HARVARD UNIVERSITY

lifesiences
concentration cluster

2019-2020 Advising Booklet

Biomedical Engineering • Chemical & Physical Biology • Chemistry
Human Developmental and Regenerative Biology • Human Evolutionary Biology
Integrative Biology • Molecular & Cellular Biology • Neuroscience
Psychology (Cognitive Neuroscience and Evolutionary Psychology)
Welcome to the Life Sciences at Harvard!

The Life Sciences encompass a broad array of disciplines that share a focus on understanding living systems. Given the rapid pace of scientific discovery, the Life Sciences at Harvard is an exciting place to be. It’s easy to be part of the excitement by getting involved in research opportunities, whether through courses or supervised projects in faculty labs. Students may choose between nine Life Sciences concentrations:

- Biomedical Engineering
- Chemical and Physical Biology
- Chemistry
- Cognitive Neuroscience and Evolutionary Psychology, a track in the Psychology concentration
- Human Developmental and Regenerative Biology
- Human Evolutionary Biology
- Integrative Biology
- Molecular and Cellular Biology
- Neuroscience

The Science Education Group has a variety of advising resources. The Life Sciences Concentration Advisors provide students with advice on courses, concentration planning, and research opportunities. Each concentration is overseen by a faculty member who acts as the concentration’s Director of Undergraduate Studies or Head Tutor. Additionally, a dedicated Science Undergraduate Research Advisor (see page 24 of this booklet) helps students in all years and concentrations identify research opportunities and funding for life sciences research both at Harvard and outside Harvard. If you are interested in any of the Life Sciences concentrations, we encourage you to speak with at least one of the Advisors or Head Tutors. We look forward to talking with you!

Note to first-year students and their advisors: Pages 2 and 3 are especially important to first-year students. Students do not specialize during their first year, but instead take courses that provide a foundation for all of the Life Sciences concentrations.

For more information about the Life Sciences, please visit www.lifesciences.fas.harvard.edu
Advice for First-year Students

Students interested in concentrating in the Life Sciences are advised to take courses in Life Sciences, chemistry, and mathematics during their first year and should take the corresponding placement exams.

Placement Exam Information

Placement exams for incoming students are found online. All first-year students should have taken the math placement exam during the summer, and any student interested in the life sciences should have taken the biology and chemistry exams. Placement exam results and recommendations may be found at My.Harvard.edu. For more information about the placement exams, see the First-year Dean’s Office website (http://fdo.fas.harvard.edu/placement-exams).

Course Information

All Life Sciences concentrations share a common foundation consisting of:

• **Life Sciences 1a (LS 1a) or Life and Physical Sciences A (LPS A) – Fall term**
  - Life Sciences 1a (LS 1a) integrates chemical and biological concepts throughout the semester, and applies these concepts to issues of broad interest such as HIV and cancer. The semester culminates in a project in which students propose novel experimental directions for a scientific question of their choice.
  - Life and Physical Sciences A (LPS A), which is aimed at students with less high school preparation in science, introduces topics in general chemistry in the first half of the semester, followed by topics in molecular and cellular biology.

• **Life Sciences 1b (LS 1b) – Spring term**
  - LS 1b covers genetics, genomics, and evolution.

**Life Sciences 50ab (LS 50ab)** is an optional, alternative first-year life science curriculum offering early involvement in original research and incorporation of relevant concepts from math, physics, chemistry, and computer science. LS 50ab is equivalent to four semester-length courses; it substitutes for LS 1a/LPS A and LS 1b, as well as other requirements, as specified by the concentration a student joins. Enrollment is limited to 35 students and requires an application due before classes begin. More details and the application are available online at https://projects.iq.harvard.edu/ls50.

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**Physical Sciences 1**, which is offered in the spring term, is a course that covers topics in chemistry and the physical sciences. It is intended for students interested in the life and physical sciences.

**Physical Sciences 10 (fall) and Physical Sciences 11 (spring)** cover topics in chemistry and the physical sciences and are for students with strong placement scores in chemistry and math. Physical Sciences 10 is intended for those interested in concentrating in physical sciences; however, some life science concentrations accept this course for credit.

Students with an exceptionally strong chemistry background may begin with Physical Sciences 10 in the fall followed by Chemistry 20 or Physical Sciences 11 in the spring. Although first-year students may take either the Chem 17/27 organic chemistry sequence, which begins in the fall term, or the Chem 20/30 sequence, which begins in the spring term, Chemistry 20 is designed primarily for first-year students with an interest in Chemistry. Students considering enrolling in organic
chemistry during their first year are strongly encouraged to consult with the Director of Undergraduate Studies in Chemistry, Dr. Gregg Tucci.

Math: Students begin studying mathematics in their first year according to their preparation and placement scores. Life Sciences 50ab fulfills a math requirement for some life science concentrations.

Course Sequence Recommendations
For First-year students Considering the Life Sciences

The following course sequence is appropriate for most students who are interested in the Life Sciences, regardless of concentration. For more specific recommendations, please read the following pages and talk with a Life Sciences Concentration Advisor.

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences 1a or Life and Physical Sciences A (according to placement) or Life Sciences 50ab</td>
<td>Life Sciences 1b or Life Sciences 50ab</td>
</tr>
<tr>
<td>Math (according to placement)</td>
<td>Physical Sciences 1 or Physical Sciences 11</td>
</tr>
</tbody>
</table>

Advice for Sophomores

After the first year, students can further explore their interests by taking more specialized courses. If you are uncertain about which Life Sciences concentration you will choose, it is possible to take courses during the sophomore year that will keep your options open. We suggest that you read the course sequence recommendations in this booklet and that you consult with a Life Sciences Advisor or Director of Undergraduate Studies (Head Tutor) as you select your courses during the sophomore year.
Concentrating on your concentration?

Here we try to dispel some common myths and supply you with some tips for making a good decision.

Myth 1: High levels of stress are justified in the face of concentration selection.

**Reality:** You can relax. Selecting your concentration is a serious decision, and you should do plenty of research and thinking. But panic is not necessary! Keep in mind that (a) you can change your mind later; (b) you really can pursue what you feel passionate about; and (c) success in most careers does not require a specific undergraduate concentration.

Myth 2: I am the only one who hasn’t yet planned a specific career path, and this is a good reason to feel nervous.

**Reality:** First, you are not alone: while they may not advertise it, many students are in the same boat. Second, your “boat” is an exciting place, and there is no need to be nervous! You will have ample time and freedom at Harvard to take risks, to learn about yourself and the world around you, and to adjust your goals. You can experiment with internships, electives, research and extracurricular activities to explore careers. Choose a concentration that you will enjoy, while realizing that regardless of your choice you will have abundant career opportunities and options after you graduate.

Myth 3: A Life Sciences concentration is not good preparation for Wall Street or Silicon Valley.

**Reality:** Your undergraduate concentration does not dictate your career opportunities. Employers tend to place less emphasis on undergraduate majors and more on a candidate’s skill set. Useful and desirable skills, such as the ability to learn quickly, think critically, solve complex problems, write and speak clearly and persuasively, and analyze information, are absolutely central to the Life Sciences.

Myth 4: If I want to go to medical school, I should choose a particular Life Sciences concentration.

**Reality:** All of the Life Science concentrations allow you to fulfill your pre-med course requirements while leaving significant room for electives and Gen Ed requirements. You may be surprised to learn that when it comes to medical school admissions, no concentration – either within the Life Sciences or outside of science altogether – will give you an advantage. The Office of Career Services’ publication, “Medical School Admissions Data,” contains information about admissions rates according to undergraduate concentration, as well as other helpful information for pre-med students.

Myth 5: (a) I didn’t enjoy an introductory course in X, so won’t enjoy being in concentration X. (b) I loved an introductory course in Y, so concentration Y is the one for me.

**Reality:** Introductory courses may not be the best or only way to get a feel for the courses in a given concentration. They should provide insight into the types of questions being asked and approaches to finding answers, and you may discover whether you feel drawn to and excited by these issues and modes of analysis. Many of your concentration courses will be smaller and more focused upper-level courses and they may differ significantly from introductory courses in teaching style, level of student participation, content, and assessments of student learning. To get a better idea of classes in a given concentration, talk with junior and senior concentrators, professors and advisors, and consult the course catalog in myHarvard.

Myth 6: I will not change my mind about my academic interests and career plans.

**Reality:** We hope that when you graduate from Harvard, you will have grown and changed significantly from the time you entered! Many students change their minds at least once about their concentration, and most people change careers several times. Within the Life Sciences, changing concentrations is relatively easy, because all the concentrations require similar foundation courses. However, if you’re not certain about your concentration choice, make sure you discuss with the appropriate advisors the steps you would need to take in order to switch concentrations after the initial declaration deadline during your Sophomore fall.
Tips for choosing a concentration

1. **Familiarize yourself with the Life Sciences concentrations.**
   
   In addition to reading this booklet, consult the Life Sciences Concentrations website at https://lifesciences.fas.harvard.edu/concentrations, department websites, and the Advising Programs Office guides to concentrations at https://advising.college.harvard.edu/concentrations. These resources will help you gain an understanding of each concentration, even if you are fairly certain of what your decision will be. You may come across a research question or class description that unexpectedly sparks your interest. While the Life Sciences concentrations share broad intellectual goals and foundation courses, they vary in important ways, such as the specific intellectual focus, the type of required courses, and honors and research requirements.

2. **Reflect on your interests and talents.**
   
   Make a list of topics that you find interesting and exciting: situations that compel you to discover more; assignments that have energized you; classes you’ve loved; types of books/websites/blogs you like to read, and how you spend your leisure time. Consider your talents. What comes easily to you? In what areas do you perform significantly above average? What do you struggle with?
   
   What are the common threads? Which concentration(s) best reflect these? Bring this list with you to advising discussions.

3. **Consider whether you want to do research and how the opportunities vary by concentration.**
   
   What are your goals for conducting research? Be sure to speak with students who are engaged in research that you find interesting, and find out how they got started. Does one concentration offer more of the kinds of research opportunities in which you’re interested? If you’re interested in research, but are unsure of where to start, schedule an appointment with the Science Undergraduate Research Advisor. (See the last page of this booklet.)

4. **Ask questions — of yourself, fellow students, faculty, family and others.**
   
   Ask junior and senior concentrators in the fields you are considering about their impressions on classes, research, flexibility, and requirements. Talk with college graduates about their undergraduate concentrations/majors and careers, consult family and friends of family, and speak with Harvard teachers, researchers, staff, administrators, advisors, and alumni. What were their interests as an undergraduate? What are they doing for work? How is their career related to their undergraduate major? What advice do they have for you?

5. **Take advantages of the resources available to you at Harvard.**
   
   Attend advising events, speak with advisors (First-year/Sophomore and concentration), your Resident Dean, and professors in the concentrations in which you’re interested. Be sure to meet with the advisor(s) in the concentration(s) in which you find yourself most interested, earlier rather than later in the process (i.e., by the end of your first year). Don’t worry if you have absolutely no idea of what your academic focus should be! The Life Science advisors are happy to meet with you to discuss your interests and help you make the best choice. The more we know about you, and the more research you’ve done ahead of time, the better we can help you to make the most appropriate choice.

Come and talk to any of the Life Sciences advisors if you’d like more help with your decision!
Biomedical Engineering

The Biomedical Engineering concentration lies at the intersection of the John A. Paulson School of Engineering and Applied Sciences and the Life Sciences cluster. The mission for this concentration can be summarized as follows:

Harvard is committed to broadly educating engineers who will become leaders in the developing field of Biomedical Engineering. The objectives of this concentration include providing students a solid foundation in engineering and its application 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. It enables the acquisition of a broad range of skills and attitudes drawn from the humanities, social sciences and sciences, in addition to engineering, which enhance engineering knowledge and which will contribute to future leadership and technical success.

Biomedical engineering lies at the intersection of the physical and life sciences, incorporating principles from math, 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. An education in Biomedical Engineering enables students to translate abstract hypothesis and scientific knowledge into working systems (e.g., prosthetic devices, imaging systems, and biopharmaceuticals). This enables one to both test the understanding of basic principles and to further this knowledge, and it places this understanding in the broader context of societal needs. This concentration complements the scientific goals of knowledge discovery embodied in the other life science concentrations.

Most BME graduates pursue careers in medicine, engineering, or research. Others have applied their quantitative training and problem-solving skills to pursue careers and further education in fields including business/finance, computer science, pharmacy, education, and law.

Contact Information and Advising:

Director of Undergraduate Studies:
Prof. Conor Walsh (walsh@seas.harvard.edu)

Assistant Director of Undergraduate Studies:
Dr. Linsey Moyer (lmoyer@seas.harvard.edu, 617-496-2840)
Office: Pierce Hall 206C

Dr. Moyer is available to provide pre-concentrators guidance on course selection, laboratory research, and fulfilling concentration requirements. Students should feel free to email her directly to set up a time to meet. More information about biomedical engineering and the School of Engineering and Applied Sciences can be found at: www.seas.harvard.edu/bioengineering.
Course Sequence Recommendations  
For Students Considering the Biomedical Engineering Concentration

Below is a suggested path through the first two years, although there are many possible pathways through the degree. Ordinarily, students should plan on enrolling in two science courses per semester.

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<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
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</thead>
<tbody>
<tr>
<td>Life Sciences 1a or Life and Physical Sciences A</td>
<td>Physics* or LS1b</td>
<td>Physics*</td>
<td>Physics* or LS1b</td>
</tr>
<tr>
<td>Math (according to math placement)</td>
<td>Math (according to placement)</td>
<td>ES 53</td>
<td>Additional Math or concentration course</td>
</tr>
</tbody>
</table>

- First-year students should enroll in Life Sciences 1a or LPS A (fall semester, according to placement) and complete Life Sciences 1b by the end of sophomore year (spring semester).
- *It is highly recommended to complete a physics series by the end of sophomore year. Two semesters of physics (AP 50a, 50b; Phys 12a,12b; Phys 15a, 15b; or PS 2, 3) are required.
- In their first two years, students enroll in mathematics courses according to their preparation and placement scores. Concentrators in Biomedical Engineering must complete either Applied Math 21a and 21b, Math 21a and 21b, Math 22a and 22b or Math 23a and 23b by the end of sophomore year.
- During first year or sophomore year, students should enroll in ES 53 (Quantitative Physiology as a Basis for Bioengineering, fall semester).
- Students subsequently enroll in four additional courses to form the biomedical engineering core: BE 110; ES 123; either ES 181 or ES 112; and one of: BE 121, BE 125, BE 160, BE 191, or ES 227.
- Students must also complete one semester of statistics (AM 101 or Stat 111), one semester of organic chemistry (Chem 17 or 20), and one approved elective.

Students interested in attending medical school can complete the following premedical requirements within the biomedical engineering concentration:

- General chemistry with a lab (one year): Life Sciences 1a/LPS A and ES 181
- Biology with a lab (one year): Life Sciences 1b and ES 53
- Organic chemistry with a lab (one year): Chem 17 and Chem 27 (taken junior year)
- General physics with a lab (one year): Applied Physics 50a & 50b, Physics 12a &12b, PS 2& 3 or Physics 15a &15b.

If you have any questions about Biomedical Engineering, please contact the Assistant Director or Director of Undergraduate Studies.
Chemical and Physical Biology

The CPB concentration emphasizes a quantitative approach to the life sciences that involves using tools, approaches and methodologies from mathematics, chemistry, and physics to study biology. It is ideally suited for students who are interested in applying the knowledge they gain from higher-level coursework work in mathematics, chemistry, and physics to current research in the Life Sciences.

Harvard has tremendous strength in biology, chemistry, and the physical sciences, with renowned teachers and researchers in each of these areas. Students are taught by leading experts in these disciplines and are encouraged to get involved in faculty laboratories. Harvard fosters interdisciplinary research through the departments on the Cambridge and Medical School campuses, as well as through the affiliated Centers (such as the Center for Systems Biology, the Center for Brain Science, and the Harvard Stem Cell Institute). Most CPB concentrators choose to write a senior thesis, and the concentration provides strong support for thesis writers to make it an enriching experience.

Most CPB graduates pursue careers in research. Others have applied their quantitative training and critical thinking skills to pursue careers and further education in fields including business/finance, computer programming, education, engineering, law, and medicine.

**Tutorial:** Shortly after declaring the concentration, students are assigned a tutor from the Board of Tutors in Biochemical Sciences. Concentrators typically meet with their tutor every two weeks to discuss primary research literature in a small group or one-on-one setting. Mentoring on career choices, the research experience, and other academic issues is a logical extension of the tutorial. The tutorial is not taken for credit and therefore does not appear on the transcript.

**Contact Information and Advising:**
*Co-Head Tutors:* Professor Adam Cohen  
Professor Rachelle Gaudet

*Concentration Advisor/ Assistant Director of Undergraduate Studies:* Dr. Dominic Mao  
email: dominicmao@fas.harvard.edu

Dr. Mao is available to provide pre-concentrators guidance on course selection, laboratory research, and fulfilling concentration requirements. For appointment sign-ups and more information about CPB, please visit [https://www.mcb.harvard.edu/undergraduate/chemical-and-physical-biology/](https://www.mcb.harvard.edu/undergraduate/chemical-and-physical-biology/).

For Google map directions to the concentration office, please click here.
Course Sequence Recommendations
For Students Considering the Chemical and Physical Biology Concentration

Ordinarily, students should plan on enrolling in two science courses per semester in the first year and sophomore years as follows:

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
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</thead>
<tbody>
<tr>
<td>Life Sciences 1a or Life and Physical Sciences A or LS 50a</td>
<td>Life Sciences 1b or Life Sciences 50b</td>
<td>MCB 60</td>
<td>MCB 64, 65 or 68</td>
</tr>
<tr>
<td>Math (according to math placement*)</td>
<td>Physical Sciences 1 or Physical Sciences 11</td>
<td>Chem 17</td>
<td>Chem 27</td>
</tr>
</tbody>
</table>

- First-year students should enroll in LS 1a or LPS A (fall semester, according to placement) and Life Sciences 1b (spring semester) as well as math (according to preparation and placement scores). Alternatively, completing LS 50 is equivalent to LS1a, LS1b, Math 19a, and a research course (CPB 91).
- Ordinarily, first-year students take Physical Sciences 1 or Physical Sciences 11 in the spring semester; however, students with an exceptionally strong chemistry background may instead begin with Physical Sciences 10 in the fall semester or organic chemistry (Chem 20) in the spring semester. First-year students considering enrolling in organic chemistry should consult the section regarding Physical Sciences 1 on page 2 of this booklet or consult with Greg Tucci, Director of Undergraduate Studies for Chemistry.
- In the third semester, students ordinarily enroll in organic chemistry (Chem 17). Students with an exceptionally strong chemistry background who took Chem 20 in the spring of their first year typically enroll in Chem 30 in their third semester.
- In the third semester, most CPB concentrators take MCB 60, which provides an integrated introduction to molecular, cellular and developmental biology with an emphasis on biological mechanisms and their frequent connections to medicine.
- In the fourth semester, many CPB concentrators take a second intermediate course, chosen from MCB 64 (The Cell Biology of Human Life in the World), MCB 65 (Physical Biochemistry), or MCB 68 (Cell Biology Through the Microscope). MCB 63 (Biochemistry and Molecular Medicine), a fall course, is another option. MCB 63, 64, 65 and 68 do not require MCB 60 as a prerequisite.

* In their first two years, students enroll in mathematics courses according to their preparation and placement scores. Concentrators in Chemical and Physical Biology must complete either Math 19a and 19b, Math 21a and 21b, or Applied Math 21a and 21b. Math 1b (Calculus) or the equivalent is required for each of these courses.

This suggested course sequence also fulfills requirements for students who decide to concentrate in Chemistry, Human Developmental and Regenerative Biology, Molecular and Cellular Biology, Neuroscience, or Integrative Biology.

First-year students interested in studying the Life Sciences should take the online Biology and Chemistry placement exams. If you have any additional questions about the Life Sciences, please contact a Concentration Advisor.
Chemistry

Chemistry is both a basic science, fundamental to an understanding of the world we live in, and a practical science with an enormous number and variety of important applications. Knowledge of chemistry is fundamental to an understanding of biology and biochemistry and of certain aspects of materials science/nanotechnology, astronomy, physics, and engineering. Students concentrating in Chemistry can do research in Chemistry laboratories as well as in laboratories in Physics, Engineering Sciences, MCB, Harvard Medical School and the Broad Institute. Because of the diverse interests of prospective chemistry concentrators, the Department of Chemistry and Chemical Biology has a very flexible set of requirements that allows each student to select an area of emphasis.

Previous students who earned a degree in Chemistry continued on to Ph.D. programs in Chemistry, Chemical Biology, and Chemical Engineering as well as to professional programs in Law, Business, and Medicine. Several students each year also begin careers in industrial research (biotechnology, pharmaceutical), government, consulting, and finance.

Contact Information and Advising:
Director of Undergraduate Studies: Dr. Gregg Tucci (tucci@fas.harvard.edu)

Dr. Tucci is available to provide pre-concentrators guidance on course selection, laboratory research, and fulfilling concentration requirements. Students should feel free to email him at tucci@fas.harvard.edu to set up a time to meet. More information about the Chemistry concentration can be found at: lifesciences.fas.harvard.edu

Map to Dr. Tucci’s Office, Science Center Room 114
Course Sequence Recommendations
For Students Considering the Chemistry Concentration

Ordinarily, students should plan on enrolling in two sciences courses per semester in the first year and sophomore years as follows:

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Sciences 10, Life Sciences 1a, LPS A or LS 50ab</td>
<td>Physical Sciences 1, Physical Sciences 11, or Chem 20</td>
<td>Chem 17 or 30</td>
<td>Chem 27</td>
</tr>
<tr>
<td>Math (according to math placement *)</td>
<td>Life Science 1b, LS 50ab or Math 19a</td>
<td>MCB 60 or Physics</td>
<td>Chem 135 or CCB 100</td>
</tr>
</tbody>
</table>

- First-year students should enroll in Physical Sciences 10, Life Sciences 1a or LPS A (fall semester, according to placement scores) and Physical Sciences 1, Physical Sciences 11, or Chemistry 20 (spring semester) as well as math (according to preparation and placement scores). Students completing LS 50ab will fulfill requirements for LS1a, LS1b, Math 19a and Chem 91r.
- In the third semester, students ordinarily enroll in organic chemistry (Chem 17 or Chem 30).

* In their first two years, students enroll in mathematics courses according to their preparation and placement scores. Students should try to complete Math 21a by the end of their sophomore year.

A student creating a carefully chosen program of study can simultaneously keep concentration options in Chemistry, Chemical & Physical Biology, Molecular & Cellular Biology and Chemistry & Physics. To do this, it is highly recommended that a student seek individualized advice in the departments of interest.

First-year students interested in studying the Life Sciences should take the online Biology and Chemistry placement exams. If you have any additional questions about the Life Sciences, please contact a Concentration Advisor.
Cognitive Neuroscience & Evolutionary Psychology
(a track within Psychology)

Psychology is the scientific study of the mind. Observing, experimenting, and analyzing human and other minds is our focus. How we do this varies greatly. We can, of course, look at the brain itself to understand the mind and we increasingly do so. But the measure of behavior is our primary method to understand the mind. The kinds of questions psychologists attempt to answer are: How do we perceive the physical world? How do we make sense of the social world? Can we really understand the minds of others? Do the groups others belong to matter? How do memories form and how do we forget? What are the rules by which we reason and think? How much of our behavior is influenced by conscious mental processes? What’s the role of emotion as expressed in the joy, surprise, sadness, anger and fear of everyday life as well as in depression, schizophrenia, and other disorders? What are the causes of these kinds of disorders, and how can they be treated? How do all these processes develop from infancy to adulthood, including the ability for language? To answer these and other questions about the mind, psychologists pay attention to evolutionary factors, the biological bases of behavior, cultural and social inputs, as well as the day-to-day situations in which individuals find themselves.

Cognitive Neuroscience & Evolutionary Psychology is one of the specialized tracks within the Psychology concentration and is part of the Life Sciences cluster of concentration options (a General Psychology track and a MBB track in Cognitive Science are also available). As such, it is one of the major paths toward bridging the Social and Life Sciences at Harvard. The track reflects the increasingly interdisciplinary nature of learning and research in psychology, emphasizing integration across the subdisciplines within psychology (social psychology, cognitive psychology, developmental psychology, abnormal psychology) as well as connections between psychology and the other Life Sciences. Students in this track have the opportunity to study the interplay between traditional interests in psychology such as vision, memory, language, emotion, intergroup relations, and psychological disorders and recent developments in neuroscience and evolutionary science.

To support this learning, the track provides a strong foundation of knowledge in psychology and the Life Sciences, as well as analytical and quantitative skills scientists in these areas employ. A thesis option is available for students with strong interests in research, and requires both the advanced research methods course and a laboratory course. Students who are considering writing a thesis are strongly encouraged to get involved in a research laboratory as early as possible.

Contact Information and Advising:

**Director of Undergraduate Studies:** Professor Jill Hooley

**Associate Director of Undergraduate Studies:** Dr. Katherine Powers ([kpowers@fas.harvard.edu](mailto:kpowers@fas.harvard.edu)) Katie is available to answer questions regarding research, study abroad, careers, pre-med, etc. Email Katie for an appointment.

**Program Coordinator:** Andrea Lynch ([andrea_lynch@fas.harvard.edu](mailto:andrea_lynch@fas.harvard.edu)) Andrea is available for questions regarding fulfilling concentration requirements. Email Andrea for an appointment.

**House Concentration Advisors:** Students are encouraged to reach out to the advisor assigned to their house to discuss requirements and course selection (list available at [https://undergrad.psychology.fas.harvard.edu/advisors](https://undergrad.psychology.fas.harvard.edu/advisors)).

**Undergraduate Office:** William James Hall 218 ([psychology@wjh.harvard.edu](mailto:psychology@wjh.harvard.edu)). Open advising hours are posted on the Undergraduate Program website: [http://www.wjh.harvard.edu/psych/ug/advising/PreConc.html](http://www.wjh.harvard.edu/psych/ug/advising/PreConc.html)

**Psychology Undergraduate Website for detailed information:** [http://undergrad.psychology.fas.harvard.edu](http://undergrad.psychology.fas.harvard.edu)
Course Sequence Recommendations for Students Considering the Cognitive Neuroscience and Evolutionary Psychology Track (CNEP)

Students who are considering the CNEP track should plan on enrolling in the following:

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<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
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<tbody>
<tr>
<td>Psychology 1 (Fall or Spring)</td>
<td>Psychology 975 (Spring; or 971 in Fall)</td>
<td>Basic Methods (Fall or Spring)</td>
<td>Psychology 1900</td>
</tr>
<tr>
<td>Choose one of:</td>
<td></td>
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<td></td>
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<tr>
<td>Fall: LPS A or Life Sciences 1a or LS 50a</td>
<td>Spring: Life Sciences 1b or LS 50b</td>
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<tr>
<td>At least one Foundational Course during first two years: Psychology 14, Psychology 15, Psychology 16, Psychology 18, or MCB 80.</td>
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- First-year students should enroll in one of: Life Sciences 1a or Life and Physical Sciences A (in Fall, depending on placement), Life Sciences 1b in Spring, or LS 50. Students in CNEP are required to take at least one of these courses, but may count more toward concentration requirements, and should take both if considering other Life Science concentrations.
- First-year students should take Psychology 1, Introduction to Psychological Science, which is offered in Fall and Spring. Students with a score of 5 on the Psychology AP exam have met the Psy 1 prerequisite and may begin taking Foundational Courses.
- Students should try to complete one Foundational Course by the end of Sophomore year, and First-year students are permitted to take Foundational Courses if they have completed Psy 1 or Psych AP=5. Students may choose from the following Foundational Courses: Psy 14, Cognitive Neuroscience; Psy 15, Social Psychology; Psy 16, Developmental Psychology; Psy 18, Abnormal Psychology; or MCB 80, Neurobiology of Behavior. MCB 80 or Psy 14 and one other Foundational Course are required.
- In the third or fourth semester, students ordinarily enroll in Sophomore Tutorial (Psy 975; Psy 971 may be substituted) and Basic Methods (Psy 1900).

Pre-med or considering other Life Science concentrations? Students can simultaneously keep several life science concentrations open as possibilities, or complete pre-med requirements together with psychology requirements, by creating a carefully chosen program of study. Such students may wish to consider taking math (according to placement) and PS 1 in their first year and Chem 17 and Chem 27 in their second year. It is highly recommended that students seek out advising about course selection and progression of psychology requirements.

Directions to William James Hall: From the Science Center, walk across the intersection of Oxford Street and Kirkland Street and continue to the right along Kirkland Street. William James Hall is at 33 Kirkland St, and is the 15-story, white building on the left just beyond Annenberg/Memorial Hall. Take the elevators to the 2nd floor and turn right for the Undergraduate Office, room 218.
Human Developmental and Regenerative Biology

Human Developmental and Regenerative Biology (HDRB) is a life science concentration that educates students on how human beings develop from a fertilized egg, are maintained and repaired throughout adulthood, and age till life’s end. Students will be given a broad education in modern life sciences by studying important biological principles within the specific rubric of the developing and regenerating body. By adding an explicit and heavy emphasis on hands-on research opportunities in all four undergraduate years, HDRB will engage students with an interest in research and take advantage of Harvard’s special strengths as a teaching college and research university.

To the extent that “translational” or “applied” research focuses on the application of discoveries made in model systems to humans, the HDRB concentration will embrace the opposite approach. Its emphasis will be on rigorous basic science with a focus on what the study of humans reveals about fundamental biology and reciprocally, what a greater understanding of biology teaches us about ourselves. We believe that a fundamental understanding of how the human organism develops and maintains itself requires foundational knowledge in life sciences, chemistry, and physical sciences, which are in turn dependent on a fundamental knowledge of mathematics. The requirements for the concentration reflect this view.

The framework of the concentration takes advantage of faculty strength in both the Faculty of Arts and Sciences, and Harvard Medical School. HDRB concentrators will focus on human biology with significant emphasis on hands-on research. The curriculum provides a range of courses that will benefit students interested in medicine and biomedical research, as well as other fields in which a comprehensive understanding of human biology is needed.

Contact Information and Advising:

Director of Undergraduate Studies: Dr. Bill Anderson (william_anderson@harvard.edu)

Co-Head Tutors: Professor Kevin Eggan (eggan@mcb.harvard.edu)
Professor Doug Melton (dmelton@harvard.edu)

Education Coordinator: Lisa Fountain (lisa_fountain@harvard.edu)

Dr. Anderson is available to provide pre-concentrators with guidance on course selection, laboratory research, and fulfilling concentration requirements.

More information on the Human Developmental and Regenerative Biology concentration can be found at: lifesciences.fas.harvard.edu
Course Sequence Recommendations For Students Considering the Human Developmental and Regenerative Biology Concentration

Ordinarily, students should plan on enrolling in two science courses per semester in the first year and sophomore years as follows:

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences 1a or LPS A or Life Sciences 50a</td>
<td>Life Sciences 1b or Life Sciences 50b</td>
<td>SCRB 10</td>
<td>SCRB 50 or Elective‡</td>
</tr>
<tr>
<td>Math (according to math placement)†</td>
<td>Physical Sciences 1 or Physical Sciences 11</td>
<td>Chem 17</td>
<td>Chem 27</td>
</tr>
</tbody>
</table>

- First-year students should enroll in Life Sciences 1a or Life and Physical Sciences A (fall semester according to placement) and Life Sciences 1b (spring semester), as well as Math (according to preparation and placement scores). Alternatively, students may take LS 50ab in fall and spring.
- Ordinarily, first-year students take Physical Sciences 1 (PS 1) or PS 11 in the spring semester; however, students with an exceptionally strong chemistry background may instead begin with organic chemistry, and may take either the Chem 17/27 sequence (which begins in the fall term) or the Chem 20/30 sequence (which begins in the spring term). Students considering beginning with organic chemistry are strongly encouraged to consult with the HDRB Concentration Advisor and/or with the Director of Undergraduate Studies in Chemistry, Dr. Gregg Tucci.
- In the third semester, students ordinarily enroll in human developmental and regenerative biology (SCRB 10) and organic chemistry (Chem 17). Students with an exceptionally strong chemistry background who took Chem 20 in the spring of their first year typically enroll in SCRB 10 and Chem 30 in their third semester.

† HDRB concentrators must complete one course in math at the level of Math 1b (calculus) or above, OR a course in Statistics (e.g., Stat 102, 104, 107, 110, 115).
‡ Students have no rigid course requirements to be taken in the fourth semester. This space can be used for SCRB 50, HDRB concentration elective requirements or General Education requirements.

First-year students interested in studying the Life Sciences should take the online Biology and Chemistry placement exams. If you have any additional questions about the Life Sciences, please contact a Concentration Advisor.

Directions to Bill Anderson’s office – Fairchild Biochemistry, Room G55: Enter through the Fairchild entrance (see map) and proceed into the ground floor office suite. Dr. Anderson’s office will be ahead of you on the right.
Human Evolutionary Biology (HEB)

Overview: Evolutionary theory is a pillar of modern science and provides a powerful framework for investigating questions about why humans are the way we are. Human evolutionary biologists seek to understand how evolutionary forces have shaped our anatomy, physiology, psychology, culture and behavior. Research in human evolutionary biology influences many professions and social issues including medicine, politics, business, and gender and race relations.

Some of our key of questions include:

- What psychological, anatomical and physiological traits are uniquely human and why did they evolve?
- Why did our species evolve such large brains?
- Why do humans walk upright?
- Why and how do humans cooperate on such large-scales compared to other primates?
- How has cultural evolution shaped our species’ biological evolution?
- How does our gut microbiota influence patterns of disease?
- How can we better address our current health challenges by learning about our species’ evolutionary history?
- How does the lifestyle of modern humans (e.g., diet, activity levels) impact our evolutionary trajectory?

Research: This is an exciting time to tackle questions of how evolution made us human. Research in HEB provides you the opportunity to learn and contribute. HEB faculty lead projects spanning a spectrum of interests and methods, including fieldwork studying diverse societies or African apes, laboratory-based work on endocrinology, genetics, comparative neuroscience, anatomy, the microbiota and nutrition, and computationally intensive projects on genomics and cultural evolution. Our faculty work closely with undergraduates on research projects of all kinds, for senior theses, and in seminar classes. Examples of HEB research include:

- human and primate nutrition
- comparative neuroscience
- reproductive and behavioral endocrinology
- cultural evolution
- evolutionary genetics and phylogenetics
- human anatomy and biomechanics
- primatology
- paleoanthropology
- human behavioral ecology

Options: We offer students three HEB degree options: the basic non-honors degree, thesis honors, and non-thesis honors. Additionally, students interested in addressing questions about human and non-human primate cognition and behavior from the perspective of human evolutionary biology may pursue a Mind/Brain/Behavior (honors thesis) track.

Contact Information and Advising:
Director of Undergraduate Studies: Professor Daniel Lieberman (danlieb@fas.harvard.edu)
Concentration Advisors: Dr. Neil Roach (ntroach@fas.harvard.edu), Dr. Daniel Green (drgreen@fas.harvard.edu)
Course Sequence Recommendations For Students Considering the Human Evolutionary Biology Concentration

Students should aim to complete either the LS 1a/LPS A and LS 1b sequence or LS 50ab in the first year. Concentrators are required to complete the Sophomore Tutorial in HEB (HEB 97), usually during Sophomore Spring. In the Junior year, students take a Junior Research Seminar that aligns with their interests (see the Life Sciences website for course listings).

Required Courses:

<table>
<thead>
<tr>
<th>Fall Semester First year</th>
<th>Spring Semester First year</th>
<th>Spring Semester Sophomore</th>
<th>Junior Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS 1a or LPS A, or first semester of LS 50ab</td>
<td>LS 1b, or second semester of LS 50ab</td>
<td>Sophomore tutorial (HEB 97)</td>
<td>Research Seminar (various courses count)</td>
</tr>
</tbody>
</table>

Along with the above required courses, students must take nine additional courses, including: three HEB courses that fulfill distribution requirements for Evolution, Anatomy/Physiology, and Behavior (various courses count); two HEB elective courses; and four “Related Fields” courses, which are chosen from fields such as HEB, Math/Statistics, Physical Sciences, Chemistry, Archaeology, Computer Science, Integrative Biology, MCB, and HDRB, and approved courses from other departments such as History and Science, Psychology, and Astronomy.

First-year students should take the online Biology and Chemistry placement exams for placement recommendations.

See the HEB section of the Life Sciences website for more information on requirements, courses, etc.: http://lifesciences.fas.harvard.edu/heb

Directions to the HEB advisor’s (Neil Roach) office.

- If entering from 24 Oxford Street, take elevator to the 5th floor, turn left (passing through Archaeology), and left again through an open door that leads down a long hallway to the HEB lounge. Just before reaching the lounge, take a left down the staircase to the fourth floor.
- If you enter from 11 Divinity Avenue, take elevator or stairs to the 5th floor, and turn left into the HEB lounge, pass through the lounge and take a right down the staircase to the fourth floor.
- Dr. Roach’s office is Peabody Museum 47.
Integrative Biology

IB takes as its guiding principle the maxim that "nothing makes sense in biology except in the light of evolution." Evolution is the strand that ties together all of biology: from the adaptive specifics of a membrane pore to grand events in the history of life, such as the Cambrian Explosion, when, 540 million years ago, animal life went in a single bound from simple to complex. IB therefore is inherently inter-disciplinary, encompassing mathematical and computational biology, functional and genetic approaches to morphology and development, as well as genetics, evolution, and ecology.

IB asks questions about the function, evolution, and interaction of organisms, both now and in the past. What kinds of organisms are there and how are they related? How is an organism's functional design and behavior related to its environment? What are the genetic and developmental mechanisms underlying an organism's morphology, or how is evolution influenced by development and vice versa? The study of IB can be approached in many ways, reflecting primary interest in specific groups (e.g., plants, animals, micro-organisms); in a particular level of organization (e.g., ecological systems, evolutionary genetics); in an approach (e.g., biomechanics, developmental biology); or simply in a desire to sample broadly across many topics.

From the firm foundation of a series of introductory courses, students explore in depth by taking upper-level courses. Students are encouraged to chart their own course through the concentration requirements. Some "pathways" (i.e., possible combinations of mid-level and upper-level courses) for perennially popular areas are:

- Plant Sciences
- Marine Biology & Biological Oceanography
- Vertebrate Anatomy & Physiology
- Mathematical & Computational Biology
- Evolutionary Genetics

For many students, the concentration will culminate in independent research leading to a Senior Thesis, but a thesis is not the only way to participate in research. In particular, the concentration provides opportunities for students to study biological diversity in the field. Over recent Spring Breaks, for example, these OEB courses took students to the field:

- OEB 51 (Biology and Evolution of Invertebrate Animals): Panama
- OEB 103 (Plant Systematics): Brazil
- OEB 126 (Vertebrate Evolution): Arizona (Triassic fossil dig)
- OEB 167 (Herpetology): Costa Rica
- OEB 190 (Biology & Diversity of Birds): Mexico

Contact Information and Advising:

Director of Undergraduate Studies: Professor Gonzalo Giribet (ggiribet@g.harvard.edu)
Concentration Undergraduate Advisor: Dr. Andrew Berry (berry@oeb.harvard.edu)

Dr. Berry is available to provide pre-concentrators guidance on course selection, laboratory and field research, and fulfilling concentration requirements. Students should email for an appointment. More information about the IB concentration can be found at lifesciences.fas.harvard.edu.
Course Sequence Recommendations For Students Considering the Integrative Biology Concentration

IB recommends that students have completed Life Sciences 1a (or Life & Physical Sciences A), Life Sciences 1b, and OEB 10 by the end of their Sophomore year. Ordinarily, students enroll in two science courses per semester. A typical sequence looks like this, but many permutations are possible.

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences 1a or Life &amp; Physical</td>
<td>Life Sciences 1b or Life Sciences</td>
<td>OEB 10</td>
</tr>
<tr>
<td>Sciences A or Life Sciences 50a</td>
<td>50b</td>
<td></td>
</tr>
<tr>
<td>Math (according to placement)</td>
<td>Physical Sciences 1 or Physical</td>
<td>Chem 17 or MCB 60 or a</td>
</tr>
<tr>
<td></td>
<td>Sciences 11</td>
<td>mid-level OEB course,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or…</td>
</tr>
</tbody>
</table>

- First-year students typically enroll in Life Sciences 1a or LPS A (fall semester, according to placement) and Life Sciences 1b (spring semester) as well as math (according to preparation and placement scores). Alternatively, they may enroll in Life Sciences 50ab, which IB considers equivalent to Life Sciences 1a, Life Sciences 1b, and two 'related field' courses (i.e. courses in math, physics, chemistry, etc.)
- First-year students often take Physical Sciences 1 or Physical Sciences 11 in the Spring semester; this is required for more advanced chemistry courses. IB only requires a total of four courses in math (above the level of 1a), physics, chemistry, computer science (at the level of CS 50 or above), and statistics. If, however, you are pre-med, you would typically do a full year of Organic Chemistry (usually Chem 17, 27) as a Sophomore.
- OEB 10 is required for IB concentrators and is a pre-requisite for many advanced IB classes.

If you are uncertain about which Life Science concentration you will choose -- Chemistry, Chemical and Physical Biology, Human Evolutionary Biology, Cognitive Neuroscience & Evolutionary Biology, Neuroscience, Molecular & Cellular Biology or IB – it’s possible to design a Sophomore year track that keeps your options open, allowing you to switch among concentrations at a later date.

Students considering concentrating in IB are strongly encouraged to schedule a meeting with Dr. Berry, the IB pre-concentration advisor.

Directions to Dr. Berry’s Office, BioLabs 1082: Enter the BioLabs via the main entrance (aka The Rhinos; see map); turn left down the hallway; first office on your right.
Molecular and Cellular Biology

Molecular and Cellular Biology (MCB) concentrators are interested in understanding the intersection of modern research in cellular biology with medicine and society. MCB is therefore ideally suited for students who wish to study cellular processes at the heart of both normal physiology and molecular medicine. It focuses on fundamental principles of modern biology at the hub of nearly all life science subdisciplines, and integrates many different methodologies ranging from chemistry and genetics to computer science and engineering, as well as fundamental concepts in physics and mathematics.

Through coursework and hands-on research, MCB concentrators have the opportunity to explore many of the central questions in biology and medicine and will acquire an understanding of scientific methods as they explore a wide range of contemporary subjects, including genomics, systems biology, immunology, cancer biology, the microbiome, global health and infectious disease. Students will also have the opportunity to tackle subjects of a more applied nature, such as drug design, personalized medicine and biotechnology. The MCB faculty is dedicated to supporting undergraduate research, and we encourage students to get involved in an MCB faculty lab, in one of the affiliated Centers, or at Harvard Medical School and affiliated institutes. We consider the senior thesis to be a capstone academic experience, and the concentration provides a lot of support to thesis writers to make it an enriching experience.

MCB graduates will be informed citizens who can understand and evaluate the impact of new research discoveries in the life sciences, discoveries that are unfolding at a breathtaking and accelerating pace. They will stand poised to pursue a wide range of careers, including biological and medical research, public and global health, medicine, science policy, law and intellectual property, business, education, and science writing.

Tutorial: Shortly after declaring the concentration, students are assigned a tutor from the Board of Tutors in Biochemical Sciences. Concentrators typically meet with their tutor every two weeks to discuss primary research literature in a small group or one-on-one setting. Mentoring on career choices, the research experience, and other academic issues is a logical extension of the tutorial. The tutorial is not taken for credit and therefore does not appear on the transcript.

Contact Information and Advising:

Head Tutor: Professor Vladimir Denic

Concentration Advisor / Assistant Director of Undergraduate Studies: Dr. Dominic Mao

email: dominicmao@fas.harvard.edu

Dr. Mao is available to provide pre-concentrators guidance on course selection, laboratory research, and fulfilling concentration requirements. For appointment sign-ups and more information about MCB, please visit https://www.mcb.harvard.edu/undergraduate/molecular-and-cellular-biology-mcb/.
# Course Sequence Recommendations

**For Students Considering Molecular and Cellular Biology**

Ordinarily, students should plan on enrolling in two science courses per semester in the first year and sophomore years as follows:

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences 1a or Life and Physical Sciences A or Life Sciences 50a</td>
<td>Life Sciences 1b or Life Sciences 50b</td>
<td>MCB 60</td>
<td>MCB 64, 65 or 68</td>
</tr>
<tr>
<td>Math (according to math placement*)</td>
<td>Physical Sciences 1 or Physical Sciences 11</td>
<td>Chem 17</td>
<td>Concentration Elective</td>
</tr>
</tbody>
</table>

- First-year students should enroll in Life Sciences 1a or LPS A (fall semester, according to placement) and Life Sciences 1b (spring semester) as well as math (according to preparation and placement scores). Alternatively, completing LS 50 is equivalent to LS1a, LS1b, Math 19a, and a research course (MCB 91).
- Ordinarily, first-year students take Physical Sciences 1 or Physical Sciences 11 in the spring semester; however, students with an exceptionally strong chemistry background may instead begin with organic chemistry. First-year students considering enrolling in organic chemistry should consult the section regarding Physical Sciences 1 on page 2 of this booklet.
- In the third semester, most MCB concentrators take MCB 60, which provides an integrated introduction to molecular, cellular and developmental biology with an emphasis on biological mechanisms and their frequent connections to medicine.
- In the third semester, students ordinarily enroll in organic chemistry (Chem 17). Students with an exceptionally strong chemistry background who took Chem 20 in the spring of their first year typically enroll in Chem 30 in their third semester.
- In the fourth semester, many MCB concentrators take a second intermediate course, chosen from MCB 64 (The Cell Biology of Human Life in the World), MCB 65 (Physical Biochemistry), or MCB 68 (Cell Biology Through the Microscope). MCB 63 (Biochemistry and Molecular Medicine), a fall course, is another option. MCB 63, 64, 65 and 68 do not require MCB 60 as a prerequisite.

* MCB concentrators must either complete Mathematics 1b and either Mathematics 19a, Statistics 102 (or 110 or 111), or CS 50. Alternatively, students may demonstrate competency beyond Math 1b by taking Mathematics 19a (or higher) or an approved calculus-based statistics course (such as Statistics 110 or 111). Please note that we only accept Stat 102 as an introductory statistics course, not Stat 104.

This suggested course sequence also fulfills requirements for students who decide to concentrate in Chemistry, Human Developmental and Regenerative Biology, Neuroscience, or Organismic and Evolutionary Biology.

**First-year students interested in studying the Life Sciences should take the online Biology and Chemistry placement exams.**
Neuroscience

The goal of the Neuroscience concentration is to provide students with a strong foundation in the sciences and a deep understanding of how the nervous system works at the biological level. Neuroscience students explore phenomena on vastly different scales – from molecules to societies – by studying individual nerve cells, connections and circuitry among neuronal networks, information processing, and behavior. The only prerequisite for students concentrating in Neuroscience is an intense curiosity about how the brain works!

We offer three tracks in Neuroscience: ‘Neurobiology’, ‘Mind, Brain, Behavior’, and ‘Computational Neuroscience’. The Neurobiology Track and the Mind, Brain, Behavior Track typically begin with the foundational life science courses (LS1a/LPSA and LS1b). The Computational Neuroscience Track typically begins with courses in Math, Computer Science, and/or Life Sciences. In their sophomore year, all students take an introductory course (Neuro 80), which lays out the body of knowledge in neuroscience, and a foundational course in one of five key areas of (behavior, networks, circuits, cells, or molecules). Students then go on to take 2-3 courses on advanced topics in neuroscience, as well as 2-3 courses on related fields (physical, computer, and/or applied sciences). In the Mind, Brain, and Behavior track, students look beyond the biology of the brain to study how the brain impacts other disciplines (e.g. anthropology, linguistics, philosophy, psychology, etc.) and vice versa. In the Computational Neuroscience Track, students learn how to apply analytical and modeling tools to understand information processing and network dynamics in the brain.

As neuroscience is one of the most vibrant fields of research at Harvard, students will have many opportunities for hands-on laboratory experience and independent research projects during their studies.

Contact Information and Advising

Head Tutor: Professor Jeff Lichtman

Neuroscience Advisors: Dr. Ryan Draft (draft@fas.harvard.edu)
Dr. Laura Magnotti (magnotti@fas.harvard.edu)

Dr. Draft and Dr. Magnotti are both available to provide pre-concentrators with guidance on course selection, laboratory research, and fulfilling concentration requirements. Students should feel free to email draft@fas.harvard.edu or magnotti@fas.harvard.edu to set up a time to meet. For regular updates, advising hours, appointment sign-ups, and more information about the Neuroscience concentration, please visit https://www.mcb.harvard.edu/undergraduate/neuroscience/.

Directions to the offices of Dr. Draft and Dr. Magnotti,
BioLabs 1082: Our offices are on the first floor of the Biological Labs Building. (See X on the map.) The offices are just inside the main courtyard entrance (in between the rhino statues), across from the sand volleyball court.
Course Sequence Recommendations
For Students Considering the Neuroscience Concentration

We recommend that Neuroscience and MBB Track students complete LS 1a/LPS A and LS 1b first year. Computational Neuroscience Track students should complete Math 21a/b and CS 50. All students should try to complete Neuro 80 by sophomore fall. Ordinarily, students enroll in no more than two science courses per semester.

### Neurobiology and MBB Track

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS 1a or LPS A or LS 50 a (see note #1 below)</td>
<td>LS 1b or LS 50b</td>
<td>Neuro 80</td>
<td>Foundational Course (see note #5 below)</td>
</tr>
<tr>
<td>Math (see note #2 below)</td>
<td>Related Fields Course (e.g. PS 1 or PS 11 - see note #3 below)</td>
<td>Related Fields Course or Intermediate Biology (see note #4 below)</td>
<td>Related Fields Course or Intermediate Biology</td>
</tr>
</tbody>
</table>

### Computational Neuroscience Track

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
<th>Third Semester</th>
<th>Fourth Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 50 (or LS 1a/LPS A)</td>
<td>CS 51 (or LS 1b)</td>
<td>Neuro 80</td>
<td>Foundational Course (see note #5 below)</td>
</tr>
<tr>
<td>Math 21a or LS 50a (see note #1 below)</td>
<td>Math 21a or LS 50b</td>
<td>Stat 110 or Bio Elective</td>
<td>Bio Elective or Modeling/Analysis Elective</td>
</tr>
</tbody>
</table>

1. Students completing LS50ab will get credit for the equivalent of LS1a, LS1b, Math 21a, and one ‘Related Fields’ course or ‘Modeling/Analysis’ Course.
2. Neurobiology & MBB students must complete two math, applied math, statistics and/or computer science courses, one of which must be at the level of Math 1a or higher (e.g., Mb, 1a, 1b, 19a, 21a, AM 21a, etc.).
3. Neurobiology & MBB students complete 2-3 courses in ‘Related Fields’ (drawn from physics, chemistry, computer science, engineering, math, and other approved courses). These need not be taken in the first year or sophomore year as shown.
4. All students must complete one ‘Foundational Course’. These include Neuro 57, 105, 115, 120 and 125. Computational Neuroscience Track students must enroll in Neuro 105, 115, or Neuro 120.
5. Neurobiology and MBB students must complete one 'Intermediate Biology Course' (HEB 1420, LS 2, MCB 60, 63, 64, 65, 68, OEB 50 and 53).
   - The Neuroscience concentration does not give AP credit. Students with very strong science backgrounds should meet with one of the neuroscience advisors for advice on courses.

First-year students interested in studying the Life Sciences should take the online Biology and Chemistry placement exams. If you have any additional questions about the Life Sciences, please contact a Concentration Advisor.
**Undergraduate Research Opportunities in Life Sciences: FAQs**

http://lifesciences.fas.harvard.edu/research

**Where can I do research?**
There are over a thousand life science research labs at Harvard. They are located not only at the Cambridge campus (Faculty of Arts & Sciences and School of Engineering and Applied Sciences), but also at the Harvard Medical School, Harvard School of Public Health, and at Harvard-affiliated hospitals and research institutions: https://lifesciences.fas.harvard.edu/harvard-affiliated-labs.

**When can I start an independent research project in a laboratory or research group?**
Most students dedicate the first semester of their first year to getting acclimated to college life, academic courses and extracurricular activities. We advise that students join a lab in the summer following first year or sophomore fall, but it is possible to start during the first year Spring term as well. Some students may start even later; however, if you intend to complete a senior thesis, plan to join a lab at the latest by junior Fall.

**How can I find a lab research group to join?**
Contact Dr. Anna Babakhanyan (ababakhanyan@fas.harvard.edu), our research advisor who can provide personalized advice. She can help you define your research interests, find labs, contact faculty and investigate funding options: https://lifesciences.fas.harvard.edu/research-contact-us. The Harvard Undergraduate Research Opportunities in Science (HUROS) Fair will be held on 11/14/19. HUROS is a great way to meet prospective labs looking for undergraduates. We recommend you attend the preparatory workshops on October 9 and 23. See https://lifesciences.fas.harvard.edu/huros for more information. Also attend Research Spotlight on October 16: https://lifesciences.fas.harvard.edu/undergraduate-research-spotlight.

**Do I need previous experience doing research?**
No, you don’t need previous experience to join many research labs. Most research groups are willing to train and mentor undergraduates who have no previous lab or field research experience. Over time you will gain the skills and knowledge you need for an independent project. Also, most students acquire basic laboratory skills in the laboratory sections of their science courses, and these help you transition into a research environment.

**Can I earn course credit for term-time lab research?**
Yes. The requirements for course credit vary among the different Life Sciences concentrations, so it’s best to contact a Concentration Advisor for specific details. The contact information for each of the Concentration Advisors are on the Life Sciences Education website in the Concentrations tab.

**Can I be paid for doing research during the summer or term time?**
Yes, but note that you can’t simultaneously get paid and earn course credit for your research. For summer research, there are many sources of funding. To see a list of funding opportunities, go to http://lifesciences.fas.harvard.edu/research and select Research Opportunities. Notable funding sources include the Harvard College Research Program (HCRP), PRISE and the Faculty Aide Program. In addition, if you are eligible for the Federal Work-Study Program, you can qualify for term time and summer research funding.

**For more information or to make an appointment:**
Please contact Dr. Anna Babakhanyan at ababakhanyan@fas.harvard.edu.

**Directions to Dr. Babakhanyan’s office in the BioLabs, room 5010:** Enter the main entrance of the BioLabs. (See X on the map; it's the door flanked by rhinoceros statues). Turn right after you enter and take elevator to the 5th floor, walk to room 5010.

Visit the Life Sciences Education Website at: http://lifesciences.fas.harvard.edu.
Why did you pick your concentration?

“I chose to concentrate in Biomedical Engineering for three main reasons. I wanted to develop a quantitative understanding of human physiology before embarking on the journey to become a physician. I hoped to gain a concrete, mathematical skill-set, so that I could be an active participant in my medical education and any research in which I might take part. And finally, it was important to me develop the ability to communicate across disciplines (medicine, basic science, engineering, etc.) for successful, collaborative teamwork throughout my professional career.” - Marlee Sabatino, BME ‘18

“The Biomedical Engineering A.B. seemed to offer me the perfect mix of biology, engineering, and technology, while still giving me the room to take all of my premed requirements. Now looking back after being admitted into medical school, I know I made the right decision!” - Derek Ponce, BME ‘18

“I love math and science and wanted to combine these fields to improve medicine, which is why I chose Biomedical Engineering. After taking organic chemistry, I fell in love with chemistry, so I decided to pursue a joint concentration in Chemistry and Biomedical Engineering. This would give me the design skills I would need to engineer chemical compounds that could potentially have medical applications in treatments and drug delivery.” - Maria Brouard BME ‘18

"There are two general factors that make a Harvard chemistry undergraduate education truly unique and potentially transformative: having the opportunity for valuable interactions with thought leaders and pioneers of chemistry and having a guide to help you navigate the rich, and perhaps daunting, resources of Harvard Chemistry. In my three years here, I've found the Professors accessible and attentive; all my interactions with chemistry faculty, as a whole, have been influential; this is all in large part a result of excellent mentoring. I've never felt lost in the sea of potential chemistry courses or completely unsure in terms of how to approach a research opportunity.” - David Jaramillo, Chemistry ’15

“In many ways, chemistry at Harvard is taught like a language rather than a collection of unlinked facts. It is incredibly gratifying to approach a test having memorized very little but be able to puzzle solve your way through all the problems.” - Ellie Lin, Chemistry ’15
“I chose psychology because I was interested in the subject matter and how it intersects with the people-side of basically any industry you might want to enter after college…being in the psychology department gives you a lot of great opportunities to get involved with research and get to know really interesting professors.” - Taylor Ladd, CNEP ’18

“I chose to concentrate in psychology because I was curious about the origins of our thoughts, attitudes, and behaviors. I wanted to explore how understanding these elements might help us design more cooperative social and institutional structures.” - Terry Lee, CNEP ’18

“I chose CPB because I wanted a broad foundation in the sciences and am excited about the ways in which the physical sciences might be applied to the study of biology….the concentration consists of an amazing and diverse group of people who have each followed a unique path through their CPB coursework.” - Alan Gao, CPB ‘18

“CPB gave me the mathematical, chemical, and physical tools I needed to uncover a chemical and physical intuition for how the biological world might work.” - Tina Huang, CPB ’18

“I chose HEB because I wanted to learn what makes human *human*. To me, the evolutionary framework is really helpful to analyzing any sort of question — ranging from scientific hypotheses to medical conditions, to societal structure.” - Elianna Shwayder, HEB ’18

“Approachable faculty, fascinating classes and topics, unique perspective unavailable at most colleges. I particularly was fascinated by the focus on human energy expenditure and diet, and explaining it from an evolutionary perspective.” - Jacqueline Epstein, HEB ‘18

“I was interested in the human body, how it worked, and why it is the way it is. I chose HEB because as is oft repeated within the department, ‘Nothing in biology makes sense, except in the light of evolution.” - Kainoa McCauley, HEB ‘18

“I chose Psychology because it is widely applicable to all aspects of life—public health, politics, education, law, economics, business, computer science, AI, and more. Psychology gives us the critical skills and knowledge necessary to better understand individual behavior and decision making, intergroup relations, and the impact of addiction, disorder, and disease. Ultimately, I chose Psychology because I wanted to help change people's lives for the better.” - Amanda Brandt, CNEP ’18
"I feel so lucky to have been able to be a part of a department that is so current, cutting edge, and fascinating. Yet, despite all of the amazing work being done in the SCRB department, the close contact with the faculty, concentration get-togethers and amazing advising team have made the concentration feel like such a supportive community within the larger Harvard community." - Rachel Halperin HDRB ‘16

"I chose to study HDRB because it represented the best intersections of my interests. I am interested in the biology of the human body and HDRB presents an opportunity to study the miraculous ways that we develop, heal and age." - Ryan Ouillette HDRB ‘16

"I chose HDRB because it offers both an incredibly strong advising and academic network, as well as teaches some of the most interesting and relevant aspects of biology today. The way classes are taught and the emphasis on research brings students to forefront of knowledge in developmental and regenerative biology." - Sam Watrus, HDRB ‘16

"There is a multitude of amazing opportunities, including hands-on wet labs, access to museum/lab collections, and even (fully subsidized!) spring break field trips" - Vanessa Lam, IB ’18

"I see IB as the real liberal arts choice within biology because the flexibility of its requirements means that you can both take time to explore different areas within biology and focus deeply on whatever interests you most. The program exposed me to a huge breadth of biological science and allowed me to figure out with confidence what parts I personally want to study in the future." Abba Parker, IB ‘17

"The students in IB are a big part of why I enjoyed the concentration — they’re some of the most genuine and welcoming people I’ve met at Harvard. Many Harvard courses feel competitive, but OEB courses are very cooperative because students study together and want to help each other learn." Patrick Moran, IB ‘18
“When I came into college, I knew I wanted to study biology but choosing between the biology concentrations turned out to be especially difficult. Many of them piqued my academic interests but what swayed my decision was the community I found in MCB. Everyone from the professors to upperclassmen to peers made me feel at home. I really enjoyed my experience studying MCB at Harvard and know that it was the perfect concentration for me.” - Azraa Chaudhury, MCB ‘18

“As a senior in the college, pursuing MCB as my concentration was one of the best decisions I’ve made. Not only was I able to take courses about the underlying cellular phenomenon I was most interested in, but I also was able to create personal connections with highly accomplished and inspirational MCB faculty at Harvard.” - Shree Bose, MCB ‘16

“During the summer after my freshman year, I had a blast studying abroad in Trento, Italy with the Harvard Summer School, taking classes in neuroscience and cognitive psychology. I was fortunate to have been exposed to neurobiology early on, and I was even luckier to have chosen a concentration with great research opportunities, friendly and knowledgeable advisors, and interesting classes. I especially enjoyed my neurobio tutorial junior year and Ryan Draft’s "Neurobiology of Pain" class, both of which are small, seminar-style courses. To top it all off, I had a great experience doing neuroscience research and writing my senior thesis, the culmination of my academic work in college.” - Ned Lu, Neurobiology ’16

“Some of the most fascinating problems in science have already been solved, and there’s an immense satisfaction in learning about those solutions. What I never grasped until I was introduced to the Neuro concentration was that there’s an even greater fulfillment in not knowing all the answers, and Neuro puts you at the very heart of that feeling. The concentration has helped me creatively brainstorm questions rather than answers, and in doing so, and has pushed me to becoming a better student and scientist.” - Vibav Mouli, Neurobiology ’16