Department of Biostatistics and Bioinformatics

Department’s mission:
To develop, apply and provide training in quantitative methods that can improve human health by teasing out the information contained within modern data.
Our Education Philosophy

- **Provide comprehensive** training in theory and methods.
- **Provide tailored** instructions for different student backgrounds.
- **Provide flexible** opportunities for different career paths (industry, government, academic research).
- **Provide ample experience to develop soft skills.**
<table>
<thead>
<tr>
<th>MPH</th>
<th>MSPH</th>
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<tbody>
<tr>
<td>Found. of Biostatistical Methods (4)</td>
<td>Biostatistical Methods (4)</td>
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<tr>
<td>Applied Regression Analysis (4)</td>
<td>Applied Linear Models (4)</td>
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<tr>
<td>Intro. to Probability Theory (4)</td>
<td>Probability Theory I (4)</td>
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<td>Intro. to Statistical Inference (4)</td>
<td>Statistical Inference I (4)</td>
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<td></td>
<td>SAS Programming (2)</td>
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<td>Epidemiologic Methods I (4)</td>
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<tr>
<td>Applied Survival Analysis (2)</td>
<td>Survival Analysis Methods (2)</td>
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<td>Longitudinal/Multilevel Analysis (2)</td>
<td>Modern Regression Analysis (3)</td>
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<td>Statistical Practice I (2)</td>
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<td>Statistical Practice II (2) or Thesis Research</td>
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<td>Statistical Practice I</td>
<td>Statistical Practice II (Capstone)</td>
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<tr>
<td>• Lectures on consulting, collaboration, ethics, human</td>
<td>• Lectures on project management, reproducibility, literature review, and scientific writing.</td>
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<td>subjects protection, best practices in programming, and</td>
<td>• Peer-review writing assignments.</td>
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<td>study design.</td>
<td>• Effective communications (oral presentation and poster).</td>
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<td>• Real-life group consulting project.</td>
<td>• Career panels from industry, government, and academia.</td>
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<td>• Develop study protocol, analysis plan, tables shells.</td>
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<td>• Project documentation (research journal, Coding</td>
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<td>practice)</td>
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## Elective Courses

<table>
<thead>
<tr>
<th>2019-2020</th>
<th>2020-2021</th>
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<tr>
<td>• Geographic information systems</td>
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<tr>
<td>• Sampling applications</td>
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<tr>
<td>• Statistical computing</td>
<td>• Statistical computing</td>
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<tr>
<td>• Intro to large-scale biomed data analysis</td>
<td>• Intro to Bioinformatics</td>
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<td>• Machine learning</td>
<td>• Machine learning</td>
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<td>• High-throughput data analysis</td>
<td>• High-throughput data analysis</td>
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<tr>
<td>• Analytic methods for infectious disease</td>
<td>• Analytic methods for infectious disease</td>
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<td>• Observational studies</td>
<td>• Data Science Toolkits</td>
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<td>• Advanced clinical trials</td>
<td>• Causal inference</td>
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<td>• Applied and advanced spatial analysis</td>
<td>• Bayesian modeling</td>
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<tr>
<td>• Advanced survival statistics</td>
<td>• Advanced statistical computing</td>
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<tr>
<td>• Advanced neuroimaging statistics</td>
<td>• Missing and mismeasured data</td>
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<td>• Time series</td>
<td>• Time series</td>
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# Required Student Projects

<table>
<thead>
<tr>
<th>Training:</th>
<th>Applied Practice Experience (APE)</th>
<th>Thesis / Capstone</th>
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<tr>
<td><strong>Length:</strong></td>
<td>Supervised professional practice</td>
<td>Independent research with BIOS faculty member</td>
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<tr>
<td><strong>Location:</strong></td>
<td>Minimum 200 hours</td>
<td>1-2.5 semester</td>
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<td><strong>Time:</strong></td>
<td>Companies, Institutions, Emory, China</td>
<td>Within BIOS</td>
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<tr>
<td><strong>Summer after Yr 1 – March Yr 2</strong></td>
<td>Summer after Yr 1 – April Yr 2</td>
<td>Research journal, codes, report, poster, oral presentation</td>
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**Requirements:**

- Written goals and deliverables
Typical Student Projects

- 2-3 projects per student
- Capstone/Thesis research projects are mostly on data analyses with collaborators under the guidance of faculty advisor
- APE projects are more diverse (data management, data cleaning, quality control, data analyses etc.)
- Some students take on additional projects of their interest.
Rollins Earn and Learn (REAL) program

• Get paid for learning through practice
• $3000 per semester ( $15 / hour)
• Eligible work: TA, RA, APE projects, Capstone/Thesis projects, other projects
• At Emory or outside partners
Career Development

• Panel discussion: Considerations for pursuing a Biostatistics PhD degree (Yr 1)
• Panel discussion: PhD application process (Yr 1)
• Develop professionalism through APE
• Panel Discussion: Biostatistician career, what is important? (BIOS 580)
• Master-level Job search and interviews (BIOS 580)
• Panel Discussion: Technical preparations for job interviews (BIOS 581)
• Salary negotiations (BIOS 581)
Example Methodological Research

- Causal inference
- High-dimensional data
- Machine learning
- Risk prediction
- Bayesian methods
- Spatial statistics
- Latent class analysis
- Measurement error
- Fundamental theory

Faculty and Research

Survival Analysis
- Eugene Huang, PhD
- Limin Peng, PhD
- Steve Qin, PhD
- Hao Wu, PhD

Bioinformatics
- Michael Haber, PhD
- Max Lau, PhD
- David Benkeser, PhD

Infectious Disease

Mental Health
- Amita Manatunga, PhD
- Mary Kelley, PhD
- Ying Guo, PhD
- Limin Peng, PhD
- Rob Kraffty, PhD

Neuroimaging
- Ying Guo, PhD
- Suprateek Kundu, PhD
- Ben Risk, PhD

Statistical Genetics
- Yijuan Hu, PhD
- Karen Conneely, PhD
- Michael Epstein, PhD

Epidemiology & Env. Health
- Bob Lyles, PhD
- Howard Chang, PhD
- Lance Waller, PhD
Faculty and Research

Clinical Trials
- Mike Kutner, PhD
- Kirk Easley, MSStat
- Azhar Nizam, MS

Aging
- John Hanfelt, PhD

Collaboration Core
- Renee Moore, PhD
- Christina Mehta, PhD

Consulting, Analysis, Data Management
- George Cotsonis, MS
- Lisa Elon, MS
- Traci Leong, PhD
- Paul Weiss, MS
- Rebecca Zhang, MS
- Xiangqin Cui, PhD

Cancer
- Jeff Switchenko, PhD
- Yuan Liu, PhD

Cardiovascular
- Jose Binongo, PhD
- Yi-An Ko, PhD

- RSPH Biostatistics Collaborative Center
- Directors of Biostatistics Cores for:
  - Georgia Clinical & Translational Science Institute
  - Atlanta VA Health Care System
  - Children’s Healthcare of Atlanta
  - Emory Center for AIDS Research
  - Emory Winship Cancer Institute
  - Emory Alzheimer’s Disease Research Center
  - Emory Exposome Research Center
  - Emory Specialized Center of Research Excellence in Sex Differences
Identifying correlates of protection for COVID-19 vaccines:

➢ It takes substantial time and effort to get COVID-19 vaccines approved by the FDA, commonly involving randomized trials that last months and involve upwards of 30,000 people.

➢ Vaccine approval could be accelerated if we can identify immune responses that predict whether a vaccine is effective.

➢ Data from randomized trials of COVID-19 vaccines to identify these immune responses.

➢ Automated pipeline for a harmonized, reproducible analysis of all the US and some international studies of COVID-19 vaccines.
Emory Cardiovascular Biobank

- Longitudinal data extracted electronic health records (medication, history) behavior, sleep quality, and many more
- Over 8000 individual patients have been followed annually for adverse CVD events.
- Relationships between genetic basis of oxidative stress, vascular dysfunction, metabolomics, and inflammatory biomarker assays, and cardiovascular outcomes.
- Findings from the biobank include discovery of novel biomarkers for better patient risk stratification and outcome prediction.
Latent class analysis of neurodegenerative diseases

- Currently, there are no available therapies to prevent, cure, or slow the progression of Alzheimer’s disease and related dementias

- High-dimensional longitudinal information from EHR to classify people at high risk of dementia into precise subtypes that are predictive of the rate of disease progression and underlying disease etiology

- Latent class analysis uses a rigorous probabilistic framework that allows inferences with attractive optimality properties
Children’s Healthcare of Atlanta

- Population health using Electronic medical records (EMR) throughout Emory Healthcare
- Pediatric antibiotic resistance and susceptibility over space and time
- Effects of program evaluation and implementation at the organizational, provider, and patient levels
- Development and commercialization of medical devices
Yuan Liu, PhD
Research Associate Professor

Winship Cancer Institute

➢ Predict overall survival and progression free survival for cancer patients with metastatic renal cell carcinoma (mRCC).

➢ Retrospective analysis of 100 mRCC patients at Winship Cancer Institute from 2015-2018 with inflammation biomarkers, body mass index, and number and sites of metastases were obtained at baseline.

➢ Statistical Highlights: optimal cutpoints, small sample size, machine learning algorithms, prediction performance evaluation and calibration.
Atlanta VA Medical System

1. Predicting kidney function decline in patients with polycystic kidney disease (PKD) using electronic health record (EHR) data
   - Develop new prediction methods using machine learning and regressions. Validate and modify prediction models in the VA PKD cohort.

2. Similarity assessment between patient brain tumor samples and the derived tumor models based on gene expression profiles
   - Using gene expression data (microarray and next-gen sequencing) to evaluate different similarity/distance metrics.
**RSPH 2020 Incoming Students**

- **637** Total Incoming Students
- **26** Average Age
- **34%** Students of Color
- **13%** International Students
- **71** Languages Spoken

**BIOS Students**

- **37** – MPH in Biostatistics
- **35** – MSPH in Biostatistics
- **5** – 4+1 Program (BS/MSPH Dual Degree)

**40** – PhD Students

**Female**

- **79%**

**Male**

- **21%**

**Non-binary**

- **5%**

**Dual Degree Students**

- **42**

**Undergraduate GPA Average**

- **3.48**
Neighbors of RSPH

Centers for Disease Control and Prevention  American Cancer Society  The Carter Center

Care International  The Task Force for Global Health

Rollins Earn and Learn (REAL)
• BIOS Departmental Activities

• Student Government Association
  - Numerous Student Organizations
  - Convos on Tap
Questions to Current BIOS Students

1st Year BIOS Students:
➢ Why did you choose RSPH?
➢ What is it like to be a BIOS student?

2nd Year BIOS Students:
➢ Discuss the job positions you’ve had at RSPH? (TA/RA/REAL/APE)
➢ What are your future goals (next steps after graduation)?
Examples of Careers of MPH/MSPH Alumni

➢ ORISE Fellow, FDA, CFSAN (Center for Food Safety and Applied Nutrition)
➢ Mathematical Statistician, U.S. Consumer Product Safety Commission
➢ Associate Scientist II, American Cancer Society- Surveillance Department
➢ Data Systems Programmer, The SPHERE Institute, Acumen
➢ Biostatistician I, Brown University, Center for Statistical Sciences - School of Public Health
➢ Biostatistician I, Leidos Biomedical Research (support to NIAID)
➢ Biostatistician, Atlanta VA Medical Center through FAVER; in the Data Analytics Core
➢ Senior Statistician-Computation, Eli Lilly and Company
➢ Associate Research Scientist, Precision for Value: Health Economics and Outcomes Research Department
➢ Statistical Analyst, Department of Biostatistics, St. Jude Children's Research Hospital
Questions
&
Thank you!!