

# Ph.D. in Biomedical Research



# What is Biomedical Research?

- Biomedical research is the pursuit of answers to medical questions. These investigations lead to discoveries, which in turn lead to the development of new preventions, therapies and cures for human and veterinary health. Biomedical research generally takes two forms: basic science and applied research.
- Basic biomedical research is the quest for knowledge about how organisms and pathogens function. The applicability of these studies to human health may not always be immediately obvious. For example, one might question the purpose of determining the precise molecular structure of the vitamin folic acid. However, it was this type of investigation that led directly to the synthesis of the first successful anti-leukemia drugs during the 1950s and 1960s. Used in combination, these medicines halved the death rate for leukemia, which had been the second greatest killer of children during the mid-20th century.

# Who are Biomedical Scientists?

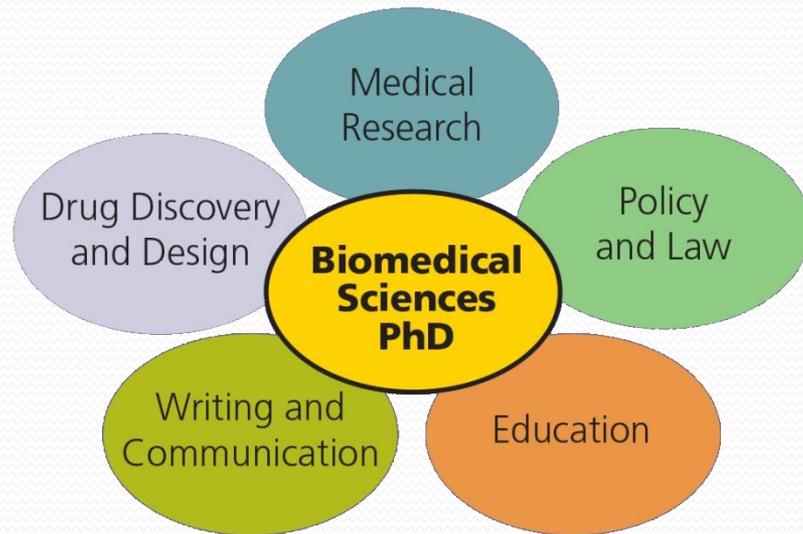
Biomedical scientists bridge the gap between the basic sciences and medicine. The Ph.D. degree is the gateway to a career in biomedical research.

Biomedical scientists:

- Think outside the box and are innovators
- Are critical and analytical thinkers
- Get excited by discovering new things
- Look at biology and see previously unrecognized patterns
- Enjoy the freedom to pursue interesting questions
- Have the persistence to see a project through from small beginnings to great discoveries
- Want to improve the human condition through their work
- See the power of biomedical research to change the world

# Biomedical Research Disciplines to Pursue Based on Your Area of Interest

- Biochemistry
- Bioinformatics
- Biomedical Engineering
- Cancer
- Cell Biology
- Genetics
- Immunology
- Neuroscience
- Physiology
- Translational Research



...and more!

# Career Paths for PhD Graduates

Biomedical scientists may use their knowledge of biomedical research to:

- Direct a research lab and decide which scientific questions to investigate
- Be part of a team of scientists working together to solve problems of health and disease
- Manage and coordinate large scientific projects (across institutions and/or across the world)
- Teach others about biomedical science including how to do research and how to think about and understand scientific information
- Inform policy makers about scientific matters that impact health and science
- Communicate (by writing and speaking) and disseminate the latest information about scientific and medical discoveries
- Translate discoveries and inventions from the most fundamental level to every day usage

# Undergrad Preparation Timeline

## Freshman Year

- Introductory level courses
  - Basic science courses
  - English
  - Reading
  - Writing
  - Research Techniques
- Participate in a summer research experience
- Begin to develop a curriculum vitae (resume)

## Junior Year

- Advanced science courses
- Independent research
- Prepare for the [Graduate Record Examination \(GRE\)](#)
- Start collecting information on graduate schools and funding agencies from
  - Internet
  - Faculty advisors
  - National science meetings
  - Peers
- Continue taking non-science courses
- Take the GRE in the spring semester
- Participate in a summer research program
- Continue to develop your CV/resume

## Sophomore Year

- Advanced science courses
- Advanced research techniques
- Take non-sciences courses to give you a broad education
- Serious discussion/planning about graduate schools
- Participate in a summer research experience
- Continue to develop your CV/resume

## Senior Year

- Review informational/application materials for programs of interest in the early summer/fall
- Write the personal statement (should start in the summer and refine in the fall)
- Complete the requirements for graduate school, including advanced courses and non-science electives
- Explore [funding opportunities](#)
- Meet with professors and mentors to request STRONG letters of recommendation
- Refine your school list, send applications and transcripts in the fall – many schools have rolling or priority admissions deadlines in November/December
- Interview at schools (if required)
- Get accepted!

# Required Research Experience: Make the Most of Your Summer

- Participate in research summer programs throughout the undergraduate years. These can be at your home institution or at other institutions.
- Identify and apply to several summer programs. This will give you a preview of the application process for graduate school.
- Apply to schools that you may be interested in for graduate school.
- Complete and submit the application materials during the prior winter/spring.
- Become fully immersed in the research projects that you work on.
- Talk with advanced students and faculty advisors about graduate school and their experiences.
- Take advantage of other skill-building activities that the summer program offers.
- See Princeton [Office of Undergraduate Research](#), [HPA website](#) and HPA Vitals newsletter (linked from [homepage](#), or [email hpa@](mailto:hpa@) to be added to listserv) for opportunities.

# Sample PhD Curriculum

*from Harvard University PhD Program in Biological and Biomedical Sciences*

- **Year I**
  - **Course work** in the sciences; experimental design; critical reading and analysis; others in consultation with program advisor
  - **Laboratory Rotations** allow students the opportunity to explore important questions asked in different fields and the many approaches that are used to address these questions. During rotations, students get a feel for different labs: nature of the work and the lab community, to determine the best environment for their dissertation research.
- **Year II**
  - **Begin work on thesis project**
  - **Preliminary Qualify Examination (PQE)** The PQE ensures that students have achieved the high standard of scientific scholarship and skills that are critical for successful completion of the Ph.D. thesis and beyond. It assesses foundation in sciences and tests ability to: develop a set of original, testable hypotheses; prepare a compelling research plan to test these hypotheses; orally explain and defend these hypotheses and the research plan; and critically analyze and interpret data.
  - **Dissertation Advisory Committee Meetings (DAC)** After passing the PQE, a Dissertation Advisory Committee (DAC) of at least three members (not including the Dissertation Advisor) will be selected by student and their mentor.
- **Subsequent Years**
  - Complete thesis, defend in front of a separate dissertation defense committee
  - Average time to degree currently 5.5 years
- **Additional Activities**
  - Required semester of Teaching / Community Education
  - Faculty seminar series
  - Opportunities to present your work via Rotation Club, poster sessions
  - Student retreat, student organization activities

# Financing Your Graduate Education

## Some of the Types of Funding that are Available

- Fellowships - an award from a government agency or private foundation for support of a graduate student during advanced study. (See independent funding below)
- Scholarships - gift aid, may be merit or need based.
- Grants - support that is usually applied for that may include support for research activities as well as some salary support.
- Loan - a sum of money provided for a period of time and repayable with interest.
- Research assistantships - a form of financial support provided to a graduate student for performing research; usually provided by the thesis advisor from their research grants.
- Teaching assistantships - a form of financial support for a temporary teaching job; usually provided by the institution.
- Graduate student assistantships - financial support for a graduate student for research that may or may not be related to thesis research.

# Sample PhD Programs in Biomedical Research



[Vanderbilt University School of Medicine Interdisciplinary Graduate Program](#)



[Duke University School of Medicine Biomedical Graduate Programs](#)



[Johns Hopkins School of Medicine Graduate Programs](#)



[The Institute for Biomedical Sciences at George Washington School of Medicine & Health Sciences](#)



[Mayo Clinic Graduate School](#)



[Stanford School of Medicine: Biosciences](#)



[Weill Cornell Graduate School of Medical Sciences](#)



[University of Chicago Graduate Programs in the Biomedical Sciences](#)

# For Additional Information...

- National Institutes of Health: [NIH.gov/Science](https://www.nih.gov/science)
- AAMC, PhD in Biomedical Sciences: [AAMC.org/Students/Research/PhD](https://www.aamc.org/students/research/phd)
- The American Association for the Advancement of Science: [AAAS.org](https://www.aaas.org)
- Occupational Outlook Handbook: Medical Scientists Overview: [BLS.gov/OOH/Life-Physical-and-Social-Science/Medical-Scientists.htm](https://www.bls.gov/oooh/life-physical-and-social-science/medical-scientists.htm)
- Foundation for Biomedical Research: [FBResearch.org](https://www.fbr.org)

