PhD Program Review
Department of Biostatistics Retreat
Core Curriculum
April 29, 2006

Biostatistics comprises the theory and methods for designing studies, analyzing data and drawing inferences in public health and biomedicine. The Johns Hopkins Department of Biostatistics PhD program prepares persons who have ambition, demonstrated aptitude for mathematics and the natural or social sciences and communication skills to become leading research biostatisticians in academia, industry, or government.

Our PhD graduates:

- conduct and publish original research on the theory and methodology of biostatistics;
- identify key public health and biomedical problems and apply statistical theory and methods to their solution, often as part of a multidisciplinary team of investigators;
- teach biostatistics to health professionals and scientists and to graduate students in biostatistics.

PhD Candidates: Hopkins Biostatistics seeks students who have ambition to solve important problems in public health and biomedicine. They have mathematical aptitude, an appreciation for the scientific method and are effective communicators.

Principles for the core curriculum:

- Set the highest standard for scholarship.
- Provide a theoretical foundation equivalent to what is available from mathematical statistics programs so that our graduates are competitive for academic positions.
- Students should finish core courses and have time to integrate statistical ideas and methods within the first two years so they are prepared to take their preliminary oral exam by the end of year 2.
- Students must master the ability to work at the statistics-science interface: formulating scientific questions in statistical terms; using mathematical and statistical models to quantify empirical evidence relevant to scientific questions; interpreting estimates and their uncertainty in scientific terms and communicating key statistical ideas for scientific audiences.
- Use an apprenticeship model where students learn professional skills and attitudes by working on projects with faculty, often in multidisciplinary teams.

Core Curriculum: We propose that the PhD Core Curriculum include two components:

- *Biostatistics core* of course work as detailed below. Student mastery of the material will be tested by written exams at the end of courses and in a first year written exam/data analysis;

- *Scientific core* whereby students develop a working expertise in a health-related discipline other than biostatistics. Students will demonstrate their expertise through the thesis proposal, preliminary oral and final public oral exams.

Biostatistics Core Curriculum:
The core curriculum comprises two course sequences, on statistical theory and statistical methods. In addition, students must demonstrate a working knowledge of a scientific discipline beyond statistics. They must demonstrate the ability to communicate statistical ideas to scientific colleagues from other disciplines.

The **core theory sequence** will be 3 semesters (6 term courses) and comprise:

- *probability:* a combination of measure-theoretic probability theory with applied models (e.g. mix of Billingsley and Feller)
- *mathematical statistics*: integrating frequentist, likelihood and Bayesian ideas through a second course level such as Cox and Hinkley
- *stochastic processes* essential to advanced biostatistical methods including Markov Chains and counting processes

The **core methods sequence** will comprise 3 semesters (6 terms) and comprise the essential content of 651-4 and 751-4. One strategy is cover the major parts of three leading books: McCullagh and Nelder (1989) for generalized linear models and likelihood inference, Carlin and Louis (199?) for modern Bayesian analysis and Hastie, Tibshirani, Friedman (2001) for frequentist/computational statistics. The suggestion was made to cover a unified treatment of GLMs in the first semester being sure to cover the key components of the entire 651-4 in one semester.

Implementation of Curriculum Change

1. Two committees have been established to develop revised 3-semester curricula for the theory (Frangakis-chair, Tan, Wang) and methods (Bandeen-Roche-chair, Louis, Caffo, Crainiceanu) sequences. They will report back to the entire faculty within the next three weeks with a proposed sequence of topics/lectures. Once the faculty has approved the changes, the instructors will develop their respective sequences for the 2006-7 (671-4, 751-754) and 2007-8 (771-772, 755-756) academic years. There was consensus that we should rely on textbooks more than in the past to establish greater consistency in the core courses across faculty.

2. New PhD students entering in 2006-7 will enroll in the updated theory sequence 671-4 and updated methods sequence 751-4. They will take the new versions of these courses

3. Second year PhD students may be exempted from 751-2 but will take 753-4 and the new 755-6 when it is offered for the first time in 2007-8. We will teach the old 771-772 for these students in 2006-7 academic year.