Overview of the Harvard Biostatistics Department and Academic Programs

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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 1\textsuperscript{st} 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
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 (e.g., 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
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 Phython 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)