BROWN

GUIDE TO INDEPENDENT STUDY

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WHY?

Why do it:

Directed research/Independent study for course credit (BIOL 1950/1960) is an integral part of many biology concentration programs. It may be carried out by non-biology majors. It also serves as the basis for Honors in biology programs.

The opportunity for an in-depth, hands-on experience in research may serve various functions. For example,

1. Students contemplating graduate training should obtain first-hand experience with research. Some may find that the lab life just isn't for them and may, as a result, reassess their plans. Others may find the research endeavor very appealing, and helpful in determining which area of biology to pursue on the graduate level.

2. Students will go well beyond the lab experiences offered in standard courses. They will learn about developing an experimental hypothesis into a workable design; working out protocols, collecting data and analyzing results, as well as keeping up with current activities in a specific area of biological research. They may participate in journal clubs and attend section seminars. In addition, they will observe their sponsor in the day-to-day activities of managing their laboratories (and possibly, clinical practice), teaching, writing, and preparing grant proposals.

3. It provides the opportunity for a real student-mentor relationship with a faculty member. This is very helpful in seeking references or recommendations for graduate school, professional school or job applications, as well as for enriching your undergraduate experience.

4. For those with a program featuring a strong theme or focus, it may be the culmination of coursework in that area.

5. It may give exposure to an advanced area of study not covered specifically by other coursework.

6. It can provide students with practical laboratory experience, training on equipment, and research skills, which will be useful in job hunting later on.

Why some should NOT do it:

1. Constraints due to other necessary activities will not permit time for a whole-hearted effort.

2. Material in standard coursework with lab format is better suited to student's academic interests.

3. In some cases, the program which includes Independent Study may be too narrow. The student may benefit more from the breadth of standard coursework with lab and advanced material or advanced seminars which include critical evaluations of current research literature.

4. A student may have a self-imposed limit of only one semester for an independent project (for example, one who waits until the 8th semester, end of senior year). It must be recognized that many projects can barely be started in one semester. Rather than do a superficial job, such a student might be better off taking a standard course.

WHEN?

When to do it:

Seniors:

Most students enrolled in BIOL 1950/1960 (directed research) are seniors. An advantage to this is that they have background and perspective from prior coursework. A disadvantage may be that if this is the very first exposure to research, it is late for getting a sense of whether graduate school would be a good choice. It may also seem late for developing a working relationship with a faculty member. These may be problems only if a student intends to go to graduate school or medical school immediately following graduation from Brown! (Remember that a large percentage of students wait *one or more* years before entering graduate or professional school, with no harm done.) Note that many students mitigate these problems by beginning projects in the summer prior to their senior year.

Juniors:

Some students begin research as juniors, depending on their coursework, experience, advanced standing, lab experience, and available time.

Sophomores:

Occasionally, sophomores begin research for credit, but due to time and intensity, students should consult with an advisor if this is appropriate timing.

Freshmen:

RARE. First year students are getting acquainted with the curriculum, new environment, and assessing other course demands. Volunteering in a lab is possible if extracurricular time permits.

Summer:

Many arrangements incorporate the summer. For example, a student may start a project during the summer and carry it through the next semester or two. Or, a project started during the academic year may continue through the following summer. Funding may be available, through the UTRA (Undergraduate Teaching and Research Awards) programs (deadlines early February), or through individual faculty member's grant support.

When to PLAN it:

Remember, once you've determined *when* to begin, start planning during the academic year prior to the one in which you intend to begin your work. If you are pursuing a Summer Fellowship at Brown, these arrangements need to be made even earlier, keeping the February application deadlines in mind.

WHERE?

WHERE to do it:

You have the following choices:

Campus-based labs (these include the Ship Street facility) -The advantage to campus based labs is that the faculty, principally engaged in research and teaching, are experienced with undergraduate student projects. They know how to train students, and what to expect from them. There may be other undergraduates working in the same lab, along with graduate students, and postdoctoral fellows. Along with the professor, this makes for a lively, interactive group. Yet, in spite of such a group, students can and should expect access to and attention from the professor. The shuttle runs on a schedule between College Hill and Ship Street.

Hospital-based labs: You may wish to work at one of the eight hospitals* affiliated with Brown. Advantages include: a different ambiance, away from the student populace; a sense of the real world; and access to the clinical environment. Remember, however, that the clinical responsibilities of your sponsor *may* limit his or her accessibility. A disadvantage is that travel adds time. *Do you have a car? Do you have a bicycle? Consider the weather. Consider conforming to bus schedules.* These factors may affect the convenience of your plans.

***Affiliated Hospitals**

Butler Hospital (psychiatric facility)

Emma Pendleton Bradley Hospital (neuronpsychiatric hospital for children)

Memorial Hospital of Rhode Island (general hospital and Family Care Center)

Miriam Hospital (general hospital)

Rhode Island Hospital (general hospital)

Veteran's Administration Medical Center

Women and Infants' Hospital

HOW?

How to go about finding a project:

First, to burst two bubbles for you:

1. You don't do not need to dream up a unique project all by yourself. "Independent Study" projects are really directed research experiences, aspects of on-going research. You will learn about your sponsor's research in detail, including relevant techniques that may require practice. Remember that independent does not mean in a vacuum. A lab is a community, with opportunities for questions, discussions and seeking help. What distinguishes you is that you are not hired to perform a particular measurable service; instead you are given a chance to learn, work, understand and try new things.

2. In general, you don't need extensive prior laboratory or research experience. It isn't usually expected. You are expected to read, learn and practice as you go. It is true that a few labs and projects may require specific background, but faculty will usually indicate this at the outset. What you should have is adequate coursework to give you perspective on your project. For example, if a project has a biochemical basis, you should have had a least one biochemistry course (or equivalent experience).The same goes for genetics, physiology, etc.

Now, how to proceed. There are several routes.

- You may take a BioMed course and enjoy the material and instructor. (Instructors often divulge the nature of their research during lectures.) You may ask whether there is an opportunity in that instructor's lab.
- You may have done research elsewhere, perhaps during the summer. You may thus have a particular idea you would like to pursue. You would try to find the person at Brown who could best help you develop your idea.
- You may **not** have a clear idea and need some input. **This** is the case for most students.

The PRINCIPAL RESOURCE for research opportunities is the Projects Collection found on line via the biology undergraduate website: http://bms.brown.edu/bug/ugres.

This has information and contact information for faculty offering projects, and is organized by department, alphabetically, and by keyword search.

WHAT AND WHO?

WHAT to do and with WHOM:

Once you have identified some prospects and made a few appointments, **prepare yourself**. Read an article or two; find out what the person teaches; be prepared to ask intelligent questions.

The First Meeting

At this meeting, you will chat with your potential sponsor, in their laboratory or office. Sponsors look for commitment, enthusiasm, ability, perhaps some special course background, and an overall sense that time devoted to you will benefit all parties concerned. If you are pursuing a hospital-based opportunity with the chance for patient contact, consider also the impression made with your personal appearance.

The Decision

You should consider the following:

1. This is a **course**; quite possibly two sequential courses, and, perhaps part of your concentration program. Will the experience you get be commensurate with what you would expect to learn by taking one or two standard classroom courses?

2. Advantages and disadvantages of **campus vs. hospital-based laboratories** (see also “Where” section).

3. **The faculty sponsor**. Consider personality dynamics. Will you get along? Are you intimidated? Will you feel comfortable asking questions, getting trained in techniques, or help with concepts? Will there be regular meetings to discuss the literature or your data and progress? For hospital-based labs, you may be the only undergraduate student your sponsor may have substantial clinical responsibilities. If your main contacts will be research associates or technicians, *meet them*. Will they be willing to help you? Are you satisfied with this arrangement?

4. **Time**. How much will the project require and in what clusters? Some experiments require multi-hour blocks; others, a few hours each day or every other day. Night work may be involved, since some experiments may require attention at set intervals and you may be responsible. How many average total contact hours per week are expected (adding travel time)? *Will your schedule permit this*? Consider your other courses and labs; extracurricular activities; *even* (no small thing) *time away for medical school interviews*! Be honest with yourself. If your life style *cannot* or *will not* jive with the time demands of a certain project, look elsewhere.

5. **The Project Itself**

   a. **Understanding** - Do you have adequate educational background to deal with this project? Can you make sense of important supporting literature?

continued

b. **Time and Detail** - Some projects pose interesting questions that will ultimately have interesting answers, but the road there (your job) might be paved with tedious minutiae. Be realistic: research is hard work, repetitive and techniques often don't work the first time. It is not flashing lights of new knowledge and news releases. Don't be wooed by promises of potential publications. A publishable paper might be generated by your work, but making this your preconceived goal could lead to disappointment. The success of experiments cannot be obtained. Furthermore, obtaining substantial data takes time. That is why two semesters are strongly recommended. (Honors candidates often spend summers and semester breaks as well.)

c. **Techniques** - What skills are required and how quickly can they be learned? Sometimes students spend whole semesters working out a protocol before beginning data collection.

d. **Warnings** - Worry, if:

- A sponsor is vague about a project, and tells you to "call when you return in September".
- It appears that you'll be tagging along in the lab, waiting for others to get started before you can begin.
- The project does not seem well-conceived (a tough one for you to judge). Seek your concentration advisor's help.

e. **Be glad if:**

- Your sponsor suggests articles or texts for you to read before formally beginning the project (during break, the prior summer, or the prior semester). This will help you hit the ground running when the semester begins.

Choices

If your first choice doesn't work out, take heart. You should investigate more than one possibility, for comparison's sake. This is **not** casual shopping, but important information gathering. Independent Study is an experience that can range from outstanding to mediocre to waste of everyone's time. Aim for outstanding!

Help

Your **concentration advisor** should be consulted during your planning process. Ask for help at any or many point(s) along the way. Your advisor must ultimately sign off on your proposal form (see below), an indication that in his/her opinion, your project is a suitable component to your academic program. So INCLUDE your advisor in the process. He/she may give you some excellent ideas. Remember also that Dean Thompson is accessible for assistance with this process.

Registration

Please see our site: Registering for BIOL 1950/1960: http://bms.brown.edu/bug/ugres.

THAT'S NOT ALL, FOLKS…

Evaluation:

Students often take this course for a grade. Whether or not they ought to is a separate question, but the means of evaluation must be agreed upon at the outset. In fact, the B1950/1960 Proposal form requires that there be a *written or oral* (or both) basis of evaluation. Your evaluation should not be based on the volume of positive data collected, but on the quality of your effort.

Here is a suggestion that will generate a PAPER, in ANY case: Keep a lab notebook or journal. Write down everything you do each time you are in the lab; tabulate your data here; keep notes on techniques, etc. During the semester, write up a historical background, based on literature you have reviewed. Focus on what led to the hypothesis you are now testing. Write up a materials and methods section. For help with this format, use a standard published paper for an example. Organize your data (charts, graphs, histograms, lists) and statistical tests, if any. Describe these data in words (your results section). Now you are ready for a discussion of the results, considering what actually turned up. Touch upon what did not get done: What additional data are needed for a more complete answer to your original question? Suggest experiments that would continue your line of reasoning. What if nothing "worked"? Perhaps you have negative results, or techniques failed so that no data were obtained. You can still use the same format described herein, to document your efforts. Include what you do have, and use the Discussion for commenting on what went wrong, what could be corrected, and whether the hypothesis should be pursued further by a different analysis ...etc.

YOUR PAPER SHOULD DOCUMENT YOUR WORK. It should reflect your actual activity and background work in a very real way. Such a paper can be written at the end of every semester you are registered for the course. In case you planned on two semesters but wish to terminate after one, this paper can be a good basis for a clean stopping point.

Some students take an **Incomplete** at the end of the first semester (assuming that they will continue for a second semester). Although it is not recommended, you may discuss this option with your sponsor, and clarify its conditions.

HONORS:

Please see site URL: http://bms.brown.edu/bug/ugres.

OTHER WAYS OF GETTING RESEARCH OR LAB EXPERIENCE

1. **Volunteer in a lab** (campus or hospital) during the school year. The Questionnaires in the Research Projects Collection indicate whether sponsors will allow this. No academic credit is awarded, but less time is required for a beginning exposure to research.

2. **Work ($) in a lab** during the school year. If you are on work/study or want a part-time job, an alternative to food services, etc. may be a lab maintenance job. Even if it is menial work (bottle washing), you may prefer the environment and get a sense of what goes on in a lab. Check with student employment and the bulletin board outside the *Biology Undergraduate Affairs Office* (Room 122, Arnold Lab); ask your course instructors or other faculty in the Division.

3. **Summer Programs**. There are over 700 summer programs listed in the Internships in Biology indexed collection. These programs are found all over the USA, and some abroad. Deadlines for applications to some begin as early as December, and through until May. Use this collection during University hours, Monday - Friday; no appointment is necessary. It is just outside the *Biology Undergraduate Affairs Office*, Room 122, Arnold Lab.

4. **Summer jobs at Brown**. Each year, a collection of positions in the Division (campus and hospital) is compiled, beginning in mid-February. There are paid, volunteer and work/study jobs with BioMed faculty. Ask at the Office (beginning late February) for this listing.

5. **Summer research fellowship programs at Br**own. By proposal/funded by UTRA program.

6. **Find a summer research job** (rather than a formal internship program). **The Step-by-Step, Do-it-Yourself JOB SEARCH WORKBOOK** on line at: http://bms.brown.edu/bug/ditlp.html suggests resources and methods for lining up jobs in the natural sciences.

7. Participate in the **Day in the Life program**, with a local or Brown-affiliated mentor. This is a job-shadowing program that invites Brown undergraduates to spend a day with a professional in the life or health sciences. Information is available at the *Biology Undergraduate Affairs Office*.