Student Handbook for Undergraduate Research in Life Sciences

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Preface

To not take advantage of opportunities to do Life Sciences research as an undergraduate is to miss one of the truly transformative benefits of being at Harvard. Science in the context of the liberal arts seeks to forge connections between fields and to foster habits of mind with wide applicability, both in science and elsewhere. This goal of understanding what it means to think scientifically is most effectively achieved by tackling a problem directly and doing independent research. Fortunately, the world-class research university that grew up around Harvard College presents a wealth of opportunities to engage with cutting edge science in nearly every field imaginable. When you combine the research horsepower of the faculty on both Cambridge and Boston campuses, there is little doubt that you will find someone doing something that you are excited about.

The pursuit of an idea, a problem, or an approach that inspires you should be an integral part of your engagement of the Life Sciences at Harvard, and we are committed to facilitating that experience wherever possible. This student handbook is therefore part of a broad effort across the Life Sciences concentrations to provide guidance, insight and useful information to help you join the scientific enterprise. Never forget that science is not only an intellectual framework with many supporting methods and modes of inquiry, it is also a human community held together by a mutual passion for discovery. With this in mind and independent of your concentration and future career plans, we sincerely hope you will join this community during your time at Harvard.

Sincerely,

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**Why Do Research as an Undergraduate?**

**Introduction**

What does it mean to be involved in a hands-on scientific research project? All scientific research involves working on a question to which the answer is unknown - otherwise there would be no point in pursuing the work! Indeed, one of the most exciting aspects of being involved in research is that you will have the chance to learn something, however small, that no one has ever known before.

Harvard undergraduates have the opportunity to become involved in many different types of scientific research. Many undergraduates do bench work in Harvard faculty laboratories (including laboratories at Harvard affiliated hospitals) while others work on projects in the field or do clinical research. Because the majority of students work in labs and for the sake of simplicity, in this handbook we refer to research groups as “labs.” However, the term “labs” should be interpreted broadly because some students may work with faculty who are primarily engaged in fieldwork or more clinically related types of hands-on, non laboratory-based research.

Typically, the faculty member who directs the group's research goals and writes the grants that fund the work is referred to as the "Principal Investigator" (PI). It is common for students to refer to their PI as their faculty sponsor or faculty mentor. However, faculty normally do not directly supervise students in the lab or the field, rather, it is common for a graduate student or postdoctoral fellow working in the PI's research group to act as the student’s mentor and supervise their day-to-day work.

**What is the intrinsic value of research to an undergraduate experience?**

Exposure to basic research has many benefits for students; even those who do not plan to pursue it as a career. Hands-on experimental science is the practice of science and as such it is an integral part of a science education. Active engagement with the concepts and principles of science not only encourages students to grapple with new ideas but also teaches them how to solve scientific questions, formulate hypotheses, design experiments, analyze data and make informed decisions about the next steps in the research process. Some students find their undergraduate research so enjoyable and rewarding that they reconsider their future plans and begin exploring careers in research - it happens!

Because research is such an integral part of a science education, direct participation in inquiry-based research for one semester is a degree requirement.
for most of the Life Sciences concentrations. Although a senior thesis based on independent research is not a standard degree requirement, many students choose to write one. In addition, some concentrations do require a thesis for honors eligibility.

*Independent research is an essential component of an undergraduate education, and Harvard is committed to ensuring that every Harvard undergraduate who concentrates in one of the Life Sciences will have the opportunity to engage in original, independent research.*

**Are there ways to “try out” research before committing to a research group?**

*Previous lab experience is not required for doing research at Harvard.* Most faculty expect to train students as they come into the lab, and many undergraduates choose to begin their research careers by joining a faculty member’s lab or research group.

However, some students who have not had previous laboratory experience are more comfortable gaining some exposure to basic laboratory techniques by enrolling in a project-based research course before committing to a faculty member’s group. Harvard offers several such laboratory courses designed to introduce students to experimental research, including Life Sciences 100r, Organismic and Evolutionary Biology 100 and Chemistry 100r. These courses are structured to teach students standard laboratory procedures in the context of projects that are linked to faculty research. Thus, students are exposed to basic research skills and techniques while experiencing lab culture, which may ease their transition into faculty research groups. However, these courses are not prerequisites for joining a lab; if you are certain that you want to do research, you may decide to start right out in a lab.

**When is the best time to get started in a lab?**

The answer to this question is highly dependent on individual circumstances. *We strongly recommend that freshmen wait at least until midway through their first semester at Harvard before beginning to think about finding a lab.* Even students who have had previous laboratory experience are likely to find that adjusting to life at Harvard requires time and effort. Getting involved in research is a significant undertaking, and it is best not to add such a major commitment too soon. Freshmen who are eager to get started in research during the spring semester or over the summer may want to begin the process of finding a lab shortly after Thanksgiving. Some students may feel pressured to begin working in a lab because their peers have already found research positions, however we recommend that you take your time and figure out what area of
research you would like to pursue before getting started. There will be plenty of time to work in a lab during your undergraduate time at Harvard.

Many students prefer to wait until sophomore year to get started in lab, and there are some benefits to this approach.

1. You will have settled into life at Harvard and have a better sense of how to manage your academic and extracurricular time commitments.
2. You will have had at least one or two additional semesters of coursework, and therefore have a better sense of the type of scientific questions that most interest you.
3. You will have a better understanding of the science underlying the lab’s research after you have taken some foundational science courses.
4. In many ways choosing a lab and a concentration go hand-in-hand, and you may find that your research interests will inform your concentration choice.

Some students postpone starting research until their junior year, and that is fine. Ordinarily, students who start research in the fall semester of their junior year and who plan to spend the summer before senior year working on their project will have made sufficient progress in their research to write a thesis. With careful planning and close mentoring, even students who begin in the spring of their junior year (and spend the summer before senior year working on the project) usually are able to write a thesis.

It is rare for students who start a research project in the fall of their senior year to have made sufficient progress to write a thesis. In addition, it may be difficult (although not impossible) to find a PI willing to accept a student who will be in the lab for only two semesters of research. Because it takes time to properly train a student in the lab, many PIs prefer to expend their resources on students who will be available to work in the lab for at least two or three semesters and one full summer. Therefore, if you decide to wait until senior year, you may find that your lab options are more limited.

Note that the research and thesis requirements vary somewhat among concentrations; thus, it is a good idea to contact the relevant Life Science Concentration Advisor(s) to ensure that your research plan is suitable for your concentration or the concentration(s) that you are considering.
How do I find a research position?

How do I begin?

Harvard has hundreds of life sciences research laboratories that welcome undergraduates; however, finding the one that is right for you can at first seem quite daunting. It can be tempting to choose a lab because a friend or Peer Advising Fellow (PAF) has mentioned that they had a good experience there or because the location is convenient; but it is important to consider the amount of time that you will be spending in the lab over the next few years and understand that the experience will be more rewarding if you love the work that you are doing. Working in a lab should be a positive experience (although there will always be a few tough days) and for that reason, it makes sense to spend some time thinking about the kinds of research questions that truly attract you.

Defining a broad area of interest is the first step to narrowing down your lab search. Are you excited or curious about fundamental questions such as the mechanisms of chemical reactions or cellular processes such as metabolism and differentiation? Or perhaps you are intrigued by more clinically related topics such as understanding what underlies the progression of neurodegenerative disease or the proliferation of cancer cells. Maybe you are drawn to study the effects of climate change on amphibian populations in the tropics. Alternatively, if you enjoyed doing a special project or research during high school, you may want to consider using that experience as a starting point to guide your search.

If you are truly unsure about what kinds of research questions you want to pursue, it might be helpful for you to think about the courses that you’ve enjoyed - were there any lectures or readings that you found particularly stimulating? Meeting with the faculty member whose course inspired you might lead to discussions that will help you find faculty at Harvard who are doing research related to that topic. Talking to the Life Sciences Undergraduate Research Advisor, one of the Concentration Advisors, or a faculty member can be useful because they may be able to help you focus your ideas and narrow your search to specific departments or research groups.

If after talking to faculty and advisors you are still undecided about what kind of research you want to do, it may be worthwhile to wait until after you have taken a few more courses before starting in a lab. There is no rush to begin research, so take your time and use your search as an opportunity to explore new options and ideas. Whether you select a lab as a freshman or as an upperclassman, your passion for the work and how good a fit the lab seems to be when you meet with them (see page 12 for more information about this topic) should be important criteria in making your choice - don’t choose a lab simply because it seems to be an easy option.
While talking to other undergraduates may help you get information about specific labs, keep in mind that their experience is likely limited to just one or two labs and that one student's experience may not be applicable to others. A student may have had a terrific experience in a particular lab due to a great mentor or project. Conversely, if a student did not have a stellar experience in a lab, the fault may not have been entirely with the lab. It is, therefore, also a good idea to check with the Concentration Advisors or the Undergraduate Research Advisor to get a broader picture of undergraduate experiences in specific labs.

You can find more information about the ongoing research at Harvard by browsing the various department web pages and reading about faculty research. While this may seem time consuming and labor intensive, it is amazing to see the range of research projects being done in labs at Harvard. You may even find a tantalizing topic that you hadn’t previously considered. The Harvard-affiliated labs tab of the Research page on the Life Sciences website provides direct links to all the basic Life Science departments at FAS as well as Harvard Medical School, the School of Public Health, the School of Engineering and Applied Sciences, as well as other Harvard affiliated institutions. The more you explore the possibilities, the more likely you are to find lab groups who are asking the kinds of questions that fascinate you.

After spending some time focusing and defining your research interests, you will find it much easier to peruse faculty profiles and identify labs that are working in that area. Once you have found a few labs (5 to 7 is usually sufficient) whose research truly intrigues you, the next step is to read a publication or two from each of them and learn more about the scientific questions they ask and the systems and techniques they use to answer them. Don’t worry if you do not understand all the details of the research presented in their papers; for now, all you are trying to do is get a general sense of the kinds of questions that the lab is posing.

Can I choose a lab if I don’t yet know my concentration?

Yes! Sometimes the process of searching for a lab helps students identify their academic interests, which in turn may inform their concentration choice. Because most concentrations are quite flexible about the range of research topics that are acceptable for credit, if you get started in a lab and are happy there, you may be able to continue working in that lab even if your project is only peripherally related to your final concentration. Keep in mind, however, that research and thesis requirements vary among concentrations; therefore as mentioned above, to ensure that your project is acceptable for research credit in your department, it is always a good idea to discuss your research plans with the relevant Concentration Advisor.
Remember that you can always wait to find a lab until after you have chosen a concentration. You will have plenty of time for research as an undergraduate at Harvard. There is really no pressing need to get started in your freshman year, and for some, it may be better to wait until you have taken more courses and been exposed to more topics.

How do I contact a faculty member about a research position?

The next step is to prioritize your list of labs (remember that 5-7 labs is usually sufficient) and begin by writing to your top two choice labs first. Each letter will require some effort on your part, so it is more efficient to send them out a few at a time. After you have sent out your first two letters, you can work on the next two while you are waiting for a response from your top choice labs. A positive response from one or both of your first choice labs means that your work may be done.

It is essential to write personal emails that are specifically targeted to each faculty member. Do not send a generic email; it very likely won’t be read, and if it is, it probably will not be viewed favorably. Before you begin to write, make sure that you have done your homework – reread the group’s webpage, a review article and a recent research paper or two. It is not necessary at this point for you to understand all the details of the mechanisms or pathways that the lab studies; instead try to get a sense of the kinds of questions they are asking and the systems they use to answer them so you can demonstrate a basic knowledge of the lab’s work. This is key - you must be able to explain in the letter what it is about the research questions the lab is asking that makes you want to be a part of their group. If you have a specific personal reason for your interest in their research, it is fine to mention it briefly – sometimes that personal involvement can be persuasive. You do not have to describe their research in great detail (this is not a term paper) but you do have to convey some general background knowledge of their work and convince them that you are genuinely excited about it.

Previous lab experience is not necessary for a lab position but enthusiasm and a sincere interest in the lab’s work are crucial.

Keep the letter brief; most faculty do not have time to wade through an exhaustive description of your background or their research. Begin by introducing yourself in a few sentences stating your class year, concentration or potential concentrations, and why you want to start working in a lab. The main body of the letter is about the lab’s work and why it interests you as discussed above. Finally, close with a few sentences describing your general plan for timing including when you intend to start, your plans for the upcoming summer and perhaps whether you are considering writing a senior thesis. You can mention previous lab experience briefly in the letter, but you will have a chance
to describe your experience and course background more fully in a short resume that you will attach to the email letter.

Your resume also should be brief and focused on your science background; outside interests and activities are not particularly relevant in this case. Faculty prefer to be able to glance quickly at a summary of your science course work at Harvard (including relevant freshman seminars, math, applied math, computer science and statistics), your top high school awards and honors (especially those related to science such as AP courses or national and regional science and math competitions), and laboratory experience (even if it is limited to course work thus far). This is your chance to mention previous lab experience (be sure to list the name of the researcher with whom you worked as well as the research institution or company and provide a brief description of the project). If you haven’t had any lab experience outside of your courses, you can still write a solid resume that describes the skills and techniques you have learned in the course labs. You can list some of your leadership service and volunteer work, but you do not need to go into detail. It is fine to list summer jobs that you have had outside of science, but again, it is not necessary to provide as much detail about them as you do for the science jobs. Try to keep this “science” resume to one page. It is more of a guide for the lab about where you currently stand in your science education than a full CV.

An annotated template for a science resume can be found under the tab “How do I contact the labs that I’m interested in” on the Life Sciences Research page. Life Sciences web page. The Office for Career Services has suggestions for more professional looking formats, but remember to keep the content simple.

As previously mentioned, you should send out your first two letters and then wait a few days before sending out the next two. If there is a particular lab that is definitely your first choice but you don’t receive a reply from them within a week or so, it is acceptable to send a follow-up email. You can just forward your original email with a short explanation saying that you are following up on the email you sent a few days ago, that you are an undergraduate interested in joining their lab and, while you are continuing to look at other labs, their lab is still your first choice. It is not uncommon for busy faculty members to forget to respond to your email even though they are interested, so a follow-up email might be a welcome reminder. Many faculty members, but not all, will answer student emails in a timely manner even if they do not have a position available.

**How should I prepare for an interview with a lab?**

A PI who has an opening for an undergraduate and is interested in your application letter will likely contact you and invite you to meet with them. You should prepare for this meeting by reviewing the lab website and the papers you have already read. Try to find a review article that will provide you with some background in the field so you can get a sense of where the lab’s research fits
into the larger picture. You may want to use this meeting to mention which of
the several ongoing projects in the lab you find most interesting and why. It
may not be possible for you to work on a specific project if there is no mentor
available, but it is useful to let the PI know that you are proactive and have been
talking about it. The PI may ask about your future plans and if you don’t
know, it is perfectly acceptable to say that you are not sure. In general, you do
not need to propose a research project on your own; at first, you will probably
contribute to an ongoing project in the lab. Later, as your training in the lab
progresses, you will probably be involved in developing your own independent
project. For more information about the characteristics of a good undergraduate
project, see the section on Getting Started in the Lab.

Remember that the meeting with the PI is a conversation that will give you an
opportunity to find out more about the lab and their experience with
undergraduates. Among the questions that you might consider asking during the
interview are: What kinds of research projects have students done in the past?
Did you do research as an undergraduate? Do you think it is important for
students to have a research experience? How many hours per week do you
expect an undergraduate to spend in the lab? (See below for advice about this.)
How often would we interact in the lab or meet to talk about my progress?

Some PIs expect students to spend more time in the lab than others. Prior to
accepting a position in a lab, it is prudent to ask the PI about their expectations
for a student’s time commitment. For freshmen and sophomores who are still
taking lab-intensive courses, we recommend that you plan to spend no more
than 6 to 10 hours per week in the lab. However, because course workloads vary
during the semester, there may be weeks when you feel that you can comfortably
spend more time in the lab. But there may also be weeks, especially during
exams, when you might not be able to get to the lab at all. What is important is
that you have a clear understanding of the PI’s expectations and maintain good
communication about your weekly schedule with the lab. Do not commit to
spending more hours per week in the lab than you can reasonably manage.

Casual business attire is appropriate for your meeting with the PI. Lab dress
tends to be informal, but jeans and a t-shirt may not give a very good impression
for an interview. A jacket and tie is too formal and might seem out of place in
this situation.

How do I decide among offers from different labs? How do I decline offers
from the other labs?

Ideally, you will receive offers from one or more labs in response to your emails.
While it is nice to have the opportunity to meet with two or three PIs before
making an informed decision about which lab is the best fit for you, one
interview may be enough if you have done your homework and know that you
are interested in that lab’s work. Remember that the meeting is a two-way
conversation – they want to meet you to see how you will fit with their lab and you will have a chance to determine if the lab is the right place for you. Were your comfortable during the interview? Did the PI take the time to adequately explain the lab’s research? Did you get excited about working with the group? Did you have a chance to meet your lab mentor? Are their expectations for a time commitment reasonable? And importantly, are you still interested in the questions that the lab’s work addresses?

Because the vast majority of labs at Harvard provide good mentoring and research experiences for undergraduates, your choice of a lab often will come down to deciding what projects or questions most interest you. However, sometimes the lab whose research most interests you may not be the best fit in other ways. Perhaps the time commitment is too much while you are still taking lab intensive courses, you suspect there might not be much interaction with the lab PI, or you just weren’t comfortable with the lab atmosphere. These are valid issues to consider in addition to the science. Choosing a topic for your college research does not imply a life long commitment; indeed, it is unlikely that you will continue to work on your undergraduate research project in graduate school. Ultimately, in addition to your excitement about the lab’s work, you might also want to consider choosing a lab in which you will have a positive experience, receive good technical training, learn how to give a clear lab presentation, write cogently about your work, and also have fun! One way to find out about other undergraduates’ experiences in a particular lab is to contact students who are currently working there and ask whether they would recommend joining that lab. But remember, one student’s experience may not reflect the norm for that lab (see How do I begin looking for a lab?). It is worth taking your time to find a good lab fit. Many students have told us that the most significant factor in their enjoyment of their lab experience came from their engagement with others in the lab and their relationship with their lab mentors and PI.

Once you have made the decision to accept a lab’s offer, you should inform the PI as soon as possible because other students may be waiting to hear if there is space in that lab. For the same reason, be considerate and notify the labs whose offers you are declining in a timely manner so they can accept other students. The simplest way to decline a lab position is to send a brief email thanking the PI for their time and telling them that you have decided to accept another offer. Your email doesn’t have to be more than a few sentences long, but you should not delay in notifying them of your decision.
What should I expect when I get started in a laboratory?

Meeting with your lab mentor

You will likely be assigned a graduate student or postdoc mentor who will direct your daily work, be responsible for teaching you lab procedures and techniques and help you develop an independent project. During the first meeting with your mentor, you may discuss background reading for the project, basic lab rules, and your schedule for coming to the lab.

- **Background reading for the project**: You will have already read some papers about the lab’s research for your application letter, however those papers may not be directly relevant to your assigned project. Your mentor can suggest more specific readings for you. If you do not understand some of the material in the papers, ask your mentor to set aside time for discussion. Part of the mentor’s role is to ensure that you have a basic understanding of the science behind the questions that you will address in your experiments.

- **Setting up a work schedule**: This is very important for both you and your mentor. It is much easier for your mentor to design a teaching plan if they know when and how long you will be in the lab each week. *Remember to be considerate of your mentor’s time. It can be very frustrating for them if you do not show up at the appointed time so you should always make an effort to communicate a change of schedule in advance.* Having a regular schedule for going to the lab may also help you to keep track of the time you are spending there.

- **Attending Lab Meetings**: Lab group meetings are great way to get to know your lab mates and learn about other ongoing projects. Obviously your class schedule will determine whether you are available to attend group meetings regularly but you should try to participate whenever possible. At some point you will be expected to present your own work to the group, and this is easier to do if you already have attended several meetings and are comfortable talking to the other lab members and asking questions. Some lab mentors find it useful to set aside time with their students after the lab meetings to go over the material that was presented. You should take advantage of this opportunity to ask questions about the other projects in the lab.
Lab rules and regulations

- **Lab Safety Training**: Harvard requires all new employees or trainees working in Harvard labs to pass a Laboratory Safety Training Course. Your lab manager or administrator will have the information about the course. In addition, many labs may mandate further safety training for specific techniques and procedures that they use. These trainings are particularly important for students who are just getting started in the lab and may not be familiar with the procedures for handling and disposing of hazardous materials or working with animals.

- **Research Integrity Training**: Scientific research is governed at both the institutional and federal level. Harvard undergraduates are expected to become familiar with the ethical standards of their discipline and conduct their research activities with the highest level of integrity and commitment to excellence. As an undergraduate, you are encouraged to ask questions about proper practices and procedures, to be organized and accurate in all of your research activities, and to follow the directions of your faculty mentors and other research staff closely. In addition to the guidance that you receive from your faculty host, the Harvard College Office for Undergraduate Research and Fellowships offers a seminar on research integrity several times a year. Students who are actively engaged in research are encouraged to attend one of these seminars.

- **Lab Rules, Responsibilities and Jobs**: As mentioned above, many labs have rules that are more specific than those covered in the safety trainings. It is up to you (with help from your mentor) to learn about these lab-specific regulations. For example, some labs have rules about reserving heavily used instruments ahead of time. This means that if you sign up to use that equipment and your plans subsequently change, you must let someone in the lab know so it can be made available to others.

  In many labs, the members share duties for preparing common stock reagents and maintaining shared lab equipment. It is your responsibility to know which lab duties and general tasks have been assigned to you and to perform them conscientiously. This may seem trivial, but it is attention to such details that helps to keep a lab running smoothly. Your mentor should review all of this before you begin doing experiments in the lab.

  It is essential for you to allow adequate time to clean up your space in the lab before leaving for the day. *There is no faster way to annoy others in the lab than*
Starting your own research project

You will probably begin your training by working in parallel with your mentor on their project until you have mastered basic techniques and become more familiar with the science behind the experiments. But within a relatively short time, you may have acquired sufficient skills to be ready to move on to a more independent project.

The time it takes for a student to gain enough technical skills to undertake a more independent role in a project varies greatly and is influenced by factors such as how technically difficult the experiments are, the amount of time the student can spend in the lab, as well as their level of engagement and previous experience. Your independent project may be one that the PI has already identified for you or it may evolve out of your interests as you learn more about the lab’s research. You may participate in the design of the project, but it is more likely that this will be done primarily by the lab PI and your mentor.

Designing a good undergraduate project involves not only consideration of the student’s time and technical expertise, but also how the results will contribute to the overall research goals of the lab.

Most mentors help students to become more independent in the lab, but some students are fearful about that transition. Just keep in mind that undertaking an “independent” project doesn’t necessarily imply that you will be working entirely on your own. Your mentor will still be there to help you with experimental design, data analysis and planning the next experiments, but you will have more input into the process and gradually be able to perform these tasks on your own.

Conversely, if you feel that you are ready to undertake your own project but find that you are merely functioning as a lab assistant, talk to your mentor (or your PI) about what steps might be needed for you to become more independent in the lab. PIs have different philosophies regarding when an undergraduate might be ready to start working more independently, so you may need to be patient. It could be that the lab just hasn’t had much experience mentoring students so their expectations and projects are not properly gauged for undergraduate researchers. However, it is also possible that your mentor and PI may have valid reasons for deciding that you are not ready to move into a more independent research role. Perhaps they think that you need to get more technical training, change your work habits, pay more attention to detail, keep better records of your experiments or be more diligent in the lab. You should take their suggestions seriously. If after talking to your mentor and PI it becomes clear that they are reluctant to allow you to begin an independent project, you may want to talk to someone outside the lab such as your Concentration Advisor or the
Undergraduate Research Advisor. Be patient, keep the communication lines open, update your advisors about the situation and listen to their suggestions. At some point you and your advisors may decide that your conversations with the lab are not progressing satisfactorily and it is time to consider seeking a position in another lab. However, that step should be taken only after you have made an effort to find other solutions.

Most Harvard undergraduate research fellowship programs assume that students will be working either on their own project or on an independent aspect of their mentor's project soon after they start in the lab. However, the degree of independence varies from lab to lab depending on the student’s level of technical expertise and the PI’s approach to undergraduate research.

**What are my responsibilities to the lab?**

**Lab Citizenship and Effort**

Accepting an undergraduate into a research group and providing training for them is a very resource-intensive proposition for a lab, both in terms of the time commitment required from the lab mentors as well as the cost of laboratory supplies and reagents. It is incumbent upon students to recognize and respect this investment.

One way for you to acknowledge the lab’s investment is to show that you appreciate the time that your mentors set aside from their own experiments to teach you. For example, try to be meticulous about letting your mentor know well in advance when you are unable to come to the lab as scheduled. On the other hand, showing up in the lab at a time that is not on your regular schedule and expecting that your mentor will be available to work with you is unrealistic because they may be in the middle of an experiment that cannot be interrupted for several hours. In addition to adhering to your lab schedule, show you respect the time that your mentor is devoting to you by putting forth a sincere effort when you are in the lab. This includes turning off your phone, ignoring text messages, avoiding surfing the web and chatting with your friends in the lab etc. You will derive more benefit from a good relationship with your lab both in terms of your achievements in research and future interactions with the PI if you demonstrate a sincere commitment to them. We have heard reports from some PIs who were unhappy with their undergraduates because they did not appear to appreciate the time that their mentors spent working with them.

There will be “crunch” times, maybe even whole weeks, when you will be unable to work in the lab as many hours as you normally would because of midterms, finals, paper deadlines, illness or school vacations. This is fine and not unusual for students, but remember to let your mentor know in advance when you anticipate absences. *Disappearing from the lab for days without*
communicating with your mentor is not acceptable. Your lab mentor and PI are much more likely to be understanding about schedule changes if you keep the lines of communication open but they may be less charitable if you simply disappear for days or weeks at a time. From our conversations with students, we have learned that maintaining good communication and a strong relationship with the lab mentor and/or PI correlates well with an undergraduate’s satisfaction and success in the laboratory.

Perhaps the best way for you to demonstrate your appreciation of the lab’s commitment is to approach your project with genuine interest and intellectual curiosity. Regardless of how limited your time in the lab may be, especially for freshmen and sophomores, it is crucial to convey a sincere sense of engagement with your project and the lab’s research goals. You want to avoid giving the impression that you are there merely to fulfill a degree requirement or as prerequisite for a post-graduate program.

Time commitment (these are suggested guidelines)

**Term time:** As we mentioned in the lab interview section above, many freshman and sophomore science courses include time consuming lab and section components. For this reason, it can be stressful for students to manage the time needed to fulfill these course requirements while simultaneously working in an outside lab. The general rule of thumb for students who are taking lab intensive courses is to plan on spending six to ten hours per week in their research labs. It is fairly common for students to commit to more hours per week than they can reasonably manage because they think that it will increase their chances of securing a lab position. However, it is probably better to slightly underestimate the time that you are able to spend in the lab and work longer hours when possible rather than overcommit and not be able to fulfill your obligation. Falling behind in your courses because you are spending too many hours in the lab is not a good trade-off. If you receive an offer from one of your top choice labs but the PI expresses unwillingness to compromise on a reasonable time commitment, it may be best to seek another position or to talk to one of the Life Sciences Advisors about how to respond to the situation.

Most labs will be sensitive to the time issue especially if you explain the situation with your course schedule and have a clear plan for being in the lab during the January break and/or over the summer. You also may want to demonstrate a stronger commitment to the lab in the future by indicating that you plan to take an independent research course for credit in junior year and/or write a senior thesis (See Appendix B for information regarding independent course requirements for specific concentrations). Students whose course loads are lighter may consider working more than 10 hours per week in the lab. Juniors and seniors, who are doing research for credit through either an independent research or thesis course, normally spend a minimum of 15-20 hours per week in the lab.
Your course workload likely will vary during the semester and most labs will be sensitive to the “crunch” times for undergraduates. If you are overwhelmed with papers and midterms one week, talk to your mentor about making up the time later in the month. This is much better than ruining an experiment for which you have spent weeks preparing because you are unable to focus on work in the lab. Students should avoid making up lost time in the lab by working late at night or on weekends when other lab members are not present. Accidents can and do happen; therefore it is NEVER a good idea to work in the lab alone and this is especially true for students who have little or no lab experience. It is best to create a schedule that maximizes overlap time with your mentor; but if you need to work after normal lab hours, it is your responsibility to ensure that someone from the lab will be there with you.

*We strongly advise students to consider seriously the time commitment that they can make to a lab and not agree to undertake more hours per week than they can reasonably manage during the term.*

**Summer:** Working in lab full time over the summer provides students with a great opportunity to consistently devote time to and become fully immersed in their research projects. For this reason, the Harvard summer undergraduate research programs require that students work in the lab a minimum of 40 hours a week for 10 weeks. Students who have outside jobs or other obligations during the summer and who are therefore unable to commit to working full time in the lab are not eligible for these fellowships. The exception to this standard is the Harvard College Research Program (HCRP), which may fund students for part-time lab work over the summer. Students must indicate on their HCRP applications the number of hours per week and the number of weeks they plan to work in the lab (See Appendix A).
Funding for undergraduate research

Term time

Students may work in the lab during the term in one of three ways - volunteering, receiving a stipend or working for academic credit. Many students start by volunteering in a lab during term time, however, others may need a stipend so that they can pursue research rather than working at a campus job. For students who are unable to volunteer their time, there are a few ways to obtain funding for your research. Funding may be available through the faculty sponsor’s grants or from one of several sources of funding provided through the Office of Undergraduate Research and Fellowships and the Student Employment Office (see Appendix A for more details). Students who want to receive academic credit for their research (usually juniors doing an independent research course or seniors working on their theses) must obtain permission from their concentration advisor or head tutor. Students may not simultaneously receive funding and course credit for their lab work.

- **Harvard College Research Program** (HCRP) provides up to $1000 per term. Application deadlines for term time awards are normally within a few weeks after the start of the term.

- **Federal Work Study Program** (FWSP) may be used to provide a student stipend for work done during the term or over the summer. Your financial aid award will indicate whether you are eligible for FWSP. Check my.harvard.edu to verify your status. For FWSP the lab provides 30% of the student’s stipend and the US government provides the other 70%, which helps to offset the cost of a student stipend for a lab. Eligible students should apply through the Student Employment Office. Students who are not US citizens are not eligible for FWSP.

- **The Faculty Aide Program** (FAP), administered through the Student Employment Office, encourages faculty to hire research assistants. Students who are working on “independent” projects are not usually eligible. Students may earn up to $3000/year through FAP. Faculty should apply directly to the SEO for this funding.

Summer fellowships

Harvard offers several summer research fellowships for students who want to work in Harvard labs. Information can be found on the Life Sciences Research web page > Research Opportunities. See also Appendix A for more information and links to the major fellowships. Applications for summer research fellowships are due anywhere from early February to late March depending on the program. The deadlines for some of the more competitive fellowships, such
as PRISE and Herchel Smith, are normally in mid-February, whereas HCRP applications are usually due in late March.

The three primary Harvard summer undergraduate research fellowships are:

- **PRISE (Program for Research in Science and Engineering):** The purpose of PRISE is to create a small, diverse community within the larger sphere of undergraduate science at Harvard. This 10-week program provides students with housing in one of the undergraduate houses, meals during the week, a modest stipend if they do not receive any other fellowships, great social activities, and faculty lectures in the evenings. PRISE fellows are expected to fully participate in the community and attend the evening programs. PRISE is limited to around 125 to 150 students and is quite competitive. The application requires two essays from the applicant: a research proposal and an essay on the student’s expectations for and contributions to living in a science community. PRISE fellows are expected to find their own research positions; however, students may apply to the program before having secured a lab position. Obviously, students who have not found a lab placement by the application deadline will not be in a position to write a specific project proposal; however, they are expected to submit an essay that broadly outlines their research interests. The selection committee allows some leeway in these instances as long as the essay has some scientific merit and makes a connection between the applicant’s research interests and academic goals. The selection committee expects a more detailed research proposal from students who already have found research positions. Your lab mentor can provide you with background material and work with you on your project proposal. Be sure to phrase the proposal in your own words and not use wording taken directly from lab publications or their web site. You also are required to submit a second essay that describes how you plan to engage in and contribute to the PRISE community. You will need two letters of recommendation for PRISE. In addition, if you have secured a lab position before the application deadline, your lab PI must submit a brief confirmation letter affirming that you will be working in their lab for the summer.

The deadline for PRISE applications is mid-February. Students who are accepted into PRISE may also accept fellowship stipends from other programs. PRISE is administered through the Office of Undergraduate Research and Fellowships.
- **Harvard College Research Program (HCRP):** This is the largest source of undergraduate research support for students who are working with Harvard faculty members. Typically between 70% and 80% of applicants receive some funding. Students must have secured a lab position before applying. The HCRP application requires a fairly detailed research proposal and a letter of support from the lab PI. The deadline for HCRP applications for summer fellowships is late March. HCRP also provides term time funding for student research. HCRP is administered through the Office of Undergraduate Research and Fellowships.

- **Herchel Smith:** This fellowship is quite competitive and applicants are expected to submit a detailed research proposal that demonstrates a high level of understanding of the science and experimental design for the project. Herchel Smith supports highly motivated, talented and promising undergraduate scientists who have designed outstanding projects for full-time summer research. Students may not accept a Herchel Smith Fellowship award in conjunction with any other fellowships with the exception of PRISE. Herchel Smith is administered by the Office of Undergraduate Research and Fellowships. Students doing research abroad or in labs outside of Harvard may also apply for a Herchel Smith Fellowship to cover their travel and living expenses. The deadline for Herchel Smith applications is mid-February.

Ideally you should have confirmed a lab position far enough ahead of the summer fellowship deadlines to allow time to meet with your PI and lab mentor to discuss a project. This will help enormously as you prepare to write the research proposal for your fellowship applications. The more time you have to prepare drafts of your proposal and get feedback from your mentor, the stronger your application is likely to be. You may find it helpful to set up a timeline for submitting drafts to your mentor to ensure that they will have enough time to read and return them to you with comments before the deadline. DO NOT LEAVE THIS UNTIL THE LAST MINUTE. Your mentor may not have time to review your proposal if you send it to them the day before it is due.

*Many of these fellowships are quite competitive; therefore, submitting a well thought out and cogent research proposal is key to being selected. It is important that you write the proposal in your own words; copying sentences or paragraphs from the lab’s website, grant proposal or papers is not appropriate.*

The Office of Undergraduate Research and Fellowships holds several workshops throughout the course of the year to help students to prepare for the summer fellowship application process. A general session on how to identify research opportunities and apply for research funding is offered to all freshmen shortly
after Thanksgiving. In addition, the Office of Career Services hosts a summer opportunities fair in early December and this is a good chance to learn from funding sources about what is expected in the application and how best to prepare a high-quality proposal.

For most of the summer research fellowships you will also need at least two letters of recommendation (see the details for specific fellowships below or online). Faculty, advisors, proctors and house tutors receive many requests for summer fellowship recommendation letters – often at the last minute - and it can be quite difficult for them to write a strong letter with little lead-time. For this reason, it is best to arrange a meeting with your recommenders and ask for a letter in person several weeks before the application deadline. You should provide them with some background information about the fellowship(s), explain why you are applying, and give them an updated resume. The fellowship review committees rely heavily on these letters so it is worthwhile to work with your recommenders to obtain a strong endorsement.

Occasionally, students may not receive summer research funding from any of the fellowship programs either because their application was too late or not very strong. If you find yourself in this situation, contact the Undergraduate Research Advisor or your Concentration Advisor for help. In some instances the lab may be able to provide some support.

Many fellowship programs, such as PRISE and Herchel Smith, require their fellows to give oral presentations or posters on their projects at the end of the program. Other fellowship programs, such as HCRP, require a written progress report. One reason for this requirement is that learning to communicate research results, either through an oral presentation or preparation of a poster or paper, is an important part of a scientist’s training. Another important reason for requiring these presentations or papers is to ensure that students have taken some ownership and responsibility for their projects.

These presentations or papers are not expected to be final articles on your results, but rather progress reports on what you have accomplished thus far. If your program does not provide set guidelines for the paper, you should discuss it with your research mentor well in advance of the deadline; they may have advice or suggest a particular format. Don’t plan to prepare an overly technical paper that emphasizes experimental details. Instead, we recommend that students focus their writing on the "big picture" - what are the scientific questions that led to your research project, and how does your project fit into the context of the field as a whole? Describe your hypothesis and explain how your experiments test that hypothesis. Include a summary of your experimental strategy, but avoid writing a detailed "methods" section unless your lab mentor or fellowship program requires you to do so or if your project involved developing or optimizing an experimental technique or protocol. If you have
results you should describe them, and be sure to convey how your findings relate to your hypothesis. Your conclusion should summarize your project and focus on what the next steps should be. Do not worry if your results are unexpected, inconclusive, or even if you don't have any results.

The best thing to do is to be proactive and discuss the paper with your mentor(s) early in the writing process (at the very minimum, three weeks before the paper is due). It is likely that they have had similar experiences in their career, and they may have reassuring comments and advice to help you get started.

**Funding for research done away from Harvard**

Information about and links to summer fellowships for doing research away from Harvard can be found in Appendix A or on the Research tab of the Life Sciences web page under [Research Opportunities](#).

Many rising sophomores and juniors take advantage of the several summer research abroad experiences offered by Harvard. Talk to your Concentration Advisor or the Life Sciences Research Advisor about help finding these opportunities. More information about programs and funding can be found in the FAQs section of this Handbook.
When problems arise

Communication breakdown

For the most part, the labs at Harvard have a good track record for providing positive experiences for their undergraduate researchers. However, as in any situation that relies heavily on personal interactions, problems may occur from time to time.

Occasionally students find that communication with their mentor has become difficult or has completely broken down. There are many factors that can contribute to this: language or cultural misunderstandings, pressure because of workloads, differences in expectations, lack of progress on the project, or even just a mismatch in schedules that limits face-to-face conversations. Whatever the reasons, it is likely to be very stressful for both the student and the mentor. Early intervention by the PI or outside advisors may keep the problem from deteriorating beyond repair and allow the student to continue in the lab. If you find yourself in this situation, you should make an effort to talk to your lab mentor about the difficulty, but if that does not lead to a satisfactory outcome, you should arrange a meeting with the PI to ask for help in mediating the problem. The PI may want to meet with you individually or may suggest a joint meeting with your mentor. If meeting with the PI does not bring resolution, you may want to seek advice from a Concentration Advisor or the Life Sciences Research Advisor. But whomever you choose to talk to about this circumstance, we strongly recommend that you seek help before the tension between you and your mentor escalates. The sooner intervention is started, the better the chances are that a satisfactory resolution can be reached.

There are a number of ways that the situation might be resolved. Possible solutions that you and your lab PI or academic advisor might explore include:

- Providing your mentor with better training and clarifying their responsibilities to you
- Reassigning you to a new mentor in the lab
- Reevaluating the lab’s expectations to more realistically reflect your time and level of expertise
- Providing you with more technical training
- Re-examining the project protocols and results
- Assigning a new project
- Setting more specific guidelines for your continued participation in the lab, particularly if attendance or focus in the lab is an issue
Project problems

Sometimes the student’s project does not progress as well as either the PI or the mentor has anticipated. Obviously this can create stress for everyone, especially if the lab is dependent on the results for a publication or making decisions about future directions on a related project. For this reason, many PIs will avoid giving students projects that may heavily impact the lab’s immediate research goals. However, even if the student’s results are not critical to the lab at the moment, repeated experimental failures can be frustrating and discouraging.

Many factors can contribute to failed experiments including poorly designed projects, lack of sufficient technical training or expertise, untested protocols that aren’t working, or just bad reagents. The list could go on. Troubleshooting failed experiments can be an arduous proposition and you likely will need help from others in the lab. However, it is helpful to accept this as another phase of your education in the lab and see it as a valuable process to experience in your training as a scientist. At the same time, it may be prudent to examine the underlying premises of the project or think about other ways that the scientific question might be addressed. Using this approach can lead to interesting conversations with lab mates from which you may benefit in the long run. The real question is how to know when it is time to just give up on a project and start over with a new one, but ultimately, that decision is up to the PI.

It is important for students to understand that nearly everyone who has ever worked in a lab has at some point experienced times of experimental difficulties and frustration; this is inherent in the research process. Often patience and thoughtful reevaluation of experiments will lead to solutions that overcome the technical problems.

Your research interests have changed or the lab is no longer a good fit

It is not unusual for students to find that their research or concentration interests evolve as they take more upper level courses and are exposed to more topics. When this happens, it is perfectly acceptable to change labs. However, because changing labs is a significant step, we recommend that students talk to someone in the lab or to a concentration or research advisor to confirm their decision and get advice on how to proceed. If you decide to change concentrations, you may wonder whether you will have to change labs as well. Some concentrations accept a broad range of projects as fulfillment of their research requirement, so it may be possible for you to remain in your current lab. If you change concentrations but decide that you would like to remain in your current lab, talk to your Concentration Advisor to see if your project fulfills the research requirement for that concentration.
If you do decide to change labs, you should notify your current lab in a timely manner so they can find another undergraduate to fill the position. The most diplomatic way to give notice of your intent to leave the lab is to request a meeting with your mentor and/or your PI so you can talk with them directly about your decision. Sending an email is not an appropriate way to convey such a significant decision unless there has been real tension between you and the lab that would make face-to-face communication very uncomfortable. Most PIs will understand and some may even help you find a new lab. Ideally, you would like to leave the lab on good terms and taking the time to meet with your PI to openly discuss how your research or concentration interests have changed can help accomplish this.

Another reason that students might consider leaving their lab is if they realize that they have lost interest in doing research and bench work is simply not fun anymore. Bench research or fieldwork is not for everyone, so if after doing research for a summer or a couple of semesters you find that you do not enjoy what you are doing, it is perfectly acceptable to leave the lab. In some ways, it is better for a student who is not fully engaged in their project to leave the research group rather than stay on and continue working half-heartedly.

Your mentor leaves and there is no one in the lab to guide you

Postdocs normally remain in a lab for two to four years after which time many of them move on to positions in academe or industry. Sometimes their PIs will permit them to transfer the project that they have worked on in the lab as they move to set up their own research groups. When this happens, undergraduates may find themselves in the position of having to give up their part of the postdoc’s project either because the project has moved with the postdoc or because there is no one left in the lab with enough expertise in the field to oversee their work. Obviously this can be especially problematic for seniors who are close to writing their theses. Being proactive early may be the best way to avoid being caught in this situation. After you have developed the outline for your final project for your thesis, ask how long your mentor is planning to be in the lab and make sure that there will be someone else in the lab who can guide you through finishing your project and/or devising a new one if that is feasible. Usually the PI will be aware of the timing issue and will have made provisions to ensure that the student has a second mentor who can take over the advising role after the first mentor leaves and/or that the student is given a project that is not likely to be taken from the lab before their senior thesis is completed.

Your work does not meet expectations

Students accepted into faculty research groups are expected to make a sincere commitment to their projects and the lab’s research goals. A student who repeatedly exhibits a lack of effort or interest in their research project may be asked to leave. Repeated sloppy and careless work and/or a demonstrated lack
of respect for the mentor’s time are among the indications that a student is not fully engaged in the research process. Usually the PI will meet with the student to discuss their concerns and seek a solution to the problem before asking the student to leave. Is the student uncomfortable with their mentor? Is the project too difficult or has it been poorly explained? Is the student in the midst of a particularly difficult “crunch” time? However, in some cases it may be clear that the difficulty really lies with the student’s attitude toward the lab or research in general and, in this situation, it is probably best for the student to leave the lab. If you find yourself in this position (or if you realize that you have lost interest in your project before it becomes apparent to the lab), talk to your lab mentor or PI, your Concentration Advisor, the Undergraduate Research Advisor, or your Resident Dean about how to disengage from your lab commitment. It is much easier for everyone involved if you acknowledge that you have lost interest in doing research and are willing to explore other options for fulfilling your concentration’s laboratory requirements.

In the event that you do encounter a problem in the lab, early recognition and intervention are the keys to increasing the chance that the issue can be resolved. Seek help from an advisor, tutor or your Resident Dean.
FAQS

How can I get academic credit for my research?

The Life Sciences Concentrations provide several options for obtaining academic credit for lab work. The normal route is for students to enroll in an independent research course in their junior year and a thesis course in their senior year. See Appendix B for specific information about the requirements for each concentration. Some Life Sciences Concentrations require a semester of research for credit either through one of the lab courses or an independent project to be eligible for a degree; others do not. Your Concentration Advisor can help you design the best plan to fulfill this requirement.

Students do receive credit for laboratory research done through one the Harvard Summer School courses including their Study Abroad programs. However, Harvard does not automatically accept credit for courses or research experiences offered by other universities or institutions. Therefore, check with your Concentration Advisor before enrolling in research or academic programs at institutions that are not affiliated with Harvard.

*Students may not receive credit for term time research while simultaneously getting paid either by their lab or through a Harvard fellowship such as HCRP.*

Do I have to stay with one lab while I am an undergrad?

The short answer is no, you are not required to remain in the same lab for your entire undergraduate career. There are many reasons for leaving a lab: your academic interests or concentration may have changed and thus the lab project is no longer appropriate, your mentor may have moved on and there is no one in the lab to direct your project (although the lab should have planned ahead for this), the project may not be working and the lab hasn’t offered an alternative, or there may be personal reasons for leaving. It is acceptable to move on. If you do encounter difficulties but you strongly prefer to remain in the lab, get help. Talk to your PI or mentor, or reach out to someone outside the lab for advice. The PI may not be aware of the problem and bringing it to their attention may be all that is necessary to resolve it.

For students who are satisfied with their research experience, remaining in one lab for the duration of their undergraduate careers can have significant benefits. Students who spend two or three years in the same lab often find that they have become fully integrated members of the research group. In addition, the continuity of spending several years in one lab group often allows students to develop a high level of technical expertise that permits them to work on more sophisticated projects and perhaps produce more significant results.
Is it better to work at a Cambridge lab or a lab at the Medical School?

There are obvious advantages to working in labs on the Cambridge campus. The convenient location gives students more flexibility in their work schedules and less time is spent commuting on the M2 shuttle bus or the T. Students who participate in several extracurricular activities may find this option particularly appealing. However, because there are a limited number of labs in Cambridge, it may be more difficult to find space in one whose work aligns with your interests. For this reason, we suggest that students include at least a few labs that are located at Harvard Medical School or the Harvard affiliated hospitals in Boston on their lists of potential labs.

The advantages to working at one of the affiliated hospital or Medical School labs include:

- Having more potential labs to choose from and therefore a better chance of finding an opening in a lab that is doing work in your area of interest.
- Working in the Longwood Medical Area or one of the hospitals for the summer may provide more opportunities for premed students to do some physician shadowing.
- Keeping track of the time you are spending in the lab every week is easier if you have to plan ahead for the commute. This may be especially helpful during term time.

The obvious disadvantage of working off campus is the commute. At first, many students find it difficult to organize their schedule around the commute, but once they get started they often comment that it isn't so bad - most find that they can read and do some reviewing or light studying on the M2 or the T. The commute may, however, be more difficult during "crunch times" - for example, when students are spending long hours in lab doing experiments or writing their thesis. During those times, some students struggle to balance lab work with meals, House activities, and study groups; again, careful scheduling and planning is key.

The Life Sciences Education Office provides MBTA Charlie Cards during the term to Life Sciences students whose labs are located at sites not served by the M2, such as Mass General or McLean Hospitals. PRISE will cover the costs of commuting to their fellows who are working outside of the Cambridge campus in the summer.

Recent data taken informally on the distribution of students working in labs across the University suggest that students increasingly are finding that the advantages of working at off campus Harvard labs outweigh the disadvantages.
Can I take a summer off from my Harvard lab to do something else?

Many PIs will allow, or even encourage, rising sophomores or juniors to spend a summer exploring research opportunities outside of their Harvard labs. Below is some information about various options for engaging in summer research outside of Harvard. See the Research Abroad section of the Life Sciences Research webpage or Appendix D of this Handbook for more complete information.

Harvard Summer School (HSS) offers several programs for students who wish to experience life sciences research abroad. Recent programs have included lab projects or research in Bonn, Germany; Shanghai, China; Tokyo or Yokohama, Japan; Bangalore, India and field research in Borneo, Malaysia. HSS also has offered a neurobiology course in Trento, Italy and a History of Science course in Oxford, England. These programs are very popular with students because they provide housing and include cultural immersion experiences, organized excursions and language courses. Students do not need to speak the language of the country where they will be working because the labs operate in English. Some of these programs are not offered every year so it is best to check the website in late fall to find out which of them will be available the following summer. Students are charged tuition to participate in these programs (some financial aid is available) but receive academic credit from the Summer School.

Students may also find their own labs abroad and seek funding through the Office for Undergraduate Research and Fellowships (Herchel Smith), the Office of Career Services (Weissman and The David Rockefeller International Experience Grant for travel and research as well as others), the Student Employment Office (HCRP for research with a Harvard faculty member) and through the Office for International Programs (OIE Summer Study Abroad Grants). You can find help with this process by talking to the Concentration Advisors, the Life Sciences Research Advisor or staff from any of the funding offices. Note that credit is not normally granted for work performed in labs that are not part of a Harvard Summer School program.

For students who prefer to remain closer to home, many US universities offer summer research programs. A partial list can be found on the Life Sciences Research web page under Research Opportunities. Harvard does not normally award fellowships to students participating in summer research programs at other institutions except those affiliated with Harvard Summer School. Ask your Concentration Advisor whether Harvard will accept credit for the program you are interested in before you apply. Do not assume that if you take a course away from Harvard you will automatically be granted credit after the fact.

Some PIs either do not allow or strongly discourage students from taking a summer “off” from their research commitment to the lab. Unfortunately, this
policy may deny some students the prospect of participating in research in the context of a different culture and prevent them from taking advantage of Harvard’s commitment to providing international experiences for all students. For those students who are interested in going abroad for a summer during their undergraduate careers, it may prudent to broach the subject in the lab interview. If the lab policy is firmly against allowing students to “take a summer off” from the lab, it may make sense to look for a lab that is more flexible.

Where can I find information about summer research funding?

Harvard offers several summer research fellowships for students who want to work in Harvard labs. Information can be found on the Life Sciences Research web page > Research Opportunities. See also Appendix A for more information and links to the major fellowships. The Undergraduate Research Advisor or your Concentration Advisor can also help you find summer funding opportunities.

Is laboratory research required for admission to medical school?

You may be surprised to learn that the short answer to this question is “No.” Basic lab research is not a requirement for many medical schools; however students must demonstrate substantive engagement in an undergraduate project. This may be independent lab research, but it could also be clinical research or something in the area of public health or global health. What is crucial is that you become deeply involved with something that you are genuinely passionate about. It is far more beneficial for you to have a positive experience doing something about which you care deeply than it is to do a research project in a lab just because you feel you have to. For more detailed information about research for premedical students see the Office for Career Services handbook “Premedical Information for Harvard Students.” Note that a significant laboratory research experience is essential for admission to graduate school (PhD) and combined MD/PhD programs.

What is the difference between basic and clinical research?

Many students are interested in pursuing medical research. Broadly speaking, there are two categories of medical research: basic research that involves studying fundamental questions such as the mechanisms of evolution, chemical reactions or the underlying causes of disease, which also may involve developing treatments for those diseases in the lab; and clinical research, which focuses on working directly with patients or analyzing clinical data. Since clinical research projects are, generally speaking, very long term and subject to lengthy approval processes, it is rare for undergraduates to be able to make substantive intellectual contributions to clinical research projects. Students engaged in clinical research are often limited to taking patient histories, inputting data into a computer, or analyzing the results of clinical trials; whereas
students involved in basic research have the opportunity to design experiments to test hypotheses. Many concentrations do not accept clinical research projects for academic credit, therefore you should always check with the relevant concentration advisor(s) to ensure that the project you are considering is suitable.
APPENDICES

Appendix A: Funding Sources for Undergraduate Research

Information about term time and summer research fellowships for Harvard students can be found on the Life Sciences web page: http://www.lifesciences.fas.harvard.edu, go to the Research tab > Research Opportunities. This page is updated regularly with information about deadlines and links to each fellowship website.

Information about some of the fellowships that can be found at the Life Sciences site:

Harvard College Research Opportunities Database

CARAT – Central Application for Research and Travel used by all the major funding sources at Harvard.

PRISE – Summer residential program for students doing research in the sciences provides on campus housing, a modest stipend and covers a student’s summer earnings requirement. Students do not need to have summer lab plans finalized by mid-Feb but must be in the process of finding a lab position.

Deadline: Third week in February

Harvard College Research Program (HCRP) – Summer (or term time) stipend. Applications available from the Student Employment Office.

Deadline: Fall - mid September, Spring – late January, Summer – end of March.

Herchel Smith Summer Fellowship – Undergraduate research either at Harvard or elsewhere. Applications available from the Office of Undergraduate Research Initiatives.

Deadline: Mid February

Dean’s Summer Research Awards – provides partial support for summer earnings requirement for rising seniors as determined by the Financial Aid Office. To be eligible students must have received HCRP funding to pursue senior thesis research. Applications are available from the SEO.

Deadline: Same date as HCRP
Mind, Brain, Behavior – Summer support for rising senior in MBB track. Applications through MBB.

Deadline: Late March

Harvard Stem Cell Institute – for students who are doing research in labs affiliated with the HSCI. Completed applications should be emailed to Maureen Herrmann. Students apply to the program and then are placed in labs.

Deadline: Early February

FAS Systems Biology/Bauer Fellowship - Sponsored by the FAS Center for Systems Biology.

Deadline: Mid-February

Harvard Medical School Immunology Summer Program

Deadline: October

Institute of Politics Director's Internship Program- paid summer internships each year for Harvard undergraduates interested in pursuing careers in politics or public service.

Deadline: Mid-February

Harvard Global Health Institute Summer Undergraduate Fellowship (SURF) For students engaged in scholarly research with a faculty mentor at a participating laboratory or research site.

Deadline: Two deadlines for I-SURF first is early February and the second is normally the third week of February

Other funding requests mid to late February

The Joey Hanzich Memorial Undergraduate Travel and Research Fellowship provides up to $5000 to a rising junior or rising senior enrolled in the Secondary Field in Global Health and Health Policy (or another field) who pursues a summer internship, project or research in health policy or global health, either in the United States or abroad.

Deadline: Early April.

Microbial Sciences Initiative - Summer research with Harvard Faculty. Email
applications to Dr. Karen Lachmayr.

**Deadline:** Third week of February

**MCZ Grants-in-Aid for Undergraduate Research** - Applications (5 printed copies) can be dropped-off/ mailed to: Catherine Weisel MCZ Projects Coordinator, 26 Oxford St., Cambridge. Questions should be directed to Catherine at 495-2460.

**Deadlines:** late September for fall term; early February for spring term; and late March for summer.

**Ernst Mayer Travel Grants in Animal Systematics**

**Deadlines:** Mid October and early April

**Harvard Forest Summer Research Program in Ecology** - Project descriptions and applications available after Dec 1.

**Deadline:** Early February

**Harvard University Center for the Environment Undergraduate Fund** – HUCE

The grants are intended to support research related to the environment, with a preference given to rising seniors seeking funds for senior honors thesis research. Award amounts are normally between $500-$2,500.

**Deadline:** Late March

**Harvard School of Public Health Summer Program in Biological Sciences** - This intensive 9 week laboratory-based biological research program is for undergraduate students during the summer following their sophomore or junior year. Interns apply state-of-the art technology in their own research projects, which focus on biological science questions that are important to the prevention of disease, under the direction of a Harvard faculty member.

Interns receive a generous stipend, travel allowance and free dormitory housing.

**Deadline:** Early February

**Funding for Research Away from Harvard**

**NSF REU in Cell and Molecular Visualization** at Brandeis University - Brandeis University seeks qualified applicants for an NSF-funded Research Experiences for Undergraduates (REU) program in the Biological Sciences for a 10-week period (June 1 - August 5, 2011). Stipends of $5000, plus housing costs and meal allowances will be awarded to each participant.
Deadline: Mid February

**David Rockefeller International Experience Grants Program** – The purpose of the grant is to afford all students the opportunity to take part in a significant international experience, regardless of financial background.

Deadline: February

Mid February for Harvard Summer School Study Abroad Programs and non-Harvard study abroad programs.

**Hercel Smith Summer Fellowship** – Undergraduate research either at Harvard or elsewhere.

Deadline: Mid February

**Weissman International Internship** – Research abroad for rising sophomore or junior. Average award ~$4000. Applications through OCS.

Deadline: Early to mid February

**Booth Fund Fellowship** - For seniors to engage in a program of travel, study, research or observation that will further expand and challenge an existing interest in a particular field.

Deadline: Mid March

**Organization for Tropical Studies** - Duke University Field Course Travel to Costa Rica or South Africa.

Deadline: See website

**Radcliffe Fellowships** - For a “purposeful summer”. Average award $2000. Application through OCS.

Deadline: See website

**Carl and Lily Pforzheimer Foundation Public Service Fellowships** – Funding for community or public service projects during a summer or leave of absence or immediately following graduation. Open to current juniors and seniors. Applications from OCS.

Deadline: See website

**RISE (Research Internships in Science and Engineering)** – Germany provides
undergraduates with an opportunity to work in Germany on projects in Biology, Chemistry, Engineering, Geology, and Physics. Participants receive a stipend and housing assistance.

**Deadline:** Online applications open Early Dec

The Pasteur Foundation Undergraduate Summer Internships – Paris, France.

**Deadline:** Mid December

Amgen Scholars Program for Summer Research - The Amgen Scholars Program is sponsored by grants from the Amgen Corporation. These grants provide $4,000 stipends plus board to qualified undergraduates to perform biology-related research in laboratories at 10 major research universities across the US. In addition to working on original research, the students will have weekly meetings with other undergraduates in the program to discuss and present their work.

**Deadline:** Early February

Cold Spring Harbor Undergraduate Research Program (URP) - provides an opportunity for undergraduate scientists from around the world to conduct first-rate research. Students learn the scientific process, technical methods and theoretical principles, and communicate their discoveries to other scientists. Approximately 20 students come to CSHL each summer for the 10-week program, living and working in the exciting Laboratory environment.

**Deadline:** Mid January

NSF REU Program

The National Science Foundation funds a large number of research opportunities for undergraduate students through its REU Sites program. An REU Site consists of a group of ten or so undergraduates who work in the research programs of the host institution. Each student is associated with a specific research project, where he/she works closely with the faculty and other researchers. Students are granted stipends and, in many cases, assistance with housing and travel. Undergraduate students supported with NSF funds must be citizens or permanent residents of the United States or its possessions. An REU Site may be at either a US or foreign location. By using the web page, Search, you may examine opportunities in the subject areas supported by various NSF units. Also, you may search by keywords to identify sites in particular research areas or with certain features, such as a particular location. Students must contact the individual sites for information and application materials. NSF does not have application materials and does not select student participants. A
contact person and contact information is listed for each site.

**Deadlines:** vary according to research site.

**NIH Summer Internship Program in Biomedical Research** - Summer programs at the National Institutes of Health (NIH) provide an opportunity to spend a summer working side-by-side with some of the leading scientists in the world, in an environment devoted exclusively to biomedical research.

**Deadline:** See website
Appendix B: **Departmental Requirements for Research for Credit**

**Experimental Research Courses (Chem 100, LS100r, OEB 100)**

Three project-based experimental laboratory courses (Chemistry 100, Life Sciences 100r, and Organismic and Evolutionary Biology 100) are available to undergraduates who are interested in learning basic lab techniques and the process of research without making a commitment to a faculty lab. The courses are taught in laboratory space in the Northwest Building that is dedicated to undergraduate teaching and designed to accommodate research in a variety of fields. Students enrolled in these courses work on projects that are directly linked with ongoing faculty research in a highly collaborative and dynamic research environment. They provide an excellent introduction to research and research techniques and many students who take them go on to work in a faculty lab and write a senior thesis.

**Life Sciences 100r** offers projects in the following research tracks: neurobiology, microbial sciences, cell biology, and synthetic biology. New projects, including some in other research fields, are offered every term. The course is offered in both the spring and fall semesters and can be taken in any year. *LS100r is open to students from any concentration*, and may be repeated with the permission of the instructor.

**OEB 100** offers projects utilizing experimental evolution of microbial populations. The research addresses questions that synthesize knowledge of genetics, biochemistry, systems biology, microbiology, evolution and ecology. It is offered in both the spring and fall semesters. Life Sciences 1a and 1b or permission of the instructor is required for enrollment. It is open to students from any concentration.

**Chemistry 100** engages students in independent, open-ended research problems in collaboration with a research group in the chemistry department. Completion of Chem. 27 or Chem. 30 is a prerequisite for enrollment in Chem. 100.

**Biomedical Engineering**

Biomedical Engineering lies at the intersection of the physical and life sciences, incorporating principles from physics and chemistry to understand the operation of living systems. As in other engineering fields, the approach is highly quantitative: mathematical analysis and modeling are used to capture the function of systems from subcellular to organism scales. The Biomedical Engineering concentration is designed to provide students with a solid foundation in engineering, particularly as applied to the life sciences, within the setting of a liberal arts education. The concentration is flexibly structured for a diversity of educational and professional objectives.


**ES91r** - A thesis is required for recommendations of high honors and highest honors. Thesis candidates must enroll in one or two terms of ES91r.

**Chemical and Physical Biology**

Students in the CPB concentration are encouraged to begin working in a research lab as soon as they feel ready to balance research and coursework. Some students begin in the freshman year, others in the sophomore year, and most are working in a lab by the spring semester of the junior year. Those considering writing a senior thesis (which is required for honors eligibility) should be working in a lab by the spring of their junior year and ordinarily are required to spend the summer between their junior and senior years working in their thesis lab.

All CPB concentrators are required to take at least one letter-graded research course to be eligible for the degree. Courses that fulfill this requirement include LS 100r, CPB 91r, and CPB 99:

**LS 100r** – See course description above

**CPB 91r (Introduction to research)** allows students to receive course credit for research carried out in a laboratory under faculty supervision. This is a one-semester course that ordinarily may be repeated once but may not be taken as a fifth course. Students enrolled in CPB 91r are required to spend 15-18 hours per week in the laboratory and submit a 5-10 page final paper to the faculty sponsor at the end of the semester. For the final paper, students are required to write about their project in the context of the field as a whole, summarize their key findings, and outline “what to do next.” We encourage students to involve faculty sponsors in the preparation of the final paper so that they have a clear understanding of the faculty sponsor’s expectations: getting feedback from the faculty sponsor on drafts of the paper can help avoid a situation whereby the student submits an unsatisfactory paper. The letter grade for CPB 91r is determined by the faculty sponsor based on the final paper and the student's performance in the lab. CPB 91r is ordinarily taken in one or both semesters of the junior year in preparation for CPB 99, although it may also be taken in the sophomore year or, for students not intending to write a thesis, in the senior year.

**CPB 99 (Laboratory Research for Honors Thesis)** is a full-year course required for students intending to write a senior thesis. During the summer prior to their senior year, students intending to enroll in CPB 99 are expected to work closely with their faculty sponsor and direct lab supervisor to prepare a 5-10 page thesis proposal for approval by the Board of Tutors in Biochemical Sciences. Continuing their work in the academic year, students typically spend the fall semester collecting data in the lab and writing the introduction to their thesis, a draft of which is due at the end of the fall semester. In the spring
semester, students continue doing experiments, revise the draft of their introduction, make figures, and draft the remaining portions of the text. Feedback and mentoring from the faculty sponsor and direct supervisor is an essential part of the thesis writing process. The thesis is due shortly after spring break, and is evaluated by two reviewers, each of whom recommends a letter grade to the Head Tutor. The faculty sponsor selects one of the reviewers and the second is a member of the Board of Tutors in Biochemical Sciences. The final grade for CPB 99 is determined by the Head Tutor based on input from the reviewers and feedback from the faculty sponsor. The faculty sponsor is not required to suggest a final grade for CPB 99, however their written evaluation is considered in assigning the final grade.

**Human Developmental and Regenerative Biology**
Students in the HDRB concentration are required to take at least one letter-graded research course to be eligible for the degree. Those who seek honors eligibility in the concentration must write a thesis. Most students decide to work in a lab by the summer between sophomore and junior years, however freshmen and sophomores may join labs at any time. Students intending to write a thesis should be working in a lab no later than the spring semester of the junior year.

The following three courses fulfill upper-level concentration electives:

**LS 100r** - See course description above.

**SCRB 160 (Stem Cell and Regenerative Biology - Experimental Embryology)** This advanced laboratory course applies experimental approaches and surgical techniques to illustrate critical developmental events during mouse embryogenesis. Particular emphasis is placed on experiments covering the following topics: fertilization and pre-implantation embryology; reprogramming of adult somatic cells into embryonic stem cells; early organ development; and surgical manipulation of late stage mouse embryos in utero.

**SCRB 165 (Directed Differentiation of Stem Cells)** This practical laboratory course investigates the fundamental biology of human embryonic stem cells and their remarkable capacity to differentiate into all cells of the body. The course explores the underlying developmental pathways that guide embryonic stem cell development into differentiated cell types.

**SCRB 91r (Introduction to Research)** SCRB 91r is a required course for HDRB concentrators. It is a semester long research course in the lab of a SCRB faculty member or others with laboratory interests that fall within the broad field of human developmental and regenerative biology. SCRB 91r may ordinarily be repeated once but not be taken as a fifth course. SCRB 91r can fulfill both research and tutorial requirements for the HDRB concentration. Students are expected to spend roughly 15 hours per week in the laboratory. Students and
faculty mentors are required to meet regularly to discuss the project and relevant primary literature in the field. Faculty and direct supervisors should provide feedback to students on their progress throughout the semester. Students are required to submit a 5-10 page paper at the end of the semester based on their project. The paper should include how their project fits into the context of the field as a whole, a summary of the data collected, and a description of the next logical steps for future study. The letter grade for SCRB 91r is determined by the PI and is based on the final paper and the student’s performance in the lab. Ordinarily, SCRB 91r is taken during the junior year.

**SCRB 99 (Laboratory Research for Honors Thesis)** Honors candidates in HDRB are required to write a thesis. SCRB 99 is ordinarily taken both semesters during the senior year. It may not ordinarily be taken as a fifth course. Students are required to submit a 5-10 page written proposal prior to enrolling in the fall. The proposal is generally due during the summer between junior and senior year and should be prepared with strong input from the faculty advisor and direct supervisor. The Course Head and Co-Head Tutors must approve the proposal prior to a student enrolling in SCRB 99. In the fall semester, students may still be running experiments and working on the introduction of their thesis. A draft of the introduction is due at the end of the semester. In the spring, students are finishing up experiments and completing the writing of the thesis. A final draft is due after spring break. A committee of faculty, two of whom will assign the grade, reviews the thesis. While the faculty sponsor does not assign a grade, their evaluation of the thesis will be considered in assigning the final grade.

**Human Evolutionary Biology**
Research in HEB may be carried out in the lab, in the field, or may be purely literature-based. Concentrators in HEB are required to take one semester’s worth of course credit for research, and this is normally fulfilled through the Junior Research Seminar or HEB 91r. About 20 percent of HEB concentrators also pursue research through HEB 99r, taken while researching and writing the Senior Thesis.

The **Junior Research Seminar** is a small course taught by an HEB faculty member in which students learn techniques for and conduct original research. This may involve work, for example, in an endocrinology or anatomy lab, running psychology experiments, or writing an in-depth research paper. Research is closely supervised by the instructor, and may be carried out as part of a group project. Normally, students also read and discuss relevant research articles in small groups. A list of classes that count for Junior Research Seminar credit can be found at [www.lifesciences.fas.harvard.edu](http://www.lifesciences.fas.harvard.edu).
HEB 91r (Supervised Reading and Research) allows students to receive course credit for research carried out under the supervision of a faculty member. This research may be in the lab, in the field, or in some cases, it may involve analysis of preexisting data or literature-based research. Students find advisors for their 91r research classes in a number of ways: Many are inspired in class by a particular instructor and approach them about independent research; students may meet with one of the HEB concentration advisors to get recommendations about which faculty member(s) would be in a good match; or students may learn more about faculty research interests and opportunities via the web, by visiting professors’ lab pages and reading recent publications that have come out of a particular lab.

The requirements for HEB 91r are flexible, but normally students meet weekly with their faculty supervisor, read and discuss scientific articles pertinent to their research project, and submit a research paper at the end of the course. We encourage students to get feedback from the supervisor on preparation for and drafts of the paper. HEB 91r is a one-semester course that ordinarily may be repeated once. The letter grade for HEB 91r is determined by the faculty sponsor and based on the student’s research progress over the semester, the quality of preparation for meetings, and on the final paper. Frequently, HEB 91r is taken in one or both semesters of the junior year in preparation for HEB 99 and researching/writing the senior thesis, although it may also be taken in the sophomore year or, for students not intending to write a thesis, in the senior year.

HEB 99r (Senior Thesis) Students writing a senior thesis must enroll in this course both semesters of the Senior Year. Students pursuing the HEB/MBB track and students wishing to be considered for the Highest Honors recommendation must write a thesis. Students may write a thesis regardless of their GPA; but in the case of students with very low GPA’s, we may encourage them to get involved in less demanding research projects, such as an independent research project through a 91r course. Students engage in vastly different kinds of research for their theses - in the last few years, topics have ranged from the evolution of drug resistance to the malaria parasite in Ecuador, to Ultimate Frisbee players’ testosterone responses to winning and losing, to sex differences in decision making, and the role of maternal folic acid in genomic imprinting of IGF2. A few students choose to write literature-based theses.

Students find topics and advisors for their thesis research much as they do for HEB 91r, as described above. Students normally begin thinking seriously about their research in the fall of their junior year, and may even find an advisor at that point. Many students will carry out pilot studies or other preparation in the spring of their junior year as part of HEB 91r, and then conduct the bulk of the research over the summer after the junior year. Ideally, the data analysis and writing will be done during senior year.
Students enrolled in HEB 99 are required to attend several thesis-writer group meetings throughout senior year. These meetings serve mainly to provide support and guidance to thesis writers. Thesis writers are responsible for scheduling and attending meetings with their advisors and for meeting deadlines (whether set by the student or the advisor), but some advisors may prefer to take a more proactive role. Thesis writers should be independent, self-motivated, highly disciplined and proactive. They will need to take the initiative to find a faculty advisor and a topic that intrigues them, and have the resilience to persist through setbacks. While advisors are not responsible for the students’ compliance and progress, they should provide support and encouragement when possible.

The Director of Undergraduate Studies (DUS) and Concentration Advisors communicate with thesis writers and advisors to ensure that the expectations outlined above are clear. When questions and concerns arise about student progress or advisor responsibilities, parties may wish to discuss these concerns with the DUS or Concentration Advisor. They will work with both parties to ensure that the advisor/advisee relationship runs as smoothly as possible and that students receive the support they need.

The thesis is graded and evaluated by a three-person committee, including the advisor and two other faculty members or research advisors. The Concentration Advisor sets the committee. Thesis writers also participate in and grade an oral exam based on the written thesis. Thesis grading and the oral exam normally take place during reading period in the spring of the student’s senior year. Information on guidelines for the HEB senior thesis can be found at www.lifesciences.fas.harvard.edu.

Molecular and Cellular Biology
Students in the MCB concentration are encouraged to begin working in a research lab as soon as they feel ready to balance research and coursework. Some students begin in the first year, others in the second year, and most are working in a lab by the spring semester of the third year. Those considering writing a senior thesis (which is ordinarily required for honors eligibility) should be working in a lab by the spring of their third year and ordinarily are required to spend the summer between their third and fourth year working in their thesis lab. All students are required to take at least one letter-graded research course to be eligible for the degree. Courses that fulfill this requirement include LS 100r, MCB 91r, and MCB 99:

LS 100r (See course description above)

MCB 91r (Introduction to research) permits students to receive course credit for laboratory research carried out under the supervision and in the laboratory of a faculty member. It is a one-semester course that ordinarily may be repeated
MCB 91r (Laboratory Research for Independent Study) is a semester course required for students enrolled in MCB 91r. Students are required to spend 15-18 hours per week in the laboratory and submit a 5-10 page final paper to the faculty sponsor at the end of the semester. For the final paper, students are required to write about their project in the context of the field as a whole, summarize their key findings, and outline “what to do next.” We encourage students to involve faculty sponsors in the preparation of the final paper so that they have a clear understanding of the faculty sponsor’s expectations: getting feedback from the faculty sponsor on drafts of the paper can help avoid a situation in which the student submits an unsatisfactory paper. The letter grade for MCB 91r is determined by the faculty sponsor based on the final paper and the student's performance in the lab. MCB 91r is ordinarily taken in one or both semesters of the third year in preparation for MCB 99, though it may also be taken in the second year or, for students not intending to write a thesis, in the fourth year.

MCB 99 (Laboratory Research for Honors Thesis) is a full-year course required for students intending to write a senior thesis. In the summer prior to their fourth year, students intending to enroll in MCB 99 are expected to work closely with their faculty sponsor and direct lab supervisor to prepare a 5-10 page thesis proposal for approval by the Board of Tutors in Biochemical Sciences. During the academic year, students typically spend the fall semester collecting data in the lab and writing the introduction to their thesis, a draft of which is due at the end of the fall semester. In the spring semester, students continue doing experiments, revise the draft of their introduction, make figures, and draft the remaining portions of the text. Feedback and mentoring from the faculty sponsor and direct supervisor is an essential part of the thesis writing process. The thesis is due shortly after spring break, and is evaluated by two reviewers, each of whom recommends a letter grade to the Head Tutor. The faculty sponsor recommends one reader and the other is a member of the Board of Tutors in Biochemical Sciences. The final grade for MCB 99 is determined by the Head Tutor based on input from the thesis reader and feedback from the faculty sponsor. The faculty sponsor is not required to suggest a final grade for MCB 99, however their written evaluation is helpful in assigning the final grade.

Neurobiology

Students in the Neurobiology concentration are encouraged to work in a research laboratory. Students are encouraged to settle on a lab during the fall of their junior year, although many students begin before junior year, and a few wait until senior year. Students who are considering writing a senior thesis should be working in a lab by the spring of their junior year, and ordinarily spend the summer between junior and senior years working in their thesis lab.

While a research course is not a degree requirement in Neurobiology, participation in these courses does affect a student’s honors eligibility. One semester of Neurobiology 98r (see below) confers eligibility for regular or high
honors and completion of a Neurobiology thesis confers eligibility for highest honors.

**Neurobiology 98r (Laboratory Research)** allows students to receive course credit for laboratory research carried out under the supervision and in the laboratory of a faculty member. It is a one-semester course that may be repeated once, and ordinarily it may not be taken as a fifth course. Students enrolled in Neurobiology 98r are required to spend 15 hours per week in the laboratory and submit a 5-10 page final paper to the faculty sponsor (PI) at the end of the semester. For the final paper, students are required to write about their project in the context of the field as a whole, including background, methods, results, and references sections. However in place of their final 98r paper, students who intend to write a thesis in the following semester are required to submit a rough draft of either the Introduction or Results section of their thesis, along with a brief list of all experiments and analyses, stating which are complete. We encourage students to involve their PIs in the preparation of the final paper so that they have a clear understanding of the PI’s expectations. The letter grade for NB 98r is determined by the PI based on the student's performance in the lab and on the final paper. NB 98r is ordinarily taken in the spring of the junior year and/or during the senior year.

**Neurobiology 99r (Honors Thesis Tutorial)** is a one-semester course designed for students writing a senior thesis. In the spring of the junior year, students intending to write a thesis are expected to work with their PI and lab mentor/s to prepare a 2-3 page thesis proposal for approval by the Neurobiology concentration. Students should receive feedback on this proposal going into the summer before senior year, allowing them to focus on their specific senior thesis research. Ordinarily NB 99r is then taken during the student’s final semester. A one-page thesis abstract is due upon registration for NB 99r. Feedback and mentoring from the lab is an essential part of the thesis writing process. The thesis itself is due around spring break, and is evaluated by a faculty thesis committee along with the Head Tutor. The grade for NB 99r (which appears on the student’s transcript) is determined by the student’s PI. The student also receives a Latin grade on the thesis itself, which is determined by faculty committee. This grade does not appear on the student’s transcript.

**Organismic and Evolutionary Biology**
OEB students are not required to do research. However, to qualify for a recommendation of Highest Honors by the concentration, a senior thesis is required. Honors and High Honors recommendations can be made on the basis of within-concentration GPA alone (i.e. without a senior thesis), but a senior thesis can enhance a student's Honors standing: for example, a student with a GPA of 3.5 with no thesis will receive Honors; a student with the same GPA and a thesis deemed "praiseworthy" will receive High Honors. For full details, consult the OEB page on the Life Sciences website
To pursue a thesis and/or to get academic credit for doing research (i.e. an OEB 99r), OEB students must have an OEB faculty adviser. Often, the choice of adviser is simple because the student is working in the faculty member's lab. If a student develops a project in the lab of a non-OEB professor (whether in FAS - e.g. in an MCB lab - or beyond FAS - e.g. in an HMS lab or in a lab at another institution), they will still need an OEB faculty adviser. Similarly, OEB students who develop their own field-based projects, which may be entirely independent of direct institutional support, are required to have an OEB faculty adviser.

Field research is necessarily carried out over the summer. Students in the past have set up projects:
- At a faculty member's field site
- At an established research station (e.g. the Rocky Mountain Biological Lab) or field camp (e.g. Operation Wallacea)
- Independently - Various Harvard funds support summer fieldwork. See the research pages of the Life Sciences website.

Students become involved in research at varying stages in their Harvard careers. Some students switch labs. In general, a Senior Thesis involves at least the following:
- Junior year. Join lab, develop project. Students are typically volunteering in the lab over this period
- Junior-Senior summer. Generation of the bulk of thesis data, whether in the lab or the field
- Senior Fall. OEB 99r. Cleaning up summer's data; or, in the case of field work, analyzing summer's data
- Senior Spring. OEB 99r. Writing up thesis, which is due immediately before Spring Break.

Research Courses

OEB 91r (Supervised Reading). This course permits students to pursue a topic that is not adequately covered by OEB's course offerings. A student, or group of students, agrees with a faculty member on a reading list and course structure before the beginning of semester. In order to register for this course, students must submit a proposal (available on the Life Sciences Website under OEB forms), signed by the OEB faculty sponsor, with details of reading, syllabus, and assessment. Typically, the student and faculty member would meet once a week to discuss the readings and/or the student's assignments. Methods of assessment are determined by the faculty member, but typically involve a term paper. Students may not simultaneously enroll in an OEB 91r and an OEB 99r with the same faculty adviser.
OEB 99r (Supervised Independent Research). This course may be repeated for credit. In order to register for this course, students must submit a proposal (available on the Life Sciences Website under OEB forms), signed by their OEB PI, describing the work they anticipate carrying out. The work must be independent - i.e. the student will not qualify for an OEB 99r if they are in effect working merely as a research assistant. The expectation is ~15 hours of work/week. The course is letter graded by the student's OEB PI on the basis of a 10 page paper submitted at the end of the semester. It is up to the student and the OEB PI to agree on an appropriate format for the paper. If a student is doing an OEB 99r in their final semester and is submitting a Senior Thesis, the paper requirement is waived. Students who are not planning on doing a Senior Thesis may take OEB 99r for credit.

LS 100r – (see course description above).

Psychology
Students in any of the tracks of the Psychology concentration are encouraged to begin working in a research lab as soon as they feel ready to balance research and coursework. Some students begin in the freshman year, while most begin in the sophomore year. Students considering writing a senior thesis should be working in a lab no later than the fall of their junior year and often spend the summer between their junior and senior years working in their thesis lab. Many labs require a yearlong commitment to working in the lab due to the amount of training required. Students are encouraged to start by volunteering in the lab for a few hours a week, or even just asking permission to sit in on a few discussion groups or lab meetings to see if the lab is a good fit before making a longer commitment and working in a lab for course credit (see below).

All Psychology students in the life science Social and Cognitive Neuroscience track or MBB Cognitive Science track as well as all thesis writers in the General track are required to take one letter-graded research course to be eligible for the degree. Students in the general track who are not writing a thesis are not required to take a research course, but may count research courses toward their degree as psychology concentration electives. Across all tracks, students in the class of 2011 and later are allowed to count up to two research courses toward their psychology concentration requirements. Research courses in Psychology include:

LABORATORY METHODS COURSES

A list of laboratory methods courses can be found at http://wjh.harvard.edu/psych/ug/requirements/charts/Req_LabMeth.htm. Most faculty members list a “lab course” in the catalog. Although these courses have their own course numbers, they are not the same as taking a regular, classroom-based course with
lectures, exams and papers. Instead the bulk of the work is actually working on research in the lab with a graduate student or other researcher, typically 10-12 hours per week. This component may involve analyzing data, helping to design projects, running participants and collecting data, or any of a number of things to help the lab run and the project move forward. Often labs will require student attendance at regular lab meetings, and many labs will assign readings to compliment the work going on in the lab or to understand the project’s larger context. All lab courses will require some large academic assignment, typically a research paper or presentation. These courses cannot be shopped, and there is often limited space in each lab. Students interested in one of the lab courses should be in contact with the instructor in advance to express their interest and see if they are a good fit for the lab. The faculty supervisor determines the letter grade for lab courses based on the assignments in the course and the student’s performance in the lab. These courses are one-semester courses that count against the lab limit of two research courses for the concentration, but can be taken for College credit multiple times.

**PSY 910r (Supervised Research)** (see [http://wjh.harvard.edu/psych/ug/requirements/charts/Req_LabMeth.htm](http://wjh.harvard.edu/psych/ug/requirements/charts/Req_LabMeth.htm)) allows students to receive course credit for laboratory research in a lab where 1) the faculty member does not offer a lab methods course, 2) the research is outside of the normal scope of that faculty member’s lab methods course, or 3) the student has arranged to conduct research with a member of the Board of Honors Tutors. Students must apply to the faculty to enroll in this course.

Students should contact possible PSY 910r supervisors directly, but can direct questions about the scope of the course to the Psychology Undergraduate Office, WJH 218. Students enrolled in PSY 910r are required to spend 10-12 hours per week in the laboratory and submit a 10-page final research paper (with research references) to Psychology Undergraduate Office and the faculty supervisor at the end of the semester. The faculty supervisor for PSY 910r determines the letter grade the based on the final paper and the student's performance in the lab. PSY 910r is a one-semester course that counts against the lab limit of two research courses for the concentration, and can be taken for College credit up to three times.

**PSY 985 (Junior Tutorial: Honors Thesis Preparation)** is a course taken in the junior year, typically in spring, which is designed for exploring potential thesis topics and learning how to navigate the thesis process. This for-credit course involves independent study under the supervision of a department faculty member for the specific purpose of selecting a thesis topic and producing a thesis prospectus. The course also includes required group meetings with PSY 985 students that cover the thesis process. PSY 985 requires a completed prospectus or (if you decide not to write a thesis) a research paper. PSY 985 does not meet the lab methods course requirement, but it does count against the
limit of two research courses permitted to count for psychology concentration requirements. PSY 985 is graded Satisfactory/Unsatisfactory.

**PSY 990/992/993 (Senior Tutorial: Honors Thesis)** is a full-year course required for students intending to write a senior thesis. In the spring of junior year (usually while enrolled in PSY 985) or summer prior to their senior year, students intending to enroll in PSY 990/992/993 are expected to work closely with their faculty supervisor to prepare a thesis prospectus to present to their thesis committee for approval at the prospectus meeting. During the academic year, students typically spend the fall semester finishing data collection, writing the introduction and methods section of their thesis, and beginning data analysis. In the spring semester, students continue doing data analysis, revise the draft of their introduction and methods, make figures, and draft the remaining portions of the text. Feedback and mentoring from the faculty sponsor and direct supervisor is an essential part of the thesis writing process. The thesis is due the Thursday before spring break. Students also present their research orally to their committee at the thesis poster session in mid-April. The course is graded Satisfactory/Unsatisfactory, based on professional conduct in the laboratory and meeting all thesis-related requirements by their deadlines. The thesis grade is independent of the course grade; the thesis committee assigns a final grade to the thesis following the poster session, weighted 80% for the written thesis and 20% for the defense. PSY 990/992/993 does not meet the lab methods course, nor does count against the limit of two research courses permitted to count for psychology concentration requirements.
Appendix C: **Summer Research Opportunities**

NB: Listed below are a few examples of research opportunities within the US and abroad. Many other such programs exist.

**Faculty labs at Harvard University**

See: How do I find a research position in a laboratory?

**Other Domestic Opportunities**

- **Amgen Scholars Program**: The Amgen Scholars Program provides hundreds of undergraduate students with the opportunity to engage in a hands-on summer research experience at some of the world's leading institutions.

- **Cold Spring Harbor Undergraduate Research Program**: The CSH URP program is designed to give students an opportunity to conduct first-rate research.

- **Shoals Marine Laboratory**: Summer courses - SML offers undergraduate students a unique opportunity to study marine science in the field with exceptional faculty from institutions throughout North America. Instruction at SML is based upon giving participants a truly "hands-on" educational experience.

- **Janelia Undergraduate Research Scholars**: Janelia Farm Undergraduate Scholars are among the very best future scientists, engineers, and mathematicians who are interested in exploring basic neuroscience, imaging technology, and related fields of research at Janelia.

- **NIH Summer Internship Program**: SIP welcomes eligible high school, college, graduate, and professional students to spend eight to ten weeks conducting biomedical research with NIH investigators.

- **Columbia Integrative Graduate Education and Research Training (IGERT)**: The program provides an opportunity to participate fully in the interdisciplinary research activities of the BioIGERT faculty across the Departments of Physics, Biology, Biomedical Engineering, Chemistry, Chemical Engineering, Mechanical Engineering, and Electrical Engineering, and includes collaborative research with industry including IBM Yorktown Heights.

- **Stowers Institute**: Stowers Summer Scholars spend the vast majority of their time in the laboratory. There they work on a research project while receiving guidance and supervision from the laboratory head or a senior member of the lab.
Individual investigators at the MBL have various funded opportunities each year for undergraduates to do field- and laboratory-based research as part of that investigator’s research program.

Research Abroad

Harvard Summer School Research Abroad Programs for credit
See the Harvard Summer School Abroad site. Program information for summer is normally posted in the late fall. Be sure to check and make sure that the program you are interested in will be offered for the following summer. Program offerings may vary from year to year. Courses offered in 2012 included:

- Shanghai, China
- Tokyo, Japan
- Yokohama, Japan
- Bangalore, India
- Trento, Italy
- Oxford, UK

Harvard Global Health international Summer Undergraduate Fellowships (iSURF):
- There are many summer opportunities for Harvard undergraduates ranging from office-based internships, to placements in laboratories and research groups, to funding for student-initiated independent research projects.

Other foreign opportunities for laboratory or fieldwork

Okinawa Institute of Science and Technology – OIST – Okinawa, Japan.
Short-Term Student Research Assistants are persons enrolled at graduate or undergraduate programs in universities, colleges, junior colleges, and vocational schools in Japan or overseas, who do research and training in laboratories at OIST for less than six months.

Pasteur Foundation Undergraduate Summer Internships – Paris, France.
The Pasteur Foundation Summer Internship Program provides U.S. undergraduates with the rare opportunity to conduct summer research at the Institut Pasteur. The foundation’s goal is to encourage students in the pursuit of a scientific career and to expose them to an international laboratory experience.

DAAD RISE Research Internships in Science and Engineering – Germany.
http://www.daad.de/rise/en/ - RISE is a summer internship program for undergraduate students from the United States, Canada and the UK in the fields of biology, chemistry, physics, earth sciences and engineering. It offers unique opportunities for undergraduate students to work with research groups at
universities and top research institutions across Germany for a period of 2 to 3 months during the summer. RISE interns are matched with doctoral students whom they assist and who serve as their mentors.

**School of Life Sciences Summer Research Program - Lausanne, Switzerland** - The Summer Research Program in Life Sciences and Technology at the Ecole Polytechnique Fédérale de Lausanne (EPFL) will offer an intensive research training opportunity to 25 undergraduate students interested in research careers in life sciences.

**Operation Wallacea** – Biodiversity and Conservation Management. - Sites in Honduras, Egypt, Indonesia, South Africa, Cuba and Peru. Relatively few people have field experience working alongside real research projects and the Operation Wallacea research programme offers the opportunity to work with a range of academic teams to strengthen your CV (resume) or to help you decide whether tropical field work is of interest for your career. Research Assistants are involved in a wide range of tasks on each research topic and help to gather primary data.

**International Marine Summer School** – Cork or Galway, Ireland - The Irish Marine Environment 2 courses offered/summer. The 2012 International Marine Summer School (IMSS) is based in the historic and cultural maritime cities of Galway and Cork, located in west and southwest Ireland. It focuses on the marine scientific environment and will also include a programme of related cultural, social and extra-curricular activities. Practical fieldwork and marine based research will be a central feature of the programme. A combination of lectures and sea-going and terrestrial fieldtrips around Galway Bay, Cork and the surrounding coasts will allow for student participation at all levels.

**Organization for Tropical Studies** – OTS - Field research around the world. Based at OTS Field Stations, these undergraduate courses provide access to a broad array of tropical ecosystems including Costa Rica and South Africa.
Appendix D: Resources for Students Doing Research at Harvard

Life Sciences Undergraduate Education Office: 
http://lifesciences.fas.harvard.edu/

Life Sciences Research Advisor:
Margaret Lynch, Biolabs 1087, (617) 495-9533 margaretlynch@g.harvard.edu

Life Sciences Concentration Advisors: 
http://lifesciences.fas.harvard.edu/people/advisor

Harvard College Office for Undergraduate Research and Fellowships: 
http://uraf.harvard.edu/home

Student Employment Office: http://wwwseo.harvard.edu/icb/icb.do

Office of Career Services: http://www.ocs.fas.harvard.edu/

Harvard College Undergraduate Research Association:  HCURA offers support for undergraduates doing research at Harvard. “As the premier undergraduate research association at Harvard, HCURA is dedicated to building an interdisciplinary research community. We have partnered with the newly established Harvard Office of Undergraduate Research Initiatives (OURI) to run our popular Peer Advising Program, which pairs freshmen interested in research with upperclassmen peer-advisers who guide each of the freshmen through the process of finding a lab, securing funding, and balancing lab work with other commitments. In addition, we collaborate with a number of Harvard departments to host seminars and socials in order to fortify the undergraduate research community here at Harvard.

We are also committed to providing a forum for student researchers to present their research and interact with their peers. We believe that these efforts deserve a greater campus presence and that all undergraduate researchers should be proud of their contributions to the collective scholarship of our student body. To this end, we have hosted the annual Harvard Undergraduate Research Symposium (HURS) since our founding in 2007 in order to furnish an arena for students to share their work and recently launched the National Collegiate Research Conference (NCRC) in January 2012. These conferences have created opportunities for faculty to connect with students, offering a unique educational experience for all participants.”[1]
[1] Mission statement taken from the HCURA web site (http://www.hcura.org/about/)
Appendix E: Summer Housing Information

PRISE (see above) and a few other fellowships offer summer housing.

DeWolfe Apartments: 10 and 20 DeWolfe Street apartments, owned by Harvard Real Estate Services and located at the intersection of Mill and Grant streets, are licensed to Harvard College students during the summer to provide housing for students who wish to remain in Cambridge for the summer. Applications normally open at the end of March.

Other rentals in Cambridge can be found through local papers or on line listings.

Students can find roommates to share apartments by using the Harvard College Undergraduate Research Association web based roommate finder or by posting to various House open lists.
Appendix F: Life Sciences Undergraduate Research Fair – LSURF

What is the Life Sciences Undergraduate Research Fair (LSURF)?

The Life Sciences Undergraduate Research Fair is an annual poster session that provides Harvard undergraduates with the opportunity to meet faculty engaged in life sciences research. The faculty (or senior graduate students or post doctoral fellows from their labs) present posters describing their research and showing examples of the ongoing projects in their labs. This is an easy way to find out about a very wide range of research projects and talk to researchers from across the university about their work.

What is a poster session?

Poster sessions are a very standard format for scientists to share information about their research projects and results. Many major scientific conferences include one or more poster sessions as an integral part of their programs. The concept is quite simple: researchers in the faculty labs design posters that describe their research projects, provide examples of experiments, show some results, and perhaps describe some future directions for the project. Researchers from the labs (including faculty) are available at their posters to explain the experiments in more detail or answer questions about their projects.

Why should I go?

This is a terrific opportunity to meet and talk individually or in small groups to many faculty in a short period of time. If you are not sure what area of Life Sciences you are interested in, this is a very good way to talk one on one with faculty from a broad spectrum of concentrations and research areas. If, on the other hand, you already have some idea of the area of research that interests you, this is a great opportunity for you to see many examples of the types of research being done in that field and to meet faculty or lab members who are conducting the experiments. These types of conversations may give you a chance to ask questions about undergraduate research in the lab and perhaps to set up a meeting with someone from the lab to talk about the possibility of joining their group.

What do I do when I get there?

When you arrive at the LSURF venue, you will be given an Abstract booklet that contains brief descriptions of each poster. The posters are numbered and usually grouped by research field (MCB, Neurobiology, OEB, etc). You will find maps showing the location of each of poster; all you have to do is walk around and talk to people at their posters. For example if you know that you are
interested in neurobiology research, and you see in the booklet that the neurobiology posters are numbers 1-25 you can go to that area of the room to talk to neurobiology researchers.

**How can I talk to a Harvard faculty member about their work if I have no background in their research?**

The faculty (or post docs or graduate students) who come to the LSURF are aware that most of the undergraduates who come are freshmen and sophomores who are just getting started in their science careers. They are eager to talk to you and explain in relatively simple terms what their research is all about. You don’t have to have a specific, detailed question about the research; all you need to do is ask them if they can explain their work to you. They are both willing and eager to talk to you and get you interested in their work.

**If a faculty member is at the Fair does that mean that they have openings for undergraduate students at the moment?**

Many of the faculty, but not all, who present posters at the fair do have openings in their labs for new undergraduates. Some labs may not have room in the fall, but may have seniors who will be completing their theses in the spring, so that space will be available for a student who wants to start later in the spring or over the summer. After you have met and talked to a faculty mentor, whose work interests you, it is fine to ask them if they currently have space for another student.

**Are they the only faculty at Harvard who are interested in taking students?**

The answer is no. Most of the Harvard faculty doing research in the Life Sciences are open to accepting undergraduate researchers into their labs. The LSURF provides a just small sample of the many ongoing projects open to students.