

# Guide to Independent Research



**WELLESLEY COLLEGE**  
**Department of Biological Sciences**  
**2019 - 2020**

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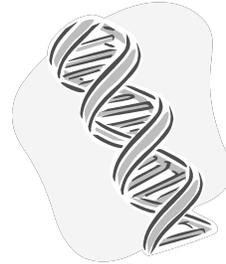
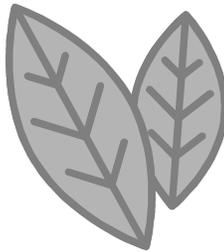
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## WELCOME

### *Why should I do independent research?*

One of the exciting and rewarding experiences Wellesley offers is the opportunity to work closely with a faculty member on an independent research project. Research is the foundation for the knowledge you learn in your classroom. Not only will you have the opportunity to participate in the process of discovery, but you will also have an opportunity to learn new techniques, to present orally or through posters, to think creatively and to problem solve. Independent research offers an experience that is different from the labs attached to your courses. Doing research is by far the best way to learn about science.

Many of our alumnae from the sciences cite undergraduate research with a faculty member as the single most influential factor in their choice of career. Talk to your peers and faculty members and learn more about doing independent research. Welcome to this exciting program!



## FAQs about independent research

- *What is the right experience for me?*

You can choose from several different research options: BISC250, 250H, 350, 350H, 355/365 and 360/370. Thesis research options, BISC355/365 and BISC360/370, are for seniors only. Details of BISC355/365 and BISC360/370 are provided later in this booklet. BISC250 and 250H are open to all students. If you are starting research as a 1<sup>st</sup> year or a sophomore, consider 250 or 250H. BISC350 and 350H are ordinarily taken by students who have taken at least four units in biology. All research courses require permission of the instructor.

**BISC 250** Research or Individual Study  
Semester: Fall, Spring Unit: 1.0

**BISC 250H** Research or Individual Study  
Semester: Fall, Spring Unit: 0.5

**BISC 350** Research or Individual Study  
Semester: Fall, Spring Unit: 1.0

**BISC 350H** Research or Individual Study  
Semester: Fall, Spring Unit: 0.5

**BISC355/365** Biological Sciences Thesis Research

A two-semester investigation of a significant research problem that culminates in writing and defending a thesis. Does not lead to departmental honors

**BISC360/370** Senior Thesis Research

A two-semester investigation of a significant research problem that culminates in writing and defending a thesis. Typically requires a GPA of 3.5 in the major and leads to departmental honors.

- *I am nervous but I still want to try out research*

If you would like to see what working in a lab is like but you are not quite ready to spend a lot of time in the lab, you might consider 250H or 350H. The H stands for 0.5 unit rather than the 1.0 unit you would earn by signing up for a 250 or 350.

- *How much time should I commit to independent research?*

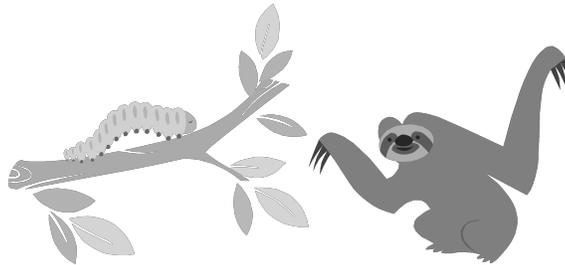
For BISC250 or 350, you should spend about 10-12 hours per week in the lab. For 250H, you should spend half the amount of time (5-6 hrs per week).

- *Does independent research fulfill the major requirement?*

No, BISC250, 250H, 350, 350H, 355/365 and 360/370 do not fulfill any of the major requirements.

- *What is the difference between 355/365 and 360/370?*

Both are a two-semester investigation of a significant research problem that culminates in the preparation of a thesis and defense of that thesis before a committee of faculty from the department. BISC355/365 does not lead to departmental honors. BISC360/370, which ordinarily requires a GPA of 3.5 in the major, does lead to graduation with honors in Biology.



## So where do I begin?

The first step to doing an independent research is to find a research advisor. Go to the Biology website (<http://wellesley.edu/biology/>) and see whose research you find interesting. You can also go to the faculty's webpage if it is available. Additionally, you may want to look up some of their papers to see if their work interests you. Then contact the faculty and express your interest in their work. Try to contact them early – before the summer if you want to start working in the fall, and during the fall if you wish to start in the spring. Labs do fill up, so the earlier you talk to the faculty, the better the chances of finding a lab. Once you have a research advisor, you and your advisor will discuss potential research projects and plan out your research experience.



**GUIDELINES FOR THESIS (355/365 or 360/370)**  
**STUDENTS AND ADVISORS**  
Department of Biological Sciences

**I. Overall Aim of the Thesis Program**

The main goal of the thesis program is to develop independent research capabilities and to encourage creativity, independence and initiative on your part. There are two options for thesis research. BISC360/370 normally requires a GPA of 3.5 in the major and leads to departmental honors. BISC355/365 does not have a GPA requirement nor does it lead to departmental honors. In both cases the thesis culminates in the writing of a research paper and an oral defense of the work. The primary goal is not necessarily for you to obtain positive conclusive results in a given project, but to develop skills that enable you to complete a thorough literature search, design an experiment, analyze results and propose future experiments. In addition, you should work closely with the faculty advisor and members of the thesis committee.

**II. General Information**

BISC (or BIOC or NEUR, depending on the student's major) 355 or 360 is elected for one unit of credit, followed by a unit of 365 or 370 contingent upon successful completion of the first semester. You are encouraged to begin the research project in the summer preceding the senior year. This might involve a literature search or working with the faculty advisor in the laboratory or field that summer.

Each unit of credit is estimated to require 10-12 hours of work per week. You should be prepared to spend this amount of time on the thesis project. The advisor's expectations for your time commitment to the project should also be consistent with this guideline.

The Office of the Registrar has some general guidelines for completing a thesis which can be found at: [http://www.wellesley.edu/registrar/honors/thesis\\_process](http://www.wellesley.edu/registrar/honors/thesis_process)

**III. Registration Requirements**

All junior majors will be invited to consider the Thesis Program. If you are interested, you should talk to faculty members whose research interests you, usually in the fall or winter prior to your senior year. Once a faculty member has agreed to serve as your thesis advisor, you should notify the department in writing. Final acceptance into the thesis program is contingent upon a vote of the department faculty. For 360/370 typically, a grade point of 3.5 or higher in courses in the major is required. In rare cases, after a positive vote of the Biology

faculty, students with a departmental GPA  $<3.5$  may also be recommended for 360/370 to the College Committee on Curriculum and Instruction. There is no GPA requirement for 355/365. Once approved by the Department, your advisor will submit your name for registration for BISC (or BIOC or NEUR) 355 or 360.

In order to continue thesis research for a second semester (BISC 365 or 370) the following requirements must be fulfilled:

- 1) A complete draft of the thesis Introduction must be turned in by the January option date.
  
- 2) Students should work with their advisor to assemble a Thesis Advisory Committee. Each BISC thesis student must have a minimum of 3 faculty members on their Thesis Advisory Committee (their advisor plus 2 additional faculty members), and at least 2 of these faculty members must be from the Department of Biological Sciences. Each BIOC thesis student must similarly have a minimum of 3 faculty members on their Thesis Advisory Committee (their advisor plus 2 additional faculty members), with at least one faculty member from the Department of Biological Sciences and at least one faculty member from the Department of Chemistry. Students must meet with their Thesis Advisory Committee at least once during the Fall semester. At the end of this meeting, the Thesis Advisory Committee will decide whether the student should continue with their thesis research during the spring semester. The committee might propose that the student transform the experience into a BISC350.

In addition, for 360/370 students, course grades must be maintained during BISC 360 research. If a 360/370 student receives grades below the level achieved at the time her thesis project was approved, the Department will review the situation and determine whether the student may continue with the BISC 370. Receiving grades below a B during the first term will generally disqualify a student from the honors thesis.

#### **IV. The Thesis Examination Committee**

The examination committee is composed of:

- The student's Thesis Advisory Committee.
- One tenured Wellesley faculty member in a field outside the department, who represents the Curriculum Committee. This person is chosen by the student in the spring and only attends the oral examination.
- The Department Chair, or their designated representative.



## **V. 2019-2020 Calendar for Thesis Program**

### **September: Request faculty to be on the thesis committee**

At the beginning of the semester, you should contact 2 faculty members to serve on your committee.

### **Late September: Informational meeting**

The Department's thesis student coordinator, will host a meeting for students and advisors to review the expectations and requirements of the thesis program (BISC355/365 and 360/370) and to answer any questions you might have.

### **October/November: 1<sup>st</sup> Committee meeting**

Your advisor and the two faculty members of the committee should meet with you during the first half of the 355 or 360 term at a time convenient for all committee members. At least 3 days prior to your meeting, you should distribute a 1-2 page outline of the research project or preliminary data from previous work on the project. During the meeting, you should also be prepared to give a 10-15 minute presentation on your progress as well as any problems you are encountering. Your committee members are there to provide support and help, so seek advice. Ideally, the committee should meet with you frequently, and each member should actively participate in the continuing evaluation and development of the project.



### **January: Deadline for introduction**

Before your advisor can register you for BISC365 or 370, you are required to turn in a draft of the introduction section for your thesis to your research advisor. You are encouraged, but not required, to give a copy of your introduction to your committee members.

### **January/February before the end of Add/Drop period: 2<sup>nd</sup> committee meeting**

You need to meet with your committee members at a suitable date and time when all committee members can meet and discuss your project and progress. This is an important milestone and a moment to check-in with your advisor and the committee regarding the timing of experiments, data collection, data analysis and writing. Your committee will help you plan the remaining weeks to maximize your experimental and writing efforts, in preparation for the thesis deadline. As mentioned in Section III, at this time, your advisor and the committee will propose the best way to go forward, either enrolling in the BISC365/370 or alternatively transforming the experience into a BISC350. Both experiences are rewarding and productive, many times resulting in student authorship in publications.

A week after this meeting, you will submit to your advisor a deadline schedule to organize the writing of your thesis. Once the writing schedule is approved, it is important to adhere to it to successfully meet the thesis deadline. For some examples of writing deadline schedules see page 11.

### **April 24: Thesis deadline!**

By noon on this day, the official copy of the thesis should be deposited into the College's repository. Information from the Office of the Registrar will be sent closer to this time. More information can be found at the Registrar's current website, [http://www.wellesley.edu/registrar/honors/thesis\\_process](http://www.wellesley.edu/registrar/honors/thesis_process).

### **April 28: Presenting your work at the Ruhlman conference**

The Ruhlman conference provides a wonderful opportunity to condense your results and their implications and present them to the college community. It is also great practice for your upcoming oral exam and a chance for other Biology Department members that are not in your committee to hear about all your wonderful work. Please remember that the Conference also has a set of deadlines for presentations.

## **Date TBD: Biology Thesis Student Final Gathering**

We will meet one last time to celebrate your accomplishments (at a date to be determined). Refreshments will be served.

## **May (during reading period): The oral exam**

## **Prior to graduation: Revised thesis due**



### Examples of writing deadline schedules:

#### *EX1:*

- by 1/14 outline of methods
- by 1/31 draft of methods (in addition to the introduction)
- by 2/15 detailed outline for results and discussion (including "mock figures")
- by 3/25 revised outline for results and discussion
- by 4/10 1st draft of completed thesis including abstract and properly formatted citations, etc.
- by 4/16 2nd draft of completed thesis
- 4/24 thesis due to Registrar's Office and committee

#### *EX2:*

- by 12/10 outline of the introduction topics
- by 1/14 outline of methods
- by 1/31 draft introduction and methods
- by 2/15 list of tables and figures and detailed outline of results
- by 3/15 outline of discussion topics
- by 3/25 completed tables and figures and draft of results
- by 4/1 1st draft of completed discussion
- by 4/10 1st draft of completed thesis including abstract and properly formatted citations, etc.
- by 4/15 2nd draft of completed thesis
- 4/24 thesis due to Registrar's Office and committee



## **VI. The Thesis**

The research project will culminate in the writing of a formal thesis and in an oral discussion with an examination committee. You should meet with your advisor frequently to discuss data, and should begin writing rough drafts and submitting them to the advisor as early as possible. A detailed draft of the Introduction should be reviewed with the advisor by the end of the first term, and is required prior to proceeding with the BISC 365 or 370. Rough drafts should be read by the advisor several times before the final draft is delivered to the Registrar's Office. The thesis should be well written, neat in appearance and carefully proofread. There is no set length for the thesis. It should be as concise as possible while being a complete report of the research project.

The Thesis should be written in journal format consisting of the following:

- Title Page
- Abstract
- Introduction
- Materials and Methods
- Results
- Discussion
- Literature Cited

### **Title Page**

The title page should include title, author, faculty advisor's name, department, Wellesley College and date.

It should also include a copyright statement including the student's name, faculty advisor's name and the year.

*This material is copyrighted by student and advisor, date.*

Note: If students utilize drawings, etc. from copyrighted books or journals, these copies cannot come under the student's copyright. The source of each such figure must be acknowledged.

After the oral examination, if the thesis committee recommends approval of the thesis for the degree with honors, the following statement should be added to the title page in the final copies of the thesis.

*This material is submitted as partial fulfillment of a B.A. degree with honors in major.*

## **Abstract**

The Abstract should be no more than one page of single-spaced type, containing 100 to 200 words.

## **Introduction**

The introduction should present the major question being addressed, and should include enough background information so that an uninformed reader can appreciate the development of the problem and understand the motivation for the research. The thesis may later be used as a reference for others working in this area, and the Introduction therefore should provide a thorough foundation for the project.

## **Materials and Methods**

The materials (chemicals, biochemicals, animals, cell types, etc.) used in the research should be included with their sources. Isotopes should include specific activity. Methods should be written clearly so that the reader could repeat the experiment based on the information provided. A more specific step-by-step description can be included in an appendix if necessary.

## **Results**

The results should be organized for clarity. Data should be displayed in tables, graphs, and photos (*e.g.* cells, gels, blots, etc.). All graph axes must be labeled and each table, graph, and photo must have a legend that contains sufficient information so that the reader does not need to consult the text. Each figure and graph must also be referred to and discussed in the text itself.

Tables and figures should be clearly presented in a form that would be acceptable to a major journal in the field. Raw data and detailed methods should be placed in appendices following the body of the thesis.

## **Discussion**

This section places the data in the context of the field, and should include a comparison of the author's results with similar data found in the literature. Similarities and differences between published data and thesis results should be discussed. The author should state the conclusions that can be drawn from the results and explain how this information fits into presently held hypotheses. The author should present alternative interpretations and hypotheses when necessary.

The Discussion section should also include a statement of possible future directions suggested by this work.

### **Literature Cited**

Each reference cited in the thesis should include:

- all authors
- the year of publication
- the title of the article
- the name of the journal with volume and page numbers

Examples:

*Textbooks:*

Campos-Ortega JA, Hartenstein V. 1997. The embryonic development of *Drosophila melanogaster*. Springer Verlag, Berlin, Heidelberg.

Journal articles:

Cayre M, Malaterre J, Scotto-Lomassese S, Strambi C, Strambi A. 2002. The common properties of neurogenesis in the adult brain: from invertebrates to vertebrates. *Comp Biochem Physiol B Biochem Mol Biol* 132:1-15.

Kemperman G, Gage FH. 1999. New nerve cells for the adult brain. *Sci Am* 48-53.

References should be either numbered in the sequence in which they appear in the text *or* in alphabetical order by the first author. Determine which format your advisor prefers.

## **VII. Thesis submission procedure**

### **1) Initial submission of the thesis (April 24, noon)**

By noon on April 24, the official copy of the thesis should be deposited into the College's repository. Information from the registrar will be sent closer to this

time. More information can be found at the Registrar's current website, <http://www.wellesley.edu/registrar/honors>.

**The student is responsible for electronically submitting a copy of the thesis:**  
<http://www.wellesley.edu/lts/collections/archives-and-special-collections/archives/thesissubmission>

**In addition, the student should email an electronic copy of the thesis to the department chairperson (Andrea Sequeira). The LTS will send electronic copies of the thesis to your committee members.**

**Make sure you deliver the thesis on time: there will be no extensions!**

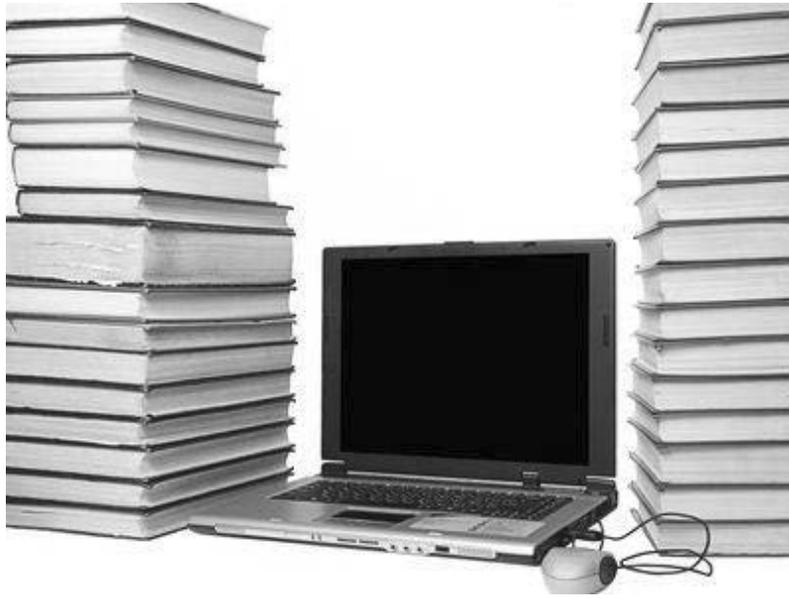
\*For the oral examination, the student and advisor can usually use one of the rough drafts.

## **2) Final Thesis Submission**

At the time of the oral examination, suggestions for thesis revisions will be made and a deadline for final submission will be set. Once these revisions are complete, the student is responsible for submitting the edited document electronically to the college's repository and working with the department academic administrators to arrange for binding.

## **3) Institutional Repository for Archiving Theses**

Wellesley College Archives manages electronic copies of honors theses in an institutional repository. For one reason or another, you may wish to place an embargo (make your thesis unavailable to the public) on your thesis for a certain duration of time. Typically, the reason to embargo is to prevent the public dissemination of data of an ongoing research project that is unpublished. You should discuss with your thesis advisor whether your thesis should be embargoed. Please see: <http://www.wellesley.edu/lts/collections/archives-and-special-collections/archives/thesissubmission> for more information.



## VIII. Thesis Oral

### 1) Scheduling

The thesis discussion will take place during reading period. Dates will be published by the Committee on Curriculum and Instruction.

The advisor is responsible for scheduling the discussion and for making sure that committee members can come at that time. The advisor should consult the master schedule at the Department Office as well as the committee members' individual schedules. After a date and time when all participants are able to attend has been agreed upon, the advisor should send letters of confirmation to each committee member. Individuals other than those on the Committee may attend the oral discussion at the invitation of the advisor. The advisor should consult with the student before issuing such an invitation. Requests to attend the discussion should be addressed to the advisor in advance.

### 2) The format of the oral exam

The oral discussion will last about one hour. After introductions of the participants, the student should begin with a fifteen-minute introductory statement giving background information, summarizing the project or discussing particularly interesting data or conclusions. The committee members will then address their questions to the student for the remainder of the hour.

Questions should be directed towards clarification of the methodology and data, and evaluation of the data. The intent is for students to share her exciting research discoveries as well as the depth of her understanding of the project and her insights about future directions the project could take. This is your moment to shine!

## **IX. Suggestions and Recommendations for thesis students**

- Be prepared to work on the 365 or 370 project over winter term in January and, if necessary, during Spring Break. If you need on-campus housing, you must arrange this during the fall semester.
- Start writing early. The Introduction must be in draft form by the January option date in order to continue research in the second term.
- Compile results as you go. Do not collect a notebook full of numbers and wait for the spring thaw to do calculations; compile tables and figures, and begin the evaluation of your data.
- **Backup your copy of the thesis frequently and keep copies in several places!**

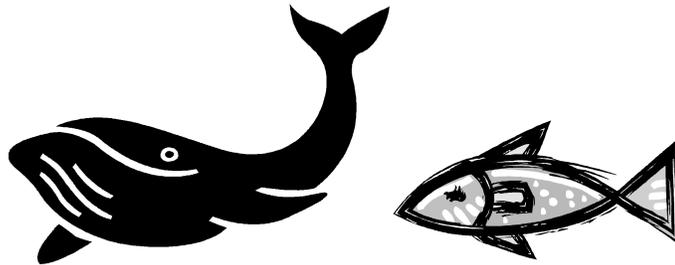


### **Funding for BISC250/250H/350/350H/355/365/360/370**

Each student is allowed a stipend to defray expenses of her research. Amount of the funds available varies, but may be estimated at \$500 per unit. The costs, which must be covered by this money, include:

- Laboratory chemicals
- Photocopying
- Photography
- EM/instrumentation charges

The students doing off-campus research may also use these funds to defrays parking and transportation costs. The account number will be issued to your on-campus research advisor at the beginning of the semester.



## **The Policy on the Use of Off-Campus Advisors for Wellesley Thesis Projects**

Although the department does not encourage off-campus thesis work for most students, we do recognize that in some situations such an arrangement may be in the best interest of the student. In such cases, the student must find a faculty member of the Biological Sciences Department who is willing to sponsor the project. This faculty member is considered the primary advisor for the overall thesis experience, and therefore should be familiar with the subject area in which the student will be involved. The student must prepare a 1-2 page summary of the proposed project, including information about the lab in which the project will be done (research site and the names of the head-of-lab and the person who will serve as the student's immediate supervisor). The outside advisor may be a faculty member or postdoctoral fellow at another institution. Graduate students may serve only as technical advisors and day-to-day supervisors of a project under the primary supervision of such a faculty member or postdoctoral fellow. Laboratory technicians are not considered appropriate supervisors for the project. It is strongly preferred that the outside advisor be someone with whom the student has already worked (for example in a summer research capacity). In this case a preliminary report should be made available by the student to the department describing the project, and presenting data accumulated to date. The on-campus advisor is responsible for presenting the student's case to the full department, which will then evaluate the student's proposal for an off-campus thesis experience.

Once a proposal has been accepted by the department, the following guidelines should be followed to insure that the research work and the thesis are progressing:

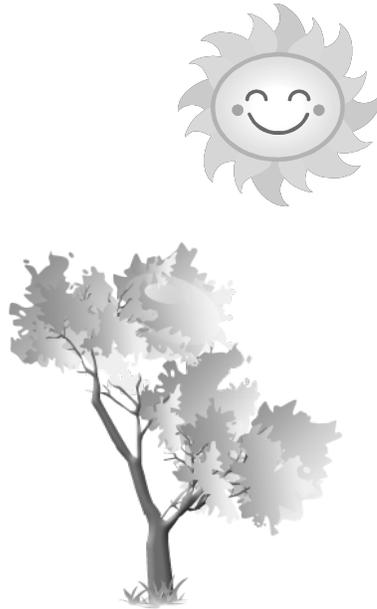
1. By the end of September, there should be an oral discussion between the on-campus advisor and the off-campus supervisor concerning the research project so that both parties are informed of the other's expectations regarding the student's level of independence and the laboratory's support of that student. The supervisor also should be informed that the on-campus advisor will direct the writing of the thesis.
2. During the first term, there should be an on-campus meeting of the full thesis committee, including the off-campus supervisor. The student will not be allowed to register for the 365 or 370 unless this meeting has taken place.
3. The student must meet with the on-campus advisor on at least a monthly basis throughout the year, to review research results and any changes in experimental plans. The student is encouraged to bring laboratory notebooks/ data and to prepare a short written summary for each of these meetings so that research progress is documented.
4. The on-campus advisor, not the off-campus advisor, will serve as the overseer of the written thesis. Since most theses require several written drafts prior to the final presentation, the on-campus advisor and the student should plan a schedule for submitting sections of the thesis for comments and evaluation by both advisor and supervisor. Input from the off-campus supervisor is encouraged, but the student is ultimately responsible to the on-campus advisor for the written product.
5. As with on-campus theses, a complete draft of the Introduction is required by the end of the first term. A student may not continue with the second semester of research (BISC 365 or 370) unless the Introduction has been turned in to the on-campus advisor.

## Summer Research Opportunities

Many students' first research experience occurs during the summer, either on-campus or off-campus. Wellesley offers generous stipends to support students to conduct research over the summer. Students wishing to conduct research over the summer with one or more of the Biology faculty are advised to contact faculty members whose research interests the student.

The applications for summer research are generally due mid-February, and decisions are made available within a few weeks. The application will ask you to identify professors you wish to work with, and it is in your best interest to meet with the faculty ahead of the application, discuss potential projects and ask if there is a position available in the lab during the summer. Start contacting professors early!

You can access the summer research application through the Science Center website:  
(<http://www.wellesley.edu/sciencecenter/students/opportunities/summer/sciaward>).



**2019 – 2020**