

HHMI – A Community of Scholars

Notes from April 2005 Meeting with the Research Interns

“Honestly, I do not know exactly what to expect yet. In general though, I hope to learn how a lab is run, to learn about whatever I end up researching, and to get a feel for research in general. I have never worked in a lab before, so I look forward to the experience and to finding out what goes on in a lab.”

During a lunch meeting in April, we asked the new Community of Scholars interns to reflect on three topics related to the summer program:

1. their expectations and goals for the summer;
2. their understanding of the scientific research process;
3. their image of a research scientist at work.

This document summarizes the major themes emerging from that meeting.

1. Intern’s Goals and Expectations for the summer

We asked the interns to write a response to the following questions: “As you prepare to participate in this program, what are your expectations (including your goals, hopes, and concerns) for yourself, your mentors and teachers, and the program overall?”

One of the most common themes involved **career goals**, with 4 of the interns writing about the connection between their summer research and their career aspirations. While this was the only intern to explicitly mention medical school, this was a typical response regarding career goals:

Well, I’m quite science-oriented so this program seems like a good fit for me. I plan to go to medical school, but I want to see if research is a possible career for me as well. I’m glad that this program is centered for inexperienced graduates because it allows us to be introduced to the basics of research prior to any project or what not. Thus, for myself, I want to see if research is a possible career for me. I hope that the mentors/teachers will aid with my gaining experience. I hope to continue research for fall semester, so I hope to find a mentor that I can work well with. Finally, I hope the program will provide insight to the research world and prepare me well for any other research endeavors I choose to partake in.

Four interns also wrote about a goal of developing a **better understanding of science and research**. In the following response, this understanding of science is tied to career goals:

I hope to learn the basics of carrying out a research experiment; in the future, I want to get more involved with research so establishing a firm knowledge base is important. I also hope to gain a greater sense of confidence in my abilities and a stronger understanding of the research process. I expect my mentors to be helpful and patient. Their knowledge of their fields should be an immense

resource for students like myself. In general, I want to leave the program with a better idea of my career goals, a better sense of self-awareness, a better appreciation for science.

Three interns mentioned the importance of personal **relationships** and a desire for interactions with other interns and mentors in ways “*not possible in the classroom or in an introductory lab course.*”

I expect to form relationships with the mentors and also with the other interns so as to get the most out of the program.

I hope that the program will make my interest in research science grow even more. I'm really anticipating meeting the other students in the HHMI program and to interact with the regular scientists in the lab on a regular basis.

In one way or another, 6 interns expressed some **concerns about their abilities** and wrote about their expectations for their mentors in showing **understanding and guidance**.

I expect mentors that are willing to give up some of their time in order to help fill in holes in my knowledge as well as guide me throughout my research. I would also hope that mentors and teachers will be forgiving and flexible and understand that as a novice in research, there will be mistakes made and results may not be produced as efficiently as expected.

I expect that I am new to the aspect of science and that I probably will make some mistakes, but as well guide me on the right direction as to thinking more critically about what is going on in the lab.

I expect the mentors/teachers to provide guidance in getting acquainted with the lab and figuring out what I am doing. I hope they will address my questions and point me in the right direction when I am confused.

And one intern expressed the desire to be given some space:

My expectations for my mentors/teachers is that they be helpful, but mainly not be too obstructive to the research experience. Having conducted research at another institution, I feel that the best experience is one that is unhindered.

2. Science and Research

We asked the interns: “How do you know what a good research question/experiment is? How do you know if the result can be trusted? How do you know if a research technique does or doesn’t work?”

The interns all have some knowledge about these issues, but none of them were able to put together a succinct and reasonably complete answer to the questions we asked. This is a representative response:

A good research experiment is probably an experiment that does not already have a definitive answer to it (e.g. running experiments to answer a question that hasn't been answered already). You would probably have to run multiple experiments, and confer with peers knowledgeable in the field to analyze and draw a conclusion from the data collected. In my opinion, a research technique doesn't work if the data collected would have no relevancy to answering the question that is trying to be solved. A research technique works if the data collected is relevant to the question that is being solved in the lab.

Ideas mentioned as being important to research included the importance of limiting the variables and using experimental controls, the difference between accuracy and precision, the use of statistics to determine significance, and the repeatability of experiments. In fact, 6 interns talked in one way or another about the importance of repeating an experiment.

Results can be trusted if replicates of the experiment are done.

The results can be trusted by replicating the experiment and making sure the results are the same. They can also be trusted by using different procedures or tests. If the two procedures give the same results, they should be good. A research technique works if it gives consistent results.

Results can be evaluated by repeating an experiment many times and by drawing on results from a wide range of these.

However, only one intern wrote about the possibility that, in fact, repeatable results might not be valid:

You can repeat an experiment many times, but if the experiment is poorly designed, the results may be false or misleading.

Three of the interns explicitly mentioned being uncertain about how to answer these questions, and three more alluded to their uncertainty by using qualifiers like “I think” and “probably” in their answers.

The most confident response to our questions included a discussion of the importance of independent thinking:

A good experiment is not one that you simply follow predetermined instructions, but rather one that you develop yourself. By immersing yourself in the material and developing your own hypothesis, you produce “good” experiments. Also, since the design is of your own, you will have expectations of the results and be able to trust them – or explain why they are not what you expected – when they are produced. Although it is off topic, getting unexpected results occurs, but by understanding your experiment, you are able to identify what is occurring and make unexpected and often significant discoveries.

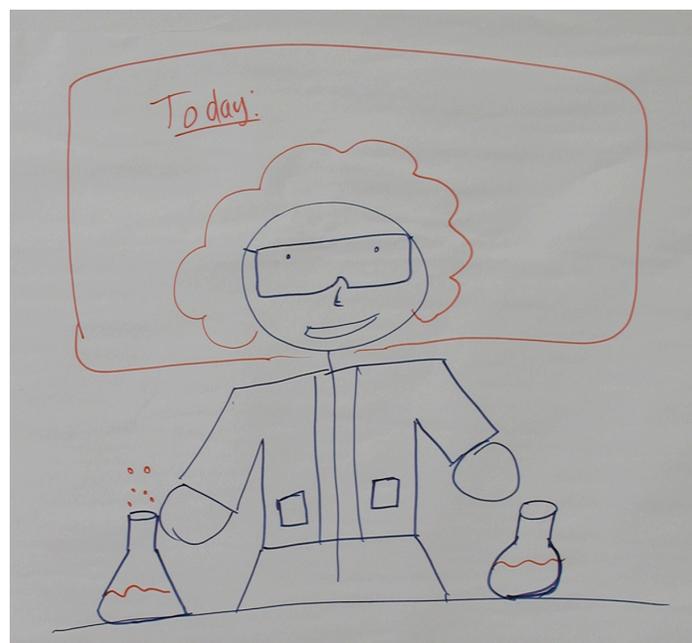
3. Scientists at Work

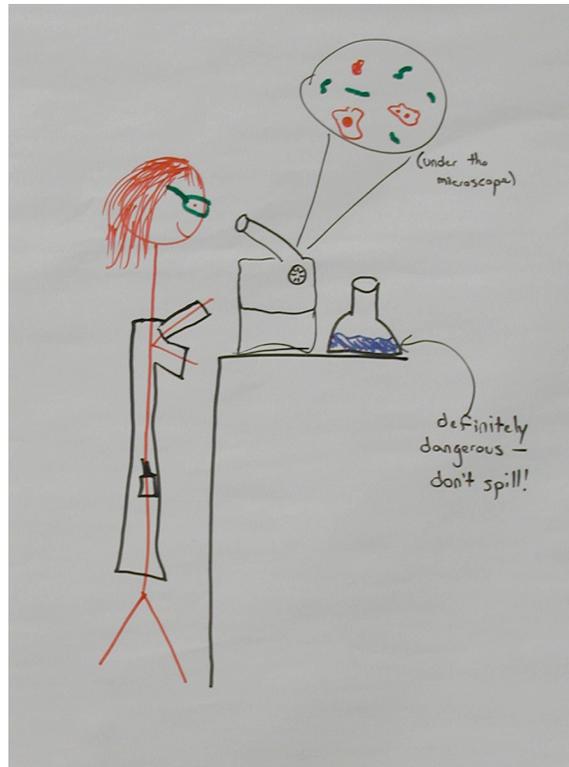
We asked the interns to draw in response to the following prompt:

“What do you picture when you think of a research scientist in biological sciences? What does the scientist look like? What does the scientist do? Where does the scientist work?”

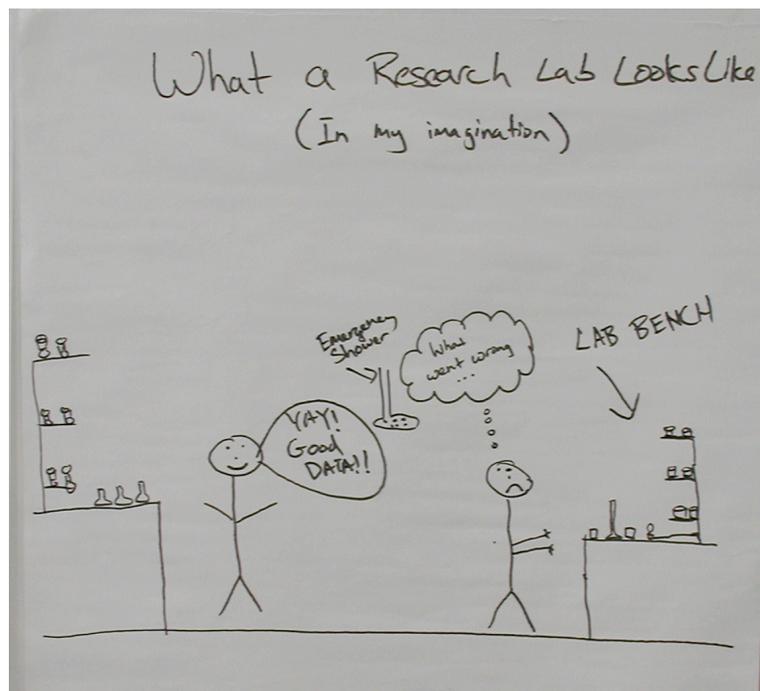
We were not hoping for fine art. Instead, this technique can be useful in surfacing implicit assumptions about a complex topic. The intern drawings from this year are similar in many ways to what we have seen during the past two years. Before their summer research experience, intern drawing tend to be simplistic, generally only involving one person (either male or androgynous) and only a few details about the lab.

With one exception all of this year’s interns drew solitary scientists in simple labs, but unlike in previous years several female looking figures made an appearance.





Laboratory safety was a common theme in the intern's illustrations, with seven drawings including safety goggles, two labeling the "dangerous" chemicals, and one including a safety shower.



One intern captured what he perceives to be an important element of scientific research in his drawing, showing open lab books with data on the left and a stack of published papers on the right. The scientist in the middle is transforming the data into publications.

