

Overview of the Harvard Biostatistics Department and Academic Programs



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HARVARD T. H. CHAN SCHOOL OF PUBLIC HEALTH (SPH)

Strengths of the Department



- Strong research focus and high productivity: *Chronicles of Higher Education* rated us as the strongest in Biostatistics in a “Faculty Scholarly Productivity Index”
- Diversity of Faculty interest and research
- Diversity of students’ backgrounds and interests
- Outstanding opportunities for collaboration with subject matter specialists
- Boston/New England activities

Statistical Areas of Faculty Interest



- Survival and longitudinal analysis
- Adaptive clinical trials and trial design
- Meta-Analysis
- Bayesian methods
- Causal inference, mediation analysis
- Machine learning, missing data
- Genetic data analysis for Gene Mapping
- Computational biology
- Network analysis
- Spatial and functional data analysis

Collaborative Areas of Faculty Interest



- HIV/AIDS research (CBAR)
- Methods for observational studies
- Cancer research (DFCI)
- Personalized medicine
- Neurostatistics
- Environmental health
- Gene-environment interactions
- Global health
- Psychiatric statistics
- Microbiome/metabolomics/proteomics
- Most biostatistics faculty collaborate with faculty in other HSPH departments and outside HSPH

Department of Biostatistics: People



- Faculty: 65 (45 primary)
- Students: 120 (~1/2 PhD, ~1/2 MS)
- Postdocs: 50+

Department of Biostatistics: Locations



- Harvard Chan SPH Buildings 1 and 2, 4th floor
- Dana Farber Cancer Institute (the “Farber”)
- Other local hospitals:
 - Brigham and Women’s Hospital
 - Boston Children’s Hospital
 - Massachusetts General Hospital
 - McLean Hospital

Department of Biostatistics: Academic Programs



- PhD in Biostatistics through Harvard's Graduate School of Arts and Sciences (GSAS), with 2 areas of interest:
 - Biostatistics
 - Bioinformatics
- MS in Biostatistics through Harvard Chan School of Public Health (SPH)

Department of Biostatistics: PhD Program



Prepares students in 5 “competencies”

- Applying innovative theory and methods to develop new biostatistical methods and solutions to public health problems
- Providing biostatistical or bioinformatics leadership in design, conduct and analysis of collaborative data
- Applying modern computational methods to analyze complex medical and public health data (including software development)
- Collaborating and communicating effectively with researchers in other disciplines
- Teaching biostatistics or bioinformatics effectively

Short Overview of PhD Program



- Epidemiologic methods
- Research ethics
- Four required biostatistics core courses:
 - Probability Theory
 - Statistical Inference
 - Methods I and Methods II
- Written “qualifying” exam (after 3rd semester), with “theory” and “methods” sections
- Selection of advanced doctoral courses in biostatistics and/or bioinformatics (35 credits, ~7 courses)
- Cognate (10 credits in a non-quantitative field)

Advanced doctoral courses: examples



- Regression and Analysis of Variance
- Advanced Topics in Clinical Trials
- Analysis of Failure Time Data
- Analysis of Multivariate and Longitudinal Data
- Probability II
- Inference II
- Design and Monitoring of Adaptive Clinical Trials
- Bayesian Methods (also possible in Stat dept.)
- Measurement Error and Misclassification
- Advanced Computational Biology and Bioinformatics

Examples of Cognate Fields



- Epidemiology of AIDS and infectious diseases/Chronic disease epidemiology
- Molecular biology / molecular epidemiology / population genetics
- Cancer biology / cancer epidemiology / cancer prevention
- Psychiatric genetics / psychiatric epidemiology/
- Health and social behavior
- Environmental risk assessment / environmental epidemiology / gene-environment interactions

PhD Program, continued



- Summer project after 1st year
- Teaching experience (once per year)
- Consulting experience
- Seminars, working groups
- Oral qualifying exam
- Dissertation and defense

For Students with a Prior MS Degree



- Waiving of core courses may be possible
- May also possibly take the written qualifying exam in first year
- Allows student to take more advanced courses in their first year, and start research earlier

August Preparatory Course



- Four week preparatory summer program (prior to orientation, starts early August)
- Review of topics in math, probability, statistics, and statistical computing
- Non-credit but strongly recommended for new PhD students without a prior Master's degree in Stat/Biostat

Department of Biostatistics: Masters Degree Programs



- Several different programs depending on student's interest and background
- **SM2** – standard 2 year MS degree program
 - Biostatistics
 - Bioinformatics
 - Best for students who are interested in doctoral programs upon completing MS degree, or medical research positions
- **SM1** – one year MS degree
 - Designed for students who already have an advanced math/stat background (eg., have PhD or Masters in a closely-related field)
- **SM60** – 1.5 to 2 year applied biostatistics MS degree
 - Best for students seeking medical research positions after obtaining MS degree

Department of Biostatistics: Masters Degree Programs



Prepare students in 5 “competencies”

- 1) Designing and analyzing health research studies
- 2) Analyzing and interpreting data for scientific inference
- 3) Using modern computational methods to analyze complex medical and public health data
- 4) Collaborating and communicating effectively with researchers in other disciplines
- 5) Depending on MS degree:
 - For SM1, SM2: Using statistical reasoning to analyze non-standard problems and to help conduct of methodologic research
 - For SM60: Communicating research findings through written reports and oral presentations

Department of Biostatistics: MS Degree Overview



- Epidemiologic methods (Introductory course)
- Research ethics
- Total of 80 credits for SM2 programs:
 - 50 credits from “core”
 - Core includes “advanced doctoral courses” shown previously, in addition to more introductory and intermediate level courses in biostatistics, bioinformatics, and epidemiology
- Total of 60 credits for SM60 program, plus at least 2.5 credits in each of environmental health and social and behavioral sciences
- Total of 42.5 credits for SM1 degree (25 from MS core)

MS Biostatistics Core: examples



- Analysis of Rates and Proportions
- Regression and Analysis of Variance (intro)
- Applied Survival Analysis
- Applied Longitudinal Analysis
- Gene mapping
- Basics of Statistical Inference
- Principles of Clinical Trials
- Survey Research Methods
- (Plus advanced courses noted previously)

Quantitative Genomics and Computational Biology MS Degree:



- Joint with Department of Epidemiology
- Best suited for student with interests in statistical genetics, high dimensional data, biological statistics, etc.
- Includes mentored practicum with faculty member or research scientist

Sources of Student Support



- PhD students are guaranteed funding for 4 years subject to remaining in good standing.
- Most students start on training grants and switch to faculty grant support after 2 years.
- Stipend \approx \$32,000, tuition & fees \approx \$45,000, Total package \approx \$77,500
- NIH Training Grants: Cancer, Statistical Genetics and Computational Biology, Environmental Statistics, HIV/AIDS, Neurostatistics
- Teaching assistantships (required)
- Research assistantships
- Other scholarships and fellowships
- Very little funding available for MS students

Training Grant Requirements



- Cognate, summer project and seminar attendance should be related to TG mission
- Departmental coursework similar for all trainees, though some specific courses may be required for certain training grants
- Dissertation related to training grant
- Flexibility whenever possible, source of funding could change over time, may be dissertation advisor-dependent

Applications and Eligibility Requirements: PhD Applicants



Required:

- GSAS general requirements (including GREs): see www.gsas.harvard.edu/prospective_students/admissions_overview.php
- Multivariate calculus
- Linear algebra
- Knowledge of programming language

Strongly Encouraged:

- Two semesters of calculus-based probability and statistics
- Two semesters of advanced calculus or real analysis
- One course in numerical analysis
- Practical knowledge of statistical computing package (SAS, R, Stata, or Python or Perl for bioinformatics)

Applications and Eligibility Requirements: MS Applicants



Required:

- HSPH general requirements see: www.hsph.harvard.edu/admissions/application-requirements/
- Applications submitted through SOPHAS
- Multivariate calculus
- Linear algebra
- Knowledge of programming language

Encouraged:

- Courses in probability, statistics, advanced calculus, numerical analysis
- For Bioinformatics: biology, genetics, comp bio
- Practical knowledge of statistical computing package (SAS, R, Stata, or Python or Perl for bioinformatics)

Applications: PhD and MS Applicants



General Requirements:

- Letters of reference (3 required)
 - At least one from your undergraduate department
 - One from any collaborative/practical training experience
- Transcript
- Personal Statement
- GRE Test scores

Sources of Information



- Xihong Lin, Chair
- Brent Coull, Associate Chair
- Paige Williams, Director of Graduate Studies
- Jelena Tillotson-Follweiler, Manager of Academic Services
- <http://www.hsph.harvard.edu/biostatistics/>
- Department's "Graduate Student Handbook" (available online)