**SPIRE Undergraduate Summer Research Program**

**Summer 2022**

***Due to the COVID-19 pandemic, this program is tentative and dependent upon UNC Chapel Hill policies for acceptance of undergraduate students into research labs for summer 2022.***

**Program Description**

The goals of the program are to provide undergraduate students the opportunity to participate in innovative research at UNC Chapel Hill, develop professional skills as a scientist, and contribute to a scholarly community. Research opportunities exist in areas such as molecular biology, cell biology, chemistry, genetics, cancer research, marine biology, and microbiology. The program will run from **May 22 – July 29, 2022** and includes required professional development seminars, journal clubs, and social events throughout the summer in conjunction with other summer research programs. Research mentors for the program will be current SPIRE postdoctoral scholar. ***See the end of this application form for a list of potential mentors.***

**Eligibility**

Research internships are awarded on a competitive basis to students who meet the following requirements:

1) Enrolled full-time at one of the following institutions: Johnson C. Smith University, North Carolina A&T State University, North Carolina Central University, UNC Pembroke

2) Current sophomore, junior, or senior majoring in a biological, biomedical or chemical science

3) A minimum grade-point average of 3.0

Previous research experience is not required. Underrepresented students are strongly encouraged to apply.

Students must be able to participate in the entire program (see dates above) including weekly professional development seminars, lab meetings, and poster session at the end of the summer.

 $6000 stipend and on-campus housing accommodations will be provided.

**How to apply -** All materials MUST be RECEIVED on or before **February 28, 2022** for consideration.

1) **Submit completed application and personal statement** (subsequent pages of this document)– submitted by student applicant directly to Dr. Rybarczyk (brybar@unc.edu)

2) **Transcripts:** Request your institution to submit a copy of your transcript directly to Dr. Rybarczyk (brybar@unc.edu). Preference is given to students with a **GPA of 3.0 or above. Unofficial transcripts are also acceptable for students to submit with their application materials.**

3) **Two Letters of Recommendation** Request a science faculty instructor, an internship advisor, or other relevant individuals to send us a letter commenting on your motivation and potential for scientific research, academic abilities, motivation, focus, work ethic, and interest in a research career. Faculty must submit letters directly to Dr. Rybarczyk **(email to** **brybar@unc.edu****).**

This program is supported by a grant from the National Institutes of Health (NIH), National Institute of General Medical Sciences (NIGMS), Training, Diversity, and Workforce Development Division and funding from various administrative offices at UNC Chapel Hill.

**SPIRE Undergraduate Summer Research Program 2022**

**Application Form & Instructions**

**Deadline for Receiving ALL Application and Supporting Materials: February 28, 2022**

**PERSONAL INFORMATION**

**Name:**

**Gender Identity:**

**Female** 🞏**Male** 🞏 **Non-binary** 🞏 (helpful for housing/roommate matches)

**Date of Birth:**

**Current Address:**

**Permanent Address:**

**Telephone:**

**E-mail address:**

**DEMOGRAPHIC INFORMATION**

What race(s) do you consider yourself to be (check all that apply) OPTIONAL

🞏**American Indian or Alaskan Native:** A person having origins in any of the original peoples of North,

Central, and South America, and who maintains tribal affiliation or community attachment.

🞏**Asian:** A person having origins in any of the original peoples of the Far East, Southeast Asia, of the

Indian Subcontinent, including Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, The Philippine

Islands, Thailand, and Vietnam.

🞏**Black or African American:** A person having origins in any of the black racial groups of Africa.

🞏**Hispanic** or **Latino:** A person having origins from Mexico, Puerto Rico, Cuba, Central or South America

or other Spanish culture or origin.

🞏**Native Hawaiian or Other Pacific Islander:** A person having origins in any of the original peoples of

Hawaii, Guam Samoa, Micronesia, the Northern Marianas, or other Pacific islands.

🞏**White:** A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.

🞏**Other**

(Pleasespecify)**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

🞏 **Decline to Indicate.**

**EDUCATION**

**College/University:**

**Year in School:**

**Expected Graduation Date:**

**Major field of Study:**

**Minor:**

**Overall GPA:**

**Science GPA:**

Are you a first-generation college student? 🞏Yes 🞏No

**Are you affiliated with any of these programs at your home institution?**

🞏**MARC** 🞏**MBRS** 🞏**McNAIR** 🞏**HHMI** 🞏**RISE**

🞏**OTHER\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**The SPIRE program will provide housing for the summer and stipend if not already provided by your home institution.**

**Please provide the contact name and information of the program director:**

Name:

Address:

Email:

Phone:

Have you participated in any summer research program(s) previously?\_No\_\_ If so, list program(s)

Are you applying to other programs this summer? Yes 🞏 No 🞏

If yes, please list program name(s)/location:

If you are accepted into this program, would you require on-campus housing? Yes 🞏 No 🞏

**RESEARCH EXPERIENCE**

Please describe any research experience you may have. Include projects you have done for your

science courses (200 words max).

**IN WHAT AREAS OF STUDY ARE YOU MOST INTERESTED? (Choose up to 3)**

\_\_\_ Biochemistry and Structural Biology \_\_\_ Cell Biology and Genetics

\_\_\_ Bioinformatics and Genomics \_\_\_ Cancer Biology

\_ \_\_Immunology \_\_\_Molecular Biology

\_\_\_Neuroscience \_\_\_Pharmacology

\_\_\_Physiology \_\_\_ Developmental Biology

\_\_\_ Other:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Personal Statement (1000 Words Max):**

Please state why you want to participate in this summer research program, describe your short- and long-term career goals and how this program will help you reach your goals. Applicants are encouraged to provide information about themselves that they feel contribute to the diversity of the biomedical sciences education at the university and/or the biomedical sciences profession, including but not limited to, information about the applicant’s background, experiences, socio-economic status, or personal qualities. How do you see yourself contributing to diversity and inclusion in research and science?

Also include the names of the researchers you would like to work with as your research mentor (see below).

**Please rank your preferences for possible research mentor matches (rank 1st 2nd and 3rd preference) from list below and provide justification for your choices.**

**Research Mentors and Project Descriptions**

**Grace Hamilton, Ph.D.** (in the lab of Amy Gladfelter, Ph.D., Biology)Almost all molecular biology knowledge comes from studies of just a few model organisms. But there is so much more we could learn from studying the diversity of lifeon earth! With modern tools, nearly any organism can now be studied at the molecular level. I'm doing just that, studying the unconventional cell divisions of little black fungus that thrives in extreme environments. It's called *Knufia petricola*, and it will be a new model system with relevance to: 1) basic cell biology, because it divides differently than any model fungus. 2) human health, because other black fungi cause disease. 3) ecology, because some black fungi can digest plastics. 4) astrobiology, because black fungi survive in diverse extreme environments, including the International Space Station!

An undergraduate researcher joining me on this project can expect to genetically modify eukaryotic cells using CRISPR, take beautiful images and videos using fluorescence microcopy, and gain experience with basic microbiology & cell biology techniques.

**Markus Nevil, Ph.D.** (in the lab of Bob Duronio, Ph.D. Biology and Genetics) - Determining how cells faithfully copy their DNA is essential for understanding both basic biology and disease. In the Duronio lab we will identify and make mutant *Drosophila melanogaster* to identify new genes that are important for DNA replication. Summer students will take charge of determining the mutants we use. Future work will detect the effects on DNA replication by measuring changes in under-replication boundaries using genomics.

**Seth O’Conner, Ph.D.** (in the lab of Corbin Jones, Ph.D. Biology) - We are looking for undergraduate researchers to join our CRISPR project in the model plant *Arabidopsis thaliana*. Genetic engineering in plants is often geared toward enhancing crop yields by selecting for advantageous crop traits. With the discovery of the CRISPR system, we can now precisely target and edit the genomes of multicellular organisms. There are many genes in plants that when knocked out (complete loss of expression) the plants demonstrate interesting phenotypes but may not live long enough to generate seeds. Our project uses a CRISPR technique called cis-editing, whereby we do not target the genes themselves but rather target regulatory elements near the gene. This way we can alter a gene’s expression without completely knocking it out. We have made an inexpensive LED light and filtering system by which we can select our CRISPR plants based on yellow fluorescence in the seeds (glowing seeds!!). This project will give undergraduate researchers the ability to develop their molecular biology skills using the ever-popular CRISPR system while working on a project with real world implications.

**Andrea Suria, Ph.D.** (in the lab of Alecia Septer, Ph.D. Marine Sciences - Bacteria play crucial roles in the lives of their animal hosts. While pathogens can cause disease, beneficial microbes can aid in their host’s digestion or proper development of the immune system. The species of bacteria that successfully colonize an animal can greatly impact the overall community structure and function in the host. Bacteria have evolved many different methods to compete with other bacteria for colonization space in their hosts. In the Septer lab, we use symbiotic bacteria isolated from the Hawaiian bobtail squid as a model to understand the mechanisms of bacterial competition. Students will be taught a combination of culture-based microbiology and molecular techniques (PCR, cloning, mutagenesis, and DNA sequencing) to determine the genes involved in competition. By mutating genes and competing bacteria on plates, we can determine what makes some bacteria into microbial killers.

**Caitlin Williams, Ph.D.** (in the lab of Rita Tamayo, Ph.D., Microbiology and Immunology) - *Clostridioides difficile* is one of the most common hospital-acquired infections worldwide. *C. difficile* colonizes the intestine and can cause severe damage to the colon and life-threatening diarrhea. Our lab is interested in understanding how *C.* *difficile* responds to the changing host environment and regulates expression of its virulence factors. We recently identified an atypical signal transduction system with two response regulators, CmrRST. Expression of the CmrRST system influences many aspects of *C. difficile* biology, including colony morphology, cell shape, biofilm formation, and virulence. We are now working to understand the interactions between the two regulator proteins, CmrR and CmrT, to understand how they regulate expression of other genes to mediate all the phenotypic changes associated with CmrRST expression. My project focuses on characterizing the protein-protein interactions and protein-DNA interactions of CmrR and CmrT. The more we understand about *C. difficile* biology, the more potential we have to develop effective therapeutic options to treat *C. difficile* infections.