JCCC STEM

Poster Symposium

April 25, 2024

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Welcome to the STEM Poster Symposium hosted by Johnson County Community College (JCCC)! We are proud that your interest in STEM has brought you to our campus to share your work, and thankful that we are able to provide a venue to support your personal and academic growth as you plan your future and set off in search of the experiences that will shape your life.

Since 1969, JCCC has been building a tradition of academic excellence, with a strong faculty and staff who are committed to creating an environment for students, scholars, and community members at-large to engage in meaningful learning experiences. This year's STEM Symposium is another chapter in that storied legacy, and we are so pleased to have you here as a part of our continued drive for academic excellence! We at JCCC are proud of the work that you will display on our campus, and we thank you for sharing that work with us through the Symposium.

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JCCC STEM Poster Symposium
April 25, 2024

PROGRAM

9 a.m.	Opening Remarks for Session 1 by Dr. Gurbhushan Singh, Vice-President of Academic Affairs / CAO, JCCC
9–10:15 a.m.	**Session 1**
10:30 a.m.	Opening Remarks for Session 2 by Dr. Judy Korb, Interim President / CEO, JCCC, and Dr. L. Michael McCloud, Executive Vice President / Provost, JCCC
10:30–11:45 a.m.	**Session 2**
Noon	Opening Remarks for Session 3 by Dr. Mary Wisgirda, Dean of Mathematics and Science, JCCC, and Chris Davis, Vice-President, PGAV Architects
Noon–1:15 p.m.	**Session 3**
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Note: Poster numbers intentionally skip from 23 to 34 in this session.

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Abstracts

Abuhamda, Jannah. Does the Integration of Coding, Problem Solving, and Computational Thinking Enhance Intelligence Among Middle School Students?
The papers examine how middle school kids' cognitive development is impacted by coding, computational thinking, and difficult problem-solving exercises. They look at how coding clubs' computational thinking activities enhance students' mathematical and spatial reasoning capacities. The studies also examine how students approach problem-solving in creative coding tasks, emphasizing the value of both technical proficiency and creativity. Additionally, the study looks at how students use programming environments such as Alice 2.2 to work on challenging problems and highlights the importance of social contexts in the development of skills. Overall, the results highlight the advantages of include computational thinking and coding exercises in middle school curricula to improve students' cognitive capacities and problem-solving abilities.

Aitken, Olivia. What is the Source: Finding Antibiotics.
Today, we use antibiotics to treat infections caused by bacteria. Antibiotics have become a main staple in the medical industry when used to treat infections that potentially lead to death and disease. The discovery of antibiotics has helped us greatly cure infectious diseases worldwide. The problem today is antibiotic resistance. That is when bacteria slowly evolve to create a resistance to antibiotics, making the antibiotic not effective anymore. This is why we need to keep discovering antibiotics to keep up with the bacteria that have resistance. Today we use samples of dirt to find bacteria that produce chemicals we can use as antibiotics. This is the serial dilution technique. In this project, I used the same technique to see if I found any microbes that had any inhibition to certain bacteria taken from my dirt sample. The microbe I discovered inhibits a handful of bacteria. I named my microbe #3 as it was the 3rd microbe I pulled from my dirt sample. I discovered that #3 did have good inhibition with *Mycobacterium smegmantis*, *Enterobacter aerogenes*, and *Staphylococcus epidermidis* just to name a few. In this presentation, I will explain my work and discovery of the serial dilution technique that I have been working on this semester.

Albahra, Mawaddah. Candidate #1.
This project as made for the search of antibiotics, resulted by the increase and threat of antibiotics resistance. The search started in Overland Park, KS, where a soil sample was collected. This sample was serially diluted with water and placed on agar plates. 4 candidates were first chosen, and then were screened against ESKAPE pathogen relatives. Some inhibition was shown on the *Pseudomonas putida* by candidate #1, and on the *Staphylococcus epidermis* screening plate by candidate #4. This resulted in the battle of the last two candidates. After more screening and experimentation, candidate #1 was chosen as the top candidate for inhibition. It was then found to be a Gram + spore formulating rod bacteria.

Albright, Parker. Adapting to the Future: Examining LLMs and AI for Education Advancement.
In this presentation, I will be exploring the multifaceted applications of LLMs (Large Language Models) and AI within educational contexts. The advancements in this realm present vast opportunities for enhancing student feedback, accelerating the learning process, providing invaluable tools for both educators and students, and easing the burdens on the teachers in large class sizes. Given the budding stage of this field, it presents an exciting frontier for research and development, holding the promise of large shifts in the paradigms of learning and education in the foreseeable future.

Alderman, Iain. Rocket Launch and Lan d Systems Modeled through Dynamical Systems.
Rockets, especially when launching and landing, have many varying components that must be considered. These range from the velocity, acceleration, and even the mass. Often times, in order to model this, a dynamical system is constructed. In this poster, we shall explore some of the ways in which these dynamical systems are constructed.

Ampofo, Jessica. The Hunt for Antibiotics.
Over the course of decades, the hunting of Antibiotics has been exceedingly unsuccessful. In a world where we are advancing in technology every single day, the only thing that seems to be hidden from the world is the production of new antibiotics. The unfolding of antibiotic-resistance microorganisms is a serious health matter and for that reason many renowned have used soil microorganisms in hope of finding the next Antibiotic that can help save world. My project describes the discovery and features of an antibiotic producing bacteria found in the soil on 68th St. Overland Park, KS. My soil has gone through serial dilution and after two successful master plates, a promising unknown candidate was selected. My unknown bacteria which I called 8 (my lucky number) was tested against the safe ESKAPE relatives, it showed great inhibition against *Enterococcus faecalis* and *Pseudomonas putida*. It's a Gram-positive spore forming rod and it also inhibits the growth of a test strain; *Bacillus subtilis*. I chose this unknown bacterium because of its ability to inhibit the growth of other microbes. Currently, my unknown bacterium is going through PCR sequencing.

Antonowich, Olivia. Antibiotic Resistance.
Antibiotic resistance is a problem that has become a public health issue and is on the rise. As the use of antibiotics increases, the chances of resistance to these antibiotics also increase, leading to the spread of these mutations. This experiment is designed to discover new antibiotics that come from the soil. Soil presents a diverse range of microbes and is widely available, making it an ideal and accessible source for harboring antibiotics. This is done by collecting soil, performing serial dilutions, isolating colonies on a master plate, screening them against several safe relatives, and finally isolating potential candidates on a streak plate. This allows species of bacteria that exhibited a zone of inhibition to be identified and tested for their antimicrobial abilities. Finding new antibiotics combats the rate at which resistance is spreading and is a necessary advancement in an ever-changing and adapting world.

Atta, Akoua Ange Rebecca. The Search for Antimicrobials.
The increasing number of antibiotic resistant bacteria is growing. By doing this experiment, our main objective is to study different soil microbes to discover antimicrobials. To achieve this goal, we serially diluted soil samples, selected candidates for further testing, and screened the candidates with the safe ESKAPE relatives. Through PCR testing, gel electrophoresis and sequencing the soil microbe was identified. We report that the soil contained antimicrobial producing organisms.

Baghdadi, Selma. Tiny Soil Experiment.
This project aimed to isolate bacteria from soil samples collected to determine whether they produce antibiotics and maybe discover novel antibiotics. Antimicrobial resistance has an impact on our daily lives since certain bacteria that cause disease have become resistant to antibiotics. To identify the bacteria in the soil sample and determine whether it contained antimicrobials, a number of processes were carried out. The processes are as follows: serial dilutions, master plates, screening of candidates, PCR and sequencing.

Bailey, Katharine. Searching for Antimicrobials from Kansas Soil.
The objective of this study is to find antimicrobials from Kansas soil. Serial dilutions were used to find zones of inhibition indicating antimicrobial production. More tests were done to identify the bacterial organism which included performing PCR, gel electrophoresis, sequencing and metabolic tests.

Banks, Kate. Carcinophage: Developing a Protocol for Screening Bacteria for Co-metabolic Biodegradation Potential.
Trichloroethylene (TCE) is a chemical used for several industrial purposes including degreasing metal equipment, dry cleaning, as well as making refrigerants, and batteries for electric cars. Since TCE breaks down very slowly, it stays in the environment for a long time and easily passes through soil and can accumulate in the groundwater. The Centers for Disease Control and Prevention describes TCE as a known carcinogen, and the National Cancer Institute has found that prolonged or repeated exposure to TCE causes kidney cancer and has been associated with an increased risk of non-Hodgkin lymphoma and liver cancer. Previous research has shown that specific stains of *Pseudomonas putida* and *Pseudomonas cepacia* are able to breakdown TCE when induced by toxic compounds, such as methane, phenol, and toluene. The goal of this experiment is to develop a simple protocol that future students can use to screen soil isolates for bioremediation potential. Through research and experimentation using TCE as the sample contaminate, a broader protocol was created that can be used with other contaminants that can be measured using gas chromatography mass spectroscopy. The protocol developed can be replicated using the tools available in the microbiology laboratory by any student with a basic understanding of aseptic technique and chemistry.

Barger, Alyssa; Chand, Megha; H.J.C.; Kesavan, Riya; Perez, Megan; Roman Rojas, Arien; Seaberg, Mason; Webb, Zack. The Next Flint is Here?!
This research poster, presented as part of an honors forum, explores the connections among social and environmental justice, science communication, and accessibility to clean water, beginning with the story of the ongoing water crisis in Flint, Michigan. Working in pairs, students applied lessons from Anna Clark's "The Poisoned City" to their choice of tests performed on water samples collected from locations they chose within an 65 km radius of Kansas City. Taken together, students' work highlights the power of community action and engagement, equitable policy development, and the importance of community awareness.

Barker, Dylan. N-body Dynamical System to Describe Spiderwebs.
This paper details dynamical systems that describe the formation of spider webs. Like many things in nature, the golden ratio is present in spider webs due to its structural enhancements as well as central configurations that have masses lying at intersection points. Learning about things as small as spider webs have furthered our understanding of things as large as the rings of Saturn.

Begin, Avery. The Antibiotic Capabilities of Soil Microorganisms.
Antibiotic resistance remains a persistent challenge as bacteria evolve to withstand the effects of antibiotics designed to combat them. The earth's soil, teeming with billions of microorganisms, including bacteria, serves as a vast reservoir. Cultivating bacterial colonies from soil samples allows for the identification of those capable of producing chemicals that inhibit the growth of other bacteria. Colonies exhibiting significant inhibition zones represent promising candidates for antibiotic development. A colony named "Killa," was isolated from a silty soil sample in Gardner, Kansas. Through serial dilution, "Killa" demonstrated potent inhibition against other colonies. Further testing revealed its ability to inhibit *Escherichia coli* and *Staphylococcus epidermidis*, suggesting its potential as a robust antibiotic candidate.

Beziane, Mohamed. Bacterial Resistance.
This semester's project revolves around delving into fundamental microbiology procedures with a focus on harnessing the potential of soil microbiota to extract antibiotics. Our objectives include mastering essential techniques such as PCR application, comprehension of antibiotic resistance mechanisms, and antibiotic screening procedures. Starting with the foundational stage, we started by collecting soil samples and implementing serial dilution techniques. mastering these techniques gave a better aspect in creating a master plate to select potential antibiotic-producing candidates. Subsequently, we started the antibiotic screening process to locate candidates capable of inducing a zone of inhibition. Additionally, we practiced various staining techniques, including simple staining, gram staining, fast acid, and spore staining methods. Upon mastery of these techniques, we proceeded to prepare a streak plate with our potential candidate. Following the incubation period, we conducted PCR tests. There are few other tests to perform before the end of this semester. These tests will help us to identify the antibiotic our candidate is making. The step by step techniques learned in this course not only aids in comprehending antibiotic resistance mechanisms and antibiotics, but also equips us with a diverse skill set crucial in the field of microbiology.

Bishop, Hope. Antibiotics in the Soil.
To find a potential antibiotic, I conducted a soil experiment. This research is important to find potential antibiotics to block ESKAPE pathogens, but we used safe relatives to conduct this experiment. I took a sample from the soil in my front yard and performed multiple tests and experiments. My first technique to get a good start on this was to serial dilute my original soil sample. I made four dilution plates and created eight screening plates. Each screening plate had a different candidate from my dilution plates, to see which will inhibit something the best. My final screening plate that had *Bacillus subtilis*, which is a safe relative of *Bacillus anthracis* that causes anthrax, had a great zone of inhibition. To further extend my research of my microbe, I used the Gram Staining method to see what it really was. I reviewed my results, and they showed that I was dealing with a spore forming microbe. I will conduct a spore stain to get further information about this microbe.

Blaine, Madison. Sheet Metal Lamp.
The versatility of sheet metal isn't limited to just these things. Instead of wasting good sheet metal left over from a different manufactured product, this project aims to show how this metal can be turned from trash into luminous treasure. The goal of this project is to fabricate a lamp and maximize the amount of metal used while minimizing waste by fitting as many lamp cutouts onto the sheet.

Bowman, Amaris. The Hidden World of Antibiotics.
In recent years, chemical compounds called antibiotics, which have been used to fight against bacterial infections and diseases for decades, have become ineffective. The emergence of antibacterial resistance poses a significant challenge to healthcare providers, since it limits treatment options and increases the likelihood of infections becoming untreatable in patients. In order to address antibiotic resistance, this project aims to investigate soil, an environment that contains a variety of bacteria, in order to aid future research into the discovery of a new antibiotic. In this research project, a gram of dirt was collected from an undisturbed site and placed through a series of dilutions to detect bacteria that produce antibiotics. Through a process known as screening, four candidates were selected and put to the test. In this process, all 4 candidates are placed on top of 6 different agar plates contaminated with safe relatives, pathogens in the same species as ESKAPE pathogens, but are safe to use in a lap setting, to see if the candidate will inhibit, or kill, the pathogen around it with antibiotics. The following week, the candidate known as "4" showed the most inhibition against 2 safe relatives, compared to the other 3 candidates. In the end, it is safe to assume that with candidate 4 creating inhibition against *Enterobacter faecalis* and *Acinetobacter baylyi*, it would be a good candidate to use for further research in finding the next antibiotic.

Brewer, Teighlor. Studying with Music.
Studying with music can affect your brain in several ways. Here are a few: Enhanced Focus: For some people, music can help create a conducive environment for studying by masking background noise and promoting focus. Mood Regulation: Music has the potential to affect mood, which in turn can influence cognitive processes like memory and attention. Listening to music you enjoy can help regulate mood and reduce stress, which may positively impact studying. Memory Association: Certain types of music may become associated with studying, creating a sort of "cue" that triggers memory recall during exams or when revisiting material. Distraction: On the flip side, music with lyrics or a fast tempo can be distracting for some individuals, making it harder to concentrate on studying tasks. Overall, the effects of studying with music vary from person to person, so my literature review aims to explain research on how listening to music can effect the brain, learning, and memory applications in students with and without learning disabilities like ADHD, for example.

Brown, Alexis; Ontiberos, Alexis. Alanine-Phenylalanine Dipeptide Synthesis and Antimicrobial Evaluation.
Antimicrobial peptides (AMP), due to their broad inhibitory effects on common pathogenic bacteria, are a growing area of interest within the pharmaceutical industry. In this project, two amino acids, alanine and phenylalanine, will be coupled in order to produce a dipeptide. Protecting the N-terminus of the phenylalanine with a tert-butyloxycarbonyl (BOC) group and the C-terminus of the alanine as a methyl ester allows only one type of dipeptide to form. The antimicrobial activity of the synthesized dipeptide will be evaluated and compared to other dipeptides currently understood to have antimicrobial activity.

Brown, Kristina; Boyce, Lauren. Effects of Freeze Drying on Diet Coke.
Diet coke was extracted into methylene chloride. A TLC was performed with no significant results. A sample of the extraction was then freeze dried over the course of 2 weeks. The sample was then rehydrated and extracted into methylene chloride again. A GCMS was taken of the initial extraction and the rehydrated extraction to compare the differences in composition. Initial results show that benzoic acid and caffeine stand out as present in both before and after freeze drying. Additional results including differences in the spectra are being analyzed and will be discussed.

Bryan, Sadie. The Search for Antimicrobials.
In the last 30 years there has been little to no progress in antibiotic research. The purpose of the research outlined below is to help bridge the gap in antibiotic resistance developing in pathogen microbes and the antibiotics currently available. Our contributions to these efforts aim to identify and isolate relevant antibiotic microbial species.

Burgett, Mary. The Mutation of the PETase Enzyme.
Plastic is piling up in the ocean, our backyards, everywhere. While this problem can be helped via recycling, not all plastic can be recycled. PET, the classic #1 plastic, can be recycled, but only to a certain extent; there will always be some waste leftover. The Life Sciences Department at JCCC has launched a study on an enzyme, known as PETase, that can digest PET into into smaller molecules. Though the enzyme works slow, JCCC is researching different changes that can be made to the genetic code of the enzyme, to see how to improve the efficiency of the enzyme. The subject of this particular trial was the change of the 241st amino acid from Asparagine to Threonine. The PETase with this gene mutation was acquired via a site directed mutagenesis reaction, outsourced to a different company. This genetic code was input into *E. coli* bacteria for further production, and this bacteria was isolated, genetically sequenced, and purified. The resulting enzyme will be tested for functionality and compared with the original PETase, which functions poorly unless at high temperature and high pH, at which point it functions slightly better. Any results are good results, as any research is good research, and simply knowing more about the enzyme will pave the way for the safe degradation of plastic in the future.

Burtnett, Annabelle. Unearthing Antibiotic Potential: Exploring Urban Soil Microbial Communities.
The fight against antibiotic resistance is ongoing and seemingly without end. Since 2000, only 15 new antibiotics have been approved by WHO for use against deadly pathogens that continue to evolve beyond our ability to treat. Most antibiotics are discovered within soil and fungi samples, as they give the bacteria an advantage against competing neighbors. Soil collected from The Quarters apartments in Lawrence, KS was diluted and grown in the lab resulting in 17 initial candidates for antibiotic excretion. These were then screened against the 6 nonpathogenic relatives of the ESKAPE pathogens. While most of the candidates failed to exhibit zones of inhibition when grown alongside the relatives, one showed varying degrees of resistance suggesting that it is excreting antibiotics. In addition, this species is fast growing, making it easily isolated and cultivated for further testing and research.

Butt, Aamish; Nwaege, Jennifer. GCMS of Powerade.
The poster is based on the sports drink Powerade (Mountain Berry Blast). We have done the thin layer chromatography on the liquid extract. Moreover, we have done GCMS on the extract and then freeze dried it. Then we proceeded to do extraction and GCMS of freeze dried liquid and then we did analysis of GCMS data. The purpose of this research was to identify how much organic material stayed inside of the sample. This was achieved by various methods such as GCMS, freeze drying, and methyl chloride extraction. From the results received, the data is very similar to the actual data of the Powerade drink. However, the remaining data will be discussed later.

Cafer, Amber. Discovery of Potential Antibiotic Bacteria.
Despite antibiotics being absolutely necessary for human and animal health, there is an ongoing crisis with a lack of discovery of new medications. Along with this crisis, many microbes are becoming resistant to currently known antibiotics. The hope for this experiment was to discover new antibiotics that the microbes will not have any resistance to. This was done through a soil sample in Kansas near Clinton Lake. In this experiment, the sample was diluted and screened for antibiotic properties. There were a few likely candidates for antibiotic properties that may be useful for future experiments.

Carruth, Ashlyn. Soil Dilution.
A few soil samples were gathered and brought through many tests to determine what could be obtained from this soil. Using soil dilution, I was able to create colonies using media plates. These plates grew with bacteria, and we spent the rest of the semester trying to test for antibiotics. The search for new species of antibiotic-producing bacteria continues to be one of the most promising avenues for finding the next generation of antibiotics (Hutchings,Truman, & Wilkinson, 2019). In this presentation, I will take you through the steps I have taken to get my end results.

Cerra, Lilianna. Unearthing Antibiotics: The Discovery of LGC24E1 from Soil.
With the developing problem of antibiotic resistance worldwide and the lack of research funding in this particular field, discovering new antibiotics is crucial. This research aims to isolate a strain of bacterium from a soil sample that has the ability to inhibit other strains of bacteria, potentially revealing a new antibiotic. To begin the experiment, a soil sample was collected and cultured on agar plates. Subsequently, bacteria that grew and exhibited the ability to prevent other bacteria from growing around them were transferred to another plate to be studied. Testing against various bacterial strains revealed that the selected candidate, LGC24E1, demonstrates inhibitory abilities against *Staphylococcus epidermidis* and *Bacillus subtilis*. Further investigation will involve comparing the DNA sequence of LGC24E1 with millions of known bacterial sequences to further study its characteristics. With this research, it is hoped to be able to contribute to finding a potential solution to the problems antibiotic resistance has displayed.

Chapple, Aaliyah. Using Soil Samples to Produce Potential Antibiotic.
Soil samples have been very helpful because the bacterial communities are very diverse and competitive, because of this soil samples help find antibodies for ESKAPE pathogens. In class, we experimented to see if we could find any candidates that tested positive for any safe ESKAPE relatives. For this experiment, I collected a soil sample from the front yard of my home in Olathe, Kansas. The soil sample that I collected had a silty texture and was a medium brown color. To estimate the sample's concentration, I used serial dilution. After allowing the agar plate to grow for forty-eight hours I discovered twelve different colonies across multiple different agar plates that might be good candidates for antibacterial screening using the serial dilution method. I tested these twelve candidates against the ESKAPE relatives, majority of these candidates did not test positive. However, I had one candidate that tested positive for two ESKAPE relatives whom I named Barack. This candidate tested positive for *Escherichia Coli* and *Acinetobacter Baylyi*. I then made a streak plate for this candidate and discovered that the morphology is smooth, flat, and round with an off-white color.

Charcut, Jeffrey. Dynamic Electric Circuits: Modeling and Analysis Using Differential Equations.
Dynamic electric circuits are circuits that contain at least one type of dynamic component such as capacitors or inducers. By utilizing differential equations, an engineer can predict the behavior of an RLC circuit over time with specific parameters. The ability to mathematically model different parameters allows engineers to build an RLC circuit to the exact specifications needed with the need for numerous test circuits.

Chelanga, Fridah. Creating New Antibiotics.
Antibiotic resistance is one of the problems we face in the fight against bacteria. Replication creates mutations in the cells over time, which creates resistant cells. The antibiotics kill all the sensitive cells, leaving behind the resistant cells, which take over the cell population. Over time, antibiotic-resistant organisms have evolved, and the medical field is running out of safe and effective antibiotics. In search of new antibiotic-producing bacteria, soil microbes have yielded majority of the antibiotics we use today. In my new research, I collected a sample from Milton Roy's lawn on February 1. I did a serial dilution to create a number of countable bacteria colonies. The plate with the dilution factor 10^-4 and 10^-3 created too numerous to count bacteria. Plate 10^-5 created 1.2*10^6 bacteria colonies per gram of soil. Out of the three plates, I had 12 potential candidates. I made a master plate for my potential candidates to separate them from the other bacteria colonies from the crowded plates. After growing the bacteria on my master plate, I screened them against all five escape-safe relatives. Candidate 4 showed inhibition against *Pseudomonas pituda* and *Enterobacter aerogenes*. I created a streak plate for candidate 4 to determine if it's pure and uncontaminated for PCR. I collected a sample of my pure bacteria for PCR, and I am yet to know the results. The next step will be to prepare my bacteria sample for DNA sequencing and visually inspect the cell's DNA on a chromatogram. Then perform a biochemical test to identify the bacteria.

Clark, David. Lamp Project.
Whether you realize it or not, sheet metal is everywhere. From car bodies to roofs for buildings, plane wings to medical tables, and much more. Sheet metal is a critical aspect of almost everything we do, thanks to its versatility, relatively low cost, durability, environmentally resistant and rapid production of parts. Because of this, it pays to understand what exactly it is, where it comes from. Sheet metal is metal formed into thin, flat pieces, usually by an industrial process. There are many different metals that can be made into sheet metal, such as: aluminum, brass, copper, steel, tin, nickel, and titanium. For decorative uses, some important sheet metals include silver, gold, and platinum. These metal sheets are processed through different processing technologies which are, mainly cold rolling, hot rolling, and sometimes hot dip galvanizing. Which are then manufactured by cutting, forming, and joining. The measurement is usually sort by gauges, which are specific thickness form a range between 0.018'' to 0.250'' thick. There are drawbacks in using sheet metal, such as, the high initial investment is required to acquire the necessary equipment and tooling, unsuitable complex designs that results in higher cost and production. This information can be found in Wikipedia and at https:www.servicesteel.org. With the lamp project that I am presenting there are all the advantages that sheet metal has to without the disadvantages that normally comes with it. In this simple design there will not be allot of tooling involved. It also, has low impact on environment because the process I am choosing to use is water jet technology. Because I tend to use an already established company with all the necessary equipment the cost should be lower for initial design. Also, because of the simplicity of the design, it does not require the use of a press. In conclusion, this lamp project would be a great low-cost solution to providing lighting for students at a more than reason cost.

Collins, Anna; Rico, Christine. Antimicrobial Peptide Synthesis- Broad Spectrum Possibilities.
Antimicrobial peptides occur naturally, contribute to the innate immune system and are found in each class of life on Earth. Researching new sources of antimicrobial drugs will likely help slow the effects of antibiotic resistant pathogens. This project will couple two amino acids to make a dipeptide. The goal is to produce only one type of dipeptide by using protecting groups on the N-terminus of one amino acid and the C-terminus of the other amino acid. This will reduce the number of products from four to one. The resulting product will be tested for antimicrobial properties.

Collins, Justin. Extraction and Separation of Antimicrobial Compounds Produced by a Strain of *Pseudomonas* Bacteria.
"Betty" is the working name of a bacteria collected by a JCCC microbiology student. It has previously been shown to inhibit tester strains of bacteria when grown competitively. Chemical extracts taken from these bacteria inhibit tester strains of both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions were tested for antimicrobial activity in broth. The results will be discussed.

Connett, Caden; Wersland, Karsten; Yeh, John. Freeze Drying Analysis of Cranberry Raspberry Juice.
In further exploration of the science of freeze-drying a cranberry raspberry juice cocktail was extracted using methylene chloride to separate the aqueous layer out and create a higher concentration of the non-polar compounds. This was then analyzed using gas chromatography, mass spectrometry, and thin layer chromatography. The initial data was collected, then the sample of cranberry raspberry juice was freeze dried. Once freeze-dried the sample was crushed up and mixed with boiling deionized water and cooled, once cooled it was again extracted using methylene chloride. Data was collected on this post freeze-drying sample for the three aforementioned tests. In comparison of the chemical make up of the sample before and after freeze drying, there were major differences of the compounds measured.

Cooper, Ashlyn. Searching for Antimicrobials.
Antibiotic resistance is when germs like bacteria defeat the drugs that are designed to kill them. Searching for the antimicrobials is finding the agent that kills or stops the growth of microorganisms. Throughout this semester we have collected soil to find zones of inhibition from the serial dilution plates from the soil. We have used master plates for further testing and determined stains. Our results can affect the community as we could potentially use our results to find new antibiotics or vaccines for infections. It also helps us detect diseases.

Courtney, Asilya. The Search For Antibiotic Candidates in Soil.
The Tiny Earth Network (TEN) allows for researchers around the world to explore the microbes that grow in soil. This is so that researchers can further the advancement of antibiotics. Soil is chosen because, of the highly competitive nature of soil, microbes produce chemicals that inhibit the growth of other microbes. In this Microbiology class I got to collect a soil sample and go through the process of serial dilution, antibiotic screenings, and transferring them to a master plate in search of antimicrobials. Next we did PCR and Gel Electrophoresis to do further testing on the antimicrobials that showed zones of inhibition against the safe relative tester strains. The safe relative strains were *Enterococcus faecalis*, *Staphylococcus epidermidis*, *Escherichia coli*, *Acinetobacter baylyi*, *Pseudomonas putida*, and *Enterobacter aerogenes*. If an antibiotic microbial is found from this research project this could further the studies of antibiotics and antibiotic resistance.

Cowell, Kaley. Sheet Metal lamp.
Sheet metal is everywhere around us, being used in our vehicles, refrigerators, buildings, AC units, etc. The list is endless, just take a look around yourself and you'll find many more examples. The goal of this project is to design a lamp that maximize the amount of lamps we can cut on a single sheet of sheet metal. This will allow us to mitigate the amount of sheet metal waste whilst manufacturing multiple lamps at a single time. This in turn increases efficiency and decreases wasted time and resources.

Croos, Aaron. Using Dynamical Systems to Predict Weather Patterns.
Predicting weather patterns is a multi-layer and multi-variable task that is made possible by dynamical systems. These differential systems generate models and vector fields that allow weather forecasters to predict atmospheric variables such as temperature, humidity, wind direction and velocity, surface pressure, cloud cover, and precipitation. This presentation is an analysis of such systems, and a breakdown of how they are defined.

Cunningham, Jamie; Cogswell II, James B; Dupriest, Preston. Odyssey to Europa: Was Arthur C. Clarke Correct?
The search for life beyond Earth has long fascinated humankind. Biological building blocks, such as amino acids, can form abiotically and have been found in meteorites and asteroids. However, the transition from building blocks to simple cells has only been seen on Earth – so far. Looking for life in other places has inspired this mission plan in which we explore Jupiter's moon, Europa, for signs of life. The spacecraft, Javelin, will launch from Earth and use an Earth gravity assist trajectory to reach Jupiter. In orbit around Europa, it will drop the Collaborative Ocean Objective Lander & Europa Seawater Tester (COOLEST) lander onto the surface of this moon's frozen oceans, depositing a pod to melt through the ice and reach the liquid water of Europa's ocean. Once there it contains the scientific instrumentation needed to study the composition of the ocean water, search for organic elements, and survey the ocean floor.

Demings, Cianna. Discovering Antibiotics from Northland Soil.
Antibiotic resistance is becoming a serious problem in the medical world. As antibiotics are used, some of the bacteria will die but others will develop a resistance to it which renders antibiotic treatment ineffective. It is important to find new antibiotics for this reason. The group of bacteria are collectively known as the ESKAPE pathogens. Since it is too dangerous to use these in our lab because we could unintentionally infect ourselves, safe relatives of the ESKAPE pathogens were used. Soil was collected from a lawn in Kansas City and serially diluted to identify the microbes in. Any microbes that showed signs of inhibition on serial dilution plates were isolated and screened against the safe relatives of the ESKAPE pathogens to see if they produce an antibiotic that inhibits their growth. Research was narrowed down to one specific microbe, named C11. This microbe showed inhibition of *Escherichia coli*, *Pseudomonas putida*, and *Bacillus subtilis*.

Dilley, Andrew. Sheet Metal Lamp.
What if the seemingly humble material of sheet metal holds the key to revolutionizing industries from automotive to aerospace? Throughout this project I used AutoCAD to design a lamp. The lamp is the flatten version that is ready to be laser cut, welded, and folded to reveal the final product. This particular lamp design allows for no welding needed. As soon as the lamp is cut out it can be folded into its final shape. Using this kind of design makes the production process quick and easy, in fact easy enough to allow for one person to construct the entire lamp by himself.

Dougan, Seth. Antimicrobials in Soil.
Antibiotic resistant bacteria have grown to become a major concern for medical professionals in both clinical and research environments; impacts of antibiotic resistance are widespread with effects reaching much farther than just patients in the acute care setting. Novel antibiotics still in use today were found in soil samples decades ago; this research is being continued today in the classroom setting by the Tiny Earth Project. This paper presents the steps of isolating bacteria present in soil and selecting potential candidates for antibiotic screening against the safe relatives of the ESKAPE (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacter spp.*) pathogens derived from said soil sample. Candidates producing zones of inhibition were selected to subculture onto a master plate. These microbes were tested against the safe relatives and a single bacterial colony was then selected as a prime candidate. Polymerase chain reaction (PCR) and gel electrophoresis were carried out to identify the bacterial genome and compare the candidate to known bacterial strains.

Draney, Jake; Vestal, John. Synthesis of a Dipeptide and Testing for Antimicrobial Activity.
This project will involve the production of a dipeptide using two amino acids. Both amino acids will be protected and a coupling reagent will be used to join these two peptides together in attempt to prevent unnecessary acid base reactions from happening, but also making a great leaving group to form the dipeptide. The protecting agents will be removed after the joining of amino acids which will result in a dipeptide. Work-up steps will be done to remove impurities and isolate the dipeptide. The dipeptide will be tested for antimicrobial activity after ensuring the dipeptide exists in the given sample using IR and NMR.

Duarte, Jason. The Journey of Finding an Antibiotic.
There is an unfortunate growth in microbes that are resistant to antibiotics. The purpose of this project was to find one more antibiotic that could be used in healthcare. In the microbial world, antibiotics are made to survive against other microbes. They prevent other organism from growing over them and ultimately overtaking them. Most antibiotics are found in the soil and since there is so much bacteria in the soil, the possibility of finding antibiotics is a little less than decent. In my Microbiology course, I studied a soil sample from Lawrence, Kansas. I isolated my candidate and screened for resistance to ESKAPE pathogens. In this presentation I will show what I encountered while studying my candidate. My goal was to verify if my candidate is able to contribute to healthcare by providing a solid antibiotic.

Dunn, Rayah; Lask, Megan. GC Mass Spec of Freeze Dried Pedialyte Analysis.
The experiment was done using Pedialyte. Organic and inorganic substances were separated using Methylene Chloride extraction. The separation was done on two different samples, one freeze dried and one that was directly from original packaging. Both samples were concentrated in 1mL of Methylene Chloride. Samples were then run through a GC Mass spec to determine if freeze drying makes an impact of what compounds are present. Compounds that have differences between pre and post freeze drying will be further analyzed to determine the significance, if any. Results will be shown and discussed during presentation.

Elbertai, Miriam. Per- and Polyfluoroalkyl Substances (PFAS) Removal from Wastewater Treatment.
Per- and polyfluoroalkyl substances (PFAS) encompass a broad group (roughly 15,000) of synthetic organic compounds used to make a variety of everyday products such as nonstick pans, cleaning products, and nail polish. Due to their stable carbon-fluorine bonds, PFAS exhibit exceptional thermal and chemical stability, rendering them resistant to degradation processes in the environment. Otherwise known as "the forever chemical" PFAS takes hundreds to thousands of years to break down in nature. This persistence, combined with their propensity for bioaccumulation and long-range atmospheric transport, has led to major environmental concern. PFAS has harmful effects on human health including developmental, reproductive, immune, and endocrine system dysfunctions, as well as potential carcinogenicity. Research has identified PFAS present in the bloodstream of 99% of the American population. PFAS has minimal regulations in the United States and is not treated in traditional wastewater plants. My research question is: Out of the minimal methods currently being studied on Per- and polyfluoroalkyl substances (PFAS) removal from wastewater treatment, which one is best suited for municipal wastewater treatment plants including factors such as effectiveness, efficiency, and environmental?

Everhart, Megan. Antibiotics Found Near a Parking Lot Inhibits ESKAPE Pathogens?
Antibiotic resistance is an issue around the world that Global Health Professionals are fighting. Effective treatments are becoming harder and harder to find in the effort to fight bacterial infections. Over the course of the semester we studied soil samples from local areas to help crowdsource new solutions for the growing problem of antibiotic resistance. I collected a loam soil sample nearby a parking lot in an apartment complex in Overland Park, KS. Then, over several weeks I isolated a colony, which I named 010, and biochemically tested to determine its species and relatives. Colony 010 proved to inhibit safe relatives of ESKAPE pathogens: *Staphylococcus epidermidis* and *Bacillus subtilis*. Colony 010 may be able to help treat Staph infections caused by *Staphylococcus* bacteria, and Anthrax caused by *Bacillus anthracis*.

Fanta, Feven; Nguyen, An; Kone, Aditi. Analysis of Pear Extract.
The molecules present before and after freeze drying were compared and analyzed. In both cases methylene chloride was used as the solvent. After the extraction of the organic layer 3 TLC's were taken, a chromatogram plot and GCMS report was obtained. In all 3 TLC's no spotting was observed as the concentration of the extract was low resulting in bands on the plate. In the GCMS of the extract before freeze drying 19 molecules were identified. After freeze drying only 5 molecules were identified in the extract. Only one molecule was present in both cases.

Farnham, Jim; Brandon, Kennedi; Orth, Roy; Strukel, Anne. Characterization of Chromoprotein as an Anti-Cancer Agent: Efficacy and pH Tolerance.
Cancer remains a leading cause of mortality worldwide, necessitating the exploration of novel therapeutic agents. Although their application has been minimally explored in this context, chromoproteins (CPs) have been considered for their theoretical potential as anti-cancer compounds. This study aims to characterize a specific chromoprotein's effectiveness as an anti-cancer agent across a cancer cell line and evaluate its tolerance to differing pH levels, an essential factor for its stability and functionality in physiological conditions. Building on the limited existing research on CPs in cancer therapy, our work involves the cultivation and purification of the chosen CP, followed by assessments of its cytotoxic effects on a cancer cell line. Furthermore, we investigate the CP's structural and functional stability across a range of pH levels, reflecting the diverse microenvironments encountered within the human body. Despite the challenges inherent in pioneering new treatments, we remain hopeful that further research will unveil the conditions under which chromoproteins (CPs) might exhibit beneficial effects against cancer cells. Our ongoing studies aim to explore the nuanced interplay between CPs and various cellular environments, including the impact of pH variability, to uncover potential therapeutic applications. While preliminary data have yet to definitively prove the efficacy of CPs in cancer treatment, the theoretical potential of these compounds provides a compelling basis for continued investigation.

Florentino, Allison. What's in the Office.
Antibiotic resistance is an issue for medicinal practice across the globe. Many antibiotic production companies do not prioritize or fund research for the potential discovery of new antibiotics. Soil contains billions of microorganisms, many of which have yet to be discovered. Soil also contains many antibiotic characteristics, which can be seen in the discovery of penicillin. The purpose of this experiment was to use locally found soil, examine the bacteria in the soil, and select and identify a bacteria candidate for further examination. A soil sample was taken from Lawrence, Kansas and a serial dilution was performed. The dilution yielded 25 candidates for further screening. Master plates were created for the 25 candidates to isolate the bacteria from the soil samples. From the master plates, I selected 6 candidates to screen against ESKAPE pathogen relatives. Candidate #3, Jim, showed the most promising as it yielded inhibition against *A. baylyi* and *E. Faecalis*. Jim showed gram negative rods when gram staining was performed. Polymerase chain reaction will be performed in order to hopefully identify Jim. Future examination of soils should continue to be performed in the hopes of aiding in the fight against antibiotic resistance.

Foil, Riley. Soil Antibiotic Candidate.
This semester in microbiology we have been gathering soil samples to isolate different strains of bacteria in hopes to find new antibiotics against safe relative strains of ESKAPE pathogens. By isolating a colony that has shown a zone of inhibition against safe relative *Acinetobacter Baylyi* , colony #8, I am able to perform PCR and get results on the genetic makeup of colony #8. The results of this show how to create antibiotics against this safe relative and can possibly help to create an antibiotic against its relative who is highly resistant to antibiotics, *Acinetobacter baumannii*.

France, Rylee; Eger, Alex. Synthesis of a Dipeptide and Investigation of Its Antimicrobial Activity.
Dipeptides can be synthesized for numerous purposes, one of the possible functions is as an antimicrobial agent. A dipeptide will be synthesized from two different amino acids. The N-terminus of one amino acid will be protected using a BOC protecting group while the C-terminus of the other amino acid will be protected by undergoing a Fischer Esterification reaction. The protected amino acids will then undergo liquid phase coupling using EDC to synthesize the final selected dipeptide. The lab synthesized dipeptide will then be tested and analyzed to determine if it exhibits any antimicrobial activity.

Fullbright, Patrick. Finding Antimicrobials.
Penicillin, an antibiotic, was found in the 1920's which was the start of natural occurring antimicrobials and was able to be used on humans to fight infections. Some bacteria have the ability to produce antimicrobials to better their chances of survival in a competitive environment. One competitive environment that is also readily available is soil. For this project, a soil sample was collected and studied to determine if the bacteria present had antimicrobial activity. They were called candidates and were moved to a master plate for further testing. The soil bacteria showed antimicrobial activity with 3 safe relative ESKAPE pathogens. Currently, a lot of antimicrobial research has stopped because antimicrobials are more difficult to find now. These series of experiments were done to try to fight the battle against antibiotic resistance with an intent to find new antibiotics.

Futch, Cameron. The Little Bacteria that Couldn't.
Over the past thirty years new antibiotic strains have gotten increasingly difficult to find, and with a contrasting increase in antibiotic resistant bacteria, the need to discover new antibiotic strains is becoming more and more important. And with the majority of bacteria existing in the soil, my experiment took 1 gram of soil and through dilution, tested against a bacterial candidate against different relatives of common pathogens in the hopes of seeing whether said candidate would show antibiotic resistance.

Garcia, Geraldine. In Search for an Antibiotic.
Upon Alexander Fleming's discovery of the first antibiotic substance: penicillin, the development of antibiotics has completely transformed and advanced the world of medicine as we know it today. Antibiotic therapy has been absolutely indispensable in our fight against bacterial diseases and infections, as they have not only helped save billions of lives but have also taught us how many microorganisms function. Though unfortunately, we are now facing an antibiotic resistance crisis largely due to the misuse and overuse of antimicrobial drugs. Bacterial resistance has made it more difficult to treat infections and has diminished the efficacy of current drugs used to treat pathogens. Because many antibiotic substances have been discovered and produced by microorganisms found in soil, for my project I have chosen to conduct research on a soil sample from a houseplant of mine in order to find a new potential antibiotic. In pursuit of this, I have employed a few procedures in my investigation such as a serial dilution of my soil sample to identify my antibiotic candidate, screenings on safe relatives of ESKAPE pathogens to determine any inhibition caused by my candidate, and PCR to identify my bacterial species. This research is important because it demonstrates the significance of bacteria and the fundamental role these organisms have in their relationships with us and other organisms, despite being microscopic. It is vital in delaying antibiotic resistance and developing new treatments for bacterial pathogens.

Gleeson, Ben. The Next Antibiotic Is In Your Basement.
Few things can be said to have revolutionized medicine like antibiotics. They also sparked an arms race that bacteria had billions of years of preparation for. Only constant innovation has kept humanity's narrowing edge. Since the discovery of antibiotics, soil has held immense potential for further discoveries of antibiotic mechanisms. Antibiotic resistance is rising globally at alarming rates. The speed of pathogen generational turnover, their ability to pass resistant genes across species, and the general overuse of antibiotics has medicine falling behind. Prospects for new developments in the current classes are bleak. In response, the search has been crowdsourced to microbiology students around the globe. The Tiny Earth project from the University of Wisconsin-Madison, has student scientists returning to the soil. In this paper, a sample was gathered from between gaps in the concrete basement slab of a one hundred year old house that sat abandoned and partially flooded for almost 20 years. A number of candidate species from that sample showed signs of having antibiotic properties. This was seen by zones of inhibition after serial dilutions and then again when tested against known safe relatives of ESKAPE pathogens. One of these candidate species was selected for further study. Attempts to identify that selected candidate species included staining, polymerase chain reaction (PCR) and gel electrophoresis. Results were passed on to the Tiny Earth databases.

Gonzales, Marissa. Soil Source Solutions.
One of the problems our world is facing today is a growing number of antibiotic resistant bacteria that are hard to treat. It is important to find new antibiotics that will work for this purpose. To search for these antibiotics I began by looking at soil microbes, as this is an abundant source of bacteria as well as previously found antibiotic producers. I have completed a number of protocols to find promising candidates and tested them in various ways. In my experiments I have found a promising candidate named Candidate #8 that has proven effective against two of the ESKAPE pathogens. Additional testing is being conducted and I look forward to sharing those results.

Grandin, Kayla. The Search for Antimicrobials.
Researching soil samples has become a very important part of antimicrobial discovery. In my research, I cultured soil bacteria and found some bacteria that produced zones of inhibition when grown with the safe relative ESKAPE pathogens. Those that had zones of inhibition were used for further research. I have went on to identify an interesting candidate that showed zones of inhibition for 4 of the 6 safe relative ESKAPE pathogens. This experiment was done locally; however, this research has the potential to have global effects. Without research like this, important medicines like vancomycin would have never been discovered.

Gray, Carson; Al-Ameer, Musaab. Instant Versus Drip Coffee at the Molecular Level.
The project compared the molecular composition of the methylene chloride extraction of traditionally prepared drip coffee with the molecular composition of freeze-dried coffee. This was done by performing gas chromatography/mass spectroscopy (GCMS) and comparing the results of a sample of coffee extracted with methylene chloride and a sample of coffee that was resuspended after undergoing freeze-drying. The results of the experiment indicate that the freeze-dried sample experienced a significant reduction in the presence of certain compounds but appears to retain the caffeine. This could either indicate that the compounds are resistant to resuspension after freeze-drying, or that the freeze-drying process removes the compounds entirely. Without a doubt, however, the freeze-drying process has a negligible effect on caffeine content. This may have implications for the difference in health effects or flavor of freeze-dried versus traditionally prepared drip coffee.

Gray, Dahlia. Sheet Metal Fabrication-Lamp.
The objective of this project is to create a lamp using sheet metal and reduce waste during multiple fabrication of said lamp. Sheet metal is being used because of its durability, inexpensiveness and flexibility. In layman's terms, sheet metal is using thin metal sheets to create metal parts, whose thickness is approximately between 0.018 to 0.250, which is measured in gauge. The gauge system is primarily used to measure sheet metal's weight per square foot in relation to its thickness. Stainless steel, Aluminum and cold rolled steel (CRS) are some types of sheet metal used to make items we use daily like pots, cutlery and soda cans. Cold rolled steel will be used for this project due to its finish and affordability. The forming of sheet metal varies and depends on desired outcome and several values like precision and cost. For this project I will be using laser cutting for precision, cleaner finish and bending process (application of stress to sheet metal to create a desired shape) because of the design of the lamp. Some finishes of sheet metals are Buff Polishing (which gives a smooth clean finish like that of a table knife) and anodizing which is an electrochemical process that makes surfaces corrosion resistant. For this project I will be using Powder Coating, where dry powder is sprayed on the surface of the sheet metal and usually includes pigment or additives then baked. I decided to use this method for it will be more aesthetically pleasing.

Habtamu, Tsion. An Antibiotic Quest.
Researching for new antibiotics is crucial due to the alarming rise of antibiotic-resistant bacteria. As existing antibiotics become less effective against resistant strains, there is an urgent need to discover alternative treatments to fight infectious diseases effectively. For this study, I collected soil from my backyard and identified potential candidates for antibiotic screening. After a number of different tests, candidate 5 has shown the most promise, and I was able to conclude that candidate 5 is a gram-positive rod with spores apparent. Further testing is needed to better understand this candidate.

Hall, Camille; Elghzali, Y usef. Dipeptide Formation of Phenylalanine and Lysine.
The purpose of this experiment is to look at the antimicrobial properties of a dipeptide. The amino acids used in this experiment are phenylalanine and lysine. A Boc protection and an ester protection will be conducted the amino acids, then a coupling reaction using EDC will form the dipeptide bond between the amino acids. TLC, H NMR, IR, polarimetry, and HPLC will be used to analyze the dipeptide.

Hamid, Ham ayl; Khatiwada, Shrinkhala; Magnaibayar, Anudari. Comparison of Weekly Study Hours for JCCC STEM Versus Liberal Arts Students.
This study compares the weekly study hours of two groups of JCCC students: those enrolled in STEM programs and those in liberal arts programs. The research question focuses on determining the difference in study hours as the quantitative response variable between the two groups. Understanding this distinction is critical because it reveals how academic expectations differ across STEM and liberal arts fields, therefore assisting with academic assistance and resource allocation. Surveys will be conducted on randomly selected students participating in both STEM and liberal arts programs at JCCC, collecting information on their study habits and hours. This study intends to teach educators, administrators, and policymakers about the particular needs at JCCC and obstacles that students have in various academic programs, allowing for targeted interventions and support services to improve student performance at JCCC.

Hamzat, Nuraght. Far Away From Home: Finding LAMBO.
The absence of antibiotic research and development, as well as decreasing interest in STEM fields, might have disastrous consequences in the fight against multi-drug resistant "ESKAPE" pathogens. For this experiment, a soil sample was obtained from Lawrence and subjected to several biochemical assays. To create a countable plate, the dirt was serially diluted. A master plate was created by obtaining twelve different microorganisms from the countable plate. The microorganisms were then tested against eight distinct tester strains. The goal of this experiment was to determine which of the test strains the bacteria would inhibit. I picked one promising microbe from the twelve and called it LAMBO. LAMBO morphology comprises a high elevation with a smooth entire margin and an irregular colony form that is glossy and peach in color. LAMBO showed potential by inhibiting three of the eight tester strains (*E. coli*, *E. aerogenes*, and *P. putida*). A LAMBO streak plate was created to produce a pure colony. A small sample of a colony was obtained and utilized for the Polymerase Chain Reaction (PCR). PCR will allow us to amplify (copy) a certain sequence of LAMBO's DNA in order to determine the species of bacterium it is.

Hansen, Charlene. The Role of Regenerative Ranching in a Sustainable Future.
With the rise of popularity in the regenerative agriculture movement it is important to understand the quantitative differences in greenhouse gas emissions between traditional and regenerative ranching. This literature review will add clarity to the greenhouse gas emission levels of both styles of ranching to determine next steps in our global food economy. It is imperative that greenhouse gas emissions are limited and that long term carbon sequestration methods are being implemented. The research suggests that regenerative ranching can bring the emissions associated with eating meat down to zero with carbon credits leftover.

Hasan, Yahya. The Search for New Antibiotics Producing Bacteria.
During the recent decade, the number of antimicrobial resistant infections (AMR) has significantly increased and is one of the serious threats that we are currently facing according to the World Health Organization. To combat this issue turning to the soil can be highly promising due to the presence of millions of bacteria, which can produce antibiotics that can be then developed into therapeutic drugs. By testing different strands of soil bacteria against ESKAPE safe relatives, I was able to find a match for a soil bacterium that showed a zone of inhibition against *Staphylococcus epidermidis*, a close safe relative of the pathogen *Staphylococcus aureus*. This pathogen lives on the skin and does not cause any harm unless a wound happens, it can infect immunocompromised individuals, especially in hospitals and clinical settings, causing infections and irritations. As it is common in hospitals and treated regularly, some strands of the pathogen develop resistance and the need for new novel antibiotics continues. I searched for this bacteria in a soil sample. I named the new soil bacterium "Malz", and it was taken from a flower bed outside of a college dorm in Kansas. This place was chosen to see what type of bacteria live near decomposed plants. Malz is an irregular, off-white colored specimen. The DNA was analyzed, and I identified the species using a genetic, staining, and metabolic approach.

Henderson, Avery. Antibiotic Discovery.
The purpose of conducting our research this semester is to find an antibiotic in our soil samples that shows the most antibiotic resistance to bacteria. The process of antibiotic resistance is to find which bacteria have evolved mechanisms that protect them against the effect of the antibiotic. In this process, you will see zones of inhibition around the growth of that colony of bacteria. My soil sample that I collected came from my front yard where it was diluted and tested for colony growth in class. We chose to use soil samples to grow the bacteria because they are normally non-pathogenic. Throughout diluting, transferring, and incubating our soil samples, we found large numbers of bacterial colonies in our agar plates of the soil samples. There were many potential candidates that we discovered in our agar plates. These would then transfer over to a master plate to see their individual growth on their own. Antibiotic screenings were the next step in finding which potential candidate would show antibiotic resistance. Most of mine were negative, but there were a couple that showed positive for creating a zone of inhibition against certain pathogens. After choosing the candidate with the best zone of inhibition for the potential of creating an antibiotic through antibiotic screenings, a streak plate was performed to obtain a pure culture of my potential candidate for further experiments. My single colony will later go through a polymerase chain reaction, different stainings, and other experiments to eventually identify an antibiotic. When successfully completing all of these experiments, we will be able to uncover an antibody through our isolated colony.

Hill, Stettler; Orth, Benji. Substantial Differences between Freeze Dried and Fresh Borscht.
Freeze-dried products have long been a favored method for preserving food and reducing weight by removing water. Unfortunately, freeze-drying food regularly results in a substantial difference in taste between fresh and freeze-dried products. The present study attempted to find differences between a freeze-dried and a fresh sample of borscht. Thin-layer chromatography was carried out on the fresh sample of borscht to identify the efficacy of the extraction agent. Methylene chloride was used to extract both samples and gas chromatography-mass spectroscopy (GC/MS) was used to analyze the extract. GC/MS revealed substantial decreases in certain compounds, including Hexa-2,4-diyn-1-ylbenzene, a component of tarragon and one of many possible causes for the change in flavor. Other major differences between the fresh and freeze-dried products will be discussed below.

Hohn, Lindsey. Hoping for New Antibiotics.
Over time antibiotic resistance has become worse and there are no new antibiotics surfacing. With the help of the earth's soil, a search has begun to find new antibiotics. In the lab, different colonies of bacteria were isolated and tested against safe relatives to find antibiotic resistance. The bacterial colony named "Captain America" has shown resistance from a clay type soil sample in Belton, Missouri. The safe relatives that this colony is showing zones of inhibition with are *Acinetobacter baylyi* and *Enterobacter aerogenes*. With the help of the safe relatives, we will know if this chosen colony will show resistance against the infectious relatives, the ESKAPE pathogens.

Holladay, Rodney. The Search for Antibiotics in Today's World.
Bacteria are a very eminent part of day to day life for everyday people. This fact is showing the importance to finding, understanding, and fighting antibiotics and the ever changing resistance that persists. The purpose of this experiment is to gather soil, find bacteria with antimicrobial genes, and to determine the identity of the bacteria producing the antimicrobial compound. Many different steps were done in this process which includes: soil collection, serial dilution, creating a master plate, and testing against ESKAPE pathogen SAFE relatives. Candidates were further identified through PCR (Polymerase Chain Reaction) and Gel Electrophoresis. . Breaking down this process starts with soil collection which is simply finding an area that the tester thinks might have the best chance of finding antimicrobials. The second step would be to do a serial dilution test to find the best candidate by taking from the lower dilution plates and creating a master plate to test against ESKAPE pathogen SAFE relatives. These candidates will be tested against the 6 different relatives. After this the following step is to observe the different zones of inhibition that are presented from the antibiotic screening tests. Following the screening the candidate that showed the most amount of zones of inhibition will be subjected to PCR and Gel Electrophoresis to test for the specific strand of DNA that provides the ability to fight off bacteria.

Hopson, Jacob. Can a Present-Day Formula 1 Car Drive Upside Down?
My goal for this research project is to determine whether a present day formula 1 car (2022 and beyond) could drive upside down in the right conditions. This project will dive into two major areas necessary that will determine the possibility of this experiment. Firstly, these cars are built around a singular physics principle called the Venturi effect, which channels air through thin tunnels creating a vacuum effect keeping the cars stuck to the ground. Secondly, this effect will be combined with the most optimal conditions necessary and what kind of surface the car will drive on that will generate successful results.

Horn, Thomas. Solving Antibiotic Resistance One Gram at a Time.
The purpose of this experiment is to test for antibiotic producing microbes found in soil samples. As antibiotic resistance grows more rampant and increasingly more difficult to combat, the need for new antibiotics increases as well. Since several types of bacteria have not yet been studied, the need for further tests from researchers and microbiology lab students can help expand the search. The process of steps starts with soil dilution to help find what is referred to as zones of inhibition between microbial colonies. The zones show where a bacteria has produced a chemical that is inhibiting the growth of other bacteria. These bacterial colonies are ideal for further research into antibiotic resistance. After selecting 12 viable candidates, they will be placed on a master plate and used to test the six "Safe Relatives" to the ESKAPE pathogens that have an increased resistance to antibiotics. One candidate will be selected and used in the PCR (polymerase chain reaction) testing method. Once the PCR test has been completed, the DNA results of the test will be sent to an outside laboratory to run the sequencing of the 16s rRNA gene.

Hosainzada, Soraya. Laboratory Experiments.
This research project investigates antibiotic resistance and explores potential antimicrobial agents. Through a combination of laboratory experiments and computational analysis, we identified novel compounds with promising antimicrobial properties. Our findings suggest that these compounds exhibit potent activity against a range of clinically relevant pathogens, including multidrug-resistant strains. Furthermore, our study elucidates the underlying mechanisms of action, providing insights into novel targets for drug development. The implications of our results extend beyond combating antibiotic resistance, potentially paving the way for the development of new therapeutic strategies against infectious diseases. This research contributes to the ongoing efforts to address the global health threat posed by antimicrobial resistance, offering promising avenues for future research and clinical application.

Howard, Cheyenne; Sell, Jacob; Madoumba, Ashton; Lagunas, Helen. Genetically Engineered Algae to Degrade Plastic and Improve Ecosystems.

The global production of plastics has reached over 390 million metric tons, with production expected to increase 4% each year. Further, in the North Atlantic there are estimated to be over 930 billion pieces of plastic ranging from small microplastics to large macroplastics. Multiple studies have demonstrated preliminary evidence that strains of microalgae can bind to, weaken, and partially degrade different plastic films. While preliminary studies have been done, there is still a lack of understanding on how algae could be used at a larger scale to remediate plastic waste in waterways. The major goal of this project will be to optimize the ability of microalgae to degrade plastics in the environment. Through the use of tools such as genetic cloning, strain optimization, and evaluating growth conditions, our project will advance the scientific community's knowledge of algae's potential use in plastic bioremediation in ecosystem services. While evaluating the strains for plastic bioremediation we will also collect data to better understand the impact on growth and the toxicity of plastic pollutants in culture. Finally, we will evaluate the impact this innovative approach may have on ecosystems, safety, sustainability, and growth outside of a controlled environment to help support the scale up of this bioremediation system. Plastic pollution in our waterways is a serious threat to our ecosystem and has global implications. Through the development of innovative algae strains and systems our project hopes to make an impact in reducing plastic waste in the environment.

Howard, Cheyenne; Hasan, Yahya; Kyser, Garrett; Stanley, Ethan. Testing Plastic Degrading Enzymes for Efficiency Under Various Conditions.

Plastic pollution is a global issue that impacts us socioeconomically and environmentally. More than 380 million tons of plastic is produced annually, with only 9% of the plastic being recycled. This combined with the strong and resilient chemical composition of plastics that stays hundreds of years until decomposition, causes a major pollution issue both in land and oceans. The discovery of *Ideonella sakenesis*, a bacterial strain that can degrade PET, a commonly used compound when making commercial plastics, breaks off the plastic polymer into the original monomers to be used for recycling. Building off the work of Knott et al. has led us to test a two-enzyme system for plastics depolymerization. Our research will continue on previous work and further test pH, temperature, and plastic surface area for enzyme efficiency under various conditions.

Hubbard, Brian. Dynamic Control of Inverted Pendulums.

Inverted Pendulums are a unique system in dynamics and engineering. Inherently unstable, the center of mass is above the pivot point and without added controls the system will topple. However, despite their instability we see inverted pendulums play important roles in advanced engineering systems such as rocket boosters and motor vehicles. The controls for the systems are just as important as the systems themselves as any failure could lead to catastrophic damage.

Huettenmueller, Jackson. Sheet Metal Lamp.

Sheet metal has become an increasingly valuable material in the modern world and is used heavily in industries like construction and manufacturing. It's used to make cars, trucks, airplanes, household appliances, and too many other items to count. Because of its widespread use and production, increasing the efficiency of production by even a small amount could save vast amounts of money, materials, and time. For this project I will optimize the design of a sheet metal lamp to make as many of them from a 100"x100" piece of sheet metal as possible, to best demonstrate those ideas about optimization.

Iregi, June. Poster Symposium.

The overuse and misuse of antibiotics has contributed to the resistance of antibiotics. It is crucial for patients to learn the methods to efficiently take antibiotics in order to prevent antibiotic resistance. Researching for antimicrobials found in soil could help provide new safe and effective antibiotics for the healthcare community. In class, we grew our soil bacteria with the safe relatives of the ESKAPE pathogens to determine if soil microbes are producing a chemical that inhibits antibiotic resistant pathogens. Further testing was completed to identify the organism producing the antimicrobial as well.

Jalabomy, Michelle. Mechanism of Antibiotic Resistance.

Antibiotic resistance is a phenomenon that occurs when bacteria develop the ability to survive antibiotics meant to kill them. Antibiotic resistance develops naturally over time as infections' genetics alter. Its establishment and spread are expedited by human activities, particularly the misuse and overuse of antimicrobials to treat, prevent, or control illnesses in humans, animals, and plants. A crisis is developing in modern medicine due to the emergence of resistant strains of bacteria to the antibiotics that physicians commonly prescribe. Infections that were once commonly treatable are now developing into severe infections increasing the mortality rate of humans across the globe. A comprehensive understanding of the resistance mechanisms of these bacteria can help tackle the public health challenges that these bacteria pose. A deeper understanding of resistance mechanisms could also help predict underlying or unknown resistance mechanisms for other emerging multidrug-resistant pathogens. Such a prediction could be applied to other emerging diseases as well. I obtained a soil sample to analyze to discover new species of antibiotic-producing bacteria. Soil is an abundant resource for diverse organisms that compete with each other, and many of those organisms produce chemicals that inhibit the soil sample containing many organisms with these properties. Of those, I tested the most promising organisms from my sample against safe bacteria, yet closely related to bacterial species classified as ESKAPE pathogens, or bacteria that are major threats in clinical settings and cause infections that are very difficult to treat.

James, Monica. Serial Dilution.
Antibiotic resistance refers to the ability of microorganisms to withstand the effects of antibiotics, rendering the medication against them ineffective. The evolutionary nature of these organisms helps them to evolve in ways that help them to be unharmed by the bacteria in the medication. This is why it is important to find new antibiotics that can work. In our experiment, we used the process of serial dilution to find bacteria that could be potential candidates for antibiotics. Serial dilution is a process through which cultivable microbes can be found. In this experiment, soil samples are used. By diluting the samples at different levels, the difference in growth can then be compared. The purpose is to be able to find good zones of inhibition, which would further be used in the screening process, ultimately to find potential candidates for antibiotics. After collecting soil samples and diluting it in six test tubes, we placed samples of the different dilutions on agar plates. Only one zone of inhibition grew on mine. After that, we used master plates to grow selected colonies on, specifically the ones with zones of inhibition. We have been testing those colonies against safe relatives to see if any are resistant. Only one of my colonies has been resistant to one of the safe relatives. This candidate will be further tested through staining, sequencing, and metabolic tests to identify it.

Jo, Yebbune; Obi, Ifechukwu. Peptide Synthesis.
In this experiment, a dipeptide will be synthesized with phenylalanine and alanine. N- terminus of Phenylalanine will be protected by Boc, the protecting group. C-terminus of alanine will be protected by the esterification. Phe-Ala will be tested for antimicrobial activity.

Jordan, Macy. Antibiotic Resistance.
Antibiotic resistance is one of the most pressing concerns in modern day medicine. The threat of not being able to treat fatal bacterial infections is a driving force behind antibiotic resistance studies. In this study, JCCC students were able to isolate colonies that showed zones of inhibition in order to test them against the six safe relatives of ESKAPE pathogens. Students selected a soil sample from any local area of their choosing and documented the conditions in which the soil was found. Through serial dilution, the students were able grow several species of bacteria on an agar plate. Using proper aseptic technique, a master plate was formed using any species that showed a zone of inhibition. These were the species that were then tested against the six safe relatives. Once again, the goal was to find a zone of inhibition between the safe relative and the master plate species. This study shed light on the types of bacteria present in the local environment that may possess antibiotic resistance. Research of this type is very important to medical scientists as it can provide an insight into how to treat these infections when they infect a human host. The number of bacteria that show resistance to antibiotics within this study express the urgency in which antibiotic resistance research is needed.

Kapapula, Jedidah. The Hidden Microbial World: Exploring Novel Bacteria and Unlocking Their Potential Benefits.
This research project aims to identify and characterize previously unknown bacterial strains from environmental samples using advanced molecular techniques. By harnessing the power of metagenomics, we seek to unravel the genetic diversity of microbial communities and uncover new species with unique metabolic capabilities. Through extensive laboratory cultivation and genomic analysis, we hope to elucidate the potential applications of these novel bacteria in various fields including biotechnology, medicine, and environmental remediation. As Louis Pasteur once said, "In the field of observation, chance favors only the prepared mind." By diligently exploring uncharted microbial territories, we aspire to discover invaluable resources for future scientific advancements.

Kaur, Kamalpreet. A New Hope for Antibiotics: K2024.
Over the past few years, medical professionals have seen a significant increase in the problem of antibiotic resistance among bacteria. It is becoming more difficult to treat certain diseases due to resistance to existing antibiotics. The aim of this research has been to isolate the bacteria from soil samples by using serial dilution to know whether bacteria can make antibiotics because the majority of antibiotics used nowadays are produced by soil bacteria. For example, streptomycin was discovered in soil bacteria and used to treat bacterial infections. In order to find new antibiotics, a soil sample was collected at the Claremont apartment located in Overland Park, KS to identify whether the bacteria is present in the soil sample and also to know whether this bacteria is capable of producing antibiotics. I picked this place because I live there. This place is unique because a lot of people live here and have many domestic animals, such as cats and dogs. Many procedures were followed throughout the semester. One of them, serial dilution, is used to pick isolated colonies and helps to screen potential candidates against the ESKAPE relatives. ESKAPE is an acrostic that stands for different species of bacteria that are antibiotic resistant. I took a candidate and grew it alongside an ESKAPE relative to see if it will inhibit the growth of the ESKAPE relative. Afterwards, I selected one candidate that I believe is capable of producing antibiotics. I named the discovered candidate K2024. It inhibits the growth of *Enterococcus faecalis*. Research is ongoing.

Kesinger, Amanda. Antibiotics in the Soil.
There has been an increasing concern around the world with antibiotic resistance, which we have been studying in our microbiology class. Discovery of new antibiotics has often happened from soil, which is what we studied. I collected a sample of soil from my backyard and performed a serial dilution of the sample to plate on agar plates to observe possible antibiotic candidates. A master plate was created with promising candidates to test against E.S.K.A.P.E. relatives for zones of inhibition. Unfortunately, my candidates did not have any zones of inhibition with E.S.K.A.P.E. relatives but had one successful zone of inhibition with *Bacillus subtilis*. I will begin more testing to gain more knowledge of this candidate.

Keyah, Susana. The Search of Possible Antibiotics from the Soils of Overland Park, Kansas.
With the daily rise of infection all over the world, comes the growing need for continues search for antibiotics. Soil was collected from 68st in overland park and diluted to identify possible antibiotic producing candidates. Candidate was selected and tested against ESKAPE relatives such as: *Enterococcus faecalis*, *Staphylococcus epidermidis*, *Escherichia coli*, *Acinetobacter baylyi*, *Pseudomonas putida* and *Enterobacter aergenes*, which showed it to be a good inhibitor to most of the ESKAPE relatives. More details on this will be discussed further in the poster. Additional procedures was done such as the Gram staining and Spore staining my candidate in order to determine if the candidate was a Gram-positive or Gram-negative bacteria, and also to find out if my candidate has spores present, and after staining my candidate, it was observed to be a gram-positive bacteria and had good spore in them as well. Details of the whole process will be discussed more on the rest of my poster.

Kimani, Julien; Le, Tran. The Synthesis of a Dipeptide.
Dipeptides are organic compounds that are composed of two amino acids bonded together at a peptide bond. Dipeptides have many uses, such as paternal nutrition, analgesics, and anti-tumor drugs, and some have been shown to have antimicrobial properties. In this research, the synthesis of a dipeptide was conducted from the amino acids phenylalanine and valine via a dehydration reaction. For this synthesis, the c-terminus of phenylalanine was protected via esterification with ethanol, while the amino group of valine was protected with a tert-butoxycarbonyl (N-Boc) protecting group to form a peptide bond between the amino group of phenylalanine and the carboxylic acid group of valine. After formation and deprotection of the dipeptide, it was then isolated and analyzed via TLC, NMR, IR, polarimetry, and HPLC to confirm the formation of the dipeptide. Lastly, the dipeptide was tested for antimicrobial activity.

Klusman, Drew. Lucien.
In Microbiology this semester, students were tasked with collecting soil samples in hopes of finding microbes capable of inhibiting other bacterial species. We put our colonies up against safe relatives of well known pathogens to see if they secrete antibiotics. After collecting soil from a construction site on the highway near the River Market in Downtown Kansas City, I was shocked to find a unique colony that I've named Lucien. Bright orange in color and secreting his vibrant hue into the medium it inhabited on my petri dish, he had promising potential. Lucien has displayed complete inhibition against *P. putida* and *E. faecalis*. He has displayed a large zone of inhibition against both *A. baylyi* and *S. epidermidis*. Most impressive, Lucien's inhibition against *B. subtilis* had such a large zone of inhibition that it expanded into the other quadrants surrounding him on the screening petri dish. Infections like pneumonia caused by *P. putida's* ESKAPE pathogen relative could be treated with the chemicals Lucien is making.

Koetting, Thomas. Can Non-Cooperative Game Theory Assist Modeling Security Implementation for Back-End Web App Development?
In active development environments of web-based applications, back-end engineers and developers are constantly doing battle with bad actors probing for exploits. We explore the potential of non-cooperative game theory as a framework for enhancing back-end web development security and resource management. Most traditional strategies implemented by companies focus on static defense and reactive methods. By adopting a perspective influenced by game theory, we delve into the back and forth nature of the development timeline. We assume that the two exclusive contributors to the game in this framework are the development team and the bad actors. We finally explore whether or not the model being implemented should have characteristics aligned with flexibility or rigidity, and what influence their implementation environment has on the model's final structure.

Kyser, Garrett. Extraction and Chromatographic Separation of Antimicrobials Produced by a Strain of *Burkholderia*.
"Burk" is the working name of a bacteria collected by a JCCC microbiology student previously been shown to inhibit tester strains of bacteria when grown competitively. Chemical extracts taken from these bacteria inhibit tester strains of both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions were tested for antimicrobial activity against tester strains in broth. The results will be discussed.

Lafreniere, Benjamin. Applying Programming Concepts to Solve Mathematical Equations.
This project examines the evolution of a writing the code for a basic calculator from foundational concepts, and expanding the project to evaluate quadratic expressions.

Lagunas, Helen. Culturing Microbes from Soil Sample.
In the Microbiology world we come across new research that can help us evolve and help us better the world. Believe it or not microbiology helps us open our eyes and mind into discovering things that are so small but yet have a huge impact in our world. Which is why it's important to have an understanding of microbiology and what it has to offer, with that being said. For this specific research I have collected a sample of a specific soil and had it tested for the different microbes that are currently living in my soil sample. I've learned new techniques such as serial dilution, selecting candidates, creating master plates, antibiotic screening. To explore furthermore on these microbes. I learned that there are several bacteria that live in soil and their morphologies can vary. Throughout this research I've gone through trial and error to see the evolution of the bacteria that lives in my soil sample to come up with different results and conclusions.

Lammers-Meis, Mark. Dynamical Systems for the Three-Body Problem.
The three-body problem is a centuries-old physics concept involving the motion of three objects of mass under each other's gravitational force. While the similar two-body problem is defined using simple functions, the added body in the three-body problem produces a chaotic structure requiring the use of dynamical systems. These dynamical models can map the behavior and positions of celestial bodies, such as stars, planets, and satellites, as they interact over time. Scientists use these systems to measure planetary systems' stability, plan space flights, and predict hazardous asteroids. The three-body problem is a simple yet complex pattern involved in many different celestial situations.

Lannon, Emma. Antibiotic Discovery.
Antibiotics were discovered and popularized around a century ago. Although the variety of antibiotics has increased since then, the effectiveness of specific antibiotics has decreased. Since the world is in need of new antibiotic discoveries, the Tiny Earth Committee has incorporated research for a new antibiotic as part of its curriculum. A personal soil sample from a location of choice was required and sampled in order to participate in this research. I carefully chose a section of soil to acquire my sample from in my front yard. In the soil sample I provided, one candidate in particular, named Alex H., showed a potential zone of inhibition, which sometimes is an indicator of antibiotic properties. By diluting the original soil sample and isolating the visually-promising bacteria onto a master plate, the candidates were then tested for their personal antibiotic resistance to the provided, safe close relatives of dangerous pathogenic bacteria. To identify the morphology and makeup of the potentially-identified antibiotics, biochemical tests, such as PCR, polymerase chain reaction, gel electrophoresis, as well as differential staining, were performed to identify and isolate the potential candidate.

Lawrence, Cara. Antibiotic Research.
Antibiotic resistance is increasingly problematic worldwide. Bacteria are becoming capable of withstanding a wider range of antibiotics than ever before. The earth's soil, a readily available resource, hosts billions of microorganisms. Among these microorganisms are bacteria, many of which have yet to be discovered. A small percentage of bacterial colonies from most soil types can be cultured in a lab to observe their ability to inhibit the growth of other bacteria. Colonies that boast strong zones of inhibition are potential antibiotic candidates. A bacterial colony, named "Mike," was collected from a silty soil sample in Blue Spring, Missouri. Utilizing a serial dilution technique, soil sample "Mike" was cultivated and showed a promising zone of inhibition against other bacteria on the same agar plate. When tested against safe relatives of pathogenic species *Bacillus subtilis* and *Mycobacterium smegmatis*, "Mike" exhibited a measurable zone of inhibition. The results of this screening show that bacteria "Mike" is of interest and warrants further testing for the purpose of antibiotic production.

Le, My Phuong. Burk's Journey in Isolating and Testing Antibiotic Compounds.
The alarming increase in antibiotic resistance among pathogenic microorganisms has sparked global efforts to discover novel antimicrobial compounds. This research project aims to identify potential antibiotic-producing microorganisms from soil samples, with a particular focus on a candidate strain, referred to as "Burk," that has demonstrated the ability to combat ESKAPE pathogens, a group of six highly drug-resistant bacterial species. Burk, isolated from a microbiology student, has been identified as closely related to *Burkholderia ambifaria*, a Gram-negative *Pseudomonas* species. To investigate the antibiotic potential of Burk, a multi-faceted approach is being employed. This includes the extraction of secondary metabolites, followed by testing the extracts against various bacterial strains to evaluate their antimicrobial activity. Additionally, chromatographic techniques are being utilized to analyze and purify the bioactive compounds present in the extracts. By employing these methods, the research aims to comprehensively characterize the antibiotic-producing capabilities of Burk and potentially identify novel antimicrobial compounds that could contribute to the development of effective treatments against drug-resistant pathogens.

Le, Tran. The Research of New Antimicrobial.
Antimicrobials can be used to treat bacterial diseases. However, bacteria and other microorganisms are evolving resistance to common day antibiotics. Finding a new antimicrobial is an important mission for today's world to counter deadly resistant diseases caused by microorganisms. Today, I am proud to inform you about my research in searching for new antimicrobials from soil. The project is done through experiments of serial dilution, candidate antimicrobial screening, PCR amplification, metabolic testing and finally the Kirby Bauer Assay.

Leonard, Jane. Searching for Antibiotic-Producing Microbes in Soil.
Antibiotic resistance continues to be an ongoing problem globally, and the hunt for new ones is being researched by scientists and students all over the world. Here at JCCC, microbiology students are contributing to this research by learning how to isolate candidates from soil samples that we have found locally. In the lab, we are using aseptic techniques throughout our experiments to minimize the risk of contamination. We used serial dilution and cultured our samples in agar plates. We tested our candidates against ESKAPE pathogens to find out whether there could be a new antibiotic in our samples. We have worked week by week to isolate and further isolate our candidates, starting with making master plates and streak plates. With our candidates, we did Gram staining, spore staining, and acid-fast staining to learn more about our microbes, and have used our findings to narrow down to just one candidate. We are still working to identify our microbes and maybe a student from JCCC will discover the next new antibiotic.

Lewis, Connor. Stamp Lamp.
Sheet metal is used by taking a sheet of metal material and then cutting, forming, and joining it into a final product. Some examples are metal computer cases, plumbing, and even artistic pieces. This showcase shows how sheetmetal can be used to make a simple lamp. It will show the layout before the forming process and how to optimize the use of material to minimize waste to minimize costs. It will then go on to display the forming of the lamp into its final form.

Lieber, Michael. Sheet Steel Lamp.
This poster contains the important measurements, and proportions, to create a template for the creation of the lamp's structure. On top of constructing templates, understanding the use of mechanical instruments needed for creating metal lamps is also detrimental to this project. The creations of these lamps will also need to be created as effectively as possible, without affecting the aesthetics of the lamp. The end product of this project will result in a poster of the lamp, and the subsequent information on how to efficiently construct them. The lamp blueprint corresponds to the dimensions of the lamp that is produced out of flat sheet metal. Once the shape of the metal is punched out with a special shaped die, and punch, the metal is shaped, and formed to our desired lamp form. The creation of this lamp is very similar to how a car fender would be shaped and formed. A car fender is cut from a sheet of steel in one piece. The flat steel blank is then shaped, and formed to be both, more structurally strong, and to conform to the body of a car. Within this project I am tasked with creating a three-dimensional metal lamp from a two-dimensional sheet of sheet metal. Understanding the manufacturing process of these lamps is arguably the most important part of this project. Every square inch of metal this, hypothetical, company does not use in the manufacturing process is considered scrap. Every square inch of scrap this company has is lost money. This is because the company either has to repurpose, recycle, or throw away the excess scrap, which loses the company time, and money. This gives the company a big incentive to find the most effective way to use as much of each sheet metal as they can. This same principle is seen in almost every other process within companies, from hiring effective workers, working with suppliers, and many others. In this paper we will not look at these other outside factors other than the efficiency in creating the lamps, but this point does show the importance of efficiency in companies.

Lindsey, Garret. Sheet Metal Manufacturing.
Sheet metal is malleable and strong, making it one of the most useful manufacturing materials today. It's what gives the cars we drive and the appliances we use every day their shape and structure. This poster displays the layout pattern I created for a simple appliance. The pattern is for the creation of a lamp out of sheet metal, and it is optimized to be repeated on a 100 by 100-inch piece of material with minimal waste. Creating the smallest amount of waste possible is important for the best cost efficiency and creating the least negative environmental impact.

Lowrie, Stephanie. Serial Dilution.
The purpose of this soil experiment is to determine if the microbes from the soil we collected are secreting anything that would have an inhibitory effect on some of the world's most notorious antibiotic-resistant pathogens. The methods to this experiment include collecting soil samples and using serial dilutions to dilute the samples to reach a reasonable number of bacterial colonies to count. We are finding the approximate number of species present with the ability to inhibit growth of other species of bacteria around them. We then use these candidates to test directly against the ESKAPE pathogens. We were successful in finding a colony that showed a clear zone of inhibition. We then transferred this bacteria onto a streak plate to get a pure sample. We now have a candidate that is a possible antibiotic-producing microbe.

Luangchai, Trinady. The Feasibility of the Introduction of Modifying DNA Nanotechnology in an Undergraduate Setting.
The modification of nanotechnology is part of a newer concept that has yet to be introduced into an undergraduate setting. Through this research, I will demonstrate a plausible way to create a nanoswitch and identify the target proteins using gel electrophoresis. This will allow for undergraduate students to have a greater understanding of real world applications of virus detection.

Lumbard, Nick; Hanson, Sammuel. Unearthing Hidden Antimicrobial Potential.
For almost 96 years to date, we as mankind have had the pleasant knowledge of antibiotic ability and efficacy in treating infectious disease. While the revelation of antibiotics has been an exponential breakthrough in medical treatment there have been no nuanced discoveries since the 70's well over half a century. That knowledge alone is discouraging, but thanks to programs such as CURE we as a student body are delighted to be looking for a future for antimicrobial advantage in healthcare. In the project we simply took a random sample of dirt in hopes of finding microbial candidates to be cultured and tested. In order to examine the candidates for optimal antibiotic activity specific techniques such as gram stain, culturing, PCR, etc. were used. In combination with Safe Relatives of ESKAPE pathogens we were able to take promising candidates and test them directly to see if any resistance was feasible. This overall approach allowed for multiple micro research studies to be conducted in hopes of taking a macro jump in the future for antibiotic treatment for the greater good.

Lumbard, Nicholas. Shaping the Future of Food in Space.
The effects of freeze drying Body Armor was studied in order to determine pre/post differences for future astronomical pursuits. This was accomplished by the thin layer chromatography and extraction. The analysis of the Body Armor before and after freeze drying was completed by gas chromatography mass spectroscopy. The TLC did not yield any significant results, while the GC mass spec showed the disappearance of cyclopentylidenephenylmethyl benzene and the formation of benzoic acid, among other results to be discussed.

Marion, Natalie. Antibiotic Discovery.
The purpose of our research was to produce antibiotic resistance of microbes and create an antibiotic from bacteria and various experiments. Antibiotic resistance happens when bacteria and fungi develop the ability to fight the drugs made to kill them. Antibiotics act as chemical weapons to harm soil bacteria and protect microbes. During this semester we worked on discovering a possible antibiotic from a soil microbe. We wanted to create an antibiotic produced by bacteria to kill other kinds of bacteria without harming themselves. I took a soil sample from my backyard, diluted it, and tested it frequently. I chose soil from this location because it received a lot of sunlight and was close to the side of my house where we keep our trashcan. Soil samples can contain lots of bacteria but are typically non-pathogenic. We were able to find the number of cultivating bacterial cells present in our soil samples. Different potential candidates were found and tested on master plates and streak plates to isolate single colonies. Antibiotic screenings were performed to show which candidates inhibited bacterial species that are medically important. Certain candidates were positive and negative towards the pathogens and further tested. I identified a single colony that could have potential for discovering an antibiotic. The colony will undergo the polymerase chain reaction (PCR), gram staining, other experiments, and an antibiotic will be identified and characterized. By performing these experiments and recording data, we will have isolated a colony from a possible candidate to discover an antibody.

Masoodi, Ali. Exploring Sheet Metal Fabrication to Find a Way to Reduce the Waste Material: Designing a Functional Lamp.
Sheet metal fabrication is a fascinating process that underpins the creation of everyday items like kitchen appliances and car parts. In this project, I delve into this world to design and construct a unique lamp prototype, aiming to showcase various fabrication techniques and optimize the design process for efficiency. By minimizing waste and improving efficiency, my goal is to contribute to the advancement of manufacturing processes. Join me on this journey as we illuminate the art of sheet metal fabrication and its significance in our daily lives.Sheet metal fabrication involves cutting, forming, joining, and finishing processes essential for crafting diverse products. Precision cutting methods such as laser cutting and shearing are used to divide metal sheets efficiently. To reduce waste, we employ nominal cutting sizes of 6, 8, 12, 16, and 24 inches, ensuring cost-effectiveness and sustainability for 48"x 120" metal flat sheets. Metal sheets undergo shaping processes like bending and rolling to achieve desired dimensions and contours. We work with 22- and 24-gauge metal sheets due to their optimal balance of flexibility and strength. Welding and riveting techniques securely connect individual metal components, selected based on the lamp's design and structural requirements. After assembly, parts undergo finishing processes to enhance appearance and durability. Surface treatments like painting or powder coating protect against corrosion, while deburring edges ensures safe handling. Through meticulous execution of each fabrication stage, our aim is to create a high-quality lamp prototype that showcases innovative design while emphasizing efficiency and sustainability in manufacturing practices. References: Elevate manufacture product data/https://www.holcimbe.com/en

McCarthy, Eli. Microbiology at JCCC: Antibiotic Resistance.
It all started with a bacterial swab off of the forgotten water bottle left in the back seat of my 2015 Chevrolet Cruze. After seeing the sheer diversity of bacteria on that agar plate, it was clear that this world is filled to the brim with life not seen by the naked eye. For the remainder of the semester, our class focused on learning various techniques to view, analyze, and compare microscopic bacteria found from individually-gathered soil samples. Using aseptic technique and serial dilution, it was possible to reduce and pick out specific colonies of bacteria from the soil and ultimately create a master plate of the colonies that appeared to form zones of inhibition. After comparing the bacterial colonies on the master plate to the provided "safe relatives", we were able to more closely see these zones of inhibition (which suggested antibiotic resistance). This goes to show that even bacteria compete with each other for resources in the soil - what a strange and fascinating world in which we live!

McClung, Beth Susan. Using Serial Dilution Processes from Soil Samples.
The purpose of my sample soil serial dilution project was to identify and analyze possible antibiotic agents produced by sample soil dilutions in a countable range of 25 to 250. Once I had a countable range of colonies, I was able to test these selected countable colonies from my soil dilutions and begin to make a master plate which included 8 total countable colony samples. I was then able to test from my master plate any of these soil samples that may have exhibited zones of inhibition when these colonies were tested against safe ESKAPE relatives. The purpose of this project overall was to find possible antimicrobial agents on specific strands of bacteria. The methods to test this included obtaining a natural soil sample and using serial dilutions and the crowded plate technique to plate the soil sample and isolate a countable colony and compare these to safe ESKAPE pathogens using aseptic techniques and room temperature incubation. My colonies initially showed possible zones of inhibition and therefore were chosen from the plates and then streaked. After incubation of these promising candidates from the master plate, these individual colonies were tested against the safe ESKAPE relatives again. Unfortunately, none of my serial dilutions showed zones of inhibition against the safe ESKAPE relatives.

McCollam, Joyce. The Pursuit of New Antimicrobials.
Millions of people every year become infected with antibiotic-resistant bacteria, which has led to one of the biggest threats to human health. Since no new antibiotics have been found since the 1980s, doctors have been prescribing the same antibiotics for years, leading to more antibiotic-resistant microbes, and we are running low on safe antibiotics. New antimicrobials would help prevent and treat infections that current overused antibiotics cannot. The pursuit of new antimicrobials started with a soil sample collected at a public location in Kansas, which was then serially diluted to obtain countable antimicrobial colonies on Petri dishes that could show zones of inhibition. Twelve antimicrobials with present zones of inhibition were found and transferred to a master plate for further testing against the safe relatives of ESKAPE pathogens. An antimicrobial with a broad zone of inhibition on an antibiotic screening plate was used in a polymerase chain reaction to amplify the 16s rRNA gene from the antibiotic-producing candidate. Metabolic testing narrowed down the identity of the antimicrobial, and The Kirby Bauer Assay determined the sensitivity or resistance of the antimicrobial to different bacteria. Finding a new antibiotic would help with drug-resistant bacteria and has the possibility of fighting infections that cannot be done with current antibiotics.

McGuire, Kuyumi. Finding Our Antibiotics.
As our bacteria continues to evolve and develop antibiotic resistance, it is critical for us to keep searching for potential antibacterial organisms that could fight against pathogenic species. Soil sample is one of the environmental sources where microbes with antibiotic compound can be found due to the competitive conditions. I brought some soil sample from my backyard to the lab and performed a serial dilution. After the incubation period, I carefully transferred 12 different colonies that showed the zone of inhibition to a master plate for further observation. Then, I transferred all the 12 colonies to each plate with 6 safe relatives, *Enterococcus faecalis*, *Staphylococcus epidermidis*, *Escherichia coli*, *Acinetobacter baylyi*, *Pseudomonas putida* and *Enterobacter aerogenes*. After the incubation period, I observed the zone of inhibition form on #8 and #9 colonies on the plate which *Pseudomonas putida* was applied. This project could save many lives from disease-causing pathogens, and we must continue to search for new antibiotic organisms.

McLenon, Kolbe. How Dynamical Systems Help Businessman Turn Math Into Money.
In mathematics, a dynamical system is a system in which a function describes the time dependence of a point in an ambient space. Systems of differential equations excel in describing the ever evolving world around us. One such way that humans have made use of differential equations is in the world of finance. Used extensively in Quantitative Analysis, differential equations can help us model the fluctuating nature of equity markets, help predict stock prices, and help understand market volatility. One of the key models of finance: the Black-Scholes model makes use of a system of partial differential equations to help calculate the fair price of an option. In this project we will be deep diving into the Black-Scholes model, and how financiers turn math into money.

McLenon, Kolbe. PETase Mutation Research Project.
The PETase enzyme is a fairly recently discovered enzyme that is able to break down polyethylene terephthalate, a common single-use plastic that is found in a variety of products, mainly plastic bottles and packaging. Plastic waste pollution is a rising issue on the global scale that not only negatively affects marine life, but also ocean biodiversity. The production and disposal of certain plastics can also release harmful chemicals into the air, water, and soil. The number one source of frustration that comes from dealing with plastic waste is that it can take hundreds of years for a single water bottle to be broken down. This is where PETase comes in, PETase can significantly cut down on the time needed for plastic to be broken down naturally; however, there are still a couple problems: few microorganisms have the PETase enzyme and PEtase does not work fast enough to keep up with the rate at which humans are consuming plastics. These problems are why up and coming scientific researchers have been tasked with finding ways to improve the PETase enzyme so that in the future it can break down as much plastic as we use. So far we have tested the optimal conditions for PETase function and now we are creating mutations to the enzyme itself to increase efficiency. I chose to replace the 157th codon Methionine with a Lysine. We then compared the enzyme activity data for the mutated PETase with the unmutated PETase to learn the impact of our mutation.

McLenon, Kolbe. Sheet Metal Lamp Fabrication.
Sheet metal fabrication is a key process in the creation of metal fixtures, structures, and products. Sheet metal fabrication uses flat sheets of metal, normally steel or aluminum, to create finished products by cutting, forming, joining, and assembling. Many common items we use on a daily basis are the result of metal fabrication and its processes. Since sheet metal fabrication is an important technology, this project will go into detail about how sheet metal items are manufactured, how to create a layout pattern for an item which could be used to build the item, and how to optimize the layout pattern to minimize waste. All of these steps are very important parts of the overall fabrication process, but especially optimizing the manufacturing process. Optimizing the manufacturing process helps to do a few main things, those being: minimizing waste, increasing productivity, decreasing product losses, and preventing product failures later on in the fabrication process.

McManamon, Blake; Cooper, Braden. Finding Life Underwater on Europa through Phanes.
Jupiter's moon, Europa, is one of the most considerable candidates for life to arise in our solar system aside from Earth. Being considerably unexplored, Europa requires additional investigation through the mission "Phanes". We propose to identify remnants of biological processes, vital compounds for life, and the general conditions of Europa's subterranean global ocean, so we can further understand the conditions required for life to arise outside of Earth. This mission will be achieved through a series of gravity assists in order to slingshot the craft toward the Jovian system. Once landed, a submersible will thaw through the ice using heated water powered by a radioisotope thermoelectric generator. Once underwater, the submersible which is fitted with a mass spectrometer and a device analogous to the Mars rover Perseverance's SHERLOC will uncover the underwater physical conditions and chemical composition of Europa and if it could harbor life.

Melese, Yemariamnesh. Producing Novel Antibiotics From a Local Source.
Antibiotics are a crucial component in fighting off infectious bacteria. As various illnesses and diseases rise and spread throughout the world, antibiotics help treat those who are most susceptible and infected. A huge majority of antibiotics are actually sourced from soil, and the focus of this project is finding a potentially effective antibiotic from our nearby environment. The process began by obtaining a sample of dirt then diluting and culturing it to make the antibiotic. After a series of screenings and tests, I found a potentially viable anti-microbial candidate. This candidate, that I named A, was whiteish with a yellow tint. I proceeded to test it against the safe relatives of the ESKAPE pathogen to see if it was successful in inhibiting the pathogens. I found that A created moderate inhibition against the bacteria *Acinetobacter baylyi*, which is the safe relative of *Acinetobacter baumannii*. Further screenings revealed that A is a gram positive endosporing rod bacteria. These findings are important because antibiotic resistance is on the rise so discovering new antibiotics is one way to lessen the severity of this issue.

Mendoza, Daniela. Investigating Desirable Antibiotic Microbes.
Antibiotic resistance can occur when a microbe, more commonly known as a germ, develops the ability to fight the medications that are meant to eliminate them. This phenomenon causes a global health risk, as it can be extremely problematic to treat an ill individual who is needing medical assistance. Researchers are eager to search for new microbes that can assist with expanding the amount of antibiotics available to the public. This research poster intends to showcase my work of isolating a bacterial species capable of producing an antibiotic. The soil was collected in Kansas City and brought into the lab to perform a serial dilution. The serial dilution allowed for the isolation of the millions of microbes that were present in the soil. A Master plate was then created with desirable candidates that could successfully isolate from every other candidate. Each of the 6 successful candidates were obtained. These candidates were screened to observe its ability to achieve inhibition in 8 different safe relative tester species. When the candidates were screened, 1 candidate produced the most inhibition when grown with the tester strains. Candidate "Slimey Bean" produced inhibition in three tester strains, these included: *Pseudomonas putida*, *Staphylococcus epidermidis*, and *Bacillus subtilis*. This inhibition demonstrates the ability for this microbe strain to be able to produce a chemical that could be an antibiotic used against major illnesses including skin and tissues diseases, periodontitis, pneumonia, and endocarditis.

Meridieth, Kristiana. Finding Antimicrobials In Soil.
Research was done by testing a sample of soil for antimicrobials. Through a series of labs and observations, I was able to find bacterial candidates producing chemicals as potential future antibiotics. The first step of my project was to make a soil dilution. Then I found zones of inhibition that might indicate a potential candidate to isolate and further analyze. I created a master plate that allowed me to isolate these bacteria which made it easier for me to grow the bacteria and do antibiotic screenings for each bacterium. I then tested my candidates against SAFE relatives of the ESKAPE pathogens. I found that a few of my bacteria were producing a chemical against the pathogens growth. My soil did in fact harbor antimicrobials.

Meridieth, Kristiana. JCCC Statistics Project.
College schedules can be tricky to build especially if you have a preference for which days of the week you take courses. In my project, I will be surveying students attending JCCC, both online and in person. Throughout my survey, I will figure out where they are from and what class scheduling they prefer, Monday/Wednesday/Friday classes or Tuesday/Thursday classes. Data will be collected by reaching out to students via email or in-person surveying around campus. I will also have a QR code made that I can share with classmates and post on posters around the campus. This data will allow me to determine which group prefers which schedule if any difference in preference. My two surveyed groups are in-state versus out-of-state/international students. My findings will help JCCC know which class schedules to advertise more to which group and to offer differing experiences on campus aligning with those schedules to make every Cavalier feel welcome.

Meyer, Tim. A Lamp Composed of Sheet Metal.
If there was one resource that could be considered to be commonly used within just about every industry worldwide, it would probably be sheet metal. It is used in the making of cars, construction of houses, the housing of electronics, and many more applications. These are all components of our lives that are used daily, which makes sheet metal a very important part of modern life. Considering all of this, I will be engaging in a poster project involving sheet metal for the spring 2024 STEM Poster Symposium at JCCC. For my project, I will be designing a lamp to be made out of sheet metal. The goal of this will be to highlight the different aspects of manufacturing items out of the material. The cutting, forming, joining, and finishing processes will be highlighted. Another important aspect will be optimization in the designing process to minimize the waste generated when building the lamp and showing how a small amount of sheet metal can be turned into a very useful product for the world.

Meyer, Tim. Predator and Prey: Mathematical Modeling of Animal Populations.
In nature, many different animal populations are affected by the pursuit of predators. Likewise, animals who are predators themselves are affected by the status of their prey. By using dynamical systems based on the way different species interact with each other over time, we can model and predict the changes in predator and prey populations. The goal of this work is to describe the process of predator and prey population modeling using a dynamical system of differential equations, with highlights on aspects such as the state, control variables, and parameters of the system.

Micheke, Cynthia. Stephen.
In this research basically is trying to derive antibiotics from the environment which is a natural habitat in its own self. With the current progression of the world in its own self pathogens or bacteria have become more virulence as well as changing their gene every time they replicate thus becoming very hard to cure some of the infections or diseases that affect us as humans. Since the beginning of the research, the only place the antibiotics have been derived from is from the environment, and a good example is penicillin that was derived from mold. From the beginning the soil was collected from Kessler Ln, Overland Park, KS 66204. The soil was derived 1-2 inch in depth and the color of the soil is dark brown with a soft texture to it. At the time the temperature was about 55 Fahrenheit. Ph of the soil was 8.0. The experiment used was serial dilution where it was easy to culture the microorganisms from a more diluted sample to enhance easy growth of the microorganisms in different dilution from the different agar plates cultures used. The agar plates were incubated for about 7 days at room temperatures. Upon incubation different results were obtained and transferred different candidates that did show distinction in terms of their growth to a master plate that enabled growth of organisms separately as well as giving room for the candidates to grow. Them after making of different master plate that had about 6 organism that were promising. After that screening the promising candidates with different ESKAPE pathogens to identify which of the candidates can show any inhibition. Creating of the streak plate from one of the promising candidates and in this case I derived Stephen to be the promising candidate.

Miller, John; Gearhart, Jack. Analysis of Fanta Orange Soda.
Two samples of Orange Fanta soda were analyzed to identify their organic compounds. Each sample was first dissolved in methylene chloride to extract the organic compounds. A Gas Chromatography Mass Spectrometry (GCMS) analysis was immediately run on the first sample; the second sample was first freeze-dried, then had a GCMS run on it. A comparison of the GCMS results will be further discussed.

Milstead, Delaney. Pursuit of Antibiotics.
In this microbiology lab course BIOL-231-004 we have learned about the increase of antibiotic resistance. Antibiotic Resistance is when cells are unaffected by the antibiotic, these resistant bacteria will multiply and eventually the entire infection will be a resistant strain. Working with Tiny Earth Network we get the opportunity to be a part of finding a new species of bacteria that could be the source of a new antibiotic. These bacteria may create chemicals that kill microbes in the soil around them. The chemical can be purified and used as an antibiotic if we research exactly what they are creating. Most antibiotics currently in use were discovered by researching microorganisms living in soil. We start our project by taking our own soil samples and isolating bacteria. I tested 12 microbes against eight different tester strains to check for zones of inhibition. A zone of inhibition is an area around the bacteria where there is no growth because of the chemical created by the microbe preventing the growth of other microbes. In my case I chose candidate number 6 because it inhibited the tester strain *Staphylococcus epidermidis*. This species of bacteria we use in the lab is related closely to *Staphylococcus aureus* which is a pathogen capable of causing severe MRSA infections. The inhibition of this safe relative suggests the presence of a possible antibiotic that could be used to treat staph infections.

Mitchell, Nasha. Antibiotic Resistance.
What we have been working on throughout this course has mostly been focused on finding antibiotic resistance. Antibiotic resistance is the ability of bacteria to resist the effects of antibiotics. We started by getting a soil sample from a location of our choice. The purpose of this was to find new antibiotics from the soil using our methods for later. After that we did serial dilution. Serial dilution is a series of dilutions used to reduce a culture of cells to a more usable concentration. By doing this, we were able to pick out candidates from the soil acquired to further our examination. Once we found our candidates, we put them on a separate plate to facilitate further tests. Next, we started antibiotic screening. Antibiotic screening is used to examine if the candidates have antibiotic resistance. From this experiment we were able to tell which candidates had zones of inhibition from the safe relatives used. So that tells us if the antibiotic is effective against the present bacteria or if there is resistance against the antibiotic. Next, we did even more in-depth experiments using streak plates. We picked a candidate that was effective against the bacteria and went forth with inspection. This project is important because of drug resistance, antibiotics and other antimicrobial medicines becoming ineffective, and infections becoming more difficult or impossible to treat, increasing the risk of disease spread, severe illness, disability and even death. By doing this kind of research we can identify more antibiotics that can be effective in treating certain diseases and illnesses.

Mitchell, Ryan. Unearthing Antibiotics from the Soil.
The prevalence of antibiotic resistance increases along with the spread of bacterial pathogens. One approach to combat antibiotic resistance is to study microbes that can be found in soil samples. By isolating soil microbes from these samples, we can potentially unearth new antibiotics effective against drug-resistant bacteria. In this experiment, samples were taken from clay soil near a creek bed and diluted into testing plates. We then diluted the soil samples in water to get a usable sample of microbes. Samples of the dilutions were taken and then grown on agar plates in a lab setting at room temperature. These plates were then analyzed for zones of inhibition, which are clear areas around the microbial colonies. The larger these zones are, the greater the antibiotic production. After these individual colonies were identified, samples were taken and then placed onto a master plate which is made to ensure sample purity and grow enough of the microbe for future testing. Once an effective master plate is made, the colonies are then tested against safe relatives of dangerous bacteria, called ESKAPE pathogens. The colony that showed the most inhibition was then grown by itself to be utilized in different testing that would identify what kind of microbe it is. The sample chosen is named Asher, this sample has shown inhibition for a number of safe relatives namely *Mycobacterium smegmatis* which is the safe relative of the bacteria that causes tuberculosis.

Monroe, Abby; Nguyen, Nick. Dipeptide Synthesis - Alanine and Valine.
We plan to use alanine and valine to synthesize a dipeptide using the carbodiimide compound EDC. We will use Boc-protection to protect the N-terminus of alanine and esterification to protect the C-terminus of valine. The dipeptide will then be analyzed by TLC, HNMR, polarimetry, IR and HPLC and tested for its anti-microbial activity.

Morrow, Sarah. Candidate Number Seven.
The purpose of this research is to find bacteria that can potentially produce new antibiotics. This research is important because antibiotic resistant bacteria is a huge problem in healthcare. Antibiotic resistant bacteria impacts so many lives and can cause death in both immunocompromised and healthy individuals. The search for new antibiotics is never ending due to the fact that bacteria is constantly growing and forming new mutations that make them resistant to antibiotics. I found a bacterial candidate from the front yard of my sister's house approximately 2 feet from the driveway and about 2 cm deep in the soil. This bacterial species inhibited the following organisms: *Escherichia coli*, *Enterobacter aerogenes*, *Pseudomonas putida*, *Acinetobacter baylyi*, *Staphylococcus epidermidis*, *Bacillus subtilis*, *Mycobacterium smegmatis*. It showed a small, possible zone of inhibition with *Enterococcus faecalis*. The bacterial species I discovered may be promising in producing a compound that can be used to treat the following infections: Certain urinary tract infections, bacteremia, endocarditis, MRSA, pneumonia, cellulitis, meningitis, sepsis, osteomyelitis, and more.

Mukanjiri, Olivia. PETase Wildtype Reaction.
PETase is an enzyme, originally discovered in bacteria, that works to break down certain plastics. With plastic pollution increasing, this enzyme could play a significant role in counteracting its negative effects. Research has revealed that, at higher temperatures, PETase's rate of reaction slows significantly. In an effort to accelerate this process, I attempted to mutate the bacteria. The results of the original mutation came up inconclusive, so instead, I tested the wild-type of the bacteria to serve as a baseline for my peers' research. My data will include DNA mutation by way of site directed mutagenesis, gene transformation into *E. coli*, isolation of mutated plasmid DNA, and gene sequencing. It will also include data comparing the function of the class set of mutated enzymes to that of the wild type.

Murphy, Finn. Modeling Rocketry Using Numerical Integration.
The integral is a tool of Calculus that breaks large, complicated problems into manageable segments. However, instances arise when an integral equation becomes challenging or even impossible to solve. So in order to solve such problems, we today can utilize the power of modern computing. By having a program run numerical integration on such problems, we can approximate integrals to an extremely high degree of precision. In this poster we will discuss how numerical integration works and observe its utility by creating a computer program that models various aspects of a rocket's flight. In addition, the elementary physics necessary to understand the scope of this problem will be introduced.

Murphy, Josie. Antibiotic Research from Soil.
The purpose of this research was to create an antibiotic from bacteria from soil samples that can be used for further use. The reason being to create these potential antibiotics was because these antibiotics fight infections caused by bacteria, they do this by either preventing their growth or killing them completely. To put this research into action, throughout the semester we collected various samples of soil, and attempted to find potential candidates. The soil sample I collected came from the front of my house, and for our first experiment we made a serial dilution of the sample. After the dilution was taken, we incubated the bacteria to see what growth would occur. After observing the colonies that were grown, we collected potential candidates and grew them onto a master plate. Once again after incubating the master plate, we performed antibiotic screenings against safe-relative pathogens to see if the bacteria grown could go against them. After doing so, we observed and found some that were positive and some that were negative when going up against these pathogens. I had one specific candidate that was positive against two pathogens that was used for further research. That research involved different kinds of staining like, gram staining, spore staining, acid fast staining, and polymerase chain reaction. By performing all of these experiments and research a possible candidate for an antibiotic was found.

Murphy, Morgan. Search for Novel Antibiotic from Local Missouri Soil.
The aim of this research project is to identify a potential novel antibiotic-producing bacteria from local soil samples from a wooded area of Northwest Missouri. Antibiotics are chemicals secreted by bacteria to inhibit the growth of other bacteria in competitive environments like the soil. Antibiotic resistance is on the rise, as warned by Andrew Fleming who discovered the first antibiotic (penicillin), and is a growing public health concern. The final candidate utilized in this project, nicknamed Pinky due to its pale pink colony color, was tested against several strains of ESKAPE pathogen relatives and was found to be effective against *E. coli*, *P. putida*, *S. epidermidis*, *A. baylyi*, *M. smegmatis*, and *B. subtilis*. Pinky shows promising potential as a novel antibiotic-producing bacteria. Microbiology techniques used include creation of master, streak, and screening plates, light microscopy, differential staining (particularly the Gram stain), aseptic technique, serial dilutions, PCR testing of the 16s gene, and biochemical testing. These techniques allowed for isolating the candidate, testing it against various other bacteria for inhibition, and DNA sequencing to assess the species of the bacteria and its relation to other bacteria.

Myers, Kennadi. Chromatographic Separation of Extracted Antimicrobials Produced by a *Pseudomonas* Bacteria.
A bacteria collected by a JCCC microbiology student called, "Betty," has previously been shown to inhibit tester strains of bacteria when they are grown competitively. Chemical extracts taken from these bacteria inhibit tester strains of both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions of the extract were tested for antimicrobial activity against tester strains in broth. The results will be discussed.

Nazir, Salwa; Ali, Beenish. Analysis of Fanta.
During this month-long experiment, many different tests were performed to analyze the composition of Fanta. First, a Fanta sample was prepared for GCMS in which an aqueous and organic layer formed; the organic layer was extracted for further analysis. This organic layer was separated into 2 parts, one for freeze-drying and one for GCMS analysis. Through the GCMS test, lots of Benzoic acid was found in the Fanta. The Fanta was then freeze-dried for analysis through multiple tests. A TLC plate test was also done, but without any results.

Nelson, Ella. Utilizing Microbial Diversity for Antibiotic Discovery.
Antibiotic Resistance is a growing concern that affects our global society. In order to fight against antimicrobial resistance new antibiotics must be found and studied. Soil offers a diverse and unique environment with a rich source of microorganisms. This diverse ecosystem offers hope to a possible discovery of antibiotics that work against resistant pathogens. In order to explore this idea, 1 gram of clay soil was collected then serial diluted to determine the concentration of microbes present in the small sample. Individual colonies were then isolated from the serial dilution plate and then tested against multiple different ESKAPE relatives. A positive candidate against Bacillus Subtills was then chosen and a pure sample was created. From here, Polymerase Chain Reaction, gel electrophoresis, and DNA sequencing was performed in order to make copies of the DNA, Isolate the DNA, and identify a specific gene marker present in all bacterial cells called 16s rRNA. With further testing and analysis, this positive candidate can offer potential drug development of a new antibiotic that works against the resistant pathogens of Bacillus Subtills.

Nguyen, Jordan. Analysis of Antibiotic Producing Microbes Found in Soil Samples.
The purpose of this experiment was to find, culture, and test for antibiotic producing microbes found in soil samples. As antibiotic resistance begins to grow more rampant and increasingly more difficult, new sources of valuable antibiotics that differentiate themselves from their predecessors must be discovered. These antibiotics were tested against the "safe relatives" of the six dangerous ESKAPE pathogens, as these ESKAPE pathogens have proven to be a difficult challenge in clinical settings. The soil samples were used to create serial dilutions and serial dilution plates. Ten to twelve promising candidates were selected only from countable plates (roughly 25 – 250 colonies) in order to create a master plate. The master plate was then used to create antibiotic screenings, from which the most promising candidate was isolated onto a quadrant streak plate. The selected candidate was then transferred into a tube to undergo PCR. Afterwards, the final candidate underwent electrophoresis to determine the bacterial species by observing/comparing the amplified 16s rRNA gene.

Njagui, Naomi. Exploring and Observation of Soil Microbial Diversity: Master Plate Experiment.
Exploring the diversity of microorganisms in soil is important for understanding how various ecosystems function. In this Project I conducted a master plate experiment to examine the microbial communities in the soil sample that was collected. This starred with the dilution of the soil sample several times approximately 6 times, and then spreading the 0.1 ml solution onto an agar plate that is mixed with different nutrients to encourage various the types of microbial growth. Next, the plates were closely observed for individual colonies that grew from all the plates, paying close attention to their morphology from the color, size, and shape. The bacteria from the zones of inhibition were carefully picked out with an inoculating loop after incineration and later placed on another agar plate that was organized into a master plate for antibiotic screening. The master plate consisted of10 colonies that piqued interest and moved on to the antibiotic screening plates. There were 6 safe relatives of bacteria for antibiotic screening, and each of them were swabbed before the master plate colonies were placed on it. The screening showed varying degrees of antibiotic reaction across the 6 plates. The results are yet to be read; however, these projects contributed to the understanding of how soil bacteria handle antibiotics since they can pass on resistance to other bacteria. By figuring this out, we can be smarter about using antibiotics and stop resistance from spreading.

Nolaly, Christina. Extraction, Separation, and Testing of Antimicrobial Compounds Produced by a *Pseudomonas* Bacteria.
"Johnny 5" is the working name of a bacteria collected by a JCCC microbiology student. It has previously been shown to inhibit tester strains of *E. aerogenes*, *S. epi*, *E. coli*, *E. faecalis*, *B. subtilis*, and *M. smegmatis* when grown competitively. Chemical extracts taken from these bacteria inhibit tester strains of both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatographic methods. The separated fractions were tested for antimicrobial activity in broth. The results will be discussed.

Noronha, Nyah. BioReclaim: Applying Cradle-to-Cradle Principles to Counter Algal Threats.
Through innovative and sustainable solutions, this multidisciplinary research project aims to address harmful algal blooms (HABs). Nutrient pollution is often a contributing factor to algae blooms, which threaten aquatic ecosystems, water quality, and public health. As a result of using Cradle-to-Cradle design philosophy, this project aims to inspire regenerative systems that mimic natural processes. The BioReclaim project strives to understand the underlying causes of algal blooms and develop effective strategies to counteract them through a combination of research, design, and implementation. This project investigates the ecological dynamics that drive algae bloom formation, explores developing agriculture practices to reduce nutrient runoff, and examine eco-friendly filtration systems for removing excess nutrients. Algal populations may also be managed without hazardous chemicals by using natural biocontrol methods. Algal blooms pose an immediate threat to aquatic ecosystems, but the project aims to promote their long-term sustainability and resilience. By educating and empowering people, I hope hopes inspire broader action towards a healthy and more balanced relationship with nature through Cradle-to-Cradle principles in environmental management.

North, Audrey. Exploring Soil for New Antibiotics.
As illnesses caused by bacteria are continuing to be treated with antibiotics, the rise of antibiotic resistant strains of these bacterial infections are becoming more and more of an issue. Currently, the search for new antibiotics is limited. However, JCCC has given students the opportunity to screen soil samples for bacteria that show potential of producing antibiotics. Soil is full of living organisms and has provided antibiotic producing bacteria in the past. This paper will discuss one potential candidate taken from a soil sample on the campus of MidAmerica Nazarene University. This sample was extracted from an old flower bed outside of a dorm. The reason for choosing this location is because the soil was warm, easy to sample, and likely contained diverse microbes due to being introduced to many living organisms (plants and humans) over time. One colony found in this sample showed signs of antimicrobial properties against the other bacteria present in the sample as well as other pathogens introduced during testing. This candidate will be called AN3A-1. During the screening process, candidate AN3A-1 showed signs of inhibition against ESKAPE pathogen safe relatives *Enterobacter aerogenes*, *Escherichia coli*, *Acinetobacter baylyi*, and *Pseudomonas putida*. Throughout this paper, candidate AN3A-1 will be identified and characterized through a series of genetic, staining, and metabolic testing.

O'Donnell, Isabella. Survivor: Antimicrobial Edition.
In society today there is a growing concern for the increase in antibiotic resistance among microbials. It is because of this concern that there has been a push for more research, and experimentation to find antimicrobials and discover new antibiotics. In my personal experimentation I collected a soil sample for further testing. I conducted research to select a specific candidate from my sample and began running further tests. This testing included serial dilutions, antibiotic screenings, PCR, and gel electrophoresis. Through these experiments I was able to explore the results of my microbials in the hopes of obtaining more knowledge of antibiotic research, and resistance, and ultimately to discover antimicrobial that could aid in the fight against antibiotic resistance.

Oduor, Shaquayla. Margo.
Soil, which could go unnoticed and underestimated, contains an abundant amount of micro-bacterial life that can be used for antibacterial discoveries. Many scientists have found different bacteria that have helped create antibiotics to help fight off bacterial infections. With antibiotic resistance rising, soil is being used because it has such a complex ecosystem that has a plethora of diverse microorganisms that are capable of producing microbial products that can help create antibiotics. In this lab, each student collected soil samples to test for any microorganisms that inhibit any of the possible tester strains provided by the professor. My silty soil sample, "KK Soil Sample," came from the Kiddi Kollege pumpkin patch located near the playground on January 31st, 2024 in Olathe, Kansas. For this sample, I dug down about an inch in-depth on a chilly and sunny day. I found a couple of potential candidates that inhibit different tester stains. "Margo," is the candidate I chose to do further research on. This candidate showed signs of inhibiting *Enterobacter aerogenes* and *Bacillus subtilis*, which are two different tester strains that are closely related to pathogens that can cause infections that are harmful to humans. Margo is producing antibiotics to help potentially fight off these types of harmful infections.

Oehm, Lauren. Oh No, Antibiotic Resistance!
Antibiotic resistance is a global crisis many people are not aware of. This issue is caused by the misuse and overuse of antibiotics. In order to help the researchers, I've collected some of my own data by doing a serial dilution from a soil sample collected in my backyard. After days of procedures, I selected twelve species of bacteria that formed zones of inhibition when grown around other bacteria. The next step was to create new agar plates using the six ESKAPE pathogens. After finding new zones of inhibition, I then narrowed it down to one species for further testing. Throughout my research I will examine new information to help identify this organism in hopes to find it is an antimicrobial.

Okonkwo, Ike. Extraction, Separation, and Testing of Antimicrobial Compounds Produced by a Strain of *Burkholderia* Bacteria.
A bacteria collected by a JCCC microbiology student called, "Burk," has previously been shown to inhibit *S. epi* when the two bacteria are grown in competition. Chemical extracts taken from these bacteria inhibit both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions of the extract were tested for antimicrobial activity against tester strains in broth. The results will be discussed.

Oliver, Hazen. A Ceaseless Search for Answers.
Antibiotic resistance has become a constant concern for both professionals and the general public. The Tiny Earth initiative partnered with JCCC to give resources to students so that we can help manage this problem specifically caused by the ESKAPE pathogens (six pathogens that are antibiotic resistant). Over the past semester I worked on finding a soil-based bacteria that can inhibit at least one of the ESKAPE pathogens. I took a soil sample from my backyard in Overland Park, Kansas, which was a peaty batch of bare soil that in the spring is home to a clover field. Once I had my sample, I tested it with serial dilution and inhibition challenge plates. We worked to use both genetic and metabolic techniques to identify Ceaseless so that our work can be furthered. Initially, my candidate, Ceaseless, has been shown to inhibit *Enterococcus faecalis* and *Staphylococcus epidermis*, which may be a promising new antibiotic, but the work to solve this concern remains ceaseless.

Olotu, Irene. Soil Microbes with Prospective Growth to Inhibit Antibiotic-Resistant Bacteria.
Antibiotics are chemical produced by some bacteria or synthetically made that inhibit the growth and/or kill other bacteria without destroying themselves. As effective as they may sound, they have developed a backlash, hence increasing the outburst of diseases, we call it "antibiotic resistance". Due to the life and death situation at hand, a lab experiment with microbes was conducted in hopes that it will perhaps contribute to finding solutions to overcome a medication resistance. With the presence of microorganisms being abundant, this spring 2024, we extracted soil samples to see what microbes will grow under laboratory conditions and if the result of their grow will be able to inhibit the growth of disease-causing microorganisms. From serial dilution, 12 individual candidates with unique characteristics were selected and taken though different procedures such as screening, staining, and streak plating to find individual and pure colonies from the soil that would help with the problem. The colonies were screened against different medically significant pathogens such as *Staphylococcus epidermidis*, *Acinetobacter baylyi*, *Enterococcus faecalis*, *Pseudomonas putida*, and four others which were inhibited by some of the colonies. One of the candidates (G) was able to inhibit 3 different tester strains. For example, vancomycin-resistance *Enterococcus* (VRE) is a bacteria strain specifically of *enterococcus faecalis* that is resistant to the antibiotic vancomycin. With the inhibition of this microbe by one of the selected candidates from the soil, opens a new window to our understanding of antibiotic resistance.

Onnen, Aisley. Antibiotic Candidates From Soil.
The goal of this research is to identify microbes that are potential antibiotic candidates from a soil sample from the Kansas City area. Many pathogenic microorganisms are developing resistance to the antibiotics that are used to fight infections today, so it is important to work to identify microbes which could be used to make new antibiotics. Soil is an excellent source for finding these microbes because it rarely contains pathogenic microorganisms and there are millions of microbes in each gram of soil. The soil sample used for this research was first serially diluted in order to identify microbes that inhibited the growth of others. After candidates were identified, they were transferred to a master plate. The candidates were then tested against safe relatives of pathogenic microorganisms that are medically concerning today. PCR and gel electrophoresis were used to genetically sequence the candidates that showed inhibition against the safe relatives in order to identify what species and genus they may belong to.

Oweis, Nour. Finding Antibiotic.
Despite antibiotics being absolutely necessary for human and animal health, there is an ongoing crisis with a lack of discovery of new medications. Along with this crisis, many microbes are becoming resistant to currently known antibiotics. I hope with this experiment to discover new antibiotics that the microbes will not have any resistance to. This was done through a collection of soil samples in the states of Kansas and Missouri. In this experiment, I collected the sample from an area that is near to Jacoma Lake. I diluted the soil sample using 4 tubes of sterile water. Then, I incubated the microbes in screening plates. After that, I found multiple candidates that are appropriate for antibiotic screening which have a zone of inhibition. These colonies were transferred to master plates for more organization. I tested these candidates with each safe relative bacteria to figure out which candidate has antibiotic properties. I selected one candidate from 7 candidates that have a zone of inhibition and used a streak plate to use an isolated colony. Finally, this colony will be useful for further tests to figure out the genetic sequence of this antibiotic.

Pajich, Madeleine. Antibiotic Properties of Microorganism MRPAB5.
Over the years, antibiotics have helped the human population to kill harmful bacteria. This allowed the population to live longer and healthier lives and worry less about getting sick. However, as antibiotics were used more, the bacterial populations developed a resistance to them, which started the war of antibiotic resistance. Throughout this course, microbiology students took on the obstacle to see if we could find microbes in our environment that could inhibit bacterial growth. We started by going to the main source where antibiotics come from. The soil. I took soil from my front yard and did several tests through serial dilution, and screening plates, in hopes of finding a candidate that could inhibit bacterial growth. I found a candidate that inhibited many tester strains of bacteria. This microbe was given the name MRPAB5. MRPAB5 showed promising results in fighting some of the ESKAPE pathogens, which is a step forward in helping fight against antibiotic resistance.

Petrie, Lorelai. My Backyard Bacteria: The Search for a New Antibiotic.
The emergence of the antibiotic, penicillin, in 1940 presented a world of opportunity for humans. However, researchers and scientists have battled the effects of antibiotic resistance globally. Throughout JCCC's microbiology class, a soil sample has been analyzed and experimented on to test for antibiotic-producing bacteria within the community. A pure culture of bacteria was obtained from a soil sample through a series of culturing, diluting, and analysis. Furthermore, only one candidate (LEP 4) during this experiment stood out from the rest and showed signs of resistance against *Staphylococcus epidermidis*. The significance of this project is the knowledge and power that resides within looking at the dirt nearest to us and attempting to discover a new antibiotic in the vast world of varying microorganisms. In addition, it provides students an opportunity to contribute to impactful research while also enhancing their understanding of bacteria and antibiotics.

Pinaroc, Jasmine. Sheet Metal Lamp.
Did you know that consumption makes up about 70% of the United States GDP? Mass marketing and production has only been better with modern technology. This culture of consumption also means a lot of waste whether it be from excess food or scrap metal from vehicles. In this project, sheet metal will be utilized by making a lamp out of this. A layout of this lamp is presented using AutoCAD. This project aspires to optimize the sheet metal and leave as little waste as possible. Sheet metal is durable and corrosion resistant. It is typically aluminum, copper, or stainless-steel sheets. Thanks to CAD, this project would not need to be drafted manually which could lead to inaccurate calculations and more time for labor.

Pippins, Jada. The Hopeful Discovery of Antimicrobials.
When it comes to soil, it is a remarkably rich and diverse ecosystem, hosting a variety of microorganisms, including bacteria, fungi, actinomycetes, and more. These microorganisms have evolved in complex relationships within the soil environment, leading to the production of a variety of compounds, many of which possess antimicrobial properties. The objective of my research was to isolate bacteria obtained from soil samples with the goal of investigating their potential to produce antibiotics and potentially uncover antimicrobial agents. Given the growing concern over antimicrobial resistance and its impact on public health, particularly with certain pathogenic bacteria developing resistance to conventional antibiotics, this research focused on exploring the antibiotic-producing capabilities of soil-dwelling bacteria. Various procedures were employed to identify bacteria within the soil samples and assess their ability to synthesize antibiotics. These procedures included inoculating bacterial isolates onto agar plates, conducting successive dilutions of the original soil sample, and subjecting the isolates to an antibiotic production against a panel of bacteria including "*Staphylococcus aureus*, *Enterobacter aerogenes*, *Acinetobacter Baylyi*, *Escherichia coli*, *Staphylococcus epidermidis*, *Pseudomonas putida*, and *Enterococcus faecalis*". The ultimate goal was to determine whether the soil harbored bacteria is capable of producing antibiotics, therefore contributing to the ongoing search for new antimicrobial agents.

Pittman, Autumn. From Pond to Potential Power: Discovering a Prospective Antibiotic Candidate.
Even though soil was a previously abundant and consistent reservoir of antibiotic research, in the past few decades new antibiotics have yet to be discovered from soil. In an attempt to uncover an inhibitory candidate of my own, I collected data and performed a series of tests on a soil sample I gathered from a front yard in suburban Shawnee, Kansas, but no intriguing results came to fruition. However, from a pond soil sample collected at Flat Rock Creek Park, I have found a bacteria species that has the potential to inhibit *Pseudomonas putida* and *Staphylococcus epidermidis*, safe relatives of ESKAPE pathogens. ESKAPE pathogens are the primary culprit of hospital-acquired infections worldwide; they are resistant to known antibiotics, and it is hard for medical professionals to fight with medicines available today. I found this bacterium via serial dilution, antibiotic screening, PCR amplification and sequencing of the 16srRNA gene, and metabolic testing. Antibiotic resistance is an already looming issue in medicine and the world as a whole; as a result, finding new inhibitory bacteria to combat them is more important than ever.

Portillo-Mota, Daniela; Delang, James; Banks, Kate. The ERP (Enceladus Research Probe) Mission.
The ERP mission proposes an expedition to search for evidence of life on Enceladus, one of Saturn's many moons. The goal of this project is to send a lander and an ice and water probe to Enceladus to analyze the thick icy crust for organic compounds as well as the salty liquid ocean beneath the surface where life is likely to exist. The probe's journey would involve a gravity assist from Jupiter which would take seven to eight years to reach Enceladus. In order to get to the subsurface ocean, we will use a probe, called EnExIceMole, which was designed specifically to drill through the thick icy crust of Enceladus. The type of instrumentation on this craft would include an ultraviolet spectrograph, a thermal emission imaging system, and a mapping spectrometer. The purpose of this instrumentation is to gain information about Enceladus's composition, create a map of its composition and temperature signature, and to obtain new images of Enceladus.

Ragan, Sarah. Antibiotic Activity in Soil Bacteria.
The discovery of penicillin was one of the most revolutionary breakthroughs of modern medicine. With the advent of antibiotics, doctors had tools to fight previously incurable bacterial infections. Unfortunately, the more these revolutionary drugs were used, the more bacteria began to acquire resistance to them. Antibiotic resistant infections now pose an ever growing threat to public health. It is more important now than ever to discover novel antibiotics. Since the soil is rich with competing microbes, it is the perfect environment to search for undiscovered antibiotic producing strains of bacteria. For my project, I have cultivated bacteria from a sample of local soil, in hopes to isolate a new strain of antibiotic producing bacteria.

Rahimi, Homyra; Kapapula, Jedidah. Comparison of Students Commute Time for Kansas Residents Versus Missouri Residents.
This research aims to compare the commute time between Kansas and Missouri residents here on campus, to see if they are either similar or the same, with the measure of 15 minutes being average. The commute time would be categorical being either 15 minutes or not (less or more). Understanding the comparison provides us with insight into potential disparities in access to education based on geographical location. Data for this study will be collected through a survey that will be advertised around campus.

Reeder, Ally; Reyes, Melany. Student Loan Debt & Mental Health.
Many studies have shown that increased student debt has an affect on the mental health of students. Do honors students at JCCC report different levels of stress compared to their non-honors counterparts? This will help the researchers to see if the Honors Program at JCCC is beneficial to the mental health of students in relation to their student loan debt. Data will be collected from Honors and Non-honors students with an anonymous survey that will be emailed out from the Honors Office and presented to students in Honors and Non-honors classes.

Regan, Caleb. The MicroFight: Soil Microbes in the Battle Against Antibiotic Resistance.
In today's world, antibiotic resistance is becoming a serious problem, making it harder to treat infections. That's why it's crucial to search for new antimicrobials to prevent and treat infectious diseases. In the project, I started by collecting soil samples and then diluting them to isolate different microorganisms. I then transferred the antimicrobials from the dilution plates to a master plate. I then tested their effectiveness against various pathogens through antibiotic screenings to see if any of these antimicrobials produced zones of inhibition. The findings not only expand knowledge of the microbial world in soil but also offer hope in the fight against antibiotic resistance.

Reyes, Areli. Antibiotic Candidates in Soil.
Due to the highly competitive nature of soil, microbes produce chemicals that inhibit the growth of other microbes. This type of competition favors bacteria that can then produce an antibiotic, allowing soil to be a verifiable gold mine of potential antibiotic producing microbes. Crowd-sourcing with the Tiny Earth Network (TEN) allows thousands of researchers around the world to investigate environmental samples for new antibiotic-producing strains of bacteria, which was done during this experiment. By collecting a soil sample, serially diluting the sample 5 times, and then screening for antibiotic candidates, 12 possible candidates were able to be subcultured on master plates to then start antibiotic screenings, run by the 6 ESKAPE pathogen safe relatives.

Rinck, Gabe. Sheet Metal Lamp.
Sheet metals is an extremely versatile material that is used in many products we encounter in our day to day lives. From cars to playground equipment sheet metal is everywhere. This project attempts to design a lamp that can be cut and formed from a single piece of sheet metal. By designing a lamp that can be cut from a single flat piece of sheet metal and folded into its final form we are able to achieve very high levels of efficiency in production and reduce waste. The project aims to create and elegant and efficient design for a sheet metal lamp that can be easily mass produce

Roberts, Chloe. Antibiotic Producing Bacteria.
The purpose of this experiment was to discover potential new candidates of antibiotic producing bacteria, to combat the diminishing supply of effective antibiotics. In this experiment potential candidates with antibiotic-producing properties against the safe relatives of ESKAPE pathogens were collected from a soil sample. On January 27, 2024 a silty soil sample was collected just above a water line (top 3 inches) on the bank of the Shawnee Mission Park pond by Jamie Cunningham. This soil sample was serially diluted and grown on five 50% TSA agar plates. Potential candidates showing zones of inhibition were collected from dilution plates 10^-3, 10^-4, and 10^-5. These candidates were then grown onto a master plate and individually tested against each safe relative. One candidate taken from plate 10^-5 was shown to have antibiotic producing properties against *Acinetobacter baylyi*.

Rock, Hannah. Chromatographic Separation and Testing of Compounds Produced by a *Pseudomonas* Bacteria.
"Goldilocks" is the working name of a bacteria collected by a JCCC microbiology student. It has previously been shown to inhibit *S. epi* when grown competitively. Chemical extracts taken from these bacteria inhibit *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions were tested for antimicrobial activity in broth. The results will be discussed.

Rodriguez, Azul. Exploring Soil Microorganisms: A Road to Antibiotic Discovery.
This research establishes a contribution to the field of antibiotic discovery. Soil ecosystems are known to be rich reservoirs of microorganisms that can produce different antimicrobial compounds. The procedures involved in isolating and identifying microbes with potential antibiotic properties from a soil sample. Initially, the soil sample collected from a backyard was diluted in sterile water to create a series of dilutions. From the microbial colonies grown, nine were selectively transferred to clean plates to further observe their growth characteristics, such as size, color, and margin. This step was crucial for isolating individual microbes for further study. Among these isolated microbes, a few showed potential inhibition. My final candidate, AR4A, demonstrated a promising outcome in the presence of the tester strain *Staphylococcus epidermidis*, which is recognized as a harmless relative of the more virulent *Staphylococcus aureus*. The observed zone of inhibition around AR4A, where the *Staphylococcus epidermidis* bacteria could not grow, suggests that AR4A is capable of destroying bacterial growth. This finding is medically important because it indicates that AR4A can potentially prevent the growth of pathogens known for causing severe infections. The ability of AR4A to limit the growth of *Staphylococcus epidermidis* offers a promising approach for developing treatments that could fight against *Staphylococcus aureus*.

Rubey de Guerrero, Stacy. Exploring Resources for Antibiotic Drug Discovery — An Isolation and Characterization of Antibiotic-Producing Bacteria from a Soil Sample Obtained in Jackson County, Missouri.
When bacteria no longer respond to the drugs designed to kill them, they become antibiotic-resistant, making future infections harder to treat. Without the development of new antibiotics to fight these "super" bacteria, we face a future of increasing death rates due to infections that otherwise should be treatable. In response to this growing public health threat, a soil sample was obtained from Fleming Park, a 7,800-acre recreational parkland in Jackson County, Missouri, to discover and isolate potential undiscovered antibiotic-producing bacteria in the soil. Through serial dilution of the sample, 15 bacterial colonies were isolated for further testing. Ultimately, six bacterial colonies were chosen for additional testing for inhibition against ESKAPE pathogen relatives. ESKAPE is an acronym for the names of six highly virulent and antibiotic-resistant bacterial pathogens. In the student lab setting, safe relatives of these pathogens were used to test the soil bacterial candidates in terms of their ability to inhibit the growth of these bacteria. Ultimately, one candidate stood out in its ability to inhibit pathogens' growth around it, and this candidate was named Zoe. Zoe showed promising results in inhibiting several tester strains of pathogens. There was a clear and significant inhibition zone against *Bacillus subtilis*, *Mycobacterium smegmatis*, and *Enterococcus faecalis*. Additionally, there was moderate inhibition against *Acinetobacter baylyi* and *Pseudomonas putida*, and slight inhibition against *Escherichia coli* and *Enterobacter aerogenes*. Gram and spore staining showed that Zoe was a gram-positive spore-forming rod bacterium. Polymerase Chain Reaction (PCR) and Gel Electrophoresis were conducted for DNA analysis.

Ruebelmann, Andrew; Gardner, James. Mission to Triton.
We propose a mission to Neptune's moon, Triton. We will use an orbital equipped with mass spectrometers to collect information about the material ejected into orbit by the moon's volcanoes in order to confirm the composition of the materials. This analysis will allow us to understand the internal composition of Triton and the possibility of life on Triton. The orbital will also use a spectroscope to analyze the spectroscopic output of the materials in order to gather additional information about its chemical composition. The craft will also have visual imagers to obtain photos of Triton. We plan to put the orbital in a close elliptical orbit around Triton using hydrazine thrusters to maintain a stable orbit. The orbital will get to Neptune by use of multiple gravity assist maneuvers.

Sadler, Elisabeth. Utilizing Soil to Combat Antibiotic Resistance.
Due to the highly competitive nature of soil, microbes produce chemicals that inhibit the growth of other microbes. This type of competition favors bacteria that can then produce an antibiotic, allowing soil to be a verifiable gold mine of potential antibiotic producing microbes, thus helping to solve the problem of antibiotic resistance. After serially diluting previously collected soil samples and testing the antibiotic candidates found in the sample against the ESKAPE safe relatives, it was discovered that one potential candidate, "Blem" exhibited antibacterial qualities against *Staphylococcus epidermidis*. Using PCR analysis and subsequent gel electrophoresis, the DNA of Blem was then sent to an outside facility for sequencing. The properties of this compound studied thus far suggest the discovery of a novel antibiotic and will require further study, such as performing a disc diffusion assay to determine the Minimum Inhibitory Concentration (MIC).

Salzman, Erica. Pathogens and Potential Cures.
Soil has been used as the main source of antibiotic-producing bacteria for a long time. But as time goes by the viruses we use antibiotics against become more resistant, and soon the antibiotic becomes ineffective. As the antibiotics we use become less effective, we have to search in other places. For my research to find a potentially new antibiotic, I collected a soil sample from Flat Rock Creek Park and Pool. The sample was collected from this location because the park has a lot of people that visit it, and I thought that where there are people – there are pathogens. Thus a soil sample taken from where a lot of people are frequently would have several potential candidates for a new antibiotic. After collecting the soil sample, I took it to be screened. After a long time of testing my various colonies within the sample against different ESKAPE relatives, the colony numbered "1" was inhibiting ESKAPE relative *Enterococcus faecalis*. The fact that "colony 1" is inhibiting the growth of *Enterococcus faecalis* could point to the potential that it will inhibit and become a new antibiotic to treat the ESKAPE pathogen *Enterococcus faecium*, but a lot of testing needs to be done before we can be sure if this could be the case. One of those things to be done is to run a Polymerase Chain Reaction on a sample from this colony to obtain a bit of its DNA. It will be interesting to see the results of the PCR.

Samuel, Bitanya. Search for Antibiotics.
The world's resistance to antibiotics is growing, so we need to search for more antimicrobials. Tiny Earth Network allows students to look for antibiotics from soil sources. Experiments were done with soil bacteria that included serial dilutions, master plates and antibiotic screenings. The soil bacteria were tested against the 6 safe relative pathogens, to see if the soil bacteria produced a chemical with the growth of the safe relative. The soil bacteria was identified through sequencing and metabolic testing as well. If I find an antibiotic it may become the next new antibiotic.

Sander, Gabrielle. Exploration of PETase.
Pollution is an extreme dilemma in the world today and is continuing to escalate each year. After the discovery of an enzyme called PETase, things are looking brighter for the future. The main function of PETase is to degrade plastics. In my Honors Biology class, we found that the PETase enzyme works the most optimally at a pH of 10 through an experiment that I conducted using a wide range of acidic and basic pH's. As for another experiment, I am mutating a sequence site in the PETase of DNA. I chose to replace Arginine with Lysine which results in a small change since they are both positive amino acids. This is because I believe that small changes lead to great success. To do so, we performed site directed mutagenesis, so then I could introduce it to *E. coli*. After an initial attempt it was ineffective, steps were repeated and mutated plasmid DNA was isolated. The mutation will be verified using sequencing and protein activity will be compared with wildtype. Finally, I isolated the mutated plasmid DNA to be eligible to send out for sequencing. I am currently waiting to receive my results.

Sander, Jacob. A Simple Pendulum Explained with Differential Equations.
A simple pendulum, which most of us have encountered in a Physics class, can be described with certain equations depending on what you are trying to discover. Whether it be the period, frequency, or solving for the length of the pendulum. However, what may not be realized is where exactly these equations come from. The answer is Differential Equations. What will be covered in this presentation is how these equations are derived with the applications of differential equations. Furthermore, we will discuss how the simple pendulum system can be applied in the world around us.

Santiago, Edgardo. Searching for Antibiotics; Superman May Be the Answer.
Antibiotic resistance has been an ongoing issue in the medical field for several years. Bacterial infections are becoming more resistant towards the known antibiotics in today's medicine. During the semester, I took on the challenge of discovering candidates that could possibly grow inhibition to surrounding bacteria and identifying the type of bacteria my candidates were. Antibiotics in today's medicine come from different types of soils that are collected and tested against different types of bacteria. In this lab, I collected dirt and used serial dilution and agar plates to find my own candidates that could help find a solution for this problem. While testing, I found a candidate who I named Superman, that could be the possible answer for this antibiotic problem.

Saunders, Madalen. The Search for New Antibiotics.
Antibiotic resistance has increasingly become a major ongoing problem in human health, it makes treating bacterial infections a lot harder, and more expensive, which creates a need for new antibiotic research to help fight against tougher infections. Almost all antibiotics used today were discovered in soil, but companies don't want to invest in developing and finding new antibiotics because it's too expensive, time consuming, and it doesn't make as much profit compared to producing things like cancer fighting drugs. For my research I dug up soil from the side of my house for the purpose of growing bacterial colonies and finding one potential candidate for this project that would inhibit the E.S.K.A.P.E pathogens close relatives. The E.S.K.A.P.E pathogens are the leading cause of hospital related bacterial infections worldwide, and all of them show significant antibiotic resistance. My chosen candidate "Jane" can inhibit *Enterococcus faecalis*, which is the close relative of E.S.K.A.P.E pathogen *Enterococcus faecium*, which can cause endocarditis. "Jane" also showed slight inhibition to *Staphylococcus epidermidis*, which is the close relative to *Staphylococcus aureus. S. aureus* causes MRSA, a highly antibiotic resistant bacterial infection.

Schmidt, Kayleen. Antibiotics in Soil.
In this experiment we studied the soil samples that were taken from a designated spot in order to determine if there are antibiotics within the sample. By completing serial dilution of the sample, creating a master plate of the bacteria, testing the bacteria with the ESKAPE relatives to determine what will inhibit other known bacteria. We followed that up by staining the bacteria using endospore staining to identify bacteria present, sequencing the results, and completing metabolic tests to identify what bacteria will produce antibiotics.

Schulz, Bailey. The Search for Antimicrobials in Soil Isolates.
The purpose of this study is to conduct further research on antimicrobials in soil to identify a potential candidate as an antibiotic. Antibiotic screening is crucial to addressing one of the world's biggest challenges: antibiotic resistance. A soil sample was collected to undergo serial dilution. After identifying ten promising candidates for antibiotic screening, a master plate was created to isolate these candidates. The candidates were then transferred to individual agar plates in conjunction with safe relatives of ESKAPE pathogens. Furthermore, the candidates that produced zones of inhibition were selected for further testing in determining if the candidate is an antibiotic. The findings of this study are essential to understanding factors that contribute to environments containing potential antibiotics. In addition, its implications can contribute to the growing knowledge of agents that result in antibiotic resistance.

Schutzler, Kim. Life in Soil.
Over the course of the semester, I have been testing bacterial candidates for antibiotic resistance. With the goal of searching for a new antibiotic to combat antibiotic resistance. I obtained a soil sample from my front yard in Prairie Village, Kansas, then serially diluted the soil sample. The diluted samples were then plated on 50% TSA agar plates and incubated at room temperature so that the potential candidates could grow. From there, I took candidates of interest and formed a master plate with nine different bacterial colonies. Next, I tested the selected bacterial candidates against the ESKAPE pathogen safe relatives. By screening the bacterial candidates of interest against the safe relatives I was able to safely test the candidates in class without the risk of dealing with the more harmful true ESKAPE pathogens. This research process is very important as diseases continue to evolve and antibiotic resistance will always be present and it is better to be prepared. In my research, I have found that my candidate, Bronze, showed inhibition against *Staphylococcus epidermidis*.

Seffens, Ben. Differential Equations in Population Modeling.
My project will summarize the growth of a population in a studied environment, by using differential equations to predict the future outcomes for the population. Some differential equations can be used with specific variables and values that are particular to the environment. The differential equations will be used to help predict if the population will die out, grow continuously, or plateau over time given different conditions.

Sellens, Tinuviel. Antibiotic Candidates from Soil.
This project is trying to find bacterial candidates in the soil to help to slow the antibiotic resistance problem rising in the world right now. During this project we do several tests to see if these bacteria we collect from the soil are resistant to the ESKAPE pathogens safe relatives. Seeing if these bacteria are resistant to any types of the ESKAPE pathogens, safe relatives will show if they can create antibiotics to fight off the actual ESKAPE pathogens. We also do several other tests to find out what kind of bacteria we are dealing with. For my project so far I have only found that my bacteria is gram positive and needed to be spore stained.

Serrano, Kevin. The Mechanism of Gunshot Technology on Aiding Public Safety.
Gunshots emit sound waves that can travel through air and water which are recorded in frequencies. From these given sound waves, it is possible to create a sensory device that can catch the sound waves and turn into electrical signals to be able to detect gunshots and be able to provide a rough radius from where these sound waves were received. Doing so will send a signal to any nearby public safety official. Helping aid public safety to respond quicker than a 911 caller that is on scene and having to provide details and may be in an unstable condition. There are multiple variables that could deceive the mechanism making it faulty. We will examine some of these variables and discuss methods for analyzing the effectiveness of various gunshot detection systems.

Sherman, Madison. Dirt Experiment.
The goal of my project is to demonstrate what I have learned and discovered throughout the semester on a poster. I have worked hard every week performing new tests on dirt collected from JCCC, in search of the presence of antibiotics. My poster will educate viewers on the importance of dirt and all that it contains and how I discovered this.

Sherrill, Robert. Discovery of Viable Antibiotic Candidates against ESKAPE Pathogens.
Pathogenic bacteria, or disease causing microorganisms, have always been an enemy towards human survival. It wasn't till the discovery of penicillin, the first discovered antibiotic, that gave us a fighting chance in defending ourselves against disease causing agents. Antibiotics are either naturally occurring or synthetically produced compounds that destroy or kill microorganisms. Now, the discovery and popularization of these antibiotics has become a driving force in the clinical health field, which serves extraordinary importance for human health. My research is to isolate these antibiotic producing bacteria from soil samples collected locally, and test their antimicrobial abilities against the ESKAPE pathogens. The ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species), are the main culprits of infections acquired in the health field. Therefore, the importance in treating them is high. From a soil sample collected atop a hill adjacent to a pool in South Glen, Olathe, Kansas, I isolated an antibiotic producing bacteria. This antibiotic producing bacteria has shown resistance towards *Staphylococcus epidermidis*, which is a safe-to-work with relative of *Staphylococcus aureus*. This therefore shows promise towards being a viable antibiotic candidate against the *Staphylococcus aureus* pathogen. If this discovery shows full resistance towards *Staphylococcus aureus* then it could become an important medical tool for treating diseases caused by one of the ESKAPE pathogens, giving a better fighting chance to those in need. With older antibiotics becoming ineffective to mutating pathogens it is highly important to seek new antimicrobial species capable of fully defending people.

Shin, Haseop. Sergei Underground.
The prevention of the next pandemic might be right beneath our feet. Our soil is one of the most promising sites where microbiologists look for bacteria with antibiotic properties. Without the richness and diversity of soil microbes, the conquest of bacterial infections as we know it would not be possible. However, bacteria can multiply very quickly and gain immunity to drugs, called antibiotic resistance. It is essential, then, to constantly look beneath our feet and search for a new source of antibiotics to prevent the next infectious outbreak. In this study, we investigated a bacteria, named "Sergei," collected from a residential yard in Kansas City, Kansas. It showed antibiotic resistance to three of six pathogen relatives, *A. baylyi*, *P. putida*, and *E. aerogenes*. It was tested further using Polymerase Chain Reaction (PCR) and other staining methods to identify how this bacteria relate to other known bacterial species.

Soper, William; Hare, Sade. Exploring Europas Depths: Subsurface Rover Expedition.
We propose a pioneering space mission aimed at drilling into the water reserve of Europa, one of Jupiter's icy moons. Europa is believed to possess a vast ocean beneath its icy crust, making it a compelling target for astrobiological research and potential habitability. In addition, we propose not only landing a research craft on Europa but also drilling underneath the surface ice in the hopes of accessing a subterranean water deposit for sample acquisition. A subterranean rover will be deployed to retrieve samples and return them to the lander for analysis. The mission would be an unmanned telerobotic vessel to reduce cost and risk, relying on a gravity assist maneuver to reach Jupiter's gravitational pull. The subsurface rover, outfitted with sonar, optical imagers, a sampler, and LiDAR, will deploy from the lander. The lander, in turn, will possess a sample processor to analyze and transmit the rover's findings.

Sounakhen, Nathalie. Case, The Chosen Child.
The rise of infectious diseases continues with new strains appearing. Scientists have found bacteria from soil samples to be efficient in creating antibiotics to help fight and prevent these illnesses. Most of the antibiotics used today are products from soil samples that have been taken and researched further. In our lab, we each collected our own soil sample to do a number of tests for antibiotic properties. I collected my silty soil sample from my front yard on January 31st, 2024 on a windy and chilly evening in De Soto, Kansas. With these results I found that candidate 2, also known as Case, inhibits *Staphylococcus epidermidis* and *Bacillus subtilis*. These tester strains are similar to dangerous pathogens such as *Staphylococcus aureus*, which causes pneumonia or can infect the bloodstream. The antibiotic Case is producing potentially might be able to fight these kinds of infections.

Stephens, Reagan; Ramsey, Clark; Webb, Zack. Mission to the Ocean World Ceres.
Ceres is a dwarf planet and is the largest object in the main asteroid belt between Mars and Jupiter. The Dawn orbiter found evidence of a large subsurface saltwater ocean and a tenuous water vapor atmosphere. The goal of this mission is to further examine Ceres, cataloging the chemical composition of its surface, analyzing the thickness of the crust and the extent of the subsurface ocean, and assessing the viability for organic life. The flight path will follow a gravity assist maneuver around Mars in order to perform an energy efficient trajectory to the dwarf planet. After transit, an orbiter will survey landing sites and a rover similar to Perseverance will land on the surface. The rover will include a UV mass spectrometer, an X-ray mass spectrometer, ground-penetrating radar, a gas chromatograph, and imagers in both visible light and radar.

Stofferan, Spencer. The Search for Penicillin II.
Microorganisms outnumber humans by more than a trillion to one, and with this figure comes a growing concern over the rise of antibiotic resistance. Many of these microbes can be found in soil and, luckily, can produce antibiotics to compete with and inhibit one another. One such microbe, Cerebral, taken from a soil sample at Woodridge Park was found to inhibit the relative of common pathogens. Soil dilutions, streak plates, and antibiotic screening led to the discovery of this candidate inhibiting the growth of *Acinetobacter baylyi*, possibly beginning the potential discovery of a new antibiotic that can aid in the fight against antibiotic resistance.

Talbert, Isabelle. Digging for Cures: Unearthing Antibiotic Potential from Soil Microbes.
In the face of rising antibiotic resistance, our microbiology research explored the endless potential of soil microbes as a source for antibiotics. This research was conducted through a series of serial dilutions, masterplates, and antibiotic screenings against the safe relatives of the ESKAPE pathogens. The research focused on finding zones of inhibition within our antibiotic screening plates that show the ability to resist common bacteria. One colony of bacteria named "Cat", showed tremendous potential for antibiotic research. This colony originated from a soil sample on JCCC's campus and showed zones of inhibition in the screenings of *Enterococcus faecalis* and *Acinetobacter baylyi*. This research not only highlights the soil's microbiological diversity but also emphasizes the critical role that everyday soil can have in the future of antibiotic discovery.

Thomas, Jazmine. Climbing Resistance.
Antibiotics are a vital component of our health as humans because of their ability to treat diseases and infections caused by bacteria. Since the 1960s, there's been widespread antibiotic resistance, which is one of the most significant risks to our healthcare system. We must discover new antibiotics; our soil is the easiest way to find these new antibiotics. In this experiment, we diluted soil samples to obtain a countable plate. Safe relatives of the ESKAPE pathogens tested against our candidates, and my candidate 4b showed inhibition to *Enterobacter aerogenes* and *Bacillus subtilis*. We made a series of streak plates to obtain a pure culture. After undergoing a spore stain, my candidate is a rod-shaped positive gram, forming spores. After screening for potential antibiotics, our final candidate, 4b, underwent PCR (polymerase chain reaction) sequencing. Copies of target DNA are used in gel electrophoresis to identify the candidate organism and its ability to become an antibiotic likely to avoid the development of resistance.

Tilden, Kira. Producing Antibiotics.
Soil has the largest amount of microorganisms that produce antibiotics. Discovering new antibiotics is huge in the scientific world, because antibiotics help give relief to symptoms, speed recovery time and stop the infection from spreading. Since the 1880s, scientists have been doing serial dilutions to test certain soil samples of possible antibiotic candidates. This has been successfully done by securing a soil sample, serial dilution, transferring possible candidates to a master plate, testing each candidate to a safe relative and creating a streak plate of best antibiotic candidate. After testing each candidate, it will become clearer how many or if there are any antibiotics present in the soil sample.

Trejo, Aracely Acuna. Antimicrobial Discovery: A Journey to Combat Antibiotic Resistance.
Antibiotic resistance is quickly becoming a rising global issue and an overall threat to public health as more microbes evolve to create difficult-to-treat illnesses that can be entirely resistant to antibiotics. To fight growing antibiotic resistance, the scientific community continues to search for new antimicrobials. The goal of this experiment is to find new antimicrobials from soil. A soil sample was collected in Kansas then serially diluted to be tested for antibiotic resistance. Candidates were found that showed inhibition to the antibiotic tester strains and then a PCR test was conducted.

Turner, Ethan. Unveiling March Madness: Predicting NCAA Tournament Winners with Dynamical Systems.
Unlocking the mysteries of March Madness, this study delves into predicting NCAA tournament winners using dynamical systems theory. By treating teams as dynamic entities influenced by player skills, coaching strategies, and game dynamics, we aim to capture the complexity of tournament outcomes. Leveraging advanced analytics and machine learning, our approach seeks to uncover hidden patterns and enhance predictive accuracy. Join us on a journey to unravel the unpredictable nature of collegiate basketball and revolutionize tournament forecasting.

Tyler, Clover. A New Hope: CT-16.
With the rise of antibiotic resistance growing in today's microbes and the unfortunate decline in discoveries of new antibiotics, public health is at risk and the need for new antibiotics is a more pressing matter than ever. Surprisingly, soil is an ideal resource to gather antibiotics from, as it holds a diverse, crowded ecosystem of microbes. A majority of the antibiotics discovered came from the very ground we walk on. This is due to the fact that soil is packed with microbes existing in close quarters, thus, a particular few hold a crucial ability: growth inhibition; and it was my goal to find one. I was curious as to what microbes one could find close to their home, and if one could find anything of importance in their own environment. I obtained a soil sample from my backyard, and through a series of serial dilutions, began to gather potential candidates that showed promising areas of inhibition. These candidates were then tested against specific pathogens to determine their ability to inhibit other bacteria. Only one of my chosen colonies, the sixteenth colony, showed inhibition against all pathogens, making it my strongest candidate—hence where it got its name: CT-16. The next step was to identify what bacteria I had discovered and its relatives—if it was already an existing bacteria—and determine if CT-16 truly was a new antibiotic capable of changing the world of antibiotics for the better.

Vega, Helen. Discovery of Capricorn at Jesus Trail.
Antibiotic resistance is an issue that has been becoming more prevalent in society. There are only a handful of antibiotics that are known in the pharmacological world and neither are pharmaceutical companies investing in the discovery of more. Therefore, in order to attempt discovery of something that can save many people from illness, I studied a soil sample from a trail near my house where I was able to screen potential candidates. After starting with 12 candidates and doing further research, I narrowed my attention to my candidate, Capricorn. With screening this candidate against E.S.K.A.P.E safe relatives and further examining the structure of this candidate, I present the capabilities Capricorn has that may improve the pharmaceutical world.

Vinyard, Victora. Solar Panels the Afterlife.
Since the country is obsessed with going green I wanted to investigate what is going on with solar panels. I am very much interested in putting these on my own home and have become very curious about how it all work. I know that solar panels have a life span of 25 to 30 years but what comes after? I will try to email or call companies involved in the future of new solar panel innovations and the recycling process of solar panels. I have many questions I propose to answer.... Why do solar panels wear out?, What are we doing with them after their lifespan?, What's being done to recycle them?, What's being done to extend their life? Are there any advancements to making them easier to recycle? Have they thought about where we will get the rare metals to continue production if we can no longer get them from another country?

Wade, Isabella. Finding Antimicrobials in Soil.
Antimicrobials are microbes that produce a zone of inhibition. This is important because those microbes can be used to produce antibiotics. When we overuse antibiotics the bacteria can develop antibiotic resistance. When this happens new antibiotics are needed. In class we went through the process of trying to find new antibiotics. We completed experiments in serial dilution, master plating, antibiotic screening, PCR, and gel electrophoresis. Finding new antibiotics can create new opportunities and potentially save lives.

Wahaus, William; Bush, Hayden. Synthesis of Dipeptides with Evaluation for Antimicrobial Activity.
For this poster presentation, the antimicrobial properties of a dipeptide will be tested, along efficient routes of synthesis of said dipeptide. The antimicrobial properties of some peptides and their synthesis are fields of research of great interest to pharmaceutical scientists. A dipeptide is formed by linking one amino acid to another. To ensure a uniform product, the C-terminus of one amino acid will be protected using a fairly novel esterification method described in by Turhanen et al in "Green and Efficient Esterification Method Using Dried Dowex H +/NaI Approach," while the N-terminus of the other will be protected using a Boc-group. Then, the peptide will be synthesized and evaluated for effectiveness, being compared to other synthesized dipeptides.

Walker, Trevill. Fight Against ESKAPE Pathogens.
Antibiotic resistance is part of a natural process of mutation for a bacterial species. Although this happens frequently, it poses a problem as it makes already pathogenic bacteria increasingly dangerous due to the inability to treat such infectious diseases with standard antibiotic treatments. The main culprits being named the ESKAPE pathogens which include: *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter spp*. The purpose outlined in this research is to show the findings of potential antibiotic candidates against these pathogens, which would eventually lead to possible effective treatments. This work is highly relevant due to the fact that antibiotics are mainly derived from natural products, meaning physical work needs to be done to scout and isolate these antibiotics containing bacteria. This was done from a soil sample as illustrated in this presentation. The main outcomes from this were 11 total potential candidates, now awaiting further ESKAPE testing, which were all derived from the soil sample located at Keystone Park in the surrounding Blue Springs, Missouri area.

Walker, Will. PETase Mutation M10Y.
Humans have created plastic that is now everywhere on our planet. Much of this plastic gets into the ocean and is eaten by sea creatures which either die or are caught and eaten by humans who then injest the pastic. This can cause serious problems for our ocean ecosystems and also has negative health affects for humans with the problems only getting worse. PETase is an enzyme that was discovered in a lab in Japan in 2016. This enzyme has the special function of being able to break down polyethylene terephthalate, which is the plastic found in plastic bottles. This enzyme could potentially help solve the worlds problem of plastic in the ocean. However, currently the PETase enzyme breaks down plastic only in high temperatures and is too slow to be useful. My project is to create the mutant M10Y of PETase and see if it changes how effectively the enzyme breaks down plastic. I chose M10Y as my mutation because Methionine and Tyrosine are similar amino acids and thus the Mutated DNA is more likely to work than if I picked a less similar amino acid. My data will include the effectiveness of M10Y at breaking down polyethylene terephthalate and at what temperature M10Y functions.

Warren, Maylee. PETase Mutagenesis Research.
Imagine the Empire State Building, which is 1,250 feet tall, and try to guess how much it would weigh. The answer is 365,000 tons. To put into a better perspective that is around 30,000 school buses. Now imagine 400 Empire State Buildings in weight. That is around how much plastic pollution as a global population we have added to our Earth in a 10 year span. Throughout this semester certain students have been given the opportunity to help find a new way of getting rid of plastic pollution. Scientists in Japan have discovered a plastic eating enzyme. It has been our job as students to see if there are mutations we can make to make this enzyme more effectively and efficiently eat away plastic. I have determined the change of valine to leucine for amino acid 255 in this bacteria's DNA sequence does not provide colonies after transformation of this new DNA sequence. That being said, this plastic eating enzyme was unable to form properly, due to many possibilities. Going forward, I have now taken over a new mutation change, methionine in amino acid 258 to arginine, that has previously been conducted by a fellow JCCC student. Going forward, enzyme activity and stability will help us learn the impact this enzyme is truly capable of.

Weidt, Lauren; Hussaini, Nargis. Investigation of Freeze Dried Milk and the Retention of Nutritional Qualities.
Freeze drying is a preservation technique that removes water from a substance while maintaining its structure and nutritional content. This experiment aims to explore the effects of freeze-drying on the composition and rehydration properties of milk. In this experiment, whole milk was extracted and freeze-dried under controlled conditions. Thin layer chromatography (TLC) of the fresh milk was conducted to separate and determine the solubility of the compounds in the milk. The composition of both the fresh milk and freeze-dried milk was analyzed and compared through Gas Chromatography/ Mass Spectrometry (GCMS). Overall, this research shows the difference in the composition of fresh milk compared to freeze-dried milk and the nutritional values of the kinds of milk. Lastly, investigates the chemical process of milk as it undergoes freeze-drying.

Weidt, Lauren. The Potential of Antibiotics from Wood Chips.
The origins of antibiotic resistance are due to the evolutionary dynamics of microorganisms. Antibiotic resistance has been an emerging global health concern, posing significant challenges to modern medicine. Over time, the use of antibiotics in healthcare has exerted immense selective pressure on bacteria, facilitating the development of resistant strains. Bacteria employ strategies such as enzymatic degradation, alteration of target sites, and efflux pumps to evade the action of antibiotics, rendering once-effective treatments ineffective. Mold is where the first antibiotic was discovered by Alexander Flemming. WWII was beginning at the of the discovery creating a desperate need for antibiotic treatment. This formed a momentum and desire among researchers to find more antibiotics. Researchers turned to collecting soil samples from all over the world to find these new antibiotics. Instead of soil, wood chips were analyzed to look for potential candidates for antibiotic production. The collection of the wood chips was on January 31, 2024, from the playground at Mathews Elementary School. This site was chosen due to the high foot traffic of kids. Through serial dilution, the microbes were plated and analyzed for potential candidates. Candidates were screened against safe relatives of the ESKAPE pathogens. The candidate chosen for further analysis of the bacterial cell properties, mechanisms, and antibiotic production is number 11 as it inhibited more safe relatives than any other candidate. Genetic and metabolic testing is used to identify candidate 11. This study encompasses the techniques and process of looking for antibiotics in soil.

Weis, Bailey. Soil Microbes.
This experiment was designed to detect the presence of antibiotic-producing microorganisms in soil samples. A soil sample was collected and was then ready to be diluted for candidate selection which is the procedure of looking for colonies that exhibit inhibition zones from nearby bacteria. As antibiotic resistance spreads and becomes more challenging, we need to find new sources of important antibiotics that stand out from the ones that came before them. Another challenge for researchers is that we are only able to cultivate a relatively tiny pool of bacteria because of the unfavorable growing circumstances in the laboratory. With our chosen candidate that showed zones of inhibition we use a technique known as Polymerase Chain Reaction (PCR) to copy a certain DNA sequence outside of a living cell. At the end of PCR millions of copies of the targeted DNA should be present which is now ready to sort the DNA fragments according to size by gel electrophoresis.

Wheat, Mallory. Antimicrobials in Soil.
The objective of this study is to examine various soil samples for antimicrobial activity from Kansas soil. Several experiments were conducted including serial dilution. Once colonies had grown on each plate dilution, the serial dilution plates were investigated for candidates that displayed zones of inhibition. These candidates were then used to create master plates of the colonies with zones of inhibition to be screened for antibiotics against strains of safe relative microbes. A candidate was then selected for further research based on the number of zones of inhibition that were present between each antibiotic screening. These findings could potentially lead to a discovery of a new antibiotic.

Whitehair, Calvin. Antibiotic Development from Cultivation of Soil Microbes.
Many of the antibiotics that we use today to treat bacterial infections originate from bacterial colonies. Certain microorganisms have the ability to secrete antibiotics to inhibit the spread and growth of other bacterial colonies, which is how certain antibiotics are produced. Since there are many different bacterial colonies in a small amount of soil, the environment is considered to be highly competitive. Bacterial colonies secrete antibiotics to combat other colonies for control of space and nutrients within the soil. These antibiotic secreting microbes can be obtained by collecting a soil sample and isolating the bacterial colonies. I obtained my soil sample below the deck of my parents house, which is a shady and damp location. Through bacterial isolation and testing potential candidates for antibiotics against safe relative tester strains in an aerobic lab setting. I have found that my candidates, PSD#5 and PSD#7 secrete antibiotics that inhibit the gram-positive tester strain *Staphylococcus epidermidis* and the species *Bacillus subtilis* and *Mycobacterium smegmatis*. This means that the antibiotics produced by candidates PSD#5 and PSD#7 could be used to treat infections brought on by the pathogens related to these tester strains. Infections including Staph infections, bacteremia/septicemia, and Tuberculosis.

Whitman, Gabriella. Release Your Inhibitions - Antibiotic Discovery.
Like Natasha Bedingfield once said in her hit, "Unwritten", release your inhibitions! As antibiotics are taken, immunity grows in our system. This is why it is incredibly important to discover new antibiotics. The goal of antibiotic research is to find a zone of inhibition within a bacterial screening. The bacteria, named "Holden", which was collected from a soil sample in Lenexa, Kansas, shows a resistance to the safe relative *Acinetobacter baylyi*. This was concluded through a series of serial dilutions, master plates, six different antibiotic screenings, and more.

Wilson, Jocelyn. Microbial Diversity in Soil.
In this experiment microbial diversity was studied using soil from a residential backyard. Different bacteria was looked at within the soil but specifically the antibiotics within it. Many different techniques were used during this experiment. Serial dilution was done first to isolate microbial populations. A master plate was created as a way to organize the antibodies. ESKAPE pathogens were used for antibiotic screenings to see if antibiotics can inhibit safe relatives. Once zones of inhibition are found to determine the specific bacteria PCR is used to amplify sequences and then metabolic tests are done. These methods will help to find potential antibiotics within the soil.

Wilson, Jordan. Geepers Creepers!
In my research I started off by picking an amazing spot to collect my soil sample…My back yard. The goal was to get around 2 inches in the ground and observe the type of soil I collected. With this sample J was able to run some tests through aseptic technique, serial dilution, antibiotic screening, and many many swabs samples later. The purpose of my research was to try and find safe ESKAPE relatives in the natural world to prove how antibiotics are all around us and we don't even realize it. This is very important for scientists who are working with the foreign unsafe relatives that tend to get people very sick each year so finding proper antibiotic properties in natural habitats can help create many medicines for future use. During my long research period I was able to find multiple candidates that have these antibiotic properties against certain ESKAPE relatives, but I was able to find one that had a zone of inhibition in 4 out of 6 ESKAPE relatives!

Wilson, Mia. A Breakthrough in Antibiotic Resistance: Discovering Bailey.
Germs, such as bacteria and fungi, are constantly developing the ability to resist drugs designed to fight them off. These microbes have adapted their environment and through mutations and selection have learned to resist the effects of the given antibiotic medication. As pathogens are exposed to the same antibiotic medications, their resistance to them becomes greater and the ability for the medications becomes futile. Antibiotic resistance ensures the treatment and rapid spreading of infection to be possible and therefore has become harder for medical professionals to diagnose and treat. Throughout many years, scientists have worked to uncover microbes that can lead to the discovery of new bacteria that further helps aid in medication development such as antibiotics. Research regarding the discovery of new microbes always renders them useful. Throughout the course of this semester our microbiology class has contributed to collecting many microbial species through a soil sample to identify candidates important to antibiotic screening. Through careful examination and dilution of the soil, I was able to discover 11 different microbial species. Within these promising candidates, I found 1 that portrayed a possible antibiotic breakthrough. Bailey, the name of my microbial candidate, inhibited 4 of the 6 ESCAPE relative bacteria.

Winter, Shelby; Williams, Marlena. Peptide Synthesis.
Antimicrobial peptides (AMP) are a growing area of interest in pharmaceutical research. In this project two amino acids will be coupled in order to produce a dipeptide. Protecting the N-terminus of one amino acid and the C-terminus of another allows only one type of dipeptide to form. The antimicrobial activity of the synthesized dipeptide will be evaluated and compared to other dipeptides currently understood to have activity.

Wood, Lauren. Antibiotics from Dirt Can Combat Antibiotic Resistance.
Antibiotics are often used to fight illnesses caused by bacterial infections such as strep throat and meningitis. Currently, there is a serious health threat caused by bacteria that have become resistant to these antibiotics around the world, making bacterial infections much more difficult to treat. The Tiny Earth project is a program that uses students around the world to join the fight against antibiotic resistance. Working with Tiny Earth in my microbiology class, I was able to isolate a strain of bacteria from the soil in my backyard which produces antibiotics with promising results in fighting many different ESKAPE pathogen relatives. With further testing, this bacterial strain could be proven to be effective in fighting the antibiotic resistance crisis.

Woodruff, Krystle. Fighting Antibiotic Resistance: Hope in the Hidden World Beneath Us.
Antibiotic resistance is on the rise at an alarming rate, and, without the discovery of new antibiotics, deadly bacteria are virtually unstoppable. Since Fleming's discovery of penicillin in 1928, the overuse and misuse of antibiotics have resulted in bacteria capable of resisting antibiotics, rendering our current antibiotics virtually useless against these deadly pathogens. Therefore, it is crucial that we discover new antibiotics to fight antibiotic-resistant bacteria. The students at JCCC have partnered with the Tiny Earth Network to take on the challenge of aiding in the research for new antibiotics by using the vastly available and unlimited resource of the soil beneath our very feet. Currently, many of our antibiotics are derived from microbes living in the soil. After collecting a soil sample of my own, I isolated the microbes from the soil sample for further research. Through a series of serial dilutions, master plates, and streak plates, I was able to successfully isolate a specific type of bacteria, referred to as "Finn the Destroyer," that shows strong inhibition of other bacteria, including 5 harmful pathogen relatives: *Enterococcus faecalis*, *Escherichia coli*, *Acinetobacter baylyi*, *Pseudomonas putida*, and *Enterobacter aerogenes*. In colonies, "Finn the Destroyer" appears white, convex, smooth, and round. Further testing indicated "Finn the Destroyer" is rod-shaped, gram-positive, and contains endospores. While further testing is necessary, "Finn the Destroyer" shows promise to an antibiotic breakthrough.

Wright, Shana. Exploration of Microbial Diversity: A One Piece-inspired Expedition in Soil Microbiology.
This study draws inspiration from the adventurous spirit of One Piece while linking it to soil microbiology. Employing techniques such as serial dilutions and streak plates, akin to navigating uncharted waters, the aim is to isolate a target microbe from soil samples. Subsequent antibiotic screening revealed only two microbes with antibiotic resistance in an agar plate filled with *Mycobacterium smegmatis*. Notably, Microbe #8, named after Luffy, the main character of the popular series is selected for further investigation. This exploration highlights the significance of unraveling Microbe #8's role in the ecosystem and its potential implications for human health and the importance of understanding microbial biodiversity.

Xidis, Lily. Finding Antibiotic Microbes.
Antibiotic resistant pathogens are increasing the risk to global human health in spite of the new discoveries of antibiotics. Microorganisms found in soil can help in producing such antibiotics. By screening a soil sample from a local park to isolate microbes that can potentially be used in making antibiotics against resistant pathogens. From these screenings, there was one candidate that inhibited *Staphylococcus epidermidis* which is a safe relative of one of the ESKAPE pathogens.

Yazel, Shelby. Extraction and Separation of Antimicrobial Compounds Produced by a Strain of *Pseudomonas* Bacteria.
A bacteria collected by a JCCC microbiology student called, "Johnny 5," has previously been shown to inhibit tester strains of *E. aerogenes*, *S. epi*, *E. coli*, *E. faecalis*, *B. subtilis*, and *M. smegmatis* when they are grown competitively. Chemical extracts taken from these bacteria inhibit tester strains of both *E. coli* and *S. epi* when grown in broth with the extract. This research explored the separation and isolation of components of the extract mixture using chromatography. The separated fractions of the extract were tested for antimicrobial activity against tester strains in broth. The results will be discussed.

Zamora, Valencia. The Search for Antimicrobials.
Researching soil samples has become a very important part of antimicrobial discovery. Due to a multitude of reasons, antibiotics are becoming more resistant to the ability to treat common infectious diseases around the world, threatening global health. Continuing the research for antimicrobials, my class and I collected soil samples in hopes of finding the next antibiotic. Agar plates were used in hopes of producing a zone of inhibition, which then could be tested further. This experiment was done domestically, however the microbial communities differ greatly. Due to the microbial community differing greatly, researchers are given the opportunity to discover new species of bacteria and potentially the next antibiotic.

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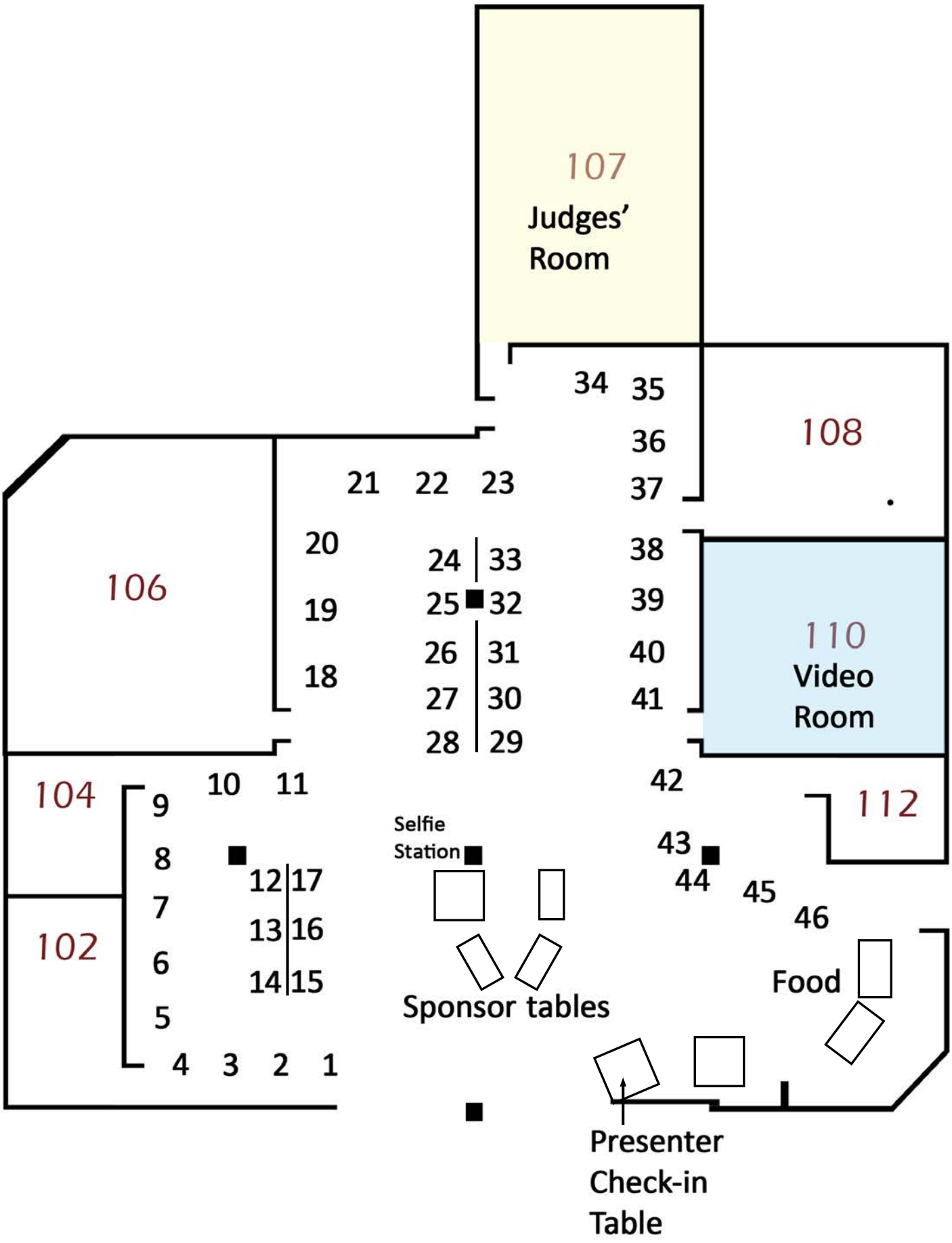
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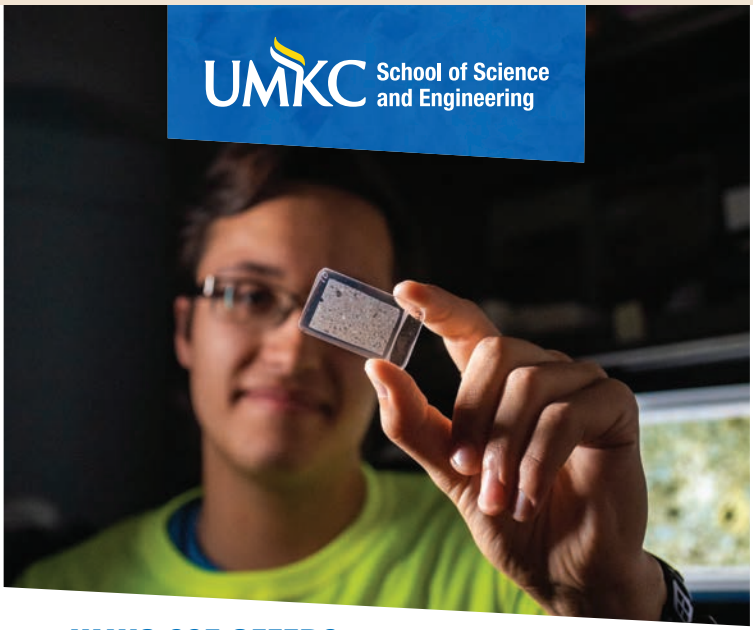

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