UTRGV
Department of Physics & Astronomy

The University of Texas Rio Grande Valley
School of Art & Design

Research Experience for Undergraduates at The University of Texas Rio Grande Valley

UTRGV
Department of Physics & Astronomy

Research Experience for Undergraduates Arts & Sciences Award Project (ASAP)

The University of Texas Rio Grande Valley
School of Art & Design

DR. VOLKER QUETSCHKE

volker.quetschke@utrgv.edu
Associate Dean for Research
and Graduate Programs-COS
Professor- Physics & Astronomy Department
UT System Faculty Advisory Council, etc…
The University of Texas Rio Grande Valley

IVAN DAVILA

ivan.davila01@utrgv.edu
Laboratory Manager
Physics and Astronomy Department
The University of Texas Rio Grande Valley

GINA GWEN PALACIOS

gina.palacios@utrgv.edu
Assistant Professor
Associate Director – School of Art & Design
The University of Texas Rio Grande Valley

ROMEO DI LORETO

romeo.diloreto@utrgv.edu
Assistant Professor
School of Art & Design
The University of Texas Rio Grande Valley

UTRGV
Department of Physics & Astronomy

Research Experience for Undergraduates Arts & Sciences Award Project (ASAP) Participants 2022-2023

The University of Texas Rio Grande Valley
School of Art & Design

CECILIA SIERRA

Participant summer 2022
Printmaking

JOSUE RUBIO

Participant summer 2022
Design

CLARISSA SIFUENTES

Participant summer 2023
Ceramics

LUZ RODRIGUEZ

Participant summer 2023
Graphic Design

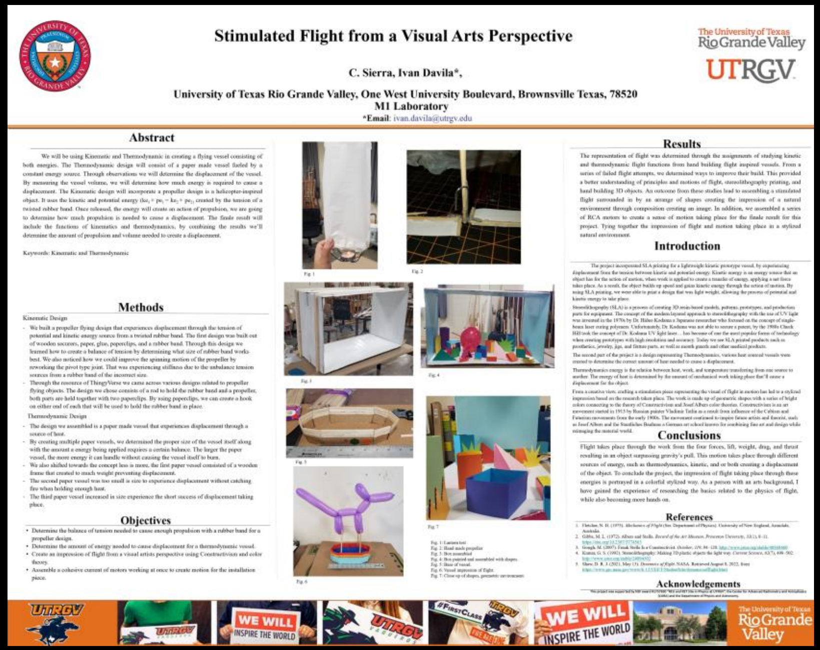
YENTAL MARQUEZ

Participant summer 2023
Studio Art

Arts & Sciences Award Project (ASAP)

- Program designed to provide undergraduate ART students with hands-on research opportunities and expose the Science students to other possibilities.

Mentor Meetings



Stimulated Flight from a Visual Arts Perspective

C. Sierra, Ivan Davila*,

University of Texas Rio Grande Valley, One West University Boulevard, Brownsville Texas, 78520
M1 Laboratory
*Email: ivan.davila@utrgv.edu

Abstract

We will be using Kinematic and Thermodynamic in creating a flying vessel consisting of both energies. The Thermodynamic design will consist of a paper made vessel fueled by a constant energy source. Through observations we will determine the displacement of the vessel. By measuring the vessel volume, we will determine how much energy is required to cause a displacement. The Kinematic design will incorporate a propeller design is a helicopter-inspired object. It uses the kinetic and potential energy ($ke_1 + pe_1 = ke_2 + pe_2$) created by the tension of a twisted rubber band. Once released, the energy will create an action of propulsion, we are going to determine how much propulsion is needed to cause a displacement. The finale result will include the functions of kinematics and thermodynamics, by combining the results we'll determine the amount of propulsion and volume needed to create a displacement.

Keywords: Kinematic and Thermodynamic

Methods

Kinematic Design

- We built a propeller flying design that experiences displacement through the tension of potential and kinetic energy source from a twisted rubber band. The first design was built out of wooden seccors, paper, glue, paperclips, and a rubber band. Through this design we learned how to create a balance of tension by determining what size of rubber band works best. We also noticed how we could improve the spinning motion of the propeller by reworking the pivot type joint. That was experiencing stiffness due to the unbalance tension sources from a rubber band of the incorrect size.
- Through the resource of ThingyVerse we came across various designs related to propeller flying objects. The design we chose consists of a rod to hold the rubber band and a propeller, both parts are held together with two paperclips. By using paperclips, we can create a hook on either end of each that will be used to hold the rubber band in place.

Thermodynamic Design

- The design we assembled is a paper made vessel that experiences displacement through a source of heat.
- By creating multiple paper vessels, we determined the proper size of the vessel itself along with the amount a energy being applied requires a certain balance. The larger the paper vessel, the more energy it can handle without causing the vessel itself to burn.
- We also shifted towards the concept less is more, the first paper vessel consisted of a wooden frame that created to much weight preventing displacement.
- The second paper vessel was too small is size to experience displacement without catching fire when holding enough heat.
- The third paper vessel increased in size experience the short success of displacement taking place.

Objectives

- Determine the balance of tension needed to cause enough propulsion with a rubber band for a propeller design.
- Determine the amount of energy needed to cause displacement for a thermodynamic vessel.
- Create an impression of flight from a visual artists perspective using Constructivism and color theory.
- Assemble a cohesive current of motors working at once to create motion for the installation piece.

Fig. 1: Lantern test
Fig. 2: Hand made propeller
Fig. 3: Box assembled
Fig. 4: Box painted and assembled with shapes
Fig. 5: Base of vessel
Fig. 6: Vessel impression of flight
Fig. 7: Close up of shapes, geometric environment

Results

The representation of flight was determined through the assignments of studying kinetic and thermodynamic flight functions from hand building flight inspired vessels. From a series of failed flight attempts, we determined ways to improve their build. This provided a better understanding of principles and motions of flight, stereolithography printing, and hand building 3D objects. An outcome from these studies lead to assembling a stimulated flight surrounded in by an arrange of shapes creating the impression of a natural environment through composition creating an image. In addition, we assembled a series of RCA motors to create a sense of motion taking place for the finale result for this project. Tying together the impression of flight and motion taking place in a stylized natural environment.

Introduction

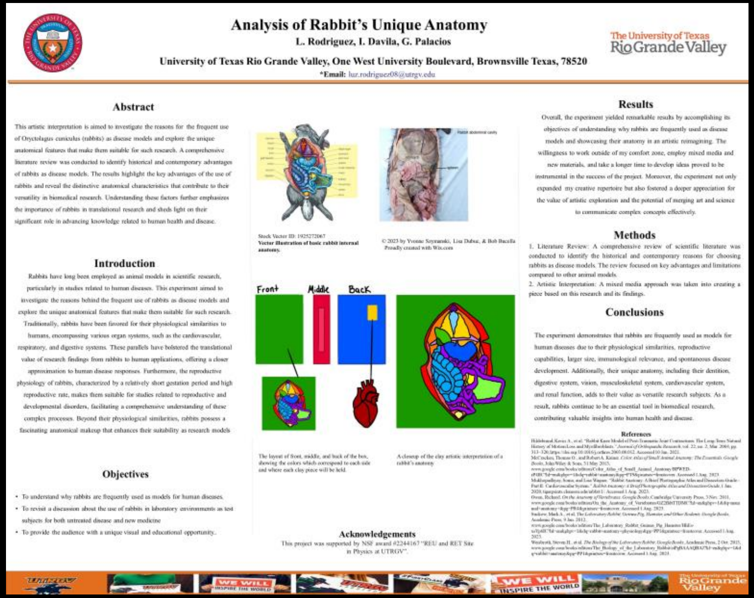
Conclusions

Flight takes place through the work from the four forces, lift, weight, drag, and thrust resulting in an object surpassing gravity's pull. This motion takes place through different sources of energy, such as thermodynamics, kinetic, and or both creating a displacement of the object. To conclude the project, the impression of flight taking place through these energies is portrayed in a colorful stylized way. As a person with an arts background, I have gained the experience of researching the basics related to the physics of flight, while also becoming more hands on.

References

Acknowledgements

CECILIA SIERRA



Analysis of Rabbit's Unique Anatomy

L. Rodriguez, I. Davila, G. Palacios

University of Texas Rio Grande Valley, One West University Boulevard, Brownsville Texas, 78520

*Email: luz.rodriguez08@utrgv.edu

The University of Texas Rio Grande Valley

Abstract

This artistic interpretation is aimed to investigate the reasons for the frequent use of Oryctolagus cuniculus (rabbits) as disease models and explore the unique anatomical features that make them suitable for such research. A comprehensive literature review was conducted to identify historical and contemporary advantages of rabbits as disease models. The results highlight the key advantages of the use of rabbits and reveal the distinctive anatomical characteristics that contribute to their versatility in biomedical research. Understanding these factors further emphasizes the importance of rabbits in translational research and sheds light on their significant role in advancing knowledge related to human health and disease.

Introduction

Rabbits have long been employed as animal models in scientific research, particularly in studies related to human diseases. This experiment aimed to investigate the reasons behind the frequent use of rabbits as disease models and explore the unique anatomical features that make them suitable for such research. Traditionally, rabbits have been favored for their physiological similarities to humans, encompassing various organ systems, such as the cardiovascular, respiratory, and digestive systems. These parallels have bolstered the translational value of research findings from rabbits to human applications, offering a closer approximation to human disease responses. Furthermore, the reproductive physiology of rabbits, characterized by a relatively short gestation period and high reproductive rate, makes them suitable for studies related to reproductive and developmental disorders, facilitating a comprehensive understanding of these complex processes. Beyond their physiological similarities, rabbits possess a fascinating anatomical makeup that enhances their suitability as research models

Objectives

- To understand why rabbits are frequently used as models for human diseases.
- To revisit a discussion about the use of rabbits in laboratory environments as test subjects for both untreated disease and new medicine
- To provide the audience with a unique visual and educational opportunity.

Stock Vector ID: 1925272067
Vector illustration of basic rabbit internal anatomy.

© 2023 by Yvonne Szymanski, Lisa Dubuc, & Bob Bucella
Proudly created with Wix.com

Front Middle Back

The layout of front, middle, and back of the box, showing the colors which correspond to each side and where each clay piece will be held.

A closeup of the clay artistic interpretation of a rabbit's anatomy.

Results

Overall, the experiment yielded remarkable results by accomplishing its objectives of understanding why rabbits are frequently used as disease models and showcasing their anatomy in an artistic reimagining. The willingness to work outside of my comfort zone, employ mixed media and new materials, and take a longer time to develop ideas proved to be instrumental in the success of the project. Moreover, the experiment not only expanded my creative repertoire but also fostered a deeper appreciation for the value of artistic exploration and the potential of merging art and science to communicate complex concepts effectively.

Methods

1. Literature Review: A comprehensive review of scientific literature was conducted to identify the historical and contemporary reasons for choosing rabbits as disease models. The review focused on key advantages and limitations compared to other animal models.
2. Artistic Interpretation: A mixed media approach was taken into creating a piece based on this research and its findings.

Conclusions

The experiment demonstrates that rabbits are frequently used as models for human diseases due to their physiological similarities, reproductive capabilities, larger size, immunological relevance, and spontaneous disease development. Additionally, their unique anatomy, including their dentition, digestive system, vision, musculoskeletal system, cardiovascular system, and renal function, adds to their value as versatile research subjects. As a result, rabbits continue to be an essential tool in biomedical research, contributing valuable insights into human health and disease.

References

Acknowledgements

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WE WILL INSPIRE THE WORLD

The University of Texas Rio Grande Valley

LUZ RODRIGUEZ

Visual Arts rendition of a stringed instrument and research to understand waves and energy.

J. Rubio, Ivan Davila*

University of Texas Rio Grande Valley, One West University Boulevard, Brownsville Texas, 78520

*Email: ivan.davila01@utrgv.edu

Abstract

Stringed instruments share key components in their design. Some components can be made with different materials. Some of these parts contribute to the sound produced by the instrument. Stringed instruments use standing waves, $\lambda = 2L/n$, the tightened strings have closed ends which when they are struck will begin to vibrate the string and cause a standing wave. The frequency that goes through the wave will determine the sound, but not all stringed instruments are the same, even if they are playing the same note each instrument has its own timbre depending on the pitch and intensity. In this project the objective is to make an instrument. Assembling the instrument required a better understanding of proportions, scaling, and design.

Keywords: Standing waves, Timbre

Methods

- A stringed instrument will be created, to show the tension of strings can produce sound and the notes can be changed based on string length. This build consisted of a wooden board, hook screws, guitar strings, and an aluminum can. The can was put under the stretched out strings to cause more tension, and allow the can to be moved further and closer to the end points to change the notes.
- There was a failed attempt at creating this contraption which was made before by using stereolithography. It was too small, but it furthered knowledge of 3D modeling software, and the idea of size and scale.
- The second design was made with recycled materials such as cardboard, foam, scrap wood, paint, magnetic strips and wire. This one was made to also be an instrument but it was also connected to a Playtron by Plantronics, which works through currents and connects to a program to produce sound. The metal strings were connected to comb connected to the machine to produce sound that can be changed unlike a traditional piano.

Objectives

- Create an instrument while incorporating topics of research throughout the program.
- Understand the use of waves in sound and vibrations along with how they can work with different mediums.

Results

Through multiple attempts both instruments were able to follow their intended function. The strings caused some difficulty as they would pop easily from too much tension. The pickup and amplifier increased the sound of the stringed instrument. The 3-D printers were helpful for understanding the importance of scaling objects. The synthesizer that was connected to the piano allowed for the manipulation of the waves and sound.

Introduction

It was believed that the first stringed instrument came to be from the sound made by a bow and arrow.[1] These strings when plucked cause waves, and this periodic movement between two end points is known as oscillation. Oscillations are vibrations that move in a repeating motion such as a pendulum. Standing waves occur when a reflected wave interferes with the incident wave and the wave appears to stand still. Such as a stringed instrument when a string is plucked it would appear to be still although the sound is still occurring. Standing waves occur throughout mediums, but through strings it can be used to show examples of them occurring. In another experiment done in Henry Ford Community College, they had fine art students collect data on standing waves with guitar, and its resonant frequency $fr = m\sqrt{2L}$.[2] There is a machine that is used to display, and analyze the frequency of the waves, it is called an Oscilloscope. An oscilloscope can be used to display standing waves. The frequency that goes into strings play a role in the sound that will be emitted. They do not only cause one sound but multiple due to the harmonics from the string vibration. String instruments were made of wood, mostly tropical hardwoods due to their density. Their designs were also a factor, according to craftsman Tom Ribbecke, he believes that the effect an instrument will leave on a listener cannot be perfectly scientifically predicted.[3] These woods would also help with the resonance of the sound, and the varnishes added would influence the acoustics. With electronic instruments this problem would not be relevant, because those woods are expensive and some even endangered, the resonance of the sound is handled through the circuitry. For many of the designs that I have found, the key components of these electric instruments are composed of a board, strings, circuitry, and in some cases piano like keys. The fine tuner, pegs and parts that will hold up the strings are what can cause a change in pitch.

The designs I have made are for two different models. One is for standing waves, and using a string that is wound like a guitar, and the other is a type of piano that is connected to wires that when played makes non-traditional sounds.

Conclusions

Sound and Energy waves can travel between mediums. Such as the vibrations of the strings will travel across the air to us and we will interpret those vibrations as sound. There is also the transfer between mediums in the piano connected to a computer, the physical keys are played are analyzed by the computer then through the speakers it will come out as sound. Each instrument has its own Timbre and the sounds can be manipulated.

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Acknowledgements

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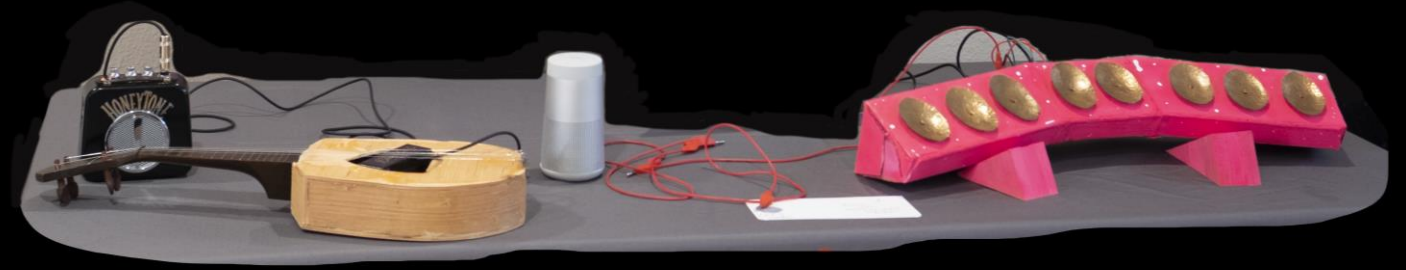

JOSUE RUBIO

Yersinia Pestis Bacterium

C. Sifuentes, I. Davila*, G. Palacios

University of Texas Rio Grande Valley, One West University Boulevard, Brownsville Texas, 78520

School of Art and Design – Studio Art

*Email: clarrissa.sifuentes01@utrgv.edu

The University of Texas Rio Grande Valley

Abstract

This work will highlight the outbreak of the Yersinia Pestis (Y. Pestis) bacterium, from Europe in the Middle Ages to the United States of America from 1970-2020. Yersinia Pestis is exceedingly tiny, at about 1.5 nm, and is spread via fleas. This work will consist of a Byzantine era study of a tryptic, and a representation of the worldwide spread of this infectious disease. Y. pestis can affect humans and animals and can be observed as swollen lymph nodes (buboes), in the armpit, groin, and neck and can become as large as eggs and can ozore pus. In this representation we also explore the effects it had on Christianity, the largest religion in Europe at that time.

Bubonic plague is one type of plague that can be derived from Y. Pestis. It gets its name from the swollen lymph nodes (buboes), in the armpit, groin, and neck and can become as large as eggs and can ozore pus. Yersinia Pestis is exceedingly tiny, at about 1.5 nm. It can create infection throughout the body (septicemic plague) and infect your lungs (pneumonic plague), without treatment, septicemic and pneumonic plague are both fatal. Using Heat maps to track the spread of this plague; I will create an artistic representation of the worldwide spread of this infectious disease as well as the effects it had on Christianity. Dating as far back as the 1340s, this bacterial infection still occurs to this day throughout the world. Due to scientific progress and a better understanding of this disease, the Y. Pestis infection can now be treated with antibiotics.

Introduction

Yersinia pestis is a facultative anaerobic coccobacillus. Anaerobic cocci are pathogens that cause a multitude of infections. They are part of the normal microbial flora of a healthy individual, but they can cause infections involving traumatized tissue or infections in the compromised host. This means it can grow in the presence or absence of oxygen and has a shape that bridges the round forms of cocci and the rod-like features of bacilli. (Bush, 2023) They look like short ovals under a microscope. A Yersinia pestis bacterium is non-motile and cannot move through its environment. To multiply, it requires a host animal. Therefore, making it an obligate parasite. (Knapp, 2020)

During the early stages of the infection, Y. pestis replicates within macrophages at peripheral host sites from there, they spread into the draining lymph nodes where they replicate and lead to the formation of buboes (hemorrhagic, swollen lymph nodes), which is the characteristic clinical feature of bubonic plague. Subsequently, Y. pestis can disseminate into the blood stream leading to a fulminant systemic infection and fatal septicemia. (Harvard, 2022) In rare occasions the infection can progress to pneumonia (pneumonic plague) which enables the bacteria to be transmitted from person-to-person via contaminated droplets (Heroven, 2014)

During infection, Yersinia, a facultative intracellular bacterial species, exhibits the ability to first invade host cells and then counteract phagocytosis by the host cells. During these two distinct stages, invasion or antiphagocytic factors assist bacteria in manipulating host cells to accomplish each of these functions; however, the mechanism through which Yersinia regulates these functions during each step remains unclear. (Ke, 2013)

Objectives

- Create an Artistic Byzantine era study of the spread of the plague in different eras.
- Implement different visual techniques to convey information.
- Develop a research-based approach to creating artwork.

1 dot placed in state of residence for each reported plague case

Since the mid-20th century, plague in the United States has typically occurred in the rural West. The case shown in Illinois was lab-associated.

Table of Reported Cases – U.S. 1970-2020

Results

- Learned new visual techniques
- Grasped a better understanding of Latex Color pigmentation
- Produced Buboe like lesions out of Latex to represent the spread of the plague.

Methods

- Literature review of Y. Pestis.
- Applied new visual techniques.
- Create a tryptic inspired by the Byzantine era and replicated Buboe like lesions.

Conclusions

The Bubonic Plague persisted for centuries in Central Asia and continues to spread globally. By the end of the outbreak the European population was cut by a third to a half. The Pandemic was a profound rupture that reshaped society and ultimately led to the reformation that split Christianity in the 16th Century and a new approach to the treatment of Disease. (Brooke, 2020). Through Direct Contact experience, Doctors became committed to new medicinal approaches and the establishment of Quarantines. In today's modern world this long-lived system of quarantine is still a potent part of the public health.

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Acknowledgements

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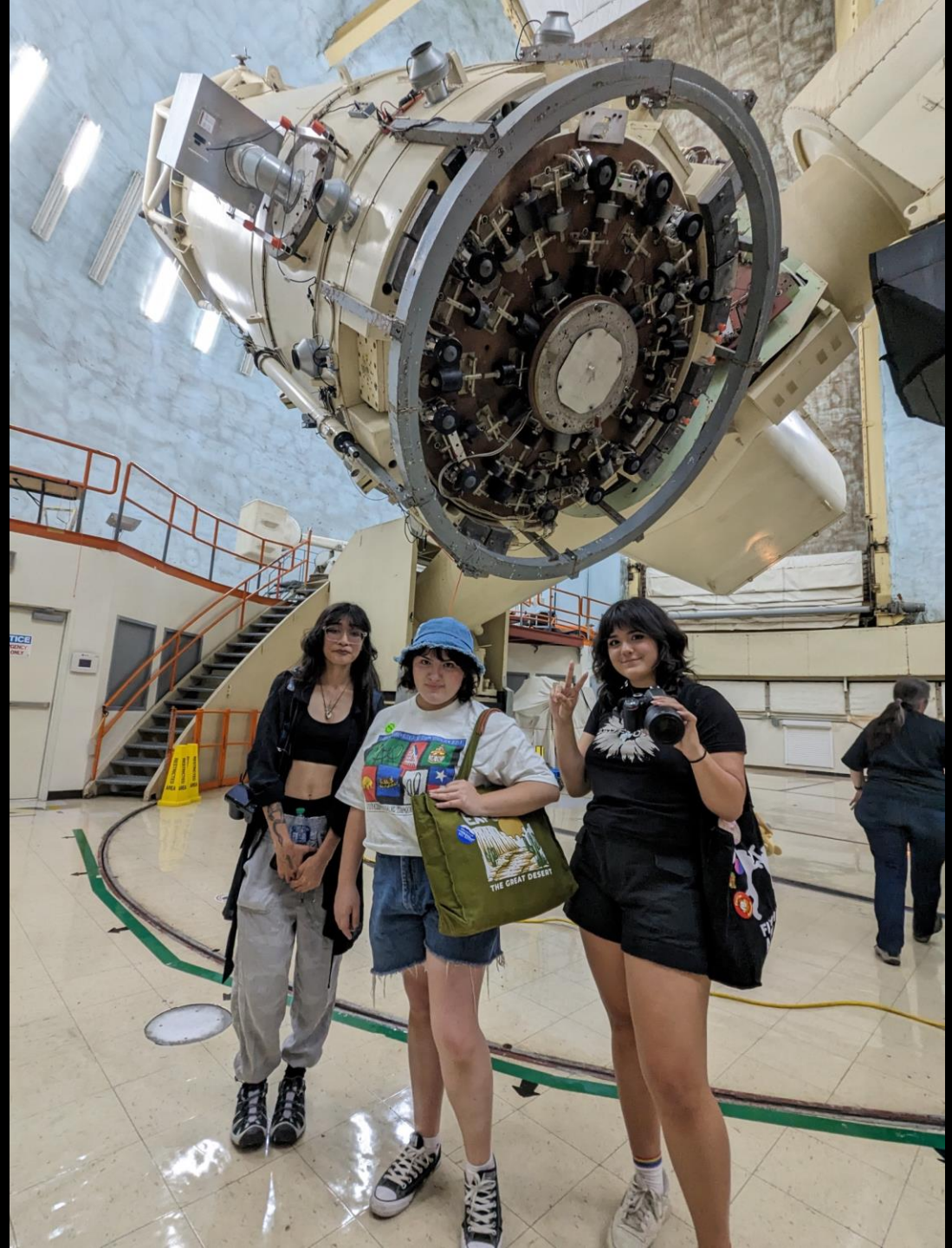
CLARISSA SIFUENTES

Camera
Obscura

Painting Workshop

Bird Sanctuary
after visiting the Sea Turtle, Inc.

Eatin’



McDonald Observatory

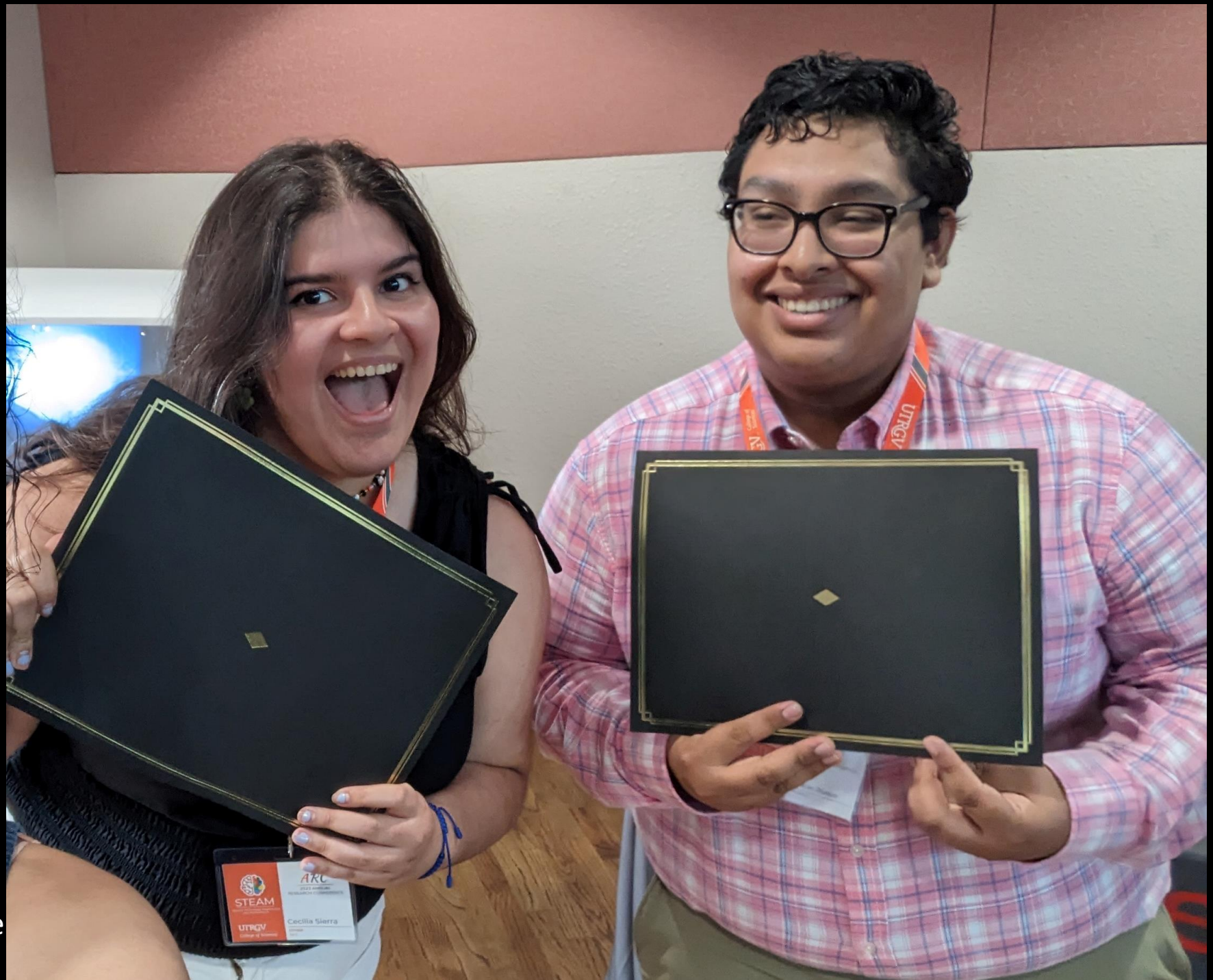
McDonald Observatory
Star Party

Chinati Foundation
Marfa

Big Bend

Poster Session

Poster Session



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