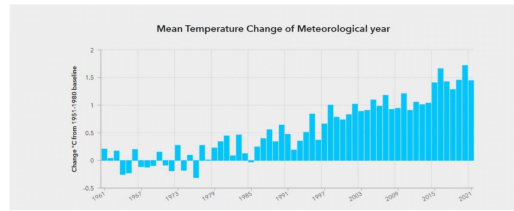
If the temperature keeps rising, will all living things decrease?  
Does climate change impact the environment and humans?  
Climate change causes the people to fight for the water?  
How can humans stop climate change?  
Global warming increases ocean pollution?  
Climate change connected to sea level?

## Impacts

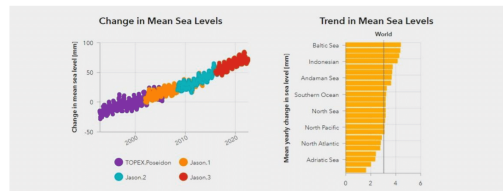
Affect the lives of coastal and The bottom layer of food will disappear, causing many creatures that feed on marine life to die. Global warming will cause ocean temperatures to rise, the bottom of the ocean food chain to die, and then to pollute the ocean, in a vicious cycle.

The rise in temperature will also cause many invertebrates to wake up from hibernation, and then these insects will miss the opportunity of predation and die in large numbers. Because the insects wake up early, they will eat a lot of forests and crops. The impact is not only on humans, also on animals. The keywords are natural disasters increase, food production decreases, and impact human life.

## What have we found?



This indicator presents the mean surface temperature change during the period 1961-2021, using temperatures between 1951 and 1980 as a baseline



This indicator gives estimates of the rise of global sea levels, based on measurements from satellite radar altimeters. These are produced by measuring the time it takes a radar pulse to make a round-trip from the satellite to the sea surface and back again.

## Conclusion

- We were able to see the data sets from different years. We know that temperature changes bring many changes and disasters. Like sea level, air quality, and natural disasters such as wildfires, hurricanes
  - The data sets prove that climate change impacts the environment and human lives.
  - Moreover, climate change causes ocean pollution. Also, water will decrease, due to the fact that there will be less water and people will fight for water.
- People must take action to stop and slow the course of climate change. I strongly suggest that everyone engages in learning about climate change so that many people can protect the earth.

## References

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## Introduction

Why is it important to conduct research about climate change? It is important to conduct research about climate change k now factors that cause Climate change in order to help the global community.

Climate change is caused by human actions.

For examples:

Driving cars that require more oil because the oil will impact the air. Also, the use of plastic items.

We should take control of the course of Climate Change. In this project, we will define climate change, will indicate factors that cause climate change and we will give recommendations (What we should do to combat climate change.

- What is Climate Change:
- Factors that cause climate change.
- Comparing climate change data in recent years.

Question: Do you think climate change impact human lives today? If you have no idea, I can tell you more.



Climate change will make our ecological environment worse, and human health will also be affected. Extreme heat will become a more frequent and more common issue for human health in the next century, mainly reflected in increased morbidity and mortality.

Climate change will melt glaciers, and the world will have conflicts and wars due to a lack of water. However, global warming has caused the accumulation of icebergs and snow to be much slower than the melting speed, and even some icebergs are no longer accumulating, which cuts off local drinking water.

We can switch to renewable sources of energy (such as solar and wind energy) to power our homes and buildings, thus emitting far less heat-trapping gasses into the atmosphere.

We can drive electric vehicles instead of those that burn fossil fuels, or we can use mass transit instead of driving our own cars.



# Classifying Public Companies into Sectors Consumer Discretionary and Consumer Staples in the context of the Pandemic

## PART 1

By Shahat Alam

### Abstract

In this project we aim to produce a classification model that re-classifies public companies belonging to either the consumer staples or consumer cyclicals sector within the context of the Covid-19 pandemic and nationwide lockdown.

### Notice

This semester was spent entirely on data collection and organization for the project. A thankless job, but arguably the most important for accurate results. Aggregating the data by hand is infeasible, so we wrote a program in R to retrieve and manipulate data from the SEC's official database using their Edgar API.

### Introduction

The pandemic not only changed our lives, but it likely caused select companies to shift sectors from consumer cyclical to consumer staple or vice versa. It is entirely possible that the national lockdown changed what we consider essential and nonessential services and products. Like, masks being considered essential during the pandemic whereas not so much priorly. For this project, our classification model will rely on a decision tree algorithm. Why? Decision trees are an excellent method of classification analysis when you have labeled inputs and outputs for your data. Our inputs should be metrics that we think will help us discern whether a company belongs to consumer cyclical or consumer staples, like the change in sales or revenue. Our labeled outputs represent the actual sector that company belongs to. And since we are only categorizing two sectors, are outputs can be binary to simplify things. Ultimately, from the model we produce, we want to redefine what is considered consumer staples and consumer cyclical during the duration of the outbreak.

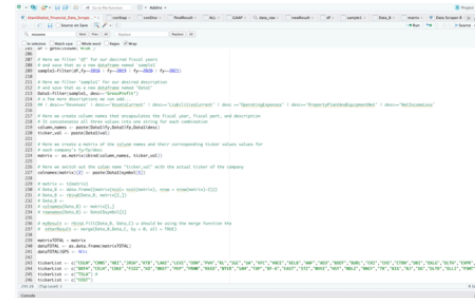
It is crucial that we understand the literal and behavioral distinctions between sectors consumer staples and consumer cyclicals in order to know how we attempt to classify between them. Consumer staples regard companies that focus on goods and services that we can consider to be essential and refuse to quit buying. And as a result, they have relatively stable revenue and are less sensitive to gyrations in the economy. By comparison, consumer cyclicals consist of companies that sell goods or services that may consider as desirables but not essential. Their revenue is more cyclical in nature as well and overall companies and industries alike in this sector tend to be more sensitive to economic sentiment .

The most creatively and intellectually demanding part of the project is selecting which metrics to study. As mentioned in the abstract, the metrics we choose to study become our inputs and should ultimately be something that helps differentiate consumer cyclicals from consumer staples, no matter the degree.

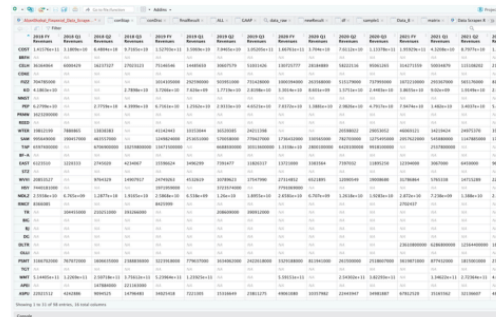
The pretext for this project was that since one sector is categorized by a lower standard deviation of revenue and the other by a higher standard deviation of revenue it should be possible to differentiate between the two based on metrics like financials (Revenue, Net Revenue, etc.) It should be noted that because all companies aren't weighted equally (different market valuations), we rely on the percentage of standard deviation to tell us how much a company is changing relative to other companies.

### Methodology

1. Pass in a list of ticker names into the Financial Data Scraper Program we built to manipulate, organize, and collect the data we need. In order to fetch the data our program makes an API call using the SEC's Edgar API .



2. Once we have our first data set with all the original raw data values to serve as a control, we can create a second data set with the manipulations on our data like the percentage of standard deviation.



3. Brainstorm metrics and provide an explanation as to why you think it might be useful in the decision-making process.

Example:

1. Fiscal and Quarterly Revenues from 2018 -2019
2. Fiscal and Quarterly Net Revenue from 2018 -2019
3. Fiscal and Quarterly Deferred Revenues 2018-2019.
4. Percent of Standard Deviation for Fiscal and Quarterly Revenues from 2018-2019

\*Steps 4-7 Are Reserved for Part II of the Project

4. Model and train preliminary versions of our trees for both the experimental data set and the control data set.
5. Use cost complexity pruning to distinguish the useful metrics from the not-so-useful ones.
6. Re-Model and Re-train our tree for more trusted results and over all a more precise model.
7. Conduct a thorough analysis of possible room for errors and reflect on experiment results.

### Conclusion

To conclude the first part of this project we created a Financial Data Scraper Program in R to handle the data collection and organization because doing it manually would be even more time consuming than to write a program to do this for us. Data collection and data organization are the most fundamental steps of data science and sit at the base of the hierarchal pyramid of Data Science. Now in Part II of the project, we will move up the pyramid to data analysis, predictive modelling, training, etc.

### Citations

Securities and Exchange Commission EDGAR Online. Securities and Exchange Commission, <https://www.sec.gov/edgar/searchedgar/companysearch>

### Acknowledgements

I would like to thank Dr. Nan Li, for his unrelenting support and guidance throughout this semester that allowed me to see the Financial Data Scrapping Program into fruition and understand the importance of proper data collection and organization.



# Computer Ethics in Curriculum

**Author:** Tiya S Williams, **Mentor:** Professor E Milonas, PhD

**Institution:** New York College of Technology

**Department:** Computer Systems



## Abstract

Ethics, specifically in Computer Curriculum, is a growing problem that has yet to be widely addressed. Although the beginning of computer ethics in the classroom can be traced back to the early 1940s, it has yet to be standardized or implemented in all computer curricula. The objective of this research is to identify the reasons why ethics is so crucial in computer curricula at all levels. Students and professors were surveyed to determine the extent to which ethics is taught in the computer curriculum. The results suggest that most CUNY colleges teach ethics in the computer curriculum. In addition, students who have yet to be taught ethics in the computer curriculum still are aware of the importance of ethics concerning computers. This project will also provide insight into why ethics is so pertinent in computer curricula at all levels. These findings are different than those in the past because ethics in computer curriculum has changed. Ethics has become more relevant and vital in people's day-to-day decisions creating computer systems, artificial intelligence, and more.



## Introduction

In this project, we are uncovering the importance of Computer Ethics in the Curriculum. Computer Ethics is impertinent to everyone, in any major and should even be incorporated into high schools curriculum.

For example, the addition of Computer Ethics can help lower the amount of daily cyber attacks.

Supplementary data were gathered for this project from a range of people from different backgrounds, educational statuses, ages, and occupations. Most people are not sure what Computer Ethics even entails. This project proves how dire the knowledge of Computer Ethics truly is and the significance it is for all people to learn.



## Method

- Survey of students
  - Ages 18 - 42
  - High school diploma - Masters Degrees
  - Black, Hispanic, Multi-Racial, Caucasian
- Survey of Educators
  - Professors of universities
  - High school teachers
  - Middle school teachers
  - Black, Hispanic, Multi-Racial, Caucasian
  - Bachelors Degrees - PhDs
- Research through accredited websites
- Advice and conferencing with mentor

## Conclusion

In conclusion, computer ethics is extremely relevant to people of all ages and should be implemented in the curriculum as soon as high school and continue more in-depth in higher education. Throughout my research, I have found that most people understand the importance of Computer Ethics and agree that it should be taught in high school as well as college. Even people who don't quite know what Computer Ethics are, believe that they should know what it is. The increase in technology only provides more need for Computer Ethics. The morality taught within Computer Ethics would lower the number of cyber-attacks/cyberbullying from a victim sense as well as an attacker. Computer Ethics would also create more moral CEOs and Computer Scientists in the future which would create a safer place.

## Literature Review

Incorporating Computer Ethics into Computer Curriculum was first taken seriously in the early 1940s. Computer Ethics was implemented as a higher education class by Norbert Weiner. Norbert Weiner was an MIT professor and published a book regarding computer ethics, *The Human Use of Human Beings*. The book laid the foundation of computer ethics; therefore, he is considered the founder. Although Computer Ethics was taught, it wasn't implemented into the standard Computer Curriculum. Currently, professors are working rigorously to incorporate computer ethics. Professor Grosz at Harvard John A Paulson School of Engineering and Applied Science is "working to instill in the next generation of computer scientists a mindset that considers the societal impact of their work and the ethical reasoning and communication skills to do so." Grosz created a course named "Intelligent Systems: Design and Ethical Challenges." The focus is "not only about what systems they could build, but whether they should build those systems and how they should design them." There has been some struggle regarding developing the right ethical questions for matching markets. Gray, another professor, says, "think about [ethics curriculum] from the very beginning of a project" rather than at the end.

## Results

The survey collected shows that most people don't know what computer ethics is and assumed it has to do with cyber attacks/cyberbullying. Many people believe that it should be taught in high school to help prevent such situations and is needed due to the increase of technology with children. When asked "Why Computer Ethics is important" some people responded with ideas similar to, "establishing a baseline for appropriate behavior and interaction with computers". When asked for an example of Computer Ethics violations, some answers were "cyberbullying, scamming, downloading programs without authorization from owners, etc".

Level of Degree in Participants		1	2	3	4	5	6	7	8	9	10	11	12	13
Masters Degree														
Bachelor's Degree														
Associate's Degree														
Degree In Stem														
Should Ethics Be Included in High School or College Curriculum?														
High School Curriculum														
College Curriculum														
Neither														

## References

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## Acknowledgements

Professor E. Milonas. Ph.D and Survey Participants.



## I. Introduction

In this project, we can examine the benefits of online education as well as its shortcomings. We aim to look at specific areas such as STEM and compare them to social studies. We want to see if there is any difference in how students perceive online education based on their area of study. We hypothesize that STEM may be more challenging to do online, but our results, which we can collect via carefully designed survey instruments, will either confirm or disconfirm the hypothesis.

## II. Research questions

- How are the benefits of online education affecting students?
- How are specific areas of STEM compared to (social) research studies?
- Is there a difference in how students perceive online education based on their area of study?
- How can STEM be more/less challenging online?
- Do students favor remote learning over personal, or hybrid learning?

## III. Data Collection -

## IV. Data Analysis (Partial as the research is ongoing).

## V. Preliminary Findings

4 students shared that they prefer in-person learning, 4 students shared that they prefer hybrid learning, and 4 other students shared that they preferred remote learning. Our experience with COVID tells us nothing about the possibilities of publicly available virtual learning as part of our educational environment since most teachers were inexperienced virtual teachers and few had the assistance or time to learn how to teach successfully online. We know that effective education, both virtual and in-person, involves students interacting with the teacher and with one another about the subject (Durant, 2022).

## VI. Conclusion.

Increased contact points between instructor and student and between peers (e.g., phone calls, small group teaching, and focused feedback) improved the quality of virtual learning, but few teachers have learnt how to foster dynamic interactions in their classrooms (Mineo, 2022). As a result, for many students, virtual learning is still a poor substitute for in-person education.

Fatimah Asad  
Professor Lubie Alatraste  
CSRP Undergraduate Research

1. The impact of online learning on your college process has been: \*

- very significant  
 significant  
 neutral  
 insignificant

2. How are specific areas of STEM comparing to (social) research studies? \*

Your answer \_\_\_\_\_

3. Is there a difference in how students perceive online educations based on their area of study? \*

- Yes, there is a difference  
 No, there is not a difference  
 Other: \_\_\_\_\_

4. How can STEM be more/less challenging online? \*

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# Impact of Polio on the Modern US Healthcare System

## A CRSP Theoretical Analysis

Student Researcher Gabriel A. Martinez

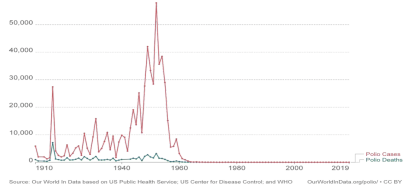
Professor Jose L. Martinez, MS, RT(R)(CT)(MR)



### Abstract

Polio struck the United States hard from the 1940s to the mid-1950s, and this deadly and debilitating disease paved the way in defining a new era of healthcare in the United States. From a booming increase in safe healthcare practices to new pharmaceuticals and vaccines from insurance giants seizing the opportune moment to create record profit margins, it is my goal to research and discover just how vast of an impact Polio had on the US Healthcare System we know it, and if it caused any detrimental or negative impacts on our healthcare system today.

Reported paralytic polio cases and deaths, United States, 1910 to 2019. The reported figures include both wild- and vaccine-derived type polio infections that occurred indigenously and as imported cases.



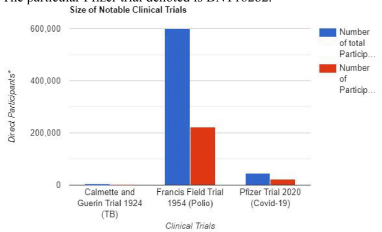
Source: Our World in Data based on US Public Health Service; US Center for Disease Control; and WHO. OurWorldInData.org/epidemiology/ CC BY

### Impact on Vaccination

The first US-mandated vaccine was the smallpox vaccine, required by all school children in Massachusetts during 1855, and in contemporary times, we have a plethora of vaccines required by both public and private institutions to work, learn, and go about our everyday lives. However, the question must be posed, how did we get to this point where vaccines have become such a large part of our daily lives and the healthcare industry?

In 1953, Dr. Jonas Salk, a renowned and brilliant medical researcher, pioneered the first successful Polio Vaccine after the US and its most remarkable minds had spent nearly 2 decades attempting to create one with even slight potential. Since the year of its advent, it has maintained a constant mandate in educational institutions and enterprises alike and is still required to this day. Polio furthermore, paved the way for major government spending on medical research.

For its time, the research effort put into discovering a vaccination for polio was unprecedented. The research for polio set the precedent for what we now refer to as clinical trials, especially phase IV clinical trials, which generally include large-scale human testing. In the case of polio, a study was done to find out the effectiveness of the Salk vaccine, which included the participation of an initial 4,000 children, and by the end of the trials, nearly 600,000 children had received the experimental dose of the vaccine. The trial was one of the famous medical experiments in history. Below is information on the scale of some famous clinical trials. Red denotes people-given placebos. The particular Pfizer trial denoted is BNT162b2.



### Impact on Health Insurance

Since the mid-1940s, health insurance was almost entirely privatized, and from 1940 to 1955, Americans with health insurance went from nearly 10% to 60%, a rather odd coincidence given that this timeframe is also when Polio hit the United States at epidemic level waves.

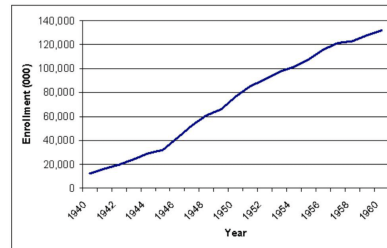
Insurance companies saw the opportunity in front of them during the 1940s. What was this opportunity? They saw a ripe and wealthy nation without a robust healthcare system that was also on the brink of a nationwide epidemic. Healthcare insurance companies, such as Aetna, Cigna, Blue Cross, and Blue Shield, launched major campaign ads during the Polio epidemic to get millions of Americans on their plans, with the idea that they would save them from any potential costs related to the treatment of polio.

To the right, displays an insurance ad from the 1950s, stating that they are the only thing separating them from financial ruin in case of health issues, at this time, most likely polio. These ad campaigns were frighteningly successful in their nature.



Data tells us that Health Insurance companies did not maintain large profit margins and that during the polio epidemic, 95 cents out of every premium dollar went to medical care. However, it is very clear that the polio epidemic led to a widespread reliance and dependence on health insurance to deal with rising medical costs, and eventually, health insurance companies began shifting their motives from healthcare to profit ever increasingly.

Figure 1: Number of Persons with Health Insurance (thousands), 1940-1960



### Impact on Medical & Hospital Practices

Polio posed grave health risks to those who had it, and there was large concern among nurses, doctors, researchers, and other healthcare workers that they might contract the disease during their fight to stop its spread.

To combat this concern, the Joint Commission was created in 1951, a non-profit private organization dedicated to accrediting hospitals. They were created during the very height of the Polio Epidemic, and remain to this day the largest organization of health accreditors, accrediting nearly 20,000 healthcare organizations.

The Joint Commission began mandating all healthcare facilities to follow what were still not very regulated practices, such as handwashing, the use of surgical masks, patient isolation, and the use of gloves. Furthermore, the Joint Commission was concerned with the quality of patient care and ensured that all patients, especially those with polio, were treated correctly.

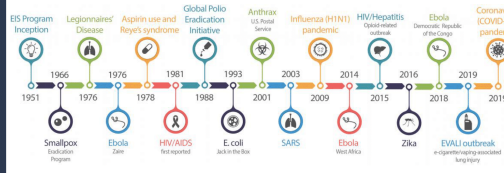


After the epidemic ended, and even after polio was declared eradicated from the United States, the Joint Commission continued to exist and exercise its power of accreditation.

To the right is The Joint Commission's Gold Seal of Accreditation. Without it, most states will not permit hospitals to operate, as the US Government fully recognizes the authority of The Joint Commission. Furthermore, they are completely tax-exempt and reserve the right to discredit any hospital for any reason they deem fit.



Along with The Joint Commission, the Epidemic Intelligence Service was created as a subsidiary agency of the Centers for Disease Control and Prevention. This intelligence agency was created in response to the polio epidemic in 1951 and was responsible for investigating and catching epidemics early.



### Conclusion

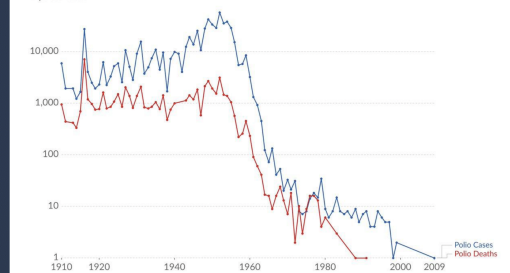
Polio was undoubtedly one of the worst diseases to ever strike the United States. From research and data gathered, it has become evident that our modern healthcare system has been impacted on a monumental level due to the consequences and innovations of the polio epidemic.

Clinical research was expanded to unprecedented scales in the name of finding a vaccine for polio, which also set precedents for funding and mandates of vaccines. In addition, polio gave Americans more reason to ally themselves with health insurance, which led to large increases in Americans becoming reliant on health insurance and paved the road for rising healthcare costs. Additionally, polio led to the creation of agencies dedicated to improving healthcare and preventing epidemics.

Polio, while having a relatively low death count compared to Covid-19, the Spanish Flu, and Yellow fever, polio was unique in its manner as it cause widespread and chronic debilitating conditions to those who contracted it.

If anything good came out of the horrid epidemic, it was new research methods, innovations in healthcare, and an improvement of workplace safety and practices that we still hold sacred today.

Reported paralytic polio cases and deaths in the United States since 1910. The reported figures include both wild- and vaccine-derived type polio infections that occurred indigenously and as imported cases.



Source: Our World in Data based on US Public Health Service (1910-1951) and US Center for Disease Control (1960-2019). OurWorldInData.org/polio/ CC BY

### Acknowledgements

A very special thanks to CUNY, City Tech, and my fantastic and dedicated mentor, Jose L. Martinez. Their dedication was indispensable to allowing undergraduates to conduct research.

An additional acknowledgment to the websites of the National Institutes of Health, The Department of Health and Human Services, the Joint Commission, and the Centers for Disease Control and Prevention.

Their libraries of medical information make it more effective for researchers like myself to conduct studies.

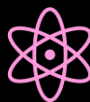


# The Motivating Factor Towards a Career in Radiologic Technology Medical Imaging at City Tech

Makadeer Kassim

DR. Jennett M. Ingrassia, Ed.D., R.T.(R)

CRSP Program - New York City College Of Technology



## ABSTRACT

For this project, we wanted to look deeper into what the motivating factor is as to why students want to enroll in the Radiology Technology & Medical Imaging major. While it is an extremely competitive program to get into, it can sometimes discourage students from pursuing another career or profession without knowing the options offered. After speaking with a few people and seeing it on my own there was a realization that a lot of us lacked the information we needed to succeed in this field. This research primarily focuses on providing information to students and collecting data on the information before deciding on the Radiologic Technology major. A good start to this is to seek information from students previously or currently enrolled in the RAD 1124 Introduction to Radiologic Technology course at City Tech as to the reasons for taking this course. For example, are they interested in the Radiologic Technology profession or are they taking the course to fulfill a full credit load for the semester? If so what modality in the field do they want to pursue and do they know how City Tech can support them to fulfill that goal? We look forward to learning more as we go.

## METHODOLOGY

For our method we will have an ongoing online survey. This will help us find out what information they know. This online survey will be conducted through "Survey Monkey"! To do so I will post the QR code around the school & directly asking students who finished the RAD 1124 course to participate in the survey.

## WHAT TO KNOW!

So far from conducting this research, here is what students need to know about the admission process:

- There is no application!- students are chosen based on preclinical performance & GPA
- Students must make sure to declare their major as a Radiology Technology student in order to be considered
- The Radiology department committee meets during the spring term to determine students for the fall semester.
- Pre Clinical requirements are as seen in figure 1.1
- GPA says 3.2 but department encourages 3.5+

## FUTURE DIRECTIONS

The next step for this research is to get results I gather from using survey monkey. In the next steps I will have known what other information is not clear to students to continue their education radiology technology. I will have also gathered what is the reason they chose a career I Radiologic Technology.

FIGURE 1.1

PRECLINICAL 1 (8 credits)	CR
2 WI courses (one in Gen Ed and one in the major), and Computer Literacy are required	
BIO 1101 Biology (minimum grade "C")	4
ENG 1101 English Composition I	3
RAD 1124 Introduction to Radiologic Technology & Medical Imaging	1
PRECLINICAL 2 (8 credits)	
BIO 2311 Human Anatomy and Physiology I (minimum grade "C", and must be within the last 5 years)	4
MAT 1275 College Algebra and Trigonometry or higher	4

## CONCLUSION

So far the conclusion of this research is that the path towards the Radiologic Technologist career is not easy. Over the years it has become a desired career & with that it becomes competitive. Students will feel discouraged when they come across the requirements & the course loads of these required classes. Also many are unsure of what modalities are there in the field & what they do.

- Radiography
- Fluoroscopy
- CT or CAT Scan
- MR or MRI
- Ultrasound/ Sonography
- Nuclear Medicine
- Mammography
- Interventional Radiography
- Vascular Interventional

## MODALITIES



# Lookism: An investigation into Discrimination in Workplace Practices

Shana Cromwell-Ramnarain and Dr. Alyssa Dana Adomaitis

New York City College of Technology, Business & Technology of Fashion. 300 Jay Street, Brooklyn, New York 11201

## Introduction

“Lookism” is a term to describe appearance discrimination or “the practice of discrimination on the basis of physical appearance in the workplace” (Ghodrati, Joorabchi, & Muati, 2015, p.1). In popular literature, it has been called “beauty prejudice” (Etoff, 1999, p. 1). The notion that a pleasing appearance results in favorable outcomes (e.g., higher wages, promotions) from others is not necessarily new, as literature on physical attractiveness is rather extensive. The Washington Post Magazine first used the term “lookism” in 1978 (e.g., Ayto, 1999), however, the term “lookism” was first recognized as a form of discrimination by authors of the Oxford English Dictionary and American Heritage Dictionary in 2000 (Ghodrati et al.)

## Purpose of Research

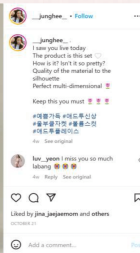
There can be social injustices due to physical appearance, whether physically attractive or unattractive. Rhodes (2010) discussed cultural injustices of being unattractive in a society appearance obsessed with the potential for “looks” to influence hiring practices, such as better career options and higher pay. Those who feel unattractive in an appearance laden society could suffer certain mental health issues potentially causing anxiety, anorexia, and depression. Research is needed for clarity to combat the issue with regards to how lookism is defined and has been examined. Scholars in the apparel and textile field are positioned to contribute to defining and examining lookism. The aim of this research is to examine scholarly literature to identify how lookism has been defined and studied in terms of racism.

## Theoretical Framework

Stone (1962) outlined the concept Symbolic Interaction process called whereby individuals use dress to state their identities to others. Stone noted an individual is recognized as having an identity when the identity is claimed by the individual, often using dress, and when others attributed the identity to the individual. Although the association of an item of dress with any one gender versus another is dynamic and changes over time (Tortora & Marcketti, 2015), customarily there have been specific dress items and practices (e.g., wearing neckties, shaving legs) that have been adopted almost exclusively by either males or females (Tortora & Marcketti). Thus, individuals could easily use dress to infer a corresponding gender identity. During the 2010s, the idea that other genders might also be symbolized in appearance emerged with the promotion of non-binary1 dress (Mackinney-Valentine, 2017). Non-binary dress refers to dress that can be worn by anyone at any time (e.g., t-shirts, jeans) and are designed to avoid creating specific distinction.

## Methods

Further research is warranted to clarify the concept of Lookism. It is a topic that seems to be increasingly important today with technology available today. It does not originate from one particular field, there are different definitions of it, beyond demographics it can be difficult to quantify, and it has the potential to be unethical or morally and legally wrong. The purpose of this paper is to analyze research literature on lookism. Such an analysis can help determine directions and future contributions that can be made, which can stimulate change in the underlying unfair biases that exist. A qualitative theme and content analyses were used to assess scholarly literature on lookism and social media on Linked in and Instagram on minorities. Social media aspects examined included: i) dress ii) hair style, iii) position, iv) context, v) definitions of lookism, vi) facial feature, and vii) number of likes



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Tortora, P. G., & Eubank, K. (2009). *Survey of historic costume*. A&C Black.  
Mackinney-Valentin, M. (2017). *Fashioning identity: Status ambivalence in contemporary fashion*. Bloomsbury Publishing.  
Mackinney-Valentin, M. (2017). *Fashioning identity: Status ambivalence in contemporary fashion*. Bloomsbury Publishing.

## Literature Review

Lookism can be influenced by a number of appearance cues, such as visible demographic traits (e.g. race, gender, age), body size, and clothing. The influence of appearance on others has been noted, particularly on demographic variables race, gender, and age. Literature has supported biases based on race, gender and age. The United States has a variety of races, ethnicities, age groups, and cultural backgrounds. Living in a culturally diverse environments can be difficult as objectification theory due to stigmas in social media can be used to understand eating disorders in Asian-American college women. Some comparisons can be of racial discrimination, persistent anti-foreigner racism, and racial/ethnic taunting as relates to Asian American college have been investigated.

Cheng, Tran, Miyake, Kim (2017) conducted a survey of 2,317 Asian American female college students ages 18-46 years were recruited through email sent by the registrar office of a Midwestern University. The survey was 20-25 minutes online with the approval of the university's Institutional Review Board. Questions included topics of racial discrimination, constant foreigner racism that influences their lives, and causes stress, racial and ethnic mocking, media internalization, body surveillance, body shame, and eating disorder symptomology. A total of 49% had an eating disorder, 48% experienced body shame, 43% had body surveillance, and 8% had media internalization. According to their findings, there was a significant level of racial ethnic taunting or racial prejudice as a result of media internalization. Internalization of media can lead to undesirable behaviors and a persistent need to conform to standard beauty ideals in order to be accepted.

Beyond demographics, appearance can be difficult to categorize and measure. What characterizes beauty varies from context or culture to culture. When it comes to appearance, African-American women have encountered numerous hardships to fit in within society. Hair and skin tone, with the internalization of societal beauty ideals, and sexually objectifying experiences are all factors in their current discontent. Dunn, Hood, and Owens (2019) investigated the link between self-worth and gender-related micro-aggression within African-American women's respect for their bodies. Lighter skin tone, long blonde, straight or wavy hair, the slim body shape are ideals in Western society. Many African-Americans do not conform to Western body ideals, as they have faced racial discrimination and even sexual harassment. African-American women are more prone than their White counterparts to engage in behaviors that are linked to longstanding cultural stereotypes. Sometimes African-women were shown to be more promiscuous, have more sexual partners, engage in unprotected sex, be single moms, and be on public assistance.

Dunn, Hood, and Owens (2019) conducted a study with participants that included 143 African-American women aged 18 to 24, which included their respective relationship status (single, never married, or in a relationship). This is a pivotal age for women as many are figuring out who they are and what they want to do with their lives within society. Findings indicated that participants revealed a high scored in both self-worth on one's physical appearance and experience as stress related to gender racial micro-aggression. Body image and self-worth among African-American women are a necessity for behavioral health to assist with these two issues studies. The findings will be used by behavioral professionals to give specific attention to coping mechanisms that African-American women might employ to combat gender racial micro-aggression.

Lookism is often noted to be unjust in popular literature. Women's studies literature discuss biases on women. In media, the issues of race and racism and the subject of colorism many times have been ignored until recent. Colorism is based on physical appearance, skin color, facial features, and hair textures worldwide. Lookism in this regard is often painful to speak about in the African- American communities because colorism is internalized. Lighter-skinned blacks are preferred over darker skin colors because lighter skins are more widely accepted in the media. From an early age, the media has had a powerful influence on children's perceptions of image and beauty due to children's cartoons rarely challenge societal conventions of White. Proud Family, a successful animation series about a traditional African American family, was the first show to feature a black production company, a black lead animator, a major black writing crew, and a black family as primary characters widely distributed on a mainstream platform, and it. Previous research on children has focused on the consequences of behavioral changes and exposure to violent programming as a promoter of aggression tendencies. Steele (2016) investigated colorism as this is a pressing issue in society.

Children's media aims to establish morals and values in children, as well as societal worth in a culture. Within certain programming such The Proud Family were all included in the study. One character is poor as she resides in a tiny apartment. The character of LaCienaga, is light-skinned and long hair. Penny's classmates and school bullies, whose distinctive traits set them apart from other characters in the cartoon series. The bullies are depicted with a deep blue skin tone, which signified their skin's blackness. This cartoon series is an example of division of people according to their socioeconomic status by using skin tone and European standards. The correlation between wealth, education and Whiteness reveals patterns of prejudice against African Americans with darker skin tones. The Proud Family was a popular children's show that promoted but mainly relied on Eurocentric values.

## Conclusion

Minorities do include many different cultural ethnicities in social media posts in which dress is apparent. Caucasians have diverse ethnic groups as well, but it seems more streamlined as in dress with British, American, Italian and Irish cultures. Ethnic minorities appear more in ethnic and religious garb. Further analysis of the data is still needed.



# HEAT SHOCK POROUS MEDIA: X-RAY EXPERIMENTS TO REVEAL ABNORMAL MINERAL DISTRIBUTION IN MINERAL-RICH FRUITS

CRSP Researchers: Aaliyah Salmon & Joanna Syska

ESP Researcher: Aravis McBroom

Mentors: Subhendra Sarkar & Eric Lobel

Departments of Radiologic Technology & Medical Imaging(1) and Physics(2), New York City College of Technology, City University of New York, New York, USA

## Abstract

Minerals exist within biomolecules in food and are not detectable in their natural form by routine analytical techniques. X-ray imaging depends solely on atomic mass, density, and photoelectric peaks, while MRI images depend on moisture content, sample porosity, magnets, and protocols. Using low energy x-rays and photoelectric absorption the minerals; iron, manganese, and copper which are transition metals, were detected in mineral rich fruits like apples. However, we found that the minerals discovered were inconclusive due to their imposing similarity in K-edges.

The use of intrinsic filters like Rhodium and Silver along with the extrinsic filter, Iodine aids in removing K and Mn from apples by using L-Edge of all three filters. The 3 minerals of interest (Fe, Mn, Cu) are hard to differentiate due to their close K-Edge.

Comparing with MRI images, we can exclude Cu since our x-ray and MRI images match exactly and MRI selectively shows Fe, Mn rich regions without Cu.

Our next goal would be to address porosity with both modalities x-ray and MRI since environmental heat waves will affect porosity of biological tissues. Thus, the goal to image mineral dynamics with heat was partially met. The use of heat shock displays the change in distribution because the minerals change both shape, porosity and brightness. The overall conclusion is that it cannot be definitively claimed that the results prove Fe redistribution with heat shock.

## Method

The experiment began with the calibration of mammography machine for optimal efficiency including air R.O.T's as a baseline for accuracy.

Four different apples (Gala, Granny Smith, Fuji and Golden Delicious) were cut into equal halves being precise with each cut to eliminate outside uniformity. One half of each apple was exposed and the second halves were microwaved, then exposed in the mammography machine.

All pieces exposed in the mammo machine were also exposed in the MRI machine. After six days the apples were exposed once again. Data was taken from all exposures and standard deviations were calculated.

## Results

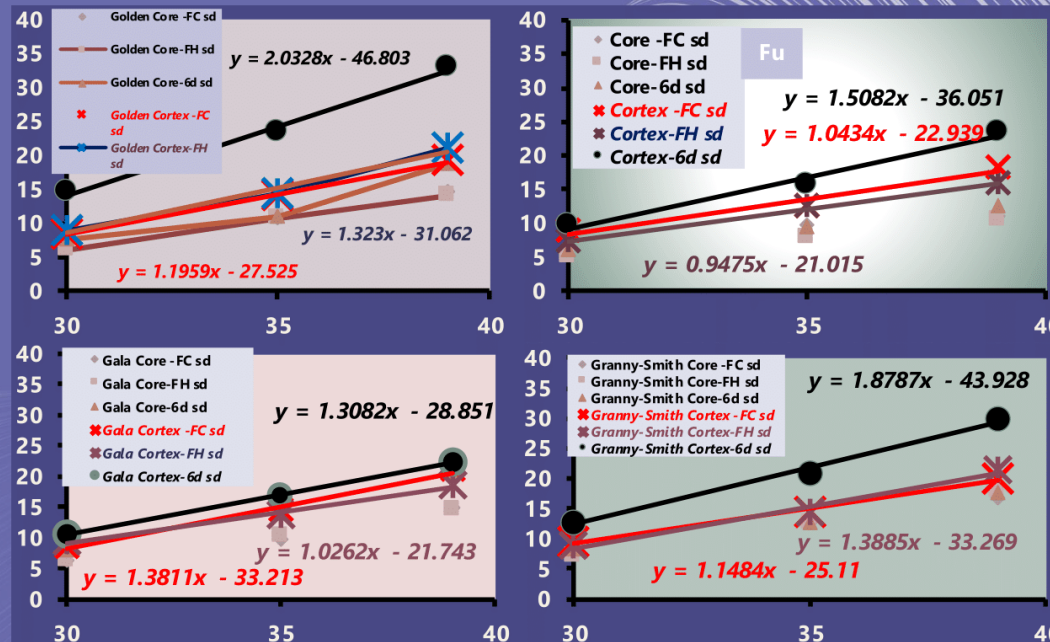


Figure 1: The graphs above show x-ray intensity fluctuations, the standard deviation is on the y-axis and x-ray energies after being filtered by inherent Ag filter and added iodine filter is on the x-axis. The abbreviations stand for FC: fresh cold apple, FH: fresh heated apple, 6d: air dried for 6 days post heat treatment. Each graph represents one of the four apples being tested.

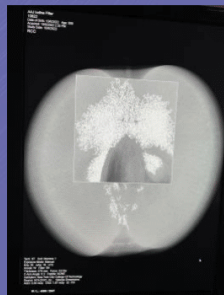


Figure 2: A x-ray image of one of the apples taken in the mammography machine showing mineral centralization movement which is magnified in the rectangular box.

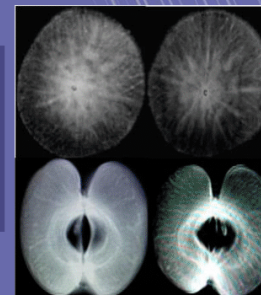


Figure 3: MRI image of apples pre and post heat shock treatment showing mineral movement.

## Conclusion/Discussion

In doing this research, we can confirm that both the cortex and the core of the apple change with heating. Cold means that the apple is less porous meaning the pores are closed. This structurally changes when heated. In our senior's research conducted before us we have seen micro (t= high resolution x rays) pores close when dry/heated. In addition, we used larger uniformed slices versus smaller slices. This gives us a new perspective as ours contained more material that was intact giving us more information.

We will continue to take these preliminary findings and monitor them into the next portion of our research experiments.

## Acknowledgements

We like to thank the school, faculty and staff for allowing us to carry out these experiments. We look forward to continuing on with this rewarding work. Thank you to our fellow Rad Tech researchers Katie, Angela, Robert and Daler. A special thank you to fellow Rad Tech researcher Somdat Kisso for the rigorous math. Special thanks to the mentors for their continued support and endless guidance.

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# Designing of X-ray beams to assess mineral loss in dehydrated fruits – radiology readiness during climate change

CSRP Researchers: Angela Moore, Katie Tam

Mentors: Subhendra Sarkar, Evan Lespinasse

Departments of Radiologic Technology & Medical Imaging New York City College of Technology, City University of New York, New York, USA

## Abstract

Key minerals such as iron, manganese and copper are necessary for optimal health and vitality of human beings. These minerals are within the biomolecules of food, particularly in fruits and are not detectable without destroying their natural biochemical roles. A compilation was done on average mineral compositions for multiple apple varieties from USDA and academic horticulture research labs to design the x-ray beams in the low energy ranges in our mammography system that provide "soft" x-rays for imaging light-weight atoms. In this project homemade external filters like Aluminum sheets, Iodine and Gadolinium contrast media were developed to modify low energy X-rays for more dedicated detection of each of these minerals. The absorption patterns and utility of such modified x-ray beams were analyzed. Differentiation between the imaging of iron and other minerals was challenging but a common distribution pattern from the core to the cortex of the apples was observed for all varieties of apples tested.

## Method

Used three filters: rhodium (Rh), silver (Ag) and iodine (I) to show mineral content in apples. Took 4 different types of apples: Fuji apple, Golden apple, Granny Smith and Gala apple  
Took a slice of each apple and made an exposure of it and labeled it as cold. Heated each apple slice for 10 seconds in a microwave and made exposures to show mineral content. These heated apple slices were labeled as hot.  
The absorption pattern of each filter was analyzed and used to identify varying minerals in the apples.

## Background

Filters were used to assess the mineral loss in the dehydrated apples for this research experiment. Filters are used to decrease the patient dose and improve the image quality in x-ray. There are two types of filters used in conventional radiography: inherent and added filtration. Inherent filtration are filters that are prebuilt into the radiographic machines. Added filters are filters that are separate from the machine and are used to improve the quality of the radiographed image by absorbing the low-energy (soft) x-rays that can cause scatter. Inherent filters have a higher K-edge than added filters. K-edge is the abrupt increase of photoelectric absorption in x-rays. The two inherent filters in the mammography machine used in this experiment are silver (Ag) and rhodium (Rh). Silver has a k-edge of 25.514 keV and rhodium has a k-edge of 23.33 keV. Aluminum is the added filtration used in this experiment ranged from 1mm to 2mm; it has a k-edge of 1.5596 keV.

## Results

Figure 1 - Table 1: Photon Flux Variation Across the Field (@20kVp, absorption units)

mAs	Lt Edge	Middle	Rt Edge
4	76	77	78
16	146	150	156
Flux Variation (SD)			
mAs	Lt Edge	Middle	Rt Edge
4	2	1.8	1.8
16	2.2	3	3
Flux variation / Flux (%)			
mAs	Lt Edge	Middle	Rt Edge
4	2.6	2.3	2.3
16	1.5	2	1.9

Figure 2 - Table 2: Photon Flux Variation Across the Field (@29kVp, absorption units)

mAs	Lt Edge	Middle	Rt Edge
4	286	284	287
16	972	974	1005
Flux Variation (SD)			
mAs	Lt Edge	Middle	Rt Edge
4	5.1	4.9	4.8
16	11.5	10.5	10.5
Flux Variation / Flux (%)			
mAs	Lt Edge	Middle	Rt Edge
4	1.8	1.7	1.7
16	1.2	1.1	1

Figure 3- Photon Flux Uniformity for Hologic Mammography Unit

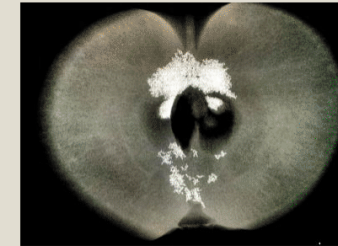


Figure 6 demonstrates less x-ray penetration exaggerates quantum noise at mineral deposits in the 3 cm thick apple. Thus, showing that the K-edge is filtered out by L-edge of iodine filter.

Figure 6 – X-ray of 3 cm thick apple

Using the basic air calibration without added filters and only using the intrinsic Rh filters at 20 and 29 kVp. The mammography machine was calibrated at various mAs ranges at 29 kVp and 16 mAs was found to be optimal with approximately 1% intensity variation across the imaging field compared to approximately 1.7% at 4 mAs which increased to approximately 2% and 2.3% at 20 kVp. Thus, the SD/SI is 1–2% maximum, meaning that the beam is quite uniform.

Week-long Dried Apple Variety Used as Absorber	Iodine + Ag Filtered, 30 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Core of Apples (%)	Iodine + Ag Filtered, 35 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Core of Apples (%)	Iodine + Ag Filtered, 39 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Core of Apples (%)	Week-long Dried Apple Variety Used as Absorber	Iodine + Ag Filtered, 30 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Cortex of Apples (%)	Iodine + Ag Filtered, 35 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Cortex of Apples (%)	Iodine + Ag Filtered, 39 kVp X ray Std Dev or Intensity Fluctuation Observed Transmitted from the Cortex of Apples (%)
Granny Smith	2.0	1.6	1.5	Granny Smith	2.4	2.2	2
Fuji	1.6	1.6	1.6	Fuji	2.4	2.1	2.1
Gala	1.95	1.9	1.85	Gala	2.6	2.3	2
Air	0.9	0.8	0.7	Air	0.9	0.8	0.7

Figure 4 –Core of Apples

Figure 5 – Cortex of Apples

As seen in the previous table for air calibration, the SD/SI% is approximately 2% at 20 and 1-1.2% at 29 kVp without iodine filter. In the tables above, we see the air calibration Sd/SI% is less than 0.9% at 30 kVp and even lower for 35 and 39 kVp with iodine filter. Hence iodine K-Edge at 33 and L-Edges at 4-5 keV have homogenized the beam to constitute more mid-band energies and truncating both low and high tails causing less scatter in air. The apple varieties, after a week-long drying, also acted as extrinsic filters and absorbed 6-8 keV components due to Fe, Mn, and Cu K-Edges that exist as biometals in apples. The SD/SI% is lower at core compared to cortex indicative of greater filtering at core, proving that the core is richer in metals than the cortex. Fuji apples may have the highest concentration of biometals, as we see that SD/SI% in minimum for Fuji. The data shows that greater mineral accumulation at the cortex does the same SD reduction at the core of apples.

## Conclusion/ Next Steps

After making exposures with all three filters: Ag, Rh and iodine. Ag proved to be the most effective in removing specific mineral content in the apples as it filtered out everything from 5 KeV and below. This allowed for the radiographing of iron, potassium, and magnesium as significant attenuation occurred with these minerals.  
Beam preparation using the Ag filter for detection of mineral composition demonstrated decreasing scatter with increasing kVp at the cortex of the apples with approximately 20-30% less absorption in the core. Decreasing scatter was also noted as pore size increased after the apples were heated and radiographed.

## Acknowledgment

Sincere gratitude is expressed to the faculty and staff of NYCCOT for providing this opportunity to be engaged in this experiment. Special thanks to our supportive mentors: Dr. S. Sarkar and Professor E. Lespinasse.

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# Studying Factors of Environmental Injustice and Ways to Achieve Equity



Arham Hussain, Reginald Metellus, Prof. Marzi Azarderakhsh

## Abstract

In today's day of age, the biggest concern for current and future generations: the environment. The urban heat island (UHI) with its significant energy, health, and societal impacts is among the major environmental issues in urban regions, especially in historically underserved and socially vulnerable communities (HUSVCs). In the 1930s, the former federal agency, Homeowners' Loan Corporation (HOLC), created "Residential Security" maps of major cities, known today as "redlined" areas. These neighborhoods were often designated as "hazardous" due to the high percentages of people of color living there, leading to systematic disinvestment based on race. While the program ended in 1968, the impacts of discriminatory lending are still experienced in redlined areas in the form of urban hotspots. The advent of new technologies and availability of environmental data from satellite and ground observations such as ArcGIS and QGIS, could improve our understanding of these heat impacts and be used to develop and assess mitigation and resiliency strategies.

## Introduction

- In the 1930s the former federal agency, Homeowners' Loan Corporation (HOLC), created "Residential Security" maps of major cities.
- Areas were bordered off and rated for mortgage lending ranging from A to D (D being the most hazardous).
- Neighborhoods were often designated as "hazardous" due to high percentages of people of color living there, leading to systematic disinvestment based on race.
- These D zones, colored red on the original HOLC maps, are known today as "redlined" areas.



Figure 1. 1936 Homeowners' Loan Corporation (HOLC) Residential Security map.

## Methods and Data

- The following research consists of data pulled from the NYC open Database for demographic and income information from the US Census Bureau data.
- In addition, satellite imagery such as Landsat 8 from 2013 to present with 30m multi-spectral spatial resolution.
- What is Landsat 8? According to USGS.gov, "Landsat 8 (formerly the Landsat Data Continuity Mission, or LDCM) was launched on an Atlas-V rocket from Vandenberg Air Force Base, California on February 11, 2013. The satellite carries the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS) instruments."



Figure 2. Landsat 8 in orbit

- Running Landsat 8 code from Google Earth Engine Code Editor, generated satellite imagery over NYC for Land Surface Temperature as well as Land Surface Reflectance.
- The Thermal Infrared Sensor (TIRS) has two spectral bands:
  - Band 10 TIRS 1 (10.6 - 11.19  $\mu\text{m}$ ) 100 m which directly measures land surface temperature
  - Band 11 TIRS 2 (11.5 - 12.51  $\mu\text{m}$ ) 100 m
- However, all the satellite imagery were presented as a raster layer (pixels) that was needed to be converted to a polygon layer in order to obtain mean surface temperature within zip code boundaries all NYC.
- To get the data within each zip code, QGIS was used to analyze the geospatial data (raster layers) from Google Earth Engine Code Editor and then to be analyzed further in Excel.
- Using QGIS, every zip code's median and household income along with mean land surface temperature was displayed which helped visualize correlations.

## Data Sets

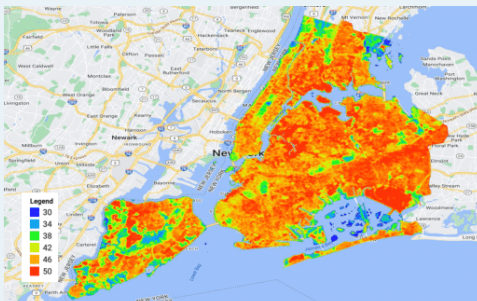


Figure 3. Map of Land Surface Temperature ( $^{\circ}\text{C}$ ) using Landsat 8-TIR band, July 2020.

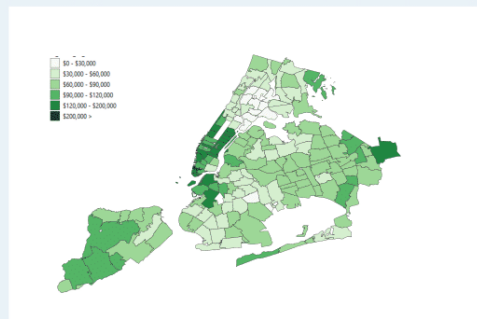


Figure 4. Median income per zip-code in NYC.

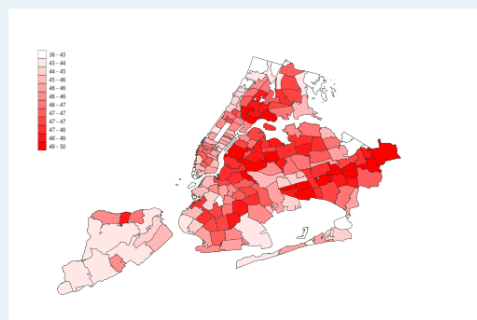


Figure 5. Averaged surface temperature per zip code ( $^{\circ}\text{C}$ ).

## Results

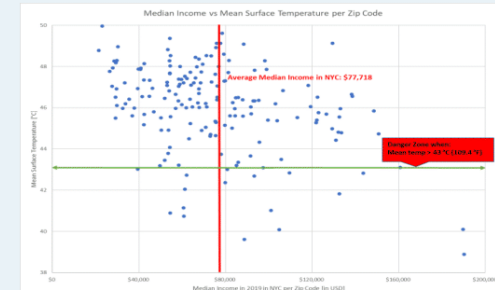


Figure 6. Mean surface temperature per zip code vs median income.

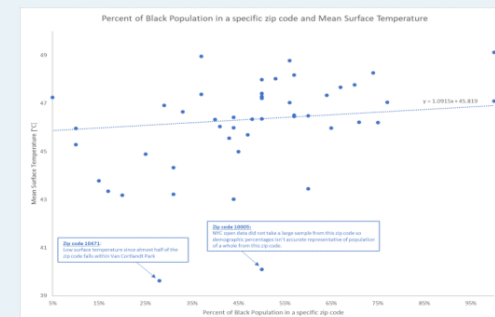


Figure 7. Percentage of black population and mean surface temperature in every zip code in NYC.

## Conclusions and future work

- In the research conducted so far, there is a clear positive correlation between income and the land surface temperature among different demographics.
- In addition, the research shows our initial findings and understanding of the matter of environmental justice issues depend on many other factors.
- To conclude, this is an ongoing research project, and more data has yet to be collected and analyzed for future findings.

## Acknowledgements and References

This project was funded by CUNY-BRESI, CUNY Research Scholars Program (CRSP), and LSAMP

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- "U.S. Census Bureau." USA.gov, <https://www.usa.gov/federal-agencies/u-s-census-bureau>



# Development of Practical Method to Quantify Infiltration Rate Through Building Entrance

Eric Reed, Ferasuddin Siddiqui, Loudelson Deguerre, and Steven Boodram  
Mentor: Professor Daeho Kang

## ABSTRACT

Infiltration through entrance doors, vestibules, cracks and other areas have a large impact in building energy consumption. It also has a significant impact on indoor air quality. There are only a few studies about air infiltration and air tightness in the literature. The purpose of this study is to develop practical methods to measure air infiltration rates through entrance doors. We have read research articles and identify several methods in the literature. Further investigation is required to help more accurately find infraction rate, crack size and location of cracks to help reduce air infiltration, energy costs, maintain comfortable indoor conditions and lower buildings' carbon footprint.

## INTRODUCTION

Other than ventilation that we need to maintain acceptable indoor air quality, unwanted airflow through large openings such as windows and doors as well as cracks on the building envelop significantly affects building energy consumption, especially in winter. Energy loss due to infiltration because of cracks is a large part of building energy consumption: 33% of energy used in heating and cooling residential buildings and 40% of industrial business. Air infiltration also has a significant impact on indoor air quality because it allows outdoor particles, gaseous containment and moisture inside. There are only a few studies about air infiltration and air tightness. Most research that has been done only focuses on residential buildings and not commercial buildings because it has not been viewed as a major issue. Industrial buildings only meet the regulations which already don't have much data to being with because of few scientific findings. The little information and research done has left the energy standard of warehouse and production buildings lagging behind. Accurate quantification of air infiltration rates through building entrance doors allows reduction of energy consumption, improvement of indoor air quality and better understanding of physical phenomena around the entrance doors.

## METHODS

### Blower Door Method

- Pull or push out air to lower or increase air pressure inside allowing air infiltration rate to be measured by the pressure difference between the indoor and outdoor space.
- This method is disruptive to the occupant because a blow fan is mounted to a door and it takes lots of effort to set up and tear down.
- It can't find where infiltration enters from and does not measure infiltration in all parts of the building envelope.

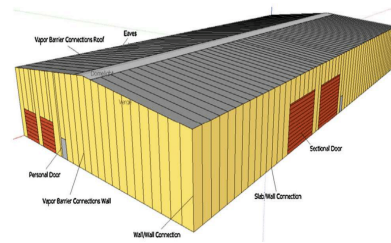


Figure 1. Relevant leakage of building component and connection of the sample building.  
(Adapted from 3)

### Thermographic images

- It along with blower door helps locate the cracks inside the building and the size of them which can help calculate infiltration more accurately leading to better building energy consumption.
- Thermographic images of a building help identify crack sizes and infiltration rates. Infrared thermography can be used with the blower door method to identify the locations of building cracks as shown in Figure 2.

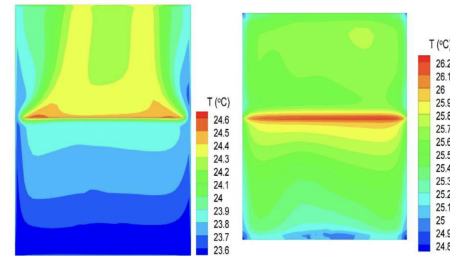


Figure 2. Temperature distribution on the wall with the crack: (left) outside surface and (right) inside surface.  
(Adapted from 2)

## DISCUSSION

Further research is needed to effectively quantify the infiltration rates through building entrance doors. As key factors affecting infiltration rates are identified, a detailed plan for field measurements, including all the instruments should be established. Differences in the infiltration rates through different types of entrance doors and the existence of vestibules. Detailed strategies to measure all the factors that are closely related to the estimation of air infiltration through large openings are essential as well.

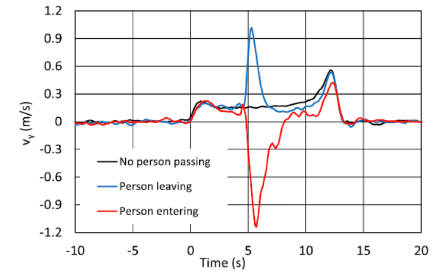


Figure 3. Comparison between velocity with and without a person passing.  
(Adapted from 4)

## RESULTS

- Lie et al. (2018) proposed a novel technique to measure infiltration rates. The trial run in the building as shown in Figure 1 revealed that the proposed method only needed one person and a half day to complete the task. Additionally, compared to the conventional blower door method, the equipment used in this method is lightweight and simple to install.
- Using a thermographic image of a building envelope taken by an infrared camera and measuring the indoor/outdoor air velocity, temperature, and pressure helps identify crack size and air infiltration rate.
- Villafrauela et al. (2016) found that the infiltration rates through the automated entrance doors of the retail stores and supermarkets ranged from 40 L/s to 5800 L/s compared to those of retail stores which only ranged from 100 L/s.m<sup>2</sup> to about 1100 L/s.m<sup>2</sup>
- Figure 3 shows that the air velocities varies significantly when occupants enter or leave the door for the case that the velocity measured at the chest height. When the air velocity was measured at the head height, the airflow is outwards without entrance or leaving.

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4. J.M. Villafrauela, J.F. San José, F. Castro, and A. Zarzuelo. (2016) Airflow Patterns Through a Sliding Door During Opening and Foot Traffic in Operating Rooms, *Building and Environment* 109 (2016) 190-198.



RESEARCH SCHOLARS PROGRAM



# Business Information Security Officer (BISO) Responsibilities and Role Development



## Authors

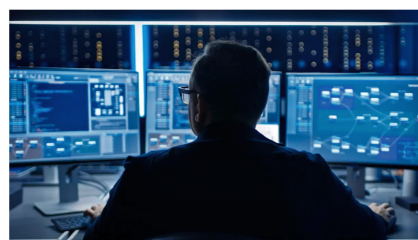
Kaung Myat Thu and Hudda Siddique

Mentor: Professor Patrick Slattery (CST)

Department of Computer systems technology (CST)

## Abstract

As technology develops in the 21st century, everything is connected through a network. Enterprises are highly dependent on that network connectivity to develop and succeed. The information security role has become critical to protect sensitive information from threats such as cyber-attack, and other information incidents to ensure the success of the business. We cannot rely on technology every time because one mistake could compromise the organization's reputation, financial impact and value. This research project is to study the Business Information Security Officer (BISO) role: its responsibility, strategy, and how BISOs handle threats. We will look at what knowledge a BISO should have and what skills required to be a BISO. BISOs need to have a combination of technical and business knowledge to maintain and improve information security in important aspects of a business. Whether a BISO needs to have an ISC<sup>2</sup> CISSP (Information Systems Security Professional), ISACA CRISC (Information Technology Risk Management), CISM (Information Security Management) or other certifications will be explored. In addition an understanding of risk management, and CompTIA Security+ qualifications will be studied. The role of a BISO is new and evolving - this study aims to contribute to the maturity of the role.



## Introduction

Business Information Security Officer (BISO) is the senior information security officer (CISO) who is in charge of all services and core platforms; accountable for prioritizing security risks across business units (BUs), technology, and serving as the CISO's representative in local security issues. Some of BISO responsibility are creating and sustaining a program for business information security including standards, guidelines and regulations directing the regulations directing the reaction to an incident involving a security breach or other occurrence.

## What are BISO responsibilities?

The BISO is one of the few roles that supports the priorities of both the business and the information security function. That's why organizations need BISOs to align business and information security priorities. They support both the core security function and help business units improve the cybersecurity program's maturity by encouraging collaboration, ensuring relevance and driving results.



## What value do BISOs provide?

- Developing and maintaining the business such as technologies, customers, partners, alliances, systems, processes, consumers, data, and customers.
- Offer guidance for cybersecurity across regions and functions.
- Implementation of the information security policies and procedures across all assigned regions or units.
- Participating in company/region related meetings and conferences and industry forums associated as part of the cybersecurity program.
- Offer reporting on a regular basis on cybersecurity status across the company/region/unit of responsibility.
- Act as the main contact for inquiries, security issues, and security issues.
- Coordinate with Crisis Management and Security Incident Response teams to help resolutions for incidents and assist with investigations.
- Work with the Information Risk Management and Compliance team for policy development and regulatory compliance.

## What knowledge do BISOs need ?

BISO has the combination of technical and business knowledge to improve information security in all aspects of a business. They understand the processes, identify and evaluate controls and risks, and suggest controls and risk management strategies so that the company is complying with Information Security Policies and Standards.

The BISO's responsibilities has a variety of tasks and include supporting core security functions with the following:

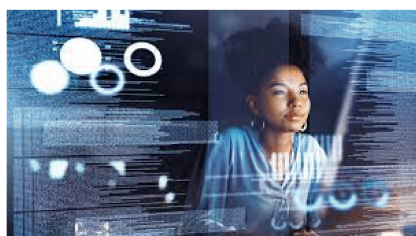
- Risk management: This includes risk identification, risk acceptance, solution development and risk mitigation implementation support.
- Education: This includes educating business and functional leaders on operationalization of policies, standards and baselines.
- Collaboration: This includes collaborating on key security tasks, such as incident management, threat modeling, vulnerability management, third party assessments, etc.

## How do you become a BISO?

One of the most common ways to become a BISO is through a mix of information science and business management study. This includes degrees in information technology management, cybersecurity policy and management, and business administration with an information security focus.

## Required certifications to be BISO :

- (ISC)<sup>2</sup> Certified Information Systems Security Professional (CISSP) demonstrates a broad understanding of existing and emerging cybersecurity threats and how to prevent them from impacting an organization.
- ISACA CRISC and CISM certifications validate a strong understanding of risk management and skills in assessing and overseeing an enterprise's information security.
- CompTIA Security+ validates baseline skills required to perform core security functions and pursue a career in information security.



## Citations

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### Abstract:

Extraterrestrial travel and housing are topics that have come up in recent times. There is a possibility of living on the moon. In order to do that while keeping costs at a minimum, we are researching and developing a geopolymer using lunar dust to 3D print houses on the moon. Because we are using lunar dust, the number of materials that need to be shipped out gets cut dramatically. We are studying the composition of both lunar mares and lunar highlands in order to fully understand what needs to be added to make a strong durable geopolymer that can withstand the varying factors and temperaments of the moon. By looking at aluminum and silicon ratios, as well as KOH, we aim to create a geopolymer that can make houses on the moon.







### Proposed Project

The manufacturing of cement demands the burning of vast quantities of fuel, as well as significant emissions of CO2 resulting from the decomposition of limestone.

## Geopolymers and Geopolymeric materials

History and Background of Geopolymers

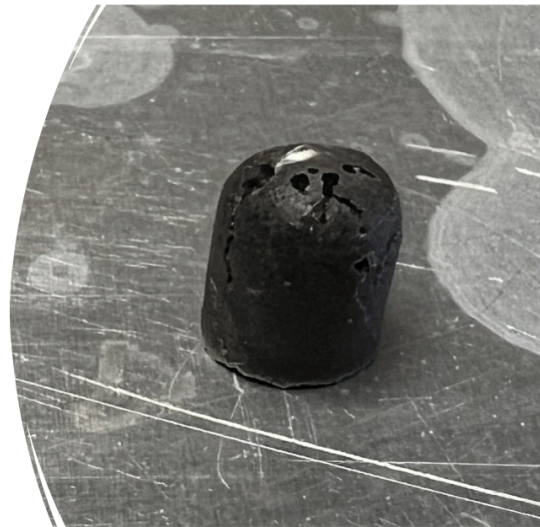
1950-2000

Viktor Glukovsky-1950 (Kiev)	Joseph Davidovits, 1991(France)
Si:Al=1 Poly(sialate) (-Si-O-Al-O-)	     
Si:Al=2 Poly(sialate-sialoxo) (-Si-O-Al-O-Si-O-)	
Si:Al=3 Poly(sialate-dialoxo) (-Si-O-Al-O-Si-O-Si-O-)	
Si:Al>3 Sialate Link	

Geopolymers are inorganic polymeric materials with three-dimensional network being composed of cross-linking [AlO4] and [SiO4] tetrahedral units and alkali metal cations

NYU

Glukovskij V.D. "Granitopodobnyj" Gesteinoidnyj Kevlar 1950. Patent USSR 245 627 (1967), Patent USSR 449494 (Patent appl. 1955, granted 1974), https://doi.org/10.1016/j.mateng.2007.07.011 https://www.intechopen.com/books/30953



## Geopolymer Production


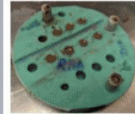

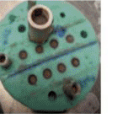
Geopolymer production is made by reacting aluminate and silicate bearing materials with a caustic activator, such as fly ash or slag from iron and metal production.

Proposa

1. Aluminosilicate precursors  
2. Activators  
3. Water  
4. Additives

Mixing → Curing → Geopolymer

A schematic flow diagram for the geopolymer production.

Geopolymer sample for Compressive Strength

Specimens were prepared by pouring the liquid solution into tubular steel resin molds with a nominal inside diameter of 6 mm and length of 30 mm.

NYU

https://doi.org/10.1016/j.mateng.2007.07.011

## Conclusion

The end goal of creating a lunar based geopolymer for the construction of habitats off-world will be understood further through testing of mechanical characteristics as well as other types of material testing.

# Bird Species and Gender Determination via DNA Sequencing

Jaden Burke and Olufemi Sodeinde

Department of Biological Sciences, New York City College of Technology, CUNY



## Introduction

Use of non-invasive techniques to sample wildlife has gained prominence in recent times. These techniques are employed in studying diet, determining which animals are present where and have been used to determine the sex of animals without needing to physically capture and examine them. DNA barcoding has enabled this. DNA extraction from birds is not a new concept as feathers have been used as a source of DNA in the past 20 years (Olsen *et al.*, 2012). An advantage of using feathers for obtaining DNA is that it is non-invasive (that is, it does not disturb or harm the organism being studied) especially if the feathers are molted (Bayard De Volo *et al.*, 2008) and not plucked from the bird. Molted feathers are also used as indices of bird presence in a habitat or area. Collected feathers can be morphologically identified to species but requires expertise in order to correctly do so. DNA barcoding solves this problem as DNA barcoding translates expert taxonomic knowledge of diagnostic morphologic characters into a widely accessible format, in form of DNA sequences (Kerr *et al.*, 2007). This enables more people to identify specimens. With this approach, a library of sequences from taxonomically verified voucher specimens, DNA barcodes, serve as identifiers for species (Hebert *et al.*, 2003). Repositories of DNA sequences for most organisms in the world include GenBank and BOLD.

## Objectives of Study

Our objectives in this study, are to: **1)** extract DNA from our feather samples; **2)** sequence the extracted DNA from the samples; **3)** identify the bird species by aligning sequences of amplified DNA of sorted feathers with previously documented sequences of DNA available in GenBank, BOLD and other such DNA sequence repositories for North American birds; and **4)** determine the sex of the birds.

## Methods

Feathers collected from the two parks in Brooklyn from a previous study were used. The feathers had been sorted according to location, Prospect Park (PP) versus Canarsie Pier (CP). Each feather was cleaned in 3% diluted bleach solution, rinsed in dd H<sub>2</sub>O until cleared of the bleach and dried. Feathers so processed were individually stored in separate sandwich bags.

Primer/Purpose	Primer name	Primer sequence
Sexing	P2	5'-TCTGCATCGCTAAATCCTTT-3'
	P8	5'-CTCCCAAGGATGAGRAAYTG-3'
COI/ species identification	COIF	5' TTCTCGAACCAGAAAGACATTGGCAC 3'
	COIR	5' ACTTCTGGGTGGCCAAAGAATCAGAA 3'

Table 1. Primer pairs for cutting the required DNA segments for sexing and identification

Component	Volume/Reaction, µL
DreamTaq Hot Start Green PCR Master Mix	25
Primer COI (F & R)	4
Template DNA	2
Nuclease-free water	19

Table 2. 50 microliter Hot Start solution mix for PCR amplification of the DNA segments

We then separated each feather to the different parts we would extract DNA from, the calamus, rachis, and barbs. For extraction, each feather part (usually rachis and barbs; more commonly barbs) was cut into very small bits. Approximately 30 mg or all the cut bits of each part was used for extraction. We performed the DNA extraction using the Qiagen QIAamp DNA Investigator Kit (Qiagen Inc.) following the manufacturer's protocol for extracting hairs and nails. DNA quantification for concentration and yield, and purity as determined by the 260/280 ratio, was done using the Nano spectrophotometer and the Nano drop 200 software. The 260/280 helps determine the purity of DNA at an absorbance level of 260 nm and 280 nm. A ratio of approx. 1.8 is generally accepted as pure for DNA.

Extracted DNA was stored at -20°C.

Step	Temperature °C	Time	Number of cycles
Initial			
denaturation	95	3 minutes	1
Denaturation	95	30 seconds	40
Annealing	50	30 seconds	40
Extension	72	1 minute	40
Final Extension	72	10 minutes	1

Table 3. PCR processing conditions for amplifying the extracted DNA segments

We performed PCR to amplify the DNA extracted following the Thermo Scientific DreamTaq Hot Start Green PCR Master Mix(2x) (Thermo Scientific) protocol. The COI gene and P2/P8 (for sex determination) were used to cut the segment of DNA to be amplified. Amplified DNA were electrophoresed. We performed the Gel electrophoresis with 2% agarose stained with ethidium bromide to visualize the bands of DNA. DNA bands were excised with gel using sterile blades and extraction of the amplified DNA was carried out using the QIAquick Gel Extraction Kit (Qiagen Inc.). Extracted DNA will be sent for sequencing on Sanger at GenScript, Piscataway, NJ, USA.

## Results

The yield (in ng/µL) of DNA extracted for both the Canarsie Pier and Prospect Park samples, ranged from 8.6 ng/µL to 230.3 ng/µL (Table 4) and the A260/A280 ratios ranged from 0.94 to 5.43.

Sample	Nucleic Acid Conc., ng/µL	A260/280
CP 3	23.1	1.63
CP 7	8.6	1.43
CP 12	17.1	1.27
CP 19	230.3	1.34
PP 2	125.7	1.05
PP 3	42.9	0.94
PP 4	53.3	0.97
PP 5	50.9	1.12

Table 4. DNA Sample concentration and A260/280 ratios

For COI, the gel electrophoresis showed bands in the ca 600 base region for CP 2 and CP 7 samples while banding was poor for other samples (Fig. 1). For the sexing gene, only CP 7 had a fairly-defined single band.

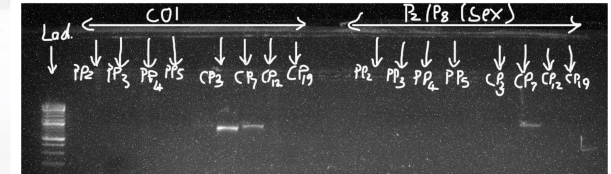


Fig. 1. Electrophoresis gel of cytochrome oxidase I (COI) fragments and P2/P8 fragments from feather specimens amplified by PCR

The purified DNA excised from the gel band did not produce DNA of substantial concentration, so, we will be repeating the exercise.

## Discussion and Conclusions

- We got DNA of varied concentrations and degrees of purity. Amplification of many samples whose DNA we extracted still needs to be done or repeated.
- One of our samples, CP 7 whose species we are yet to determine turned out to be male as it had only one band on the gel electrophoresis. Males being homozygous for the gene (ZZ) show only one band while heterozygous females (ZW) show two bands.

## Future Plans

- We will continue extracting DNA from the remaining Prospect Park and Canarsie Pier samples
- Amplify extracted DNA using the barcoding gene, cytochrome oxidase I, COI and CHD gene for sex determination
- Sequence the two genes from the purified amplified samples and carry out multiple alignment to identify the species.

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## Acknowledgements

We would like to thank the CRSP program at CUNY, New York City College of Technology for giving Jaden this opportunity to do research this semester. Jaden would also like to thank Professor Sodeinde for mentoring him on the research.



# Embedded Carbon Modeling

Mohammed Jalloh, Lauren Ramroop, Rosario Diazsalgado

New York City College Of Technology

Mentor: Alexander Aptekar

## Abstract

The evaluation is specific to the project location. We worked on determining the embedded carbon and ecological costs of different materials, also comparing traditional light wood frame construction to advanced design straw Bale construction. Start to looking up the different amounts of carbon that both materials would require and the distances suppliers to the site so that you can determine the transportation costs of the materials.

## Introduction

The purpose of energy modeling in this context is to provide high-accuracy estimates of potential energy, cost and carbon savings for energy conservation measures under consideration.

Water prevention in a multi-family home

- smart vapor barrier/ air barrier to remove rising moisture
- extend roof to prevent bales and lime wash from getting wet (we also plan to raise the bales
- building roof on floor then craning it onto the house helps with compression

Major heat factor due to increasing temperatures ->

need to find energy efficient air conditioning be of predicted increase of number of days experiencing a heat wave.

Will experience 15 days above 97 degrees in 30 years. Electricity usage for cooling purpose as a result will increase by 21.50%

The energy model should incorporate site weather data for a typical year as well as detailed information about building geometry, building construction, systems, operations, and occupancy. The energy model will use this information to simulate the building's energy consumption for every hour of the year.

## Method

Port Jervis is classified as a zone AE area, meaning there is an annual 1% chance of flooding and 26% chance of flooding over 30 years of a mortgage. Extreme risk of flooding, but deeper floods from major events (like hurricanes) are less likely to occur.

### **Solution: Elevate housing on podium**

Minor fire factor over the next 30 years due to increasing temperatures. -> some fire protection

### **•Solution: fireproof insulation-straw**

Port Jervis Reservoir #3, about 7 miles away. Located in Deer park, the reservoir is north of 26-30 Jersey Ave.

Condition is marked as fair, meaning there are no evident safety deficiencies in the reservoir, but any rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Since there are no fault lines under New York, seismic activity will be an extremely rare occurrence.

### **Details on podium design to mitigate flooding**

### **Must Have breakaway walls and pillar shape should be rectangular**

## Literature review

Port Jervis has a good chance of flooding annually. More prone to deeper floods from major events like hurricanes. Due to the rise of global Warming, it has minor fire factor over the next 30 years. Major heat factor due to increasing temperatures is the cause that we need to find energy efficient air conditioning because of predicted increase of number of days experiencing a heat wave. Solutions to counter these problems such as Elevating housing on podium, fireproof insulation-straw are ways to combat these issues.

## Conclusion

We have concluded that in order to counter our issues at Port Jervis regarding the flooding we produced the solution to elevate the housing on a 1 Foot Podium, adding that it must have breakaway walls and pillar shape should be rectangular. As regarding the toxic release of carbon onto the atmosphere and increased heat temperatures we produced the Instillation of Bale straw in the interior of the walls.

## Results



## References

<https://weatherspark.com/y/24019/Average-Weather-in-Port-Jervis-New-York-United-States-Year-Round>

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# Monitoring absorbed dose changes in parent/caregiver in the X-ray room using the principles of radiation protection



Student researcher(s): Ollana John, Lauren Gordon, Liana Reid  
Mentor: Professor Anthony DeVito  
Department of Radiologic Technology

**Abstract:** Radiation safety practices reduce dose to both the patient and the radiographer. There are cases when exposing a patient to radiation an additional individual may be present during the exposure and their safety is also monitored. The purpose of the experiment is to monitor how dose is absorbed in a secondary individual during the x-ray exposure using the principles of radiation safety. Exposures were taken with and without shielding and with and without collimation, while distance increased. Our test subject is a half body phantom (chest) that would represent a parent if they were in the room with their child during the x-ray exposure. The child is positioned for an AP Chest on the x-ray table. All technical factors remained the same (40" SID, OID kept at a minimum, 60 KV (for pediatric chest), AEC and pascal dosimeter used. Exposures were taken at 9 1/2 x 8 1/2 (W x L) collimation with and without shield and no collimation at 17 x 17 with and without shield, and distance increased laterally from the x-ray table by 1, 3 and 6 ft. The expected result is that absorbed dose in the parent will decrease as distance increases. Dose will also decrease as collimation is increased and shielding is applied. With the 17 x 17 collimation, without shield, dose decreased by 20% as distance increased from 1ft to 6ft. With the 17 x 17 collimation with shield, dose decreased by 13.5% from 1ft to 6ft. For the 9 1/2 x 8 1/2 collimation, with shield dose decreased by 11% from 1ft to 6ft. For the 9 1/2 x 8 1/2 collimation, without shield dose decreased by 13% from 1ft to 6 ft. This research is useful in radiation protection and reinforces the importance of using radiation safety practices to reduce dose exposure.

**Introduction:** Radiation protection is the practice of incorporating time, distance and shielding to limit the radiation exposure at a given time to an individual. During pediatric x-ray exams of children under 5 years old, parents stay in the x-ray room wearing a shield to hold the child for the exposure. If dad is present, it would be best for dad to be in the room to limit mom who is child-bearing from radiation exposure. The purpose of this research is to monitor the amount of dose absorbed by the parent during the x-ray exposure and to observe the dose differences as distance is increased, with shielding and collimation.

**Methods:** Positioned X-ray tube 40 inches SID (source to image distance), 60 KVP pediatric technique set. AEC set and OID kept at a minimum.

A whole- body pediatric phantom was used to represent child, positioned for AP chest and a half body phantom (chest) used to represent parent. Exposures were taken at 1 foot, 3 feet, and then 6 feet away from the edge of the collimated light field at 17x17 collimation, with the parent and shielded. Using the dosimeter dose was absorbed at each distance. Exposures were taken at 17x17 collimating, parent and child unshielded, dose recorded at 1 foot, 3 feet and 6 feet. Exposures were taken at 9 1/2 x 8 1/2 collimation with parent and child shielded at 1 foot, 3 feet and 6 feet. Dose absorbed recorded.

	1 Foot	3 Feet	6 Feet
17 x 17 w/o Shield	0.40 µgy	0.09 µgy	0.02 µgy
17 x 17 W/ Shield	0.27 µgy	0.04 µgy	0.02 µgy
9 1/2 x 8 1/2 W/ Shield	0.22 µgy	0.04 µgy	0.02 µgy
9 1/2 x 8 1/2 w/o shield	0.26 µgy	0.04 µgy	0.02 µgy

Figure 11: This chart shows the dose recorded when parent is moved 1 foot, 3 feet and 6 feet, while shield, unshielded, closed collimation (9 1/2 x 8 1/2) and open collimation (17x17). Dose decreased as distance increased. At 1 foot, 17x17 dose absorbed was more than 17x17 with a shield. At 1 foot, 9 1/2 x 8 1/2 dose was higher without a shield than with a shield. AT 6 feet, dose was much lower than at 1 foot. Dose at 6 feet was 0.02 microgray. Demonstrating the further the distance, the less dose will be absorbed.

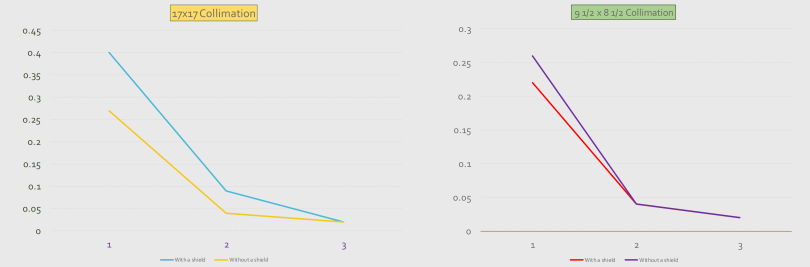


Figure 12: This graph compares dose absorbed at 17x17 collimation with a shield vs without a shield at first exposure (1 foot), second exposure (3 feet) and third exposure (6 feet).

Figure 13: This graph compares dose absorbed at 9 1/2 x 8 1/2 collimation with a shield vs without a shield at first exposure (1 foot), second exposure (3 feet) and third exposure (6 feet).



Figure 1: 17x17 Collimation on AP Pediatric chest.



Figure 3: X-ray tube positioned 40 inches SID. The child is positioned AP chest (back towards the image receptor). The parent is 1 foot away from the edge of the collimated field. The pascal dosimeter and computer is placed on the cart next to the parent to record dose.



Figure 5: Parent unshielded at 1 foot away from the edge of the exposure field.



Figure 7: Unshielded parent at 3 feet away from the edge of the exposure field.



Figure 9: Pascal dosimeter used to measure dose received by the parent. Dosimeter placed next to parent's chest.

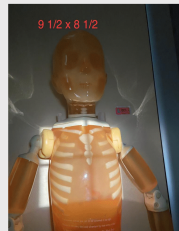


Figure 2: 9 1/2 x 8 1/2 Collimation on AP Pediatric chest



Figure 4: Parent shielded with lead apron and dosimeter next to parent's chest.



Figure 6: Parent shielded and 1 foot away from the edge of the exposure field.



Figure 8: Shielded parent 3 feet away from the edge of the exposure field.



Figure 10: Shielded parent 6 feet away from edge of the exposure field.

**Conclusions:** Radiation dose decreased as distance increased. With the 17 x 17 collimation, without shield, dose decreased by 20% as distance increased from 1ft to 6ft. With the 17 x 17 collimation with shield, dose decreased by 13.5% from 1ft to 6ft. For the 9 1/2 x 8 1/2 collimation, with shield dose decreased by 11% from 1ft to 6ft. For the 9 1/2 x 8 1/2 collimation, without shield dose decreased by 13% from 1ft to 6 ft. However, when a lead shield is worn, there is further decrease in the absorbed dose, as the distance increases. Higher radiation safety is achieved when lead shield is coupled with distance.



# A STUDY OF THE ENVIRONMENTAL, SOCIAL, AND GOVERNANCE OF ELECTRIC BATTERIES

## INTRODUCTION

The major motivation for developing battery technologies is the role of batteries in our environment. In addition to being a major part of our reliable reusable energy systems, they also power most of our everyday electronic items. The evolution of battery technology has allowed a transition from expensive, bulky, and unreliable to cheap, scalable, and reliable batteries. The field of battery technologies must not be neglected for its importance to our lives, the environment, and our collective future.

### ELECTRIC BATTERY USES

Electric batteries are used throughout the world in different capacities. Some General Uses are:

- Electric Vehicles
- Portable Electronics
- Battery Backups

Many of the amenities we take advantage of today won't work or will have to take a less convenient form without batteries.

The issue of sustainability in battery technologies is pertinent to the everyday person as availability, price, and other effects of these technologies can affect the quality of life we expect.

Most importantly, batteries can help shore up the weather dependent production of renewable energy from solar or wind. Without batteries, we would be at the whim of weather.

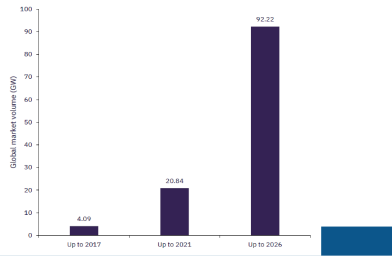


Figure 1: Outlook of Global Battery Energy Storage Capacity

## FINDING A FINDING B

**Batteries require the use of refined materials such as Cobalt and Lithium. Technologies are being developed which may reduce the reliance on these resources while maintaining the same if not better battery performance.**

**All batteries are destined to fail at some point in their lives. With the current lifecycle and recycling capability of batteries, there is concern about whether the developing technologies can offset the global reliance on critical rare earth materials.**

## RESOURCES & E.S.G.

### The Resource Rush

Securing a supply and stockpile of important resources for the production of batteries is paramount. Consider the myriad of uses for Cobalt. Apart from batteries, cobalt can be used in producing alloys for high-temperature, tooling, low-expansion, or elastic applications.

## THE HISTORY

The basic development history of the battery is from the birth of the Daniel Battery in 1836 to the invention of the lead-acid battery in 1859, to the discovery and formal development of the first practical zinc/silver oxide battery in the 1800s-1900s, and the commercialization of the battery. This was followed by the invention of the nickel-cadmium battery in 1899 and the nickel-iron battery in 1901. Battery during the early 20th century until theory and technology were in a period of stagnation after World War II when battery technology entered a period of rapid development. In order to meet the needs of heavy-duty applications, alkaline zinc-manganese batteries were developed. In the 1950s, the sealing of nickel-cadmium batteries was discovered. Then in 1958, Harris proposed the use of organic electrolytes as the electrolyte of lithium primary batteries, which helped with military and civilian applications in the early 1970s.

With the increasing awareness of environmental protection, the use of toxic metals such as lead and cadmium is increasingly restricted, and the impact on the environment is based on environmental considerations. Therefore, it is necessary to find new alternatives to traditional lead-acid batteries and nickel-cadmium batteries. The focus of battery technology research has shifted to rechargeable storage batteries. There is no doubt that lithium-ion batteries have naturally become one of the strong candidates, and polymer lithium-ion batteries (using gel polymer electrolytes as diaphragms and electrolytes) were invented in the next few years.

## BATTERY TECHNOLOGIES

After entering the 21st century, many countries began to formulate medium and long-term solar energy development plans. For this reason, solar cell technology has also made great progress: monocrystalline silicon solar cells, polycrystalline silicon thin film solar cells, and amorphous silicon thin film solar cells. Comparing these solar cell technologies, monocrystalline silicon is the most mature, but due to the high cost and price of monocrystalline silicon. It will gradually be replaced by polycrystalline silicon. In contrast, the most promising out of the three is thin-film, because it is the cheapest, but because it has the lowest efficiency class and requires a lot of space to meet the energy demand.

Based on the above development of solar cell technology, it can be determined that battery technology is developing in the direction of new materials and clean energy. It has indeed made major breakthroughs but is rarely used in commercial applications because it cannot combine low cost, multi-capacity, and greener.



## WHY ELECTRIC BATTERY TECH?

To sum up, compared to solar cells. The focus of research on battery technologies has been concentrated on lithium batteries, followed by lead-acid batteries, nickel-metal hydride batteries, and sodium batteries to improve efficiency and production. The optimization of batteries according to the needs of automobiles shows that the close integration of manufacturing and engineering technology can promote the commercial application of battery technology. But even so, the room for improvement of lithium batteries is limited due to high production costs. Not to mention the environmental pollution caused by the use and recycling of lithium batteries, and the uneven distribution of lithium mines around the world.

If a country wants to develop electric vehicles in an all-around way in the future. Without solving the issue of finding a greener battery manufacturing and adapting lithium batteries. People will rely more on lithium batteries, which will lead to more lithium metal and graphite mining which will eventually lead to the limitation of these materials, and cause more environmental pollution.

Therefore, in the future, batteries for electric vehicles should focus on the direction of using new materials and clean energy, such as solar energy, water energy, wind energy, nanocrystalline, silicon materials, etc. This is the best way to solve the high cost of batteries, environmental pollution, and energy crisis once and for all. According to the latest research report, the new battery technologies currently being researched include Carbon Nanotube Electrodes technology; Silicon Anode Batteries; Sand Batteries; nanowire batteries; Ryden dual carbon technology; Seaweed-based battery and etc.

## NEW SILICON ANODE TECHNOLOGY

Silicon anode batteries are an extension of the widely used lithium-ion batteries. Early lithium-ion batteries used lithium as the anode material. However, after several overheating and explosion events, it was replaced by carbon/graphite. Even so, in order to go further solve the problem of unstable silicon in lithium-ion batteries, researchers have developed a method to produce hybrid anodes. It uses mesoporous silicon particles and carbon nanotubes and then graphite, for the anode and replaces it with silicon. This would make it ten times its capacity. The new research aims to improve battery performance and enable a greener source of material with lower costs, as the source of the silica gel used is made from barley husk ash.

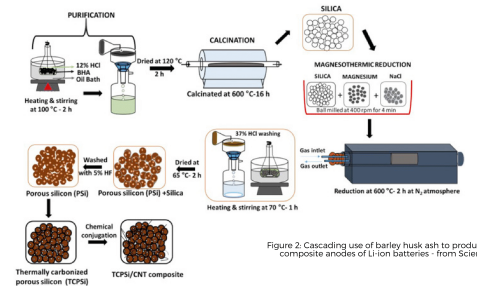


Figure 2: Cascading use of barley husk ash to produce silicon for composite anodes of Li-ion batteries - from ScienceDirect

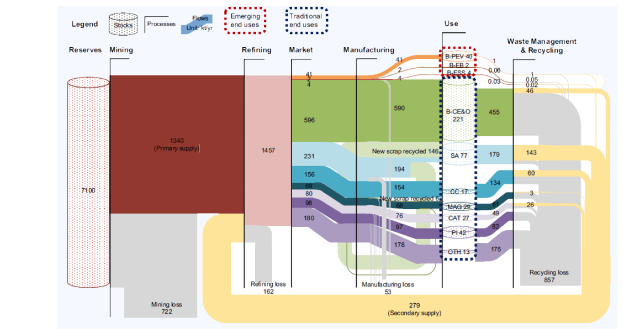


Figure 3: Cumulative Global Cobalt Cycle (in Metric Kilotons as cobalt metallic equivalent)

The above figure from an open Nature article (Zeng et al. 2022) shows the cycle of cobalt globally. Zeng et al. —in one of the scenarios they foresee—suggests that the supply of cobalt announced or scheduled by producers, cannot keep up with the demand in the next decade. The researchers discuss various methods of balancing the input and output of the cycle to reduce the possibility of a cobalt supply deficit. As seen in the previous sections, there is promise in developing low cobalt or cobalt-less cathodes for batteries; however, Zeng et al. argues that the penetration (rate of adoption), and the flaws, of cobalt-free cathode batteries prevent them from solving the supply challenge. The researchers then posit that the best solution to the challenge in the short to medium term is to develop, invest, and explore existing and unexplored cobalt deposits. However, this path can have heavy Environmental, social, and governance (E.S.G.) impacts.

## COMBATING WASTE

Waste is an issue that impacts the cobalt cycle, causing loss at nearly all stages of production to the end of the life of a product (Zeng et al. 2022). Zeng et al. show that recycling only makes up around 1/5 of the global supply and only a 1/10 of the cobalt in these products is ever extracted and reused via recycling. The IEA, in its report on the Role of Critical Minerals in Clean Energy Transitions, supports this by showing data from the World Bureau of Metal Statistics on how cobalt's recovery from the input is around 10% compared to copper's ~20%, aluminum ~25%, and lead's ~60% (IEA, 2022).

However, extracting and recycling materials from end-of-life products is only a part of the process. The IEA describes the possibility of reducing refining, production, and mining waste. Regardless of the possibilities provided by emerging technology, the supply of resources for production must meet the demand to keep the prices and availability of the end products reasonable (IEA, 2022).

## E.S.G. CHALLENGES IN THE COBALT SUPPLY CHAIN

According to data published by the United States Geological Survey (USGS), 70% of the world's cobalt supply comes from mineral deposits from the Democratic Republic of the Congo (DRC) (USGS, 2022). In addition, the DRC also has the world's largest reserves from the same data from the USGS.

On the other hand, we have consumers of cobalt. According to the USGS, China is the world's largest consumer of cobalt (USGS, 2022). Zeng et al. state further that China, the U.S., E.U., and Japan all have tiny Cobalt reserves compared to their demands (Zeng et al. 2022).

These statistics give body to three major concerns regarding the production of cobalt:

- Regional disparity
- Traceability
- Resource Curse

## REGIONAL DISPARITY

Regional disparity concerns the difference between the location of the material reserve, compared to the consumer of the material (IEA, 2022). In the case of cobalt, the largest consumers are not the producers of the material (Zeng et al. 2022). This can lead to resource insecurity and price volatility as consumer nations would not have any direct control over the producer nation's export and production policies. To combat this, countries have invested in forecasting and surveying organizations such as the USGS and investing in mining firms in the producer countries (Zeng et al. 2022). The former doesn't give any control over production, but it allows insight into future growth or contractions of supply and allows time for response planning and reserve building (USGS, 2022). On the other hand, by taking direct control over mining institutions in producer countries, third parties can levy more control over when and how much product gets mined and shipped (Calvao, McDonald, & Bolay, 2021).

## TRACEABILITY

Traceability is key in measuring and managing the environmental, social, and governance impacts of a product. In today's world, the origin of an assembled product can be difficult to determine, much less the individual components of the product. Although there are regulations pertaining to the labeling of product origin, they may not cover all circumstances nor are they of the same strength. For example, U.S. regulations on the country of origin markings are found in 19 CFR part 134 (Country of Origin Marking, 1972). In addition, the country of origin does not readily show any human rights, environmental, etc. concerns. This lack of transparency, therefore, can lead to the inability to measure harm to the environment and society in general.

## TRARESOURCE CURSECEABILITY

The resource curse is, according to Barry Posner, and Farid Tayari from the Pennsylvania State University, "...a paradox that those naturally gifted resource countries do not always develop and grow their economies." (Posner & Tayari, n.d.) The IEA in its analysis shows that the leading producer of Cobalt, the DRC, has more than 75% of its gross domestic product (GDP) made up of mineral and metal exports (IEA, 2022). The demand for cobalt can be credited to the growth of the country's GDP, but not everyone shares in that growth.

Those looking from the sidelines are lured into the dangerous and often illegal business of artisanal mining (Kushner, 2015). The World Economic Forum states that there are 40 million people who depend on ASM (Artisanal and Small-scale Mining) compared to 7 million on LSM (Large Scale Mining) (WEF, 2020). Because of its lack of oversight, ASM has been reported to engage in child labor, hazardous mining conditions, and grossly underpaying independent workers (Calvao, McDonald, & Bolay, 2021). ASMs provide a pathway for impoverished people to gain a living but requires significant oversight overhauls to ensure that it doesn't harm the environment and society that is around it.



# X-ray and MRI theory for mineral-rich fruits affected by heat waves during climate change.

ESP Scholars: Somdat Kissoon (Radiologic Technology & Medical Imaging); Robert O'Brien (Radiologic Technology & Medical Imaging); Nino Jvarishvili (Radiologic Technology & Medical Imaging); Daler Djuraev (Biological Sciences & Bioinformatics)

Mentors: Subhendra Sarkar; Zoya Vinokur; Lillian Amann (all from Dept of Radiologic Technology & Medical Imaging)

## Abstract

Conventional Nutrition facts data relays the amounts of different minerals in apples. This information from such analysis may not connect these minerals with their natural biochemical or

functional state for health or disease. These minerals may also be part of different particle sizes that affects X-ray transmission, absorption and scatter. The minerals may also redistribute within the tissue over time with or without heat shock. Current Medical Imaging procedures (X-ray and MRI) do not localize such minerals. Our work offers a way to increase detection sensitivity of transition metals in various apple varieties non-invasively. This can constitute a step in the detection and localization of these minerals in the natural biological unprocessed tissue. Our experiments also utilize detailed analyses of scatter in X-ray or MR images to correlate literature based porosity to model mineral distribution in apples. These tests were done on a small sample of a few varieties of locally grown apples. Our model of the movement and particle sizes of minerals within tissue needs to be verified in large batches of apples and other fruits before it can be tested on complex biological tissues like the human brain.

## Background & Hypothesis

The nutrition information for apples as provided by the nutrition self data indicates that 100 g of raw apples contain the following mineral metals in these amounts, obtained by making a uniform paste of the apple followed by various tests.

Calcium..... 7.5mg  
**Iron..... 0.1mg (Detection goal)**  
Magnesium..... 6.3mg  
Phosphorus...13.8mg  
Potassium...134 mg  
Sodium.....1.3mg  
Copper..... 0.03 mg (competing element)  
Manganese.....0.03 mg (competing element)

Competing due to closeness of K-edges (next column) and should be minimized by any imaging tool that maps iron (Fe)

### Hypothesis:

- (1) In our X-ray image, when soft X-rays are available close to the respective K-edges these minerals should absorb photons at the K-edges by Photoelectric effects and will be distinguishable as bright regions.
- (2) If appropriate filters are designed to filter out major mineral constituents like K, Mg, Ca AND assuming the competing elements like Mn and Cu are less intense being 1/3 of concentration of Iron (Fe), the main goal to map Fe distribution in such systems can be demonstrated.

The absorption energy levels of their K or L shell electrons are tabulated in the next column as obtained from the University of Washington database:

Element	Symbol	Atomic mass
Element 12	Mg	Atomic mass: 24
Edge	keV	
K	1.3050	
Element 13	Al	Atomic mass: 27
Edge	keV	
K	1.5586	
Element 15	P	Atomic mass: 31
Edge	keV	
K	2.1455	
Element 19	K	Atomic mass: 39
Edge	keV	
K	3.6074	
Element 20	Ca	Atomic mass: 40
Edge	keV	
K	4.0381	
Element 25	Mn	Atomic mass: 55
Edge	keV	
K	6.5390	[Competes with Fe detection]
Element 26	Fe	Atomic mass: 56
Edge	keV	A
K	7.1120	1.7433
Element 29	Cu	Atomic mass: 63.5
Edge	keV	
K	8.9789	[Competes with Fe detection]

The X-ray of an apple will normally show absorption from all alkali, alkaline earth and transition metals. However, iron is in a very low amount compared to other metals in apples. Therefore the beam needs to be tailored to show absorption from iron and the other trace minerals.

In MRI the paramagnetic minerals (Fe and Mn) strongly affect proton MRI signals from water and carbohydrate molecules in the MRI image while other minerals, e.g. Cu, Ca or K do not influence the MR signal at all. Hence with MRI correlation Fe and Mn rich regions can be detected to confirm the X-ray maps of Fe and Mn in apple samples. This may be generalized to in vivo application for iron related disorders of brain or liver

## Method and Materials

MRI Images at a 3T Siemens research system (Advance Science Research Center, CUNY) were taken for fresh apples prior to heat shock. Individual apple, one at a time, were then heated up uniformly by rotating every 6 sec for a total of 24s in a microwave oven and then allowed to air cool for an hour. MRI images were then taken of these apples after shimming at the isocenter in 20 channel receive array coil using T1 or T2 weighted spin echo sequences followed by image-based regional T1 and T2 computations from several sets of multi-TR or multi-TE image acquisitions.

Using a Hologic Mammography system, with intrinsic Ag or Rh filter and an added extrinsic iodine solution filter (Omnipaquet 350, 4x dilution) soft X-ray images were obtained of sliced apple samples (15-20 mm thick). The central core was preserved for core vs cortex mineral absorption comparison. The mAs was set at 16 and the kVp was varied at 25, 30.35 and 39 without any grid at 15cm x 15 cm collimation with large focal spot. The apple varieties ranged from McIntosh, Fuji, Red Delicious, Gala and Golden Delicious and were obtained from pre-selected, local farmers.

## Results

Figure 1. Left: Apple before (top) and same apple after 24 sec microwave at 3T ASRC MR unit (by T1-weighted image) showing displaced minerals (iron presumably)

Middle: X-ray of 3 cm thick apple; less x-ray penetration exaggerates quantum noise at mineral deposits (K is filtered out by L-edge of iodine filter)

Right: X-ray of 2 cm thick, same apple piece; better x-ray penetration shows mineral distribution similar to MRI (perhaps iron since K-absorption avoided)

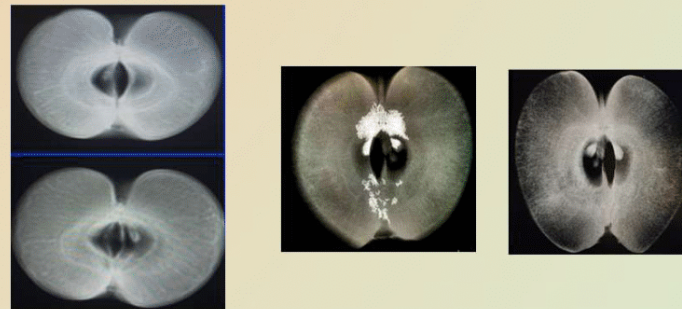


Figure 2. Comparing 39 kV/16 mAs (left) the scatter has darkened the edges, skin of apple etc; the lesser iron content cannot be seen, the white arrows

While the 25kVp/16 mAs (right) with less scatter shows iron at the periphery of apple (although we now know inside makes what apple is good for)

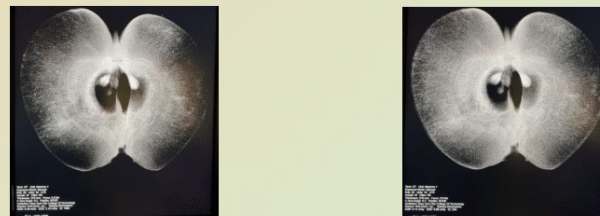
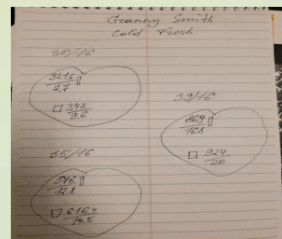


Figure 3. Sample Of Recording used to generate Table 1 and Table 2



## Discussion

The use of the silver filter attenuated the incident x-ray beam such that photons of the k-edges of all the minerals except iron, copper and manganese were removed. Therefore, the X-ray images obtained perhaps only showed the location and movement of those elements mentioned above. The grid was not used to retain all the information relating to the scatter.

(1) Air SD/SI% (Covariance) for Ag + Iodine filtered beam < 1% and becomes even lower for higher kVp. Hence iodine K-edge at 33 and L-edges at 4-5 keV have homogenized the beam to constitute more mid-band energies and truncating both low and high energy tails causing less scatter in air.

(2) The apple varieties after a week-long drying also act as extrinsic filters and absorb 6-8 keV components due to Fe, Mn and Cu k-edges that exist as biometals in apples.

(3) The SD/SI% is lower at core compared to cortex indicative of greater filtering at core perhaps supporting our hypothesis that core is more rich in metals than cortex, particularly after heat shock.

Fuji may have the highest concentration of biometals, as we see that SD/SI% is minimum for Fuji.

Week-long Dried Apple Variety Used as Absorber	Covariance of Iodine + Ag Filtered, 30 kVp X-ray beam in various apple cortex (%)	Covariance of Iodine + Ag Filtered, 35 kVp X-ray beam in various apple cortex (%)	Covariance of Iodine + Ag Filtered, 39 kVp X-ray beam in various apple cortex (%)
Granny Smith	1.04	1.0	1.02
Fuji	0.68	0.67	0.68
Gala	0.96	0.71	1.14
Air + Iodine Filter	0.9	0.8	0.7

Week-long Dried Apple Variety Used as Absorber	Covariance of Iodine + Ag Filtered, 30 kVp X-ray beam in various apple cortex (%)	Covariance of Iodine + Ag Filtered, 35 kVp X-ray beam in various apple cortex (%)	Covariance of Iodine + Ag Filtered, 39 kVp X-ray beam in various apple cortex (%)
Granny Smith	1.9	2	2.06
Fuji	1.2	1.2	1.3
Gala	1.28	1.28	1.24
Air + Iodine Filter	0.9	0.8	0.7

## Conclusion

Iodine K-edge at 33 and L-edges at 4-5 keV have homogenized the beam to constitute more mid-band energies and truncating both low and high energy tails causing less scatter in air. The apple varieties after a week-long drying also act as extrinsic filters and absorb 6-8 keV components due to Fe, Mn and Cu k-edges that exist as biometals in apples. The SD/SI% is lower at core compared to cortex indicative of greater filtering at core perhaps supporting our hypothesis that core is more rich in metals than cortex, particularly after heat shock.

X-ray and MRI can be used to localize metals and track their reorganization in organic matter. However, more detailed experiments with larger sample sizes and a diverse variety of apples are needed. This is important in tracking the consequences of global warming as well as metal redistribution in human tissues in diseases.

## Acknowledgment

❖ We would like to acknowledge valuable funding provided by the NYCCT Undergraduate Research Program.

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- X-ray Absorption Edges - [http://skuld.bmsc.washington.edu/scatter/AS\\_periodic.html](http://skuld.bmsc.washington.edu/scatter/AS_periodic.html)



# Green Roof Media Parametric Study

Student Researchers: Yehya Elfgeeh & Victor Arenzana

Faculty Mentor: Ivan L. Guzman, PhD, P.E.

Department of Construction Management & Civil Engineering Technology  
New York City College of Technology, The City University of New York (CUNY)



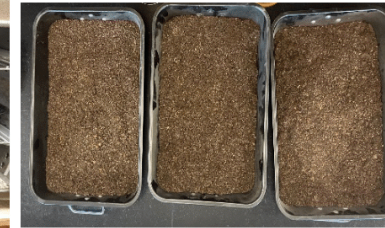
## Abstract

Green roof farms have contributed to deliver the benefits of the suburban environment to the urban setting. By installing green roofs, commercial buildings can reduce the amount of energy needed to heat/cool the building. However, existing buildings have a limited capacity to withstand the additional loads imposed by a green roof which include green roof infrastructure, growing media, and vegetation. These additions need to be light weight, so buildings can carry them without adversely affecting the structure. Adding repurposed textile to lightweight engineered soil can modify the hydrogeological properties of the soil without compromising its weight. The project focuses on adding recycled textile to green roof media (soil), and studying its effect on the properties of maximum media density (MMD), water content and hydraulic conductivity of the host soil. In previous findings, adding textile fabric (3% by weight at an aspect ratio of 1:1) to lightweight engineered soil resulted in a significant change to the hydrogeological properties of the host soil. During the ongoing study we are mixing lightweight engineered soil with similar repurposed textiles at an aspect ratio of 4:1 and recording any changes in said properties. The effects of aspect ratio on hydrogeological properties will be documented and compared to previous findings as part of a broader parametric study

## Methodology

### Day 1:

1. Percent textile by weight (1.0%, 2.0%, 3.0%, 3.5%) at an aspect ratio of 4:1 (2' x 0.5") were added to the soil.
2. Soil was then compacted in one layer with 6 blows using a Modified Proctor Hammer.
3. Soil specimens were submerged in a bath for 24-hours with weighted steel plates to prevent soil from swelling.



### Day 2:

1. After 24-hours soil specimens were placed on wood stands to drain for 120mins. At which time, the Maximum Media Density (MMD) was recorded. MMD is the weight of the soil used in dead load calculations during a structural analysis.
2. The water permeability at MMD ( $k_{mm20c}$ ) was determined by conducting a Hydraulic Conductivity Test.



## Results

The results show that the addition of recycled textile at the levels tested, significantly increased the soils moisture content by approximately 30% (49 percent change), without compromising the soils weight. This has the effect of increasing the amount of water available for plant growth, thus, potentially reducing the amount of required irrigation in a commercial roof farm. The other parameters evaluated, MMD and permeability, did not change significantly due to the addition of textiles in the quantities tested herein.

	Specimen (%Tex)			
	1%	2%	3%	3.5%
MMD (pcf)	76.83	76.20	82.94	78.07
$K_{mm20c}$ (in/s)	$2.34 \times 10^{-3}$	$3.31 \times 10^{-3}$	$1.8 \times 10^{-3}$	$2.02 \times 10^{-3}$
Moisture Content (%)	72.36	72.82	81.69	90.9

## References

- Guzman, Ivan L., and Sandra M. Torres. "Use of Repurposed Fibers to Decrease Hydraulic Conductivity without Compromising Load Restrictions in Urban Roof Farms." *Geo-Congress 2019: Geoenvironmental Engineering and Sustainability*. Reston, VA: American Society of Civil Engineers, 2019.
- ASTM International. (2015). *Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems*. West Conshohocken, PA. Retrieved from [www.astm.org](http://www.astm.org)

### Day 3:

1. Soil was transferred into aluminum pans and placed in an oven to dry at 220-250 °F for 24 hours.
2. The weight of the specimen was measured after taking out of the oven and the moisture content (w%) was calculated.

# Reviewing the Curricular Content of the Communication Design Program and Determining the Pathways to Industry Careers

Undergraduate Researchers: Frank Lema (COMD), Billal Badar (CST), and Abdullah Momin (CST)  
Professor Daniel Wong, Communication Design  
City Tech, CUNY

## Introduction

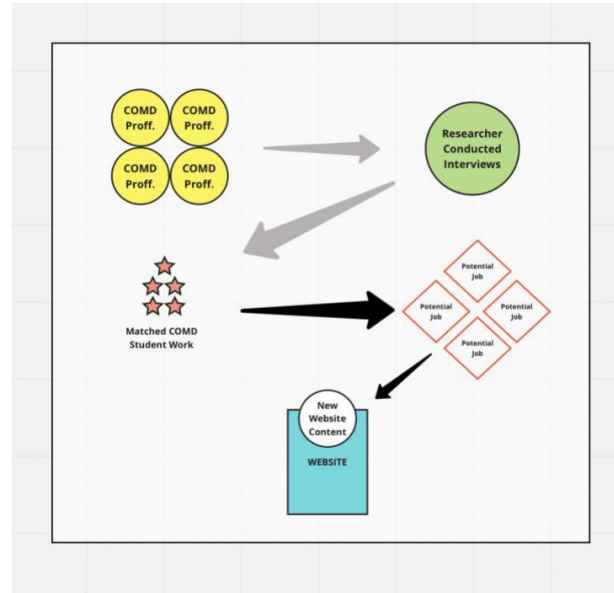
We are currently search engine optimizing the COMD marketing website, by developing new, relevant content. We looked at highly ranked communication design programs websites. We considered investigating careers options relevant to COMD senior students as well as aspiring city tech students. To gather more and to get insight in potential careers, the research team developed the research focusing on interviewing current COMD professors. We plan to interview professors, get their opinions/ experiences, connect those with their courses taught and how they might relate to a successful student.

## Methods

After identifying the research topic, the researchers designed a questionnaire that would highlight the potential careers and skills overall. Next, the team reviewed the sophomore COMD course listings to select professors of interest. With the use of zoom researchers were to meet with professors if unavailable to conduct the interview in person. Finally, the questionnaire was to be filled out by each research member, With the use of miro the team had a perfect visual layout to present the overall idea behind the project.

## Results

Upon successfully completing the research in this semester, we will begin to understand the interests and backgrounds of the instructors, which we hope will help us to guide the students into potential careers. The outcomes will be the development of content for the website which is interesting to both the students and structured in a manner which is search engine optimized. We will show potential students how courses combinations lead to specific jobs.



## References

Rowley, Jennifer. "Promotion and Marketing Communications in the Information Marketplace." *Library Review*, MCB UP Ltd, 1 Dec. 1998, <https://www.emerald.com/insight/content/doi/10.1108/00242539810239543/full/html?mobileUi=0&fullSc=1&mbSc=1>.  
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## Conclusion

Prospective students, and those who come via the marketing efforts of this website will start to understand the courses they should take with a clear view of their goals. New students will be interested in joining the program, and the COMD marketing website will have fresh new content.

## Further Information

<https://citytech.design>  
(Where content will be uploaded into.)  
<https://moz.com/blog>  
(More in depth info on search optimization.)  
<https://www.bls.gov/>  
(Inside look into COMD job market. )

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