NIST Summer Undergraduate Research Fellowship (SURF) Program

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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?

www.nist.gov/public_affairs/factsheet
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
Innovation

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

Nonprofits
- AdvaMed
- ASTM International

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

- Construction (CRF) $319 Million
- Laboratory Research (STRS) $724.5 Million
- Manufacturing USA (ITS) $15 Million
- Manufacturing Extension Partnership (ITS) $140 Million
NIST AT A GLANCE

Industry’s National Laboratory

- 3,400+ Federal Employees
- 3,500+ Associates
- 5 Nobel Prizes
- 10 Collaborative Institutes
- 2 Main Campuses
  - Gaithersburg, MD [HQ]
  - Boulder, CO
- 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
• Advanced Materials

NIST Collaborative Research Centers
NIST Laboratory Programs

- Material Measurement Laboratory
- Physical Measurement Laboratory
- Engineering Laboratory
- Information Technology Laboratory
- Communication Technology Laboratory
- Center for Nanoscale Science and Technology
- NIST Center for Neutron Research
NIST Extramural Programs

Public-private partnerships improving U.S. economic competitiveness

Hollings Manufacturing Extension Partnership

Manufacturing USA

Baldridge Performance Excellence Program
Unique NIST Products and Services

Every year:

- 32,000 SRM units sold
- 13,000 calibrations and tests
- 800 accreditations of testing and calibrations laboratories

1,200 Standard Reference Material (SRM) products

100 Standard Reference Data (SRD) products

600 measurement services
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

Credit: chesky/fotolia.com
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 @ Gaithersburg and Boulder campuses
- To date 2,812 undergraduates have participated in the program
- The 2018 SURF Program consisted:
  - Boulder: 23 participants
  - Gaithersburg: 194 participants
- SURF website: [https://www.nist.gov/summer-undergraduate-research-fellowship-surf](https://www.nist.gov/summer-undergraduate-research-fellowship-surf)
Eligibility Requirements

▪ Must be a United States citizen or US Permanent resident

▪ 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, 2019 (tentatively)

- Program Dates
  - SURF Boulder: May 20, 2019 - August 2, 2019
  - SURF Gaithersburg: May 28, 2019 - August 9, 2019
Application Process

▪ Students must apply and submit their entire application package on USAJOBS.gov. The announcement is scheduled to post on USAJobs.GOV soon.

▪ A completed application package consists of the following:
  ▪ Resume
  ▪ Transcript (Unofficial recommended)
  ▪ Two letters of recommendation
  ▪ Proof of health insurance coverage
  ▪ Proof of US citizenship or lawful residency
  ▪ Questionnaire
    ▪ Includes a question requesting the applicant to furnish a personal statement - The personal statement should contain information that helps the review committee make an informed decision about the student such as why the student wants to participate in the SURF program, what areas of NIST research interest the student, and career interest.

NOTE: All SURF Program applicants must create a profile on USAJobs.Gov to apply to the program.
Tips For Making Your Application Competitive
Questionnaire

- Answer all questions
  - Eligibility Questions: Unless you’ve been a federal employee, most of your responses are “No” or “NA.”
  - Vacancy questions: Read and answer carefully.
    - Selection of research preference
    - Personal statement (limited to 6000 characters)
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.
NIST Gaithersburg: SURFING Special Projects – Special Projects

➢ 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 for a description of the 2019 research opportunities
Example of Research Opportunity Posting @ Boulder Site

- Division Name
- Project Title
- NIST staff project contact
- Project description
Personal statement

- Limited to 6000 characters
- Put time and effort into writing your personal statement as this is what sets applicants apart.
I decided to attend North Carolina State University 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 wondrous opening before me. For example Programming Concepts and Digital Electronics did not so much as astonish me 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 electronically 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 see the differences between hardwiring a chip and programming a computer. I loved having an idea of what the computer looks at to see if 5 is truly equal to 5. But even that was not the most satisfying part of my semester. I then took what I learned from that 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 fiber 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 Solidworks part, which included spending time with lathes and use machines. In that time I also learned LaTeX, Mathematica and R and spent time exploring labview - programming a working musical tuner 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, and 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 bad "rock climbing" and others a photograph of their daughter. Finally, 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
  - Letters of recommendation (2)
  - Transcript
  - Proof of U.S. citizenship or lawful residency
  - Verification of health insurance coverage

***Failure to attach any of these documents will result in your application package submission labeled incomplete/ineligible for review.
Resume

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

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

Job Skills
- Labview, Word, Excel, PowerPoint, Mathematics,
- Laboratory: Safety procedures, titrations, reading measurements, analytical instrumentation (FTIR, SEM, EDS)
- Communication: Public speaking, technical writing
- Other: Spanish, Arabic

Projects
- Green Plastic Bag Project
  - Compared the biodegradability of green plastic bags in a kitchen compost. 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. Study the structure of the green film.
- Freshman Design Project
  - Studies the impact of various concentrations of chlorine on the outside layer of Cacoonid, Negroid, and Mongoloid hair types. Documented the change in chemical structure (FTIR) and physical structure (scanning electron microscopy)

Work Experience
North Carolina State University, Raleigh, NC
June 2015 – August 2015
Chemistry 101 Teaching Assistant
- 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
August 2014 – Present
Research Assistant
- Organize educational events and activities for 80 first year students in the University Scholars Program.

Honors and Activities
- Women in Science and Engineering (WISE) – Secretary
- American Chemical Society (ACS)
- Alpha Alpha Alpha Society – Membership Intake 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
Letters of Recommendation

- 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
- Required to be uploaded on USAJobs.Gov
Transcript

- Undergraduate transcript is required
- Unofficial is preferred
- Make sure personal identifiable information such as social security number is blacked out
Proof of U.S. citizenship or Lawful residency

- **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

- **Proof of lawful residency**
  - United States Permanent Resident Card (USCIS Form 1-551)
Verification of health insurance coverage

- Copy of health insurance card

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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
  - Travel allowance (up to $600)
  - Housing in a nearby apartment or suite-style apartment
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%
Don’t Forget!!!

- Students apply to the SURF Program on USAJOBS.Gov. The announcement is anticipated to post on December 15th.
- If applying to Boulder and Gaithersburg locations, must submit an application package to each location separately.
- SURF Boulder has 400 applicant limit while SURF Gaithersburg does not have a limit at this time.
- 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
- Application deadline is February 3, 2019
Hope you will consider applying to the SURF Program next year. We may just find you in this picture for the 2019 SURF Program!
Thank You!!!

Visit: www.nist.gov/surf
or

e-mail: Brandi.Toliver@nist.gov