NIST Summer Undergraduate Research Fellowship (SURF) Program

Dr. Brandi Toliver
Managing SURF Program Director
NIST Overview
NIST: Did You Know…

- NIST’s weight and measures services provide the basis for *fairness* and *efficiency* of sales?
- About 2.6 billion times a day (30,000 per second), NIST’s internet time service sets computer clocks and other networked devices?
- In the Army alone, 58,000 different types of equipment require NIST-traceable calibration?
- NIST led the development of performance standards for smoke detectors?
- Closed-captioning for people with impaired hearing, now featured on all TV sets, was co-invented at NIST, earning it an Emmy Award in 1980?
- More than 3,000 law-enforcement officers have been spared from death or disabling injury as a result of NIST-developed standards for ballistic-resistant body armor (“bullet-proof” vests)?
- Many of the tools and materials used in modern dentistry—from the panoramic X-ray to composite fillings to an array of adhesives—originated at NIST through a partnership with the American Dental Association that began in 1928?

NIST Mission

To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
Measurements essential to commerce, trade, and innovation.

Federal role established in the U.S. Constitution.
Measurement Science, Standards & Technology

Important to:

• Commerce
• International trade
• Innovation

Up to 92% of U.S. exports affected by standards / technical regulations
The patent system ... added the fuel of interest to the fire of genius in the discovery and production of new and useful things.

*Abraham Lincoln – April 6, 1858*

...Giving effectual encouragement as well to the introduction of **new and useful inventions** from abroad as to the exertions of skill and genius in producing them at home, and of facilitating the intercourse between the distant parts of our country...

*George Washington, State of the Union Address, January 8, 1790*
NIST’s Biggest Strength: Our Reputation

- Technical excellence
- Integrity
- Uncompromising
- Rigorous
- Unbiased
- Industry focused
- Non-regulatory

NIST Nobel Laureates David Wineland, Eric Cornell, and Bill Phillips
NIST Partners Include Industry, Academia, and Government

- Industry
  - Agilent Technologies
  - intel
  - Dow
  - GM
  - IBM
  - Pfizer

- Universities
  - University of Maryland
  - University of Colorado at Boulder
  - Penn University of Pennsylvania
  - University of Wisconsin Madison

- Nonprofits
  - AdvaMed
  - ASTM

- Government
  - NASA
  - NSF
  - Homeland Security
  - Department of Defense
  - Department of Justice
  - Environmental Protection Agency

International Technology Roadmap for Semiconductors
NIST’s Leadership Team

Chief of Staff

Kevin Kimball
Chief of Staff
NIST

Director

Walter Copan
Under Secretary of Commerce for Standards and Technology, and NIST Director

Laboratory Programs

Jim Olthoff
Associate Director for Laboratory Programs

Innovation and Industry Services

Phillip Singerman
Associate Director for Innovation and Industry Services

Management Resources

Del Brockett
Associate Director for Management Resources
NIST Budget: $1.2 B

Manufacturing USA (ITS)
$15 Million

Manufacturing Extension Partnership (ITS)
$140 Million

Construction (CRF)
$319 Million

Laboratory Research (STRS)
$724.5 Million

FY 2018 Appropriated Budget
NIST AT A GLANCE
Industry’s National Laboratory

3,400+ FEDERAL EMPLOYEES
3,500+ ASSOCIATES
5 NOBEL PRIZES
2 Main Campuses
GAITHERSBURG, MD [HQ]
BOULDER, CO
10 COLLABORATIVE INSTITUTES
Thousands of U.S. BUSINESSES Collaborate with NIST
NIST and Joint Institute Locations

NIST Main Campuses
- Gaithersburg, MD
- Boulder, CO

Joint Institutes and Centers
- National Cybersecurity Center of Excellence
- Institute for Bioscience & Biotechnology Research
- Joint Quantum Institute
- Joint Center for Quantum information & Computer Science
- JILA
- Hollings Marine Lab
- Brookhaven National Lab
- Joint Initiative for Metrology in Biology

Atomic Clock Signal Stations
- NIST Ft. Collins CO WWV
- NIST Kauai HI WWVH

NIST Centers of Excellence
- Forensic Science
- Disaster Resilience

NIST Collaborative Research Centers
- Advanced Materials
Unique NIST Products and Services

Every year:
- **1,200** Standard Reference Material (SRM) products
- **100** Standard Reference Data (SRD) products
- **600** measurement services
- **32,000** SRM units sold
- **13,000** calibrations and tests
- **800** accreditations of testing and calibrations laboratories
Accurate Time is Essential

GPS, Internet, and Telecommunications rely on NIST’s time standard
Calibrated Equipment is Essential

Boeing force measurements are traceable to the SI
Certified Reference Materials are Essential

NIST’s Genome in a Bottle reference material ensures the accuracy of new, high-throughput DNA tests
Documentary Standards

Important Role

• 400+ NIST technical staff in 100+ standard committees
• Leadership in international standards bodies

NIST’s technical expertise results in improved standards and U.S. competitiveness
Strategic Priorities, National Impacts

Cybersecurity

Advanced Manufacturing
Strategic Priorities, National Impacts

Bioeconomy

Quantum Science
Strategic Priorities, National Impacts

Artificial Intelligence

Internet of Things
Mission in STEM Education

To develop a diverse, world-class pool of scientists and engineers to support NIST's mission in measurement science and standards research, and to support the development of a general population that understands and appreciates measurement science and standards.

The development and support of highly-skilled, talented people is an integral component of U.S. economic strength.
SURF Program
Background info on the SURF Program

- Founded in 1993 in the Physics Laboratory
- Provides opportunities for undergraduates to engage in hands-on research pertaining to the NIST mission under the guidance of a NIST scientist or engineer
- A partnership supported by NIST and participating colleges/universities for students majoring in science, mathematics, and engineering
- Eleven week fellowships available in all the NIST laboratories at Gaithersburg and Boulder campuses
- To date 2,985 undergraduates have participated in the program
- The 2019 SURF Program consisted:
  - Boulder: 17 participants
  - Gaithersburg: 158 participants
- SURF website: https://www.nist.gov/surf
Eligibility Requirements

- Must be a United States citizen
- Must be an undergraduate (freshman, sophomore, junior, or senior) majoring in biology, biochemistry, chemistry, computer science, engineering, mathematics, materials science, physics, or STEM field
- Must be in good academic standing
- Considering the pursuit of a graduate degree or career in STEM
Important Dates

- APPLICATION DEADLINE: *February 3, 2020 or when the applicant limit is reached*

- Program Dates
  - SURF Boulder: May 18, 2020- July 31, 2020
  - SURF Gaithersburg: May 26, 2020- August 7, 2020
Application Requirements

- Students must apply and submit their entire application package on USAJOBS.gov. Note: SURF Boulder and SURF Gaithersburg have separate vacancies.

- A completed submission includes:
  - Responses to the on-line questionnaire
  - Transcript (Unofficial recommended)***
  - Personal Statement***
  - Resume***
  - Verification of health insurance coverage***
  - Proof of US citizenship ***
  - Two (2) letters of recommendation

***Indicates the component is an attachment

NOTE: Prospective applicants must create a profile on USAJobs.Gov to apply to the program.
STEP 1: Sign In

1. Visit USAJOBS.GOV
2. Sign in to your account. The account is called login.gov. If you do not have an account and need assistance creating it, visit https://www.usajobs.gov/Help/faq/account/login-gov/. 
Step 2: Search for the Announcement

**Keywords:** SURF, SURF Boulder, SURF Gaithersburg, NIST
Step 3: Select the Announcement

- Select the appropriate announcement.
- Reminder: SURF Boulder and SURF Gaithersburg are separate announcements. Must apply to both announcements to be considered for both locations.

Double click the vacancy name
Step 4: Read the Vacancy Announcement

Select each of the terms or scroll through the page. Note key terms.
Step 4: Read the Vacancy Announcement (continued)

To preview questions please click here.

***Note: Must provide an answer to each question. There is not an option to save.
Step 5: Apply to the Vacancy

Select the “Apply” menu on the Right side of the vacancy.
Step 6: Applying in Progress…..

-Complete the personal information.
-Select “Save and Continue” at the bottom of the page.
Step 6: Applying in Progress (continued)…..
Step 6: Applying in Progress (continued)…..

Complete the Eligibility questions. Note: These questions are applicable to permanent, full-time positions for federal employment. Most of your answers will be “no” or “NA.”
Step 6: Applying in Progress (continued)…..

-Answer all questions containing an asterisk.
-Select “Next” after completing each page.
-Eligibility, Series Grade Location, and Vacancy Questions must be completed in a single session before you can save.
Vacancy Questions

- Read and answer carefully.
  - Must request housing and commuting subsidy in questions.
  - Selection of research preference
Selecting Research Preferences for the SURF Program @ Gaithersburg

Gaithersburg Process
- Students select top two (2) laboratory preferences
- Laboratories should be chosen carefully, because the completed application is considered primarily by the first choice host laboratory.
- Occasionally, a laboratory outside of the selected preferences may align with the desired skillset
SURF Gaithersburg Lab Preferences

- Communications Technology Laboratory
- Engineering Laboratory
- Information Technology Laboratory
- Material Measurement Laboratory – consists of three concentrations
  - Chemical and Biochemical Sciences
  - Materials Science (includes projects from the NIST Center for Neutron Research.
  - Computational Materials Science
- Physical Measurement Laboratory – includes the Center for Nanoscale Science and Technology

Note: Descriptions of each lab can be found at https://www.nist.gov/surf/surf-gaithersburg/research-programs.
Periodically, there are opportunities for SURF students to participate in technical special projects (in Gaithersburg) which are not located in the NIST laboratories. NIST is soliciting applications for SURF students in the following special projects:

- Standards Coordination Office (SCO) – 2 opportunities
- Information Services Office (ISO) – 1 opportunity
- Technology Partnerships Office (TPO) – 1 opportunity
Selecting Research Preferences for the SURF Program @ Boulder

Boulder Process

- Students select top six (6) research project preferences
  - Visit [https://www.nist.gov/surf/surf-boulder/research-opportunities](https://www.nist.gov/surf/surf-boulder/research-opportunities) for a description of the 2020 research opportunities
Example of Research Opportunity Posting @ Boulder Site

**Division Name**

**Project Title**

**NIST staff project contact**

**Project description**

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**Research Opportunities**

*Application deadline is February 12, 2018.*

**Note:** All research opportunities for 2018 are listed below.

**Applied Chemicals and Materials Division**

647-1 Development of Novel Alternative Fuels
Thomas J. Bruno, 303-497-5158, bruno(at)boulder.nist.gov

The best method to study the phase properties of biofuels is the composition-explicit distillation curve developed at NIST. The technique provides an energy content channel in addition to the volatility of a fuel. We have applied this method to many fuels, and this summer we will extend this to include pyrolysis-based renewables. A SURF student working on this will become expert at gas chromatography, mass spectrometry, and many other analytical techniques. Contact adviser for more details.

647-2 Vapor Characterization and Analysis in Forensic Sciences
Thomas J. Bruno, 303-497-5158, bruno(at)boulder.nist.gov
Step 7: Uploading documents

Vacancy Documents

The following documents are requested for this application. You do not need to submit documents that are not applicable to you. Documents to your application however, they may be updated or modified prior continuing this application. Prior to the vacancy close date, documents may his application. Note: Adobe Acrobat Reader is required to view PDF files.

Documents to Attach

Your Documents from USAJOBS
There were no documents brought over from USAJobs for this application.

Additional Document Actions
- Upload from your computer
- Fax a Document

Review Your Attached Documents

<table>
<thead>
<tr>
<th>Requested Document Type</th>
<th>Attached Document Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>*SURF – Verification of U.S. citizenship</td>
<td>No document Submitted</td>
<td></td>
</tr>
<tr>
<td>*SURF – Copy of School Transcript</td>
<td>No document Submitted</td>
<td></td>
</tr>
<tr>
<td>*SURF – Personal Statement</td>
<td>No document Submitted</td>
<td></td>
</tr>
<tr>
<td>*SURF – Resume</td>
<td>No document Submitted</td>
<td></td>
</tr>
<tr>
<td>*SURF – Proof of health insurance coverage</td>
<td>No document Submitted</td>
<td></td>
</tr>
</tbody>
</table>
Transcript

- Undergraduate transcript is required
- Unofficial is preferred
- Make sure personal identifiable information such as social security number is blacked out
Verification of health insurance coverage

- Copy of health insurance card

![Healthcare Card Example](image-url)
Proof of U.S. citizenship

- Birth certificate with seal
- Unexpired passport book
- Unexpired passport card
- Naturalization Certificate
- Certificate of citizenship
- Consular Report of Birth Abroad
Resume

Michael Johnson
michaeljohnson5@gmail.com
999-565-4888

Local Address: 110 Smith Lane
Raleigh, NC 27610

Permanent Address: 123 Jackson Street
Gary, IN 27610

Objective
Obtain a research opportunity at NIH to develop my technical skills in chemistry.

Education
North Carolina State University, Raleigh, NC
B.S. May 2017 (expected)
Major: Mechanical Engineering
GPA: 3.48

Job Skills
- Labview, Word, Excel, PowerPoint, Mathematica
- Laboratory: Safety measures, titrations, reading measurements, analytical instrumentation (FTIR, ICP, DSC)
- Communication: Public speaking, technical writing
- Other: Spanish, Arabic

Projects
- Green Plastic Bag Project
  Comprised the biodegradability of green plastic bags in a kitchen composite. Documented the weight measurements and physical appearance (light microscopy) for 6 months.
- Biodegradable Film Project
  Worked under the direction of a graduate student to synthesize films using commercially available green chemicals on a hot press. Studied the structure of the green films.
- Freshman Design Project
  Studies the impact of various concentrations of chlorine on the outside layer of Cucuassid, Negro, and Mongolian hair types. Documented the change in chemical structure (FTIR) and physical structure (scanning electron microscopy)

Work Experience
North Carolina State University, Raleigh, NC
Chemistry 101 Teaching Assistant
- June 2015 – August 2015
  • Grade assignments and tests, set up review sessions, oversee studio workings and answer questions, be available for weekly office hours.

North Carolina State University, Raleigh, NC
Chemistry 102 Teaching Assistant
- August 2014 – Present
  • Organize educational events and activities for 35 first year students in the University Scholars Program ensuring their mental health and safety and serving on an on-call duty rotation while collaborating closely with other staff members.

Honors and Activities
- Women in Science and Engineering (WISE) – Secretary
- American Chemical Society (ACS)
- Alpha Alpha Alpha Sorority - Membership Initiation Chair
- Chemistry Tutor University Tutorial Center

Be sure to include the following:
- GPA
- Study Abroad Experiences
- Special Skills (research, computer, language)
- Any tutoring or mentoring experience
- Leadership Skills
- Involvement in professional organizations
Personal statement

- Put time and effort into writing your personal statement as this is what sets applicants apart.
- Limit to a single page
Part 1: Personal Statement

I decided to attend North Carolina State University s for the intellectual challenge. As a junior in the Engineering Physics program, I would say that I found that challenge. Every day, I find myself throwing my pencil to the paper and pushing myself back in my chair for the sheer magnitude of wonder that each lecture presents. I find, and have always found, physics beautiful. This is how the world works. And it is awe inspiring. My other classes only add to the wonders opening before me. For example, Programming Concepts and Digital Electronics did not so much awe me as struck by the wonders of what the world is, but instead made me breathless by the wonders of what I can do for it.

I am on the unique path of a five year combined program with an Engineering Physics Bachelor’s Degree and an Applied Mathematics and Statistics Masters. This gives me the opportunity to see the wonders of the world in a different way than many of my classmates. I am given two lenses to use when approaching electricity and magnetism or quantum mechanics. It is important to me not just to understand what these are, but to understand how they can be used to solve some of the great problems of the world. Last semester I learned how to build and use AND gates and OR gates, and electrically what that looks like. I designed and built a counter and a machine that measures and displays an unknown frequency. But what I loved most about that was taking that knowledge with me, as I learned how to program in C++, and seeing the differences between hardwiring a chip and programming a computer. I loved having an idea of what the computer looks at to see if S is truly equal to 5. But even that was not the most satisfying part of my semester. I then took what I learned from this class and brought it to my EPICS course, a course designed to give students experience in working with teams, clients and supervisors, writing paperwork, and executing a real-world problem. So I was able to take what I knew from one language and apply it to another as we learned Python in order to write a program that analyzed data for the location of water molecules in varying sizes of carbon cages and returned plots of the location and hydrogen bond density over time. Stepping from Physics and into the world of math and programming to return to physics, understanding the nature of the world around us is one of the greatest joys I will ever encounter. This is a full circle that many of my peers never get the opportunity to see.

Start your personal statement by describing why you have a passion for STEM. Think about what sparks your interest in your discipline. In other words, what energizes you.
Part 2: Personal Statement

Last summer, I attended the field season for physics. This is a summer-only class where every major at Mines offers a unique experience geared toward their students. In this time, I assembled a laser from a mirror and a He-Ne tube and used that laser to create a 3-D image on a screen. I also investigated vacuum technology, including thin film deposition and analyzing the deposition using several tools to show reflectivity and thickness. Another project was to build a small steam engine from a Solovexworks part, which included spending time with lasers and cut machines. In that time I also learned LaTeX, Mathematica and Kale and spent time exploring Labview - programming a working musical tune with Labview. It was a wonderful experience to have that many hands-on projects, and I learned a lot from that time. I hope to get as much out of this summer.

To get the opportunity to work closely with the projects at NIST would be a dream come true for me. Learning and discovering is one of my passions, and I have found in myself the desire to see that discovery benefit the world. The Center for Nanoscale Science and Technology appeals to my desire not only to be on the cutting edge of discovery, but to bring what we know forward. These projects look specifically at how to take what has been done and improve it, nanofabrication, nanophotonics, and thermoelectrics are fascinating. They seem like science fiction, yet are already in use in some places, holding within them the potential to aid in our energy crisis. Looking at the Engineering Laboratory, I see ways to improve the safety and energy efficiency of construction. At the beginning of this year, I spent some time on a construction site and noticed that each worker had a badge on which they wrote “I am safe for” some had “rock climbing” and others a photograph of their daughter or family. It made me realize that in such an environment, safety is critical. Improving guidelines and methods will not only improve the buildings we live in, but the quality of work for the people who build them. This holds for every manufacturing industry, and I feel that this is important to recognize. These two topics were discussed in an ethics course I took, and I found them of great interest from the side of morals, discussing questions such as releasing the relative unknown of nanotechnology to the public, or the perceived strictness of health and safety standards.

In my career, I hope to work in research, preferably in a laboratory working to bring new discoveries to light and to the world’s benefit. Whether I spend time at a well-known institution such as NIST or hidden within a small company, my goal is to improve the world with my knowledge. Getting the opportunity to experience that first hand is not just a resume builder for me, it is the opportunity to do my dream job.

• Include descriptions of previous research opportunities or related projects
• Elaborate on why you wish to participate in the SURF Program.
• Which lab are you interested in conducting research.
• What do you hope to gain from the experience
• What are your career interest?
• Do you plan to attend graduate school?
Supporting Documents

- The following must be attached in USAJOBS
  - Resume
  - Transcript
  - Proof of U.S. citizenship or lawful residency
  - Verification of health insurance coverage
  - Personal statement

***Failure to attach any of these documents will result in your application package submission labeled incomplete/ineligible for review.***
Step 8: Letters of Recommendation

Reference Information

Reference 1 - New

- Reference Type
  - Select

- First Name

- Last Name

- Institution/Organization Name

- Email Address

- Phone Number

- Extension

[Diagram showing a step in the process]
Step 8: Letters of Recommendation

- Indicate contact information for two (2) references. Make sure the information provided is correct as you cannot change the info after submitted.
- Must select “Next” and “Submit” on the next page for the reference writers to receive the request.
- Reference writers receive the request to provide a reference from the e-mail address noreply@monstergovt.com. Please inform the reference writer to check their Spam folder if they do not receive the auto-generated request to submit the reference.
- Request recommendations from professors who are knowledgeable about your academic background (preferably in STEM) or prior internship supervisors.
- Give adequate time for your recommenders to write a good letter.
Enrichment Activities of the SURF Program

Weekly Technical Seminars

Laboratory Tours

Professional Development Seminars
Benefits of the SURF Program
Stipend and Housing Allowance

- **SURF** participants receive
  - $5500 stipend for an 11-week fellowship or $500/week
  - Housing and travel subsidy
  - Local commuting subsidy
Benefits of Participating in the Program

- Contribute to exciting, real world, innovative, ongoing projects in the NIST laboratories
- Build professional networks with scientist and engineers
- Opportunity to establish a mentor
- Enrichment opportunities through professional development and technical seminars
- Visit new places
- Decide if a career in research is right for you
- Land a permanent position
Acceptance Rates

• *SURF Boulder*

24 acceptances
178 applications = 13%

• *SURF Gaithersburg*

194 acceptances
750 applications = 25%
SURF Spotlight

Tanya Kiryutina, MML
PhD student at Georgia Tech

Sai Meghasena Chavali EL
PREP and MS student at UMD

Ryan Need, MML
NRC and recently accepted faculty position
Don’t Forget!!!

- Apply to the SURF Program on USAJOBS.Gov now!!
- Application deadline is February 3, 2020 or when the application limit is reached.
- If considering Boulder and Gaithersburg locations, must apply to each vacancy announcement separately.
- SURF Boulder has 350 applicant limit while SURF Gaithersburg has a 1,000 applicant limit.
- Prospective applicants are anticipated to receive e-mail correspondence pertaining to a decision in the timeframe of March 1, 2020-April 15, 2020. Pay attention to your e-mail as the decision time is 3 days or less.
- Read a blog posting about “Why You Should Consider a Summer Internship at NIST” http://nist-takingmeasure.blogs.govdelivery.com/calling-college-stem-students-why-you-should-consider-a-summer-internship-nist/
- SURF Website - www.nist.gov/surf
- Plan ahead and apply early!!!
Hope you will consider applying to the SURF Program next year. We may just find you in this picture for the 2020 SURF Program!
Thank You!!

Visit: www.nist.gov/surf
or
e-mail: Brandi.Toliver@nist.gov