



Undergraduate Research Scholars Program

Handbook, Spring 2020

THE RESEARCH PROCESS



NMSU-HHMI Undergraduate Research Scholars Program

Welcome to the NMSU-HHMI Research Scholars Program. This document is meant to help orient you to the program. It is also meant to ensure that you understand the expectations of the program. If you find yourself in a situation in which you are not sure if you will be able to meet the expectations of the program, or that the program will meet your expectation, stop by and talk with either the Program Co-Director (Dr. Tim Wright), Program Director (Dr. Michèle Shuster) or the Program Coordinator (Anja Hansen). Our goal is to help you succeed.

Monetary Support

The NMSU-HHMI Undergraduate Research Scholars Program is funded by a grant from the Howard Hughes Medical Institute and by matching funds from NMSU. **Support is contingent upon continued grant funding**, and the level of support may change with changes in available funding from external sources. The Research Scholars Program generally supports juniors and seniors during the academic year, and during the junior-senior summer experience.

- Juniors and seniors are paid a stipend of **\$1,750** for each spring and fall semester.
- If a scholar does not work the full semester the stipend is prorated.
- Any student who fails to complete the program requirements in a particular semester is subject to returning their stipend for the entire semester.
- During the summer between the junior and senior year, participants are paid a stipend of **\$4,600** to work full-time on their research projects as part of the intensive summer research experience.
- Additional funds of **up to \$1,500** are available to cover research related expenses (supplies, no equipment, travel).
- Travel grants of **up to \$1,700** are available for traveling to and presenting at scientific conferences.

Program Activities

As an NMSU-HHMI Research Scholar, you have the opportunity to participate in all of the programmatic activities. Your full participation is the key to your success, the success of other students in your Research Scholars' cohort, the efficient operation of your research mentor's laboratory, and the NMSU-HHMI Program's continued funding. Participation in each of the

following activities **is required**. As mentioned above, if a situation arises that might prevent you from fully participating in any of these activities, talk to us ahead of time—be professional and proactive! If you have a medical condition, or develop one while in the program, which might put you or your lab members at risk, please talk to your mentor/NMSU-HHMI program director to discuss next steps.

Work a minimum of 10 hours per week in the laboratory. The program requires students to work a minimum of 10 hours per week in their Research Mentor's laboratory during the academic semester. The time spent working on classes associated with the Program does not count towards these 10 hours nor does the time spent writing the thesis.

Submit a report of your research activities and an evaluation from your research mentor each semester. Each student will submit a report at the end of each academic semester and have their mentor submit an evaluation form. Report and evaluation forms will be submitted to the Program Coordinator in a timely manner. The information in these reports may be included in annual reports submitted to HHMI.

Meet with the Program Coordinator. At least once a semester the Program Coordinator meets with students in the program, individually or in a group format. The purpose of these meetings is to discuss the experiences students are having in their research labs, provide feedback, review the expectations for the upcoming semesters, and answer any questions the student may have about the program.

Attend NMSU-HHMI seminars and events. The NMSU-HHMI Program brings sponsored speakers to campus to provide you with an opportunity to interact with scientists from outside of NMSU. Research Scholars participate in student/speaker lunches, and attend seminars presented by our sponsored speakers.

Participate in an intensive summer research experience. In the summer between the junior and senior year, Research Scholars spend at least 40 hours per week working on their mentored research project at NMSU and participating in the **required 1 credit summer professional development course (Biol 350)**. Student should not plan to take any other NMSU coursework during the summer period as this intensive research experience does not leave adequate time for students to take classes and do the associated work. In addition to the laboratory research, the summer experience includes cohort meetings that are organized into the professional development seminar (Biol 350). This seminar course provides students the opportunity to develop their communication and other professional skills, read the scientific literature, and begin their thesis writing.

Attend the Summer Poster Session. The capstone experience of the summer program is a poster session and reception. All Summer Research Scholars present a poster describing their research, and then enjoy a catered reception with their mentors, family and friends, and program staff. When you create your poster, please **acknowledge** the funding source for your research: *"This research was supported by Howard Hughes Medical Institute's 2014 Science Education grant 52008103 to New Mexico State University."* To obtain the official HHMI logo please contact the NMSU-HHMI office.

Write a Senior Thesis. In the fall semester of the senior year the Research Scholars complete a **thesis-writing course, BIOL 402**. This course provides the senior cohort support as you work their way through the steps of writing an honor's thesis describing their research project. For those students on the University Honors track through the Honors College, this thesis can be used to fulfill the honors thesis requirement. The final thesis must be submitted to the HHMI program by the end of the fall semester as part of the Biol 402 course, and must be approved by the program and your mentor before you can graduate with the distinction of an HHMI scholar.

Complete Undergraduate Research Surveys at the end of the participation in the Research Scholar Program.

Keep in Touch with the Program after Graduation. Contact the Program Coordinator at least once a year for 4 years after graduation to provide education and career updates. Why? Because we are proud of your accomplishments and we would like to tell other students how far graduates have gone. It is encouraging to them and to us! It is also valuable information when reporting or submitting subsequent grant applications to HHMI.

Research Conduct

Problems that arise in the laboratory are often a result of miscommunication and poorly understood expectations. Students are expected to work routinely with their direct supervisors and to meet regularly with their mentors to discuss progress on their research project. The amount of interaction with the research supervisor and mentor will vary. Below is a list of expectations common to most research laboratories. Students will:

- provide their mentor and/or supervisor with a copy of their class schedule and contact information.
- discuss their work schedule with their mentor and/or supervisor.
- maintain good communication with their mentor and other lab members.
- attend lab meetings.

- respect their colleagues' time by following the schedule and showing up on time for meetings.
- follow lab rules and procedures.
- always treat everyone with respect and professionalism.
- maintain training and certification necessary to work in the lab and on the research project.
 - Institutional Review Board (<http://research.nmsu.edu/compliance/IRB/IRB.html>)
 - Animal Use in Research (<http://research.nmsu.edu/compliance/IACUC/iacuc.html>)
 - Environmental Health and Safety (<http://www.nmsu.edu/%7Esafety/>)
 - Maintain a clear and complete document of their research results in the form of a lab notebook (available in the program office).

GPA Requirement

All undergraduate research scholars are expected to maintain an overall GPA of **3.2** or above. Any scholar whose GPA drops below a 3.2 is required to meet with the program director or program co-director to discuss and evaluate further participation in the Research Scholars program. The program director/co-director will decide on a case by case basis what measures will be taken in terms of further participation in the program (e.g. probationary semester). We acknowledge that sometimes students struggle with adjusting to college life and/or may face personal challenges. Please be proactive and talk to us if you are experiencing difficulties.

Programmatic Requirements of Research Scholars

While we hope that all Research Scholars successfully complete the program, and we realize all start the program with the intention to do so, we also realize that sometimes difficulties arise and goals need to be reconsidered. If you are having problems, please come in and talk with us. The following lists the NMSU-HHMI requirements for continued participation in the Research Scholars Program. Students who fail to meet these requirements will be dismissed from the program.

Program Activities: Fully participate in, and successfully complete, all the Program activities listed above.

Research Progress: If a program participant is not making satisfactory progress on their research project then he/she may be dismissed from the program.

Academic Progress: Participation in the program at the expense of coursework is detrimental to the student and the program. Research Scholars must meet the GPA Requirement described above to continue in the program.

Inappropriate conduct: Program participants are expected to conduct themselves appropriately as outline in the NMSU Student Code of Conduct.

Email

Scholars are required to check their NMSU email account at least **once a day**. E-mail is the quickest means of disseminating information, so it is the preferred method of communication between the program and the students. Since the program is required to communicate with students via NMSU e-mail, it is the responsibility of the students to make sure they receive NMSU email correspondence through their preferred e-mail system.

Web-based Information

Information about the NMSU-HHMI Program, including updates from past and present participants, as well as education and career opportunities are posted on the NMSU-HHMI website.

Website: <https://hhmi.nmsu.edu>

Another helpful resource is the National Science Foundation-sponsored Web Guide to Research for Undergraduates (WebGURU) <http://www.webguru.neu.edu/> which is intended to assist undergraduates navigate the hurdles of an undergraduate research experience.

Conference Travel Grants

Research Scholars can apply for a travel grant from the NMSU-HHMI Program in order to attend professional scientific conferences at which they present their research project. Please refer to <https://hhmi.nmsu.edu/scholars/> for forms and documents related to the Student Travel Grant. The maximum amount of these travel grants is \$1,700. Scholars are eligible to receive only one travel grant from the HHMI program.

Additional Opportunities

If students want to work additional lab research hours they can investigate work-study, research hours for course credit, pay by a mentor with other resources (e.g. grant funds), or volunteering.

Disclaimer

This is a grant funded program and **support to the students is contingent upon funding**. It may be necessary to make minor program modifications at times in order to address unexpected dilemmas. These modifications will be brought to the student's attention first by email notification and then as part of the semester meetings with the Program Coordinator.

General Laboratory Introduction

Safety

Before working in a research lab, students need to attend and pass the following safety classes offered by the Environmental Health & Safety Department: **“Online Employee Safety module or Lab Standard class AND HazCom (Hazard Communication)** plus any additional courses mandated by safety procedures in their own research lab (e.g. Blood Borne Pathogens or Animal Worker Safety). Online registration is available at: <https://safety.nmsu.edu/training/>.

Lab Culture

While not every laboratory operates in the same way, there are a few basic good practices to follow while developing an understanding of the lab culture. Since each of you only has one chance to make a first impression, we have included a few good practices to keep in mind for the first few weeks in the lab. This information is adapted from the book *At the Bench: A Laboratory Navigator* by *Kathy Barker*. Feel free to review the book for more detailed information:

Who works in the Lab? Laboratory Personnel

Principal Investigator (P.I.): This person is the head of the lab. She/he will generally spend a lot of time with administrative duties such as writing grants and scientific publications. Many of the P.I.'s at NMSU are also professors and have teaching, service, and administrative responsibilities.

Postdoctoral Fellow (PostDoc): A person who has received his/her Ph.D. and is doing some additional training before moving into a position as a Principal Investigator. Postdocs tend to work on their own independent research but will sometimes assist in the training of junior laboratory members.

Research Staff (Technician or Lab Manager): The research staff person will do a variety of tasks in the lab in addition to working on their own research project. This may also include training of new lab members in common lab protocols and procedures.

Graduate Research Assistants: Your P.I. may be serving as a major advisor for students working toward a Master's or Ph.D. These graduate students will be spending a great deal of time working in the laboratory on their thesis project (M.S. students) or dissertation (Ph.D. students). Some may have experience in the laboratory; others may be just starting out—they all will be very busy as they take classes, possibly teach, and work on their research.

Undergraduate researchers: NMSU has a strong history of undergraduate research with a large number of undergraduates working on research projects. In a number of cases, upper level undergraduates are conducting independent research and training lower classmen. New students are generally assigned to work with someone else until they establish their own independence.

When do I work? Hours and Time Management

Experiments do not always fit into the 8-to-5 work schedule requiring some flexibility on the part of the researcher. Most labs operate with the understanding that people are mature enough to regulate their own hours but there is usually an expected time commitment. It is good practice to have your time overlap with other lab members whenever possible, and such overlap may be required in some labs working with pathogens or hazardous materials. Furthermore, researchers are expected to manage their time in a way that it does not adversely affect an experiment. In many cases samples and reagents cannot be easily replaced. For example, allowing cells to overgrow because you have to meet your friends for lunch is not appropriate.

How should I dress? Dress Code

Academic labs generally have a very relaxed dress code. There are some common practices that apply when working in the lab.

- Don't wear expensive clothes. They risk being ruined by a chemical or some other spill.
- Don't wear open-toe shoes, shorts or clothing that reveals your back, chest, stomach or underwear. In addition to being unprofessional, it is also unsafe. Spilling acid on your clothing may be annoying but spilling it on your skin is hazardous and painful.

How do I learn about my lab? Laboratory Meetings

Most research groups have regular meetings to discuss research updates in their lab, research advances in the field and organizational issues. Research meetings often have all the lab members provide a brief update on their progress. Others may have one or two people give a longer presentation. Regular attendance at lab meetings will likely be a fundamental expectation of your

lab. Not only will regular attendance help you learn more about the research in both your lab and the research field but it will also establish you as an active participant in the group.

How do I start? What to Expect in the First Weeks

- You may be assigned a workspace. Since space is often an issue it will most certainly be constrained and you may have to share it.
- You should sit down with your P.I. or assigned research mentor and discuss your project. You may already know the basic outline of the project but now is the time to learn more detailed information. Start reading the relevant scientific literature as soon as possible. Don't worry if it doesn't make perfect sense in the beginning. Things will become clearer as you do experiments.
- You should learn about the training and certifications necessary to conduct research in your lab. If the P.I. does not mention it, then ask.
- In the beginning it is a good idea to read a few papers related to your research topic. Your P.I. or research mentor may have some good suggestions. You can also do a keyword search using one of the databases available through the library's website (<http://lib.nmsu.edu/article.shtml>).
- Do an experiment as soon as you can. This will also help establish you as a productive member of the group. Your first experiment will most likely be one that confirms a previous result.
- Introduce yourself to the other lab members. In academic labs people come and go very quickly. One good icebreaker is to ask people about their projects.
- Take lots of notes. Initially, you will be given a great deal of information. It will be nearly impossible to remember the details and details are important. Keep a notebook just for that purpose.
- Become familiar with the way the lab works. Find out where things are kept and who does what. This may include chemicals, computer use, first aid, glassware, lab meetings, lab notebook, work hours and trash disposal.
- Don't be afraid to ask questions. You don't want to bother anyone, especially when they are in the middle of a procedure. But it is better to ask a question about a reagent, procedure or piece of equipment before lots of time and money is wasted.

What should I avoid? What Not to Do in the First Weeks

- Don't read a novel or the newspaper, surf the internet, play computer games, use your cell phone, or send text messages in the lab. There will be some down time, especially in the early days. Doing something else besides what you are supposed to do at a lab is not a good idea.

Instead, use the time to read relevant scientific literature (journal articles, textbooks, etc...), review laboratory procedures, or update your laboratory notebook.

- Don't use the lab computers or printers excessively for personal use. If you must, then keep it to a minimum and don't interfere with the research progress of others.
- Don't suggest that you are working in the lab for any other reason other than the love of research. Otherwise, you run the risk of being perceived as not being serious about your work.

How do I get along with others? Sound Judgment and Courtesy

Researches are generally happy to help but are often very busy.

- Make sure you politely ask for help and this request doesn't sound like a command.
- Don't assume that someone will immediately stop an experiment to help you whenever you need it. It is best to make an appointment or request a time to speak with someone. When people are running experiments they may not look busy at the moment but then have to do something in 5 minutes. A good approach is to ask lab members when they will be free to show you something.
- Write down everything when someone is giving you instructions. You will be given a lot of information by a variety of people and you want to avoid asking the same questions over and over. Record people's names, incubation times, temperatures, reagent locations, and anything else that saves another question. This not only helps you remember but also garners goodwill points by making it obvious to people that you are interested in what they are saying.
- Never use reagents or buffers without permission. Buffers and reagents on a person's bench are personal and some may even be very specialized (e.g. sterile, RNase-free). Do not even open the container without permission.
- Don't ignore a problem whatever it is. Whether it is a common reagent that is running out, a broken piece of equipment, or an equipment alarm, either deal with it or bring it to the attention of someone who can.
- Keep common use areas clean after you are finished and don't change the location of common use equipment, buffers, reagents, etc...
- Clean up after each part of your experiment. You wouldn't want to clean up after someone else before you can do your own experiment and the same is true for the people you work with.
- Keep requesting favors of others to a minimum. It is okay to ask someone to stop an experiment for you if you must go and it will take a minimum of activity on his/her part. It is not okay to give someone a list of things to do because you want to do other things out of the lab.

How do I learn about my project? Background Research

Many mistakes can be avoided with the correct amount of preparation. Not only is it important to have all your reagents in order and to make sure your equipment is available but you also need to know the field. Having a protocol is not always enough. It is important to know the details and theories of the experiment. This will help you get to the point where you know the expected results and are in a better position to figure out the “why” when you don’t get the expected result. When you don’t get an expected result it may or may not be due to a technical error on your part. It is your responsibility to know the details well enough to evaluate the steps and confidently figure out the “why.” If you discover you made a mistake, it is okay. Everyone makes the occasional mistake. Confess and do the experiment correctly the next time. You certainly want to avoid repeating the same mistakes giving the impression that you are either not capable of learning from your mistakes or that you don’t care.

How do I perform labwork? Lab Protocols

- At first you will most likely obtain protocols from another researcher in your lab. It will be tailored to your lab and may have important details.
- Read the protocol to make sure it makes sense to you. Assumptions may be made in the protocol that is obvious to the author but not obvious to you.
- Rewrite the protocol if necessary, adding detail but not changing it, to make it more understandable to you.
- Make sure you have everything you need before you do the experiment. You may not have time to make that buffer in the middle of your experiment.
- Follow the protocol exactly the first time!! You must be able to reproduce the usual result before varying the conditions.

How do I document my work? Lab Notebooks

The lab notebook is the record you keep of your experiments and should be clear and thorough. There are many different types of notebooks used in research laboratories. Find out from your P.I. which type is typically used in your lab. If something goes wrong, you must be able to go back and figure out what happened. Furthermore, another scientist should also be able to interpret your notes.

Generally, the record of your experiment should contain the start date of the experiment, the title of the experiment, a brief statement of purpose, the protocol for the experiment, your calculations, printouts and pictures, and a short summary of the results. Essentially, you want to include enough detail so that another scientist can use your notebook to duplicate the experiment exactly. Good stewardship of your data is a fundamental expectation of being a scientist.

It is good practice to record everything as soon as you can either as you go or at the end of the experiment. At the end of the week, set aside some time to review your notebook to ensure that it is in order and make plans for the following week.

Once you have your data and reviewed it, discuss your results with your P.I. or fellow researchers. Don't feel that you need to know what the results mean before discussing it with someone but you should have a clear understanding of the data.

Confirmation of Receipt of Handbook for 2020

I confirm that I have received the Handbook and understand the requirements for participation in the NMSU-HHMI Undergraduate Research Scholars Program.

Print Name

Signature

Date

Photographic Release

Date: _____

Name: (please print) _____

I hereby give the NMSU-HHMI program of New Mexico State University irrevocable right and permission to use and publish any and all photographs given by me to, or taken of me by, NMSU staff members while being a participant of the New Mexico State University-Howard Hughes Medical Institute's Science Education Program. I recognize these same photographs and their copyright as the property of the NMSU-HHMI program solely and completely and that they may be used in university publications and promotional materials, including but not limited to the university's catalog and viewbook, recruitment materials, Internet applications, advertising in newspapers and other media, slide shows, displays and exhibits, and other generally recognized communication methods for the purpose of representing university activities and services to potential students and the community at large. I hereby release the NMSU-HHMI program from any and all claims, including libel and invasion of privacy, resulting from the usage of these photographs. I understand that no modeling fee or other compensation will be paid to me for such use of my photographic license.

Signature: _____