

Taking Advantage of Undergraduate Research Opportunities

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Molecular and Cellular Biology '14

January 2012

Johns Hopkins as a Center for Biomedical Research

If your interests lie in biomedicine, part of the allure of studying at a research university like Johns Hopkins is being able to conduct biomedical research as an undergraduate.

Research Makes You a Better Student and Professional

Research can give you real-world applications of classroom knowledge. This connection also works in reverse, and you may find that the techniques you acquire through research training appear later as the fundamental methods taught in undergraduate teaching labs, giving you an advantage in class. Through the research experiences of conducting and designing experiments, troubleshooting, writing papers, and attending lab meetings, you also develop your critical thinking skills, which are often applied in science courses.

Furthermore, participating in research is a good way to determine if you enjoy research at all. You may want a sense of direction to help you decide if you want to pursue a graduate degree. It is worth thinking about: why would you spend four to seven years pursuing a PhD, only to realize you hate being in a lab? Alternatively, what if you went through four years of medical school without knowing you love doing research? Save yourself time in the long run by doing research for a few months now.

Research Helps You Make Valuable Connections

Throughout this journey, you will have time to network with researchers at many stages of career development. Make friends with them, as they can help you with experimental problems and with your future career development. Do not be afraid to talk about your ideas, goals and aspirations with your supervisor, as it will show your dedication and creativity, and might encourage them to take an interest in your research and future.

Finding a Suitable Research Lab

Some Principle Investigators (PIs) will try to convince you that their lab is the best lab for you. However, you must choose a lab that suits your interests best.

Identify Interesting Labs

Each department has a website that lists details about PIs and their research labs. Determine which labs are conducting research that interests you, and of those find out which PIs would be good mentors. Some of this can be done by talking with friends who work at those labs or by e-mailing the head of the department. However, your motivation is what should drive most of the search. Look at the lab's website, if they have one, to read the lab's research interests, current projects, and past publications. Importantly, once you narrow your focus to a few interesting labs, you should e-mail these PIs and

request to discuss your interests in person. Each email should be unique to the lab you are contacting, and the more research you have done on the lab, the better. All of these emails should be clear, direct and sent with an attached résumé. However, give the PI or department head some time to respond, as they are busy people. To better prepare yourself for meeting with PIs, read some of their recent papers to determine what kind of experimental techniques they use, and read all of their research descriptions on their websites.

Consider Your Needs

When you are invited to interview with the PI, you want to show not only your interest but also your motivation by asking questions. Inquire about what the PI expects from you, and consider whether or not you can fulfill those expectations.

Pay attention to what kind of experiments are conducted for the various projects in the lab. For example, if you're not interested in working with only cells, avoid labs that do a lot of *in vitro* work. *In vivo* work, on the other hand, involves living animals, and sometimes even humans (as in clinical studies). If that sparks your interest, target those labs in your search. But if you are new to research and don't know what you want, don't worry, you can always switch later.

All experiments take time, and since time is limited, inquire about how much time the experiments take. You want to select a project that best fits your academic schedule.

Visit the Lab Environment

After you have talked one-on-one with the PI, request to visit the physical lab. Take note of how big the lab is: are people crowding and bumping into each other? Is the lab well supplied and organized? Ideally, everyone should have his/her own set of the basic needs (pipettes, tape, bench). Request e-mails from some of the members of the lab and write to ask what they think of the lab and the PI. The ideal lab has a supportive environment with an understanding PI and happy, cheerful members.

Lab size influences how much time each member has to meet with their PI, but if your primary supervisor will most likely be a doctoral student or post-doctorate, this isn't much of a concern. Inquire about lab meetings, which are helpful to troubleshoot problems and to develop experiments. There, you will also learn about all the projects in the lab. However, if there aren't lab meetings, ensure that the PI is readily available for individual meetings.

Find the Best Mentor

In selecting your mentor, whether s/he is a doctoral student, post-doctorate or the PI (Fig. 1), you want someone experienced who will be there at least until your training is complete. Your mentor should be patient and readily available to help you when you are at the lab. Additionally, a good mentor can explain the research concisely and clearly.

Most important, you want to choose someone you can get along with since you will be interacting primarily with your mentor.



Figure 1: Mentors come in different species. Courtesy of Dr. Jonathan W. Yewdell.

What to Watch Out For

Science should be fun, so you should find a lab that will nurture your interest in science. There are some warning signs that indicate a lab may not be suitable.

If you suspect any tension in the lab, identify the sources, which could be unfriendly lab members or dominating PIs. Sometimes this information is best determined by talking with members of the lab.

If you are considering a lab with a PI who has never hosted an undergraduate student before, proceed with caution. To ensure that both of you have the same expectations, you should discuss with the PI what you want out of the experience, and how much time you can commit. As the first undergraduate in the lab, you have the opportunity to leave a good impression not only of yourself but also of the entire undergraduate student body.

Labs without windows (Fig. 2) may indicate an intense lab. Especially true for such labs, you will need to make friends with other lab members. They will be your support and will also remind you that you have a life outside the lab.

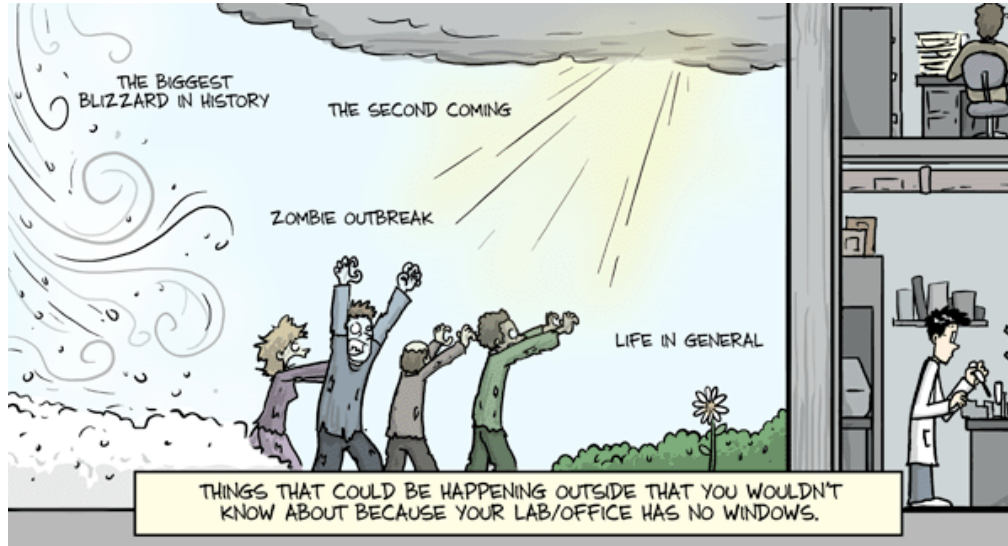


Figure 2: A representative lab without windows. Courtesy of PhDComics.com

Dispel Misconceptions about Research

Your concept of research should be rational and achievable. Don't expect to win the Nobel Prize as an undergraduate, or to cure cancer in one sitting. Additionally, don't expect accolades every day, or medical schools to admit you solely on good research. These are wonderful aspirations, but they may lead to arrogance and a frustrating research experience.

However, expect to work hard, and to fight your way through frustrations, as the structure of research is inherently to keep people thinking about the unknowns. Research responsibilities will force you to make compromises between your personal life and academic life. On the upside, do expect happiness from a day of hard work. Occasionally, you will walk out of the lab clicking your heels together, knowing that this day is perhaps your best day yet.

But don't expect an immediate answer to everything. Often, experiments will not work, and you will have to troubleshoot the design; or you may realize that the question at hand is more complex than you originally thought. All these will lead to your designing and conducting more experiments to crack the mystery.

Research is not just about the physical labor involved in doing experiments. It is necessary to also understand your experiments and the research's big picture. As you get to know your research intimately, it will be beneficial to think of research as a story. The

main characters (the what's), the plot (the experiments) and the setting (the why's) are critical for understanding research.

How to Enjoy Your Time in the Lab

Few people can maintain endless dedication, so you may need to find methods of stress relief. The key is to be happy and excited for outcomes and the future.

Be efficient with your time by keeping experiments and procedures organized. Additionally, allocate time to relax or exercise during long experiments, and use that time to take your mind off research.

Often, data may be difficult to understand. However, if you use your research story as a foundation, reliable data will begin to make sense and fit into the context. Technical errors can often cloud the data's message, and you may be discouraged when the data leads you to re-do the experiment. However, build hope by remembering the future goal, and why you are doing the experiment.

Don't be afraid to say, "I don't know," and always express any concerns to someone in the lab. Use your fellow lab members for support, and you will be a productive and sane undergraduate. In turn, your lab will enjoy your presence, and you will have a great undergraduate research experience.

Acknowledgements

Special thanks to Eric Vohr (JHMI), Amy Schettino and Raymond Tuazon (both JHU '14), and Elizabeth Partan (UMCP '14) for critical review. Sincere gratitude to Dr. Kelsie Bernot (OSU Medical Center), Dr. Nathan Coussens and Dr. Lawrence Samelson (both at the NIH), Sze-Wah Tse, Dr. Yun-Chi Chen and Dr. Fidel Zavala (all at JHSPH) for their tireless mentorship.

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