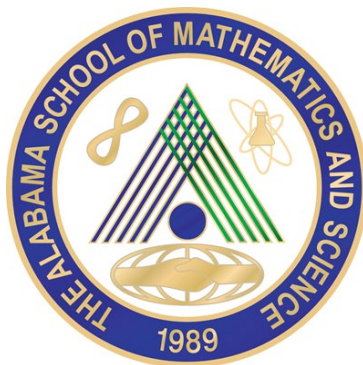


# 2021-22 Research Opportunities for ASMS Students



An academic research project demonstrates awareness of existing research in the subject area, offers a unique contribution to the field of study, and adheres to the scholarly conventions of the discipline.

The ASMS Research Fellows Program draws from the expertise of campus faculty and off-site scholars to guide ASMS students through an immersive research experience. The level of scholarship demonstrated by the student should at least be equivalent to that necessitated by a science fair exhibition or an academic conference presentation. A project may be completed by an individual student or by a team working together. While participation in the Research Fellows Program is not a requirement for graduation at ASMS, students who complete the program will demonstrate their academic tenacity, be awarded the title of Research Fellow, and graduate with a unique tassel as part of their regalia.

## Application Instructions

All students participating in a research project at ASMS must fill out this brief application, including students who are continuing an ongoing research project will need to submit the [application found here](#).

The **application deadline for research beginning Fall term 2021 is 11:59pm Tuesday, 24 August 2021**. Feel free to reach out to individual research mentors prior to this date to express your interest and find out more information.

Fall term projects will be enrolled as GE103 Research Fellows. Future terms will be enrolled as subject-specific research projects with the 399 course number (e.g. MA399 Research in Mathematics).

If a student has an idea for a research project, they may approach an individual faculty member for mentorship. If that faculty member agrees to mentor the student, the student will fill out the same application, subject to approval by the Research Committee.

## Biology

### **Silica concentrations in sediments across the Gulf of Mexico**

Corequisite: Oceanography

Mentors: Dr. Natalie Ortell & Alison Rellinger

Open to all Oceanography students

Spring Term

### **Bioinformatics-informed Eukaryote Analysis**

One of the biggest bottlenecks in biological research is in the field of bioinformatics. We have tremendous amounts of data, but struggle with analyzing it. This project aims to use certain bioinformatic tools in order to analyze the evolutionary relationships of eukaryotes by utilizing the genetic sequence of select motor proteins.

Mentor: Dr. Jeff Gray, University of Alabama

Supporting mentors: Dr. Natalie Ortell, Deborah Gray (Computer Science)

Full/ongoing (1 student)

## **Chemistry**

### **Air Pollution Study**

Air pollution is a global problem, and we are not immune on the Gulf Coast. One specific problem is particulate matter (PM) which is defined by the EPA as "a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope." Using a portable detector, we will be able to design, develop, and perform experiments in Mobile and Baldwin Counties to detect PM pollution and when it is most dangerous to humans. Students will use the detector both on and off campus to collect data and then process those data to determine patterns in PM pollution levels.

Prerequisites: Students must have passed AP Chemistry or General Chemistry I and II

Mentor: Kevin Dolbeare

Open spots for up to four students

Begins Fall term

### **Toshiba Exploravision Competition**

Students will investigate a topic in science and develop an original research paper.

Prerequisite: AP Chemistry

Mentor: Dr. Elisa Rambo

Open spots for up to 2 teams of 2-4 students each

Begins Fall term

## Computer Science

### **Machine Learning to Predict Sun Activity**

The main goal of this project is to create a machine-learning algorithm which predicts coronal mass ejections and geomagnetic storms by analyzing data of the sun.

Mentor: Dr. Jeff Gray, University of Alabama

Supporting mentors: Deborah Gray, Dr. Durga Paudel (Physics)

Full/ongoing (1 student)

### **Bioinformatics-informed Eukaryote Analysis**

One of the biggest bottlenecks in biological research is in the field of bioinformatics. We have tremendous amounts of data, but struggle with analyzing it. This project aims to use certain bioinformatic tools in order to analyze the evolutionary relationships of eukaryotes by utilizing the genetic sequence of select motor proteins.

Mentor: Dr. Jeff Gray, University of Alabama

Supporting mentors: Deborah Gray, Dr. Natalie Ortell (Biology)

Full/ongoing (1 student)

### **Natural Language Processing chatbot**

Mentor: Dr. Travis Atkison, University of Alabama

Supporting mentors: Deborah Gray

Full/ongoing (1 student)

## English

### **F. Scott Fitzgerald Studies**

Students will work with a research mentor to study the works of and criticism on F. Scott Fitzgerald. They will read several novels and stories by Fitzgerald, consult extant scholarship on these texts, and read at least one full-length author biography. Outcomes for this research should include a conference presentation or publication submission.

Mentor: Dr. Mitch Frye

## **Fine Arts**

### **Visual Semiotics**

Students will learn to see the blurred distinctions between reality and simulation that can occur in modern media. Introducing Semiotics, the study of signs and the creation of meaning, students will explore how beliefs, cultures, and social structures can be changed through mass media including product advertising, the corporate image, political rhetoric, etc. Readings will include scholarship on semiotics and the evolution of media representation. Hyped-up on Postmodern theory, students will explore these concepts through making posters, books, digital imagery, blogs, street art, short videos, PowerPoints, or poetry.

Mentor: Orren Kickliter

Open spots for 1-2 students

### **How Music Affects the Brain**

How does music affect things like actions, emotions, productivity, memory, and creativity? What makes someone "good" at music and what makes someone "bad"?

Mentor: Martha Mozer

Full (1 student)

### **Euclidean Compass and Straightedge Construction of Islamic Geometric Patterns**

Students will study historical examples and techniques of Islamic geometric pattern construction and apply that knowledge to construct patterns based on particular circle packings and tilings of the plane.

Prerequisites: Advanced Geometry and Trigonometry; Corequisite: Studio Art or AP Art

Mentor: Sarah Brewer

Open spots for 1-2 students

Ongoing/students can join any term

## History

### **Shootout at Brookley Air Base: Local Black Soldiers during WWII Engage in Armed Revolt**

This will entail original research into a little known event at Brookley Army Air Base during WWII. Relegated to a status and living conditions that were below what German prisoners in the Mobile area had to endure, black soldiers stationed at Brookley rose up and engaged in a full-blown armed revolt that led to a dramatic shootout at the main gate of Brookley Field.

Mentors: Derek Barry and Ken Robinson

Open spots for 1-2 students

Begins Fall term.

### **New Orleans WWOZ 90.07 FM**

A qualitative case study of New Orleans radio station WWOZ 90.07 FM, to be presented at a popular culture conference in the fall -- Popular Culture Association in the South/American Culture Association in the South.

Mentor: Dr. John Hoyle

Full/ongoing (1 student)

### **Mobile's Black Mardi Gras**

Mentor: Derek Barry

Open spots for 1-2 students

Term

### **The racial, gender and cultural implications of the Azalea Trail Maids**

Mentor: Derek Barry

Open spots for 1-2 students

Term

### **Bias in Voting Law Changes Through the Decades**

Students will work with a research mentor to study the history of voting laws in the U.S. and associated media bias. They will primarily read journals and newspapers to accomplish this task. Outcomes for this research could include a conference presentation or appropriate publication submission.

Mentor: Dr. Karen Palazzini

Open spots for 1-2 juniors

Students may begin in either Fall or Winter (project requires at least two terms)

## Mathematics

### **On Random Polynomials Generated by a Three-term Recurrence Relation**

In the project students will investigate the asymptotic distribution of zeros of random polynomials generated by the three-term recurrence relation with random coefficients.

Mentor: Dr. Vasiliy Prokhorov, University of South Alabama

Supporting mentor: Natalya Prokhorova

Full/ongoing (1 student)

### **Applications of Game Theory**

Game Theory has applications in several fields, such as economics, politics, law, biology, and computer science. In this project, students introduce the basic tools of game theoretic analysis and apply to examples drawn from economics, politics, the movies, and elsewhere.

Mentor: Natalya Prokhorova

Open spots for 3-4 students

### **Circle Packing and Islamic Geometric Patterns**

Using circle packings based on the 11 uniform tilings of the plane (and/or the 9 binary compact packings) to generate and classify Islamic geometric patterns.

Prerequisites: Advanced Geometry and Trigonometry

Mentor: Sarah Brewer

Open spots for 1-2 students

Ongoing/students can join any term

### **Optimizing Rob Resch's "Little Flower" Origami Corrugation**

We are clarifying the mathematics of why Uyen Nguyen's method to optimize Rob Resch's "little flower" origami corrugation for certain tilings is the optimal solution and extending this method to more complex tiling patterns.

Prerequisites: Advanced Geometry and Trigonometry; intermediate-level origami folding

Mentor: Sarah Brewer (joint work with Uyen Nguyen, Mike Assis, Ricardo Hinojosa, Xander Perrot, and Ben Parker)

Open spots for 1-2 students

Ongoing/students can join any term

### **Folding 7-fold Islamic Geometric Patterns**

It is not possible to construct a regular 7-fold polygon using traditional compass and straightedge techniques, yet 7-fold geometric patterns exist throughout Islamic art. Because of the so-called Beloch move, origami allows for the construction of 7-fold patterns. This ongoing study explores the possibilities of using origami to construct 7-fold Islamic geometric patterns.

Prerequisites: Advanced Geometry and Trigonometry; intermediate-level origami folding

Mentor: Sarah Brewer (joint work with Ricardo Hinojosa)

Open spots for 1-2 students

Ongoing/students can join any term



## **Mathematics, cont.**

### **Algorithm to Generate Spiral Corrugation Crease Patterns**

We are working on a computer simulation to model a method of generating spiral corrugation crease patterns that behaves in sometimes unexpected ways depending on the spacing between rays and angle of initial crease, as well as its sensitivity to initial conditions.

Prerequisites: Any computer programming language; intermediate-level origami folding

Mentor: Sarah Brewer (joint work with Ben Parker)

Open spots for 1-2 students

Ongoing/students can join any term

### **3D Printed Crease Pattern Imprints**

Many origamists working in the area of tessellations or corrugations use vinyl cutters or lasers to score their crease patterns, but this only weakens the paper on one side and does not consider the necessary mountains and valleys. We will investigate current technologies and determine a way to imprint paper with the appropriate mountain and valley creases.

Prerequisites: Knowledge of CAD and 3D printing; intermediate-level origami folding

Mentor: Sarah Brewer (joint work with Uyen Nguyen)

Open spots for 1-2 students

Ongoing/students can join any term

## Physics

### **Disorder Hyperuniformity in 2D and 3D Materials**

Current research argue that disordered hyper uniformed materials possess unique material properties such as large, and isotropic photonic bandgaps (PBG) which contradict the underlying concept that is PGB material requires translational order. Those types of materials have potential applications in energy-storage, batteries, and aerospace. The main goal of this research is to measure hyperuniformity in different disordered system and predict PGB.

Mentor: Dr. Durga Paudel

Full/ongoing (3 students)

### **2D Layered Nanomaterial Synthesis and Characterization**

Goal of this research is to develop advanced functional materials and nanostructures. The potential applicability of those materials in electronics, optoelectronics, catalysts, energy storage facilities, sensors, solar cells, lithium batteries etc., draw attention of researchers for significant technological advancement. Involves Atomic Force Microscopy, Mass Absorption Spectroscopy, and Physical Vapor Deposition.

Mentor: Dr. Durga Paudel (joint work with \_\_\_\_ of University of South Alabama)

Prerequisites:

Open spots for # students

Term:

### **Machine Learning to Predict Sun Activity**

The main goal of this project is to create a machine-learning algorithm which predicts coronal mass ejections and geomagnetic storms by analyzing data of the sun.

Mentor: Dr. Jeff Gray, University of Alabama

Supporting mentors: Dr. Durga Paudel, Deborah Gray (Computer Science)

Full/ongoing (1 student)

## World Languages

### **Short Visits Abroad: Germany, the Language and Culture Experience**

Determining a distinct area of study ahead of the three-months-stay, students go on at least two targeted research excursions and make use of German libraries while there, then document and present findings upon their return.

Prerequisites: Selection to this unique exchange opportunity, strong language performance.

Mentor: Muriel Hoequist (outside advisor Jen Reineke, Münster)

Open spots for 1-3 students

Special application process begins Fall Term; selection and notification is in Winter term; research begins Spring term (in preparation for Fall 2022 exchange)

### **Representations of Race in Selected Poetry of the Spanish-speaking Caribbean**

Students will work with a research mentor to examine representations of race in selected poetry of the Spanish-speaking Caribbean (Cuba, Puerto Rico, the Dominican Republic as well as the Hispanophone countries surrounding the Caribbean Sea) where indigenous peoples, Europeans, Africans, and Asians have interacted for centuries. They will read poetic works and author biographies from each of the countries, as well as relevant scholarship. The objective will be to produce a paper for publication and/or a scholarly presentation.

Prerequisite: Spanish IV

Mentor: Dr. Keith Lindley

Open spots for up to 5 students

Begins Winter term