A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES IN BIOSTATISTICS FOR THE PHD AND MS DEGREES

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EXECUTIVE SUMMARY

The proposed program will award the PhD in Biostatistics, offered as an interdepartmental program housed within the Department of Family and Preventive Medicine (FPM) at UCSD School of Medicine. Participating faculty comprise 10 members of the Division of Biostatistics and Bioinformatics within FPM, 3 faculty from the Statistics group in the Department of Mathematics on the main campus, and 3 faculty with expertise in the data sciences from the Departments of Psychiatry (Division of Biostatistics appointment pending), Electrical and Computer Engineering, and Computer Science and Engineering. Although no stand-alone Master's degree is offered, a terminal Master's degree will be given to qualifying PhD students who fail to complete the PhD.

There is strong demand for PhD-level biostatisticians in academic medical centers, in government agencies, and in the pharmaceutical and biotech industries. Biostatistics graduate programs rank highly among the PhD granting institutions of Statistics or Biostatistics listed in US News and World Report rankings, with three of the top five programs being Biostatistics programs. In California, UCLA, USC, UC Berkeley and UC Davis offer a Biostatistics PhD; no such degree is offered south of Los Angeles. The UCSD degree will be distinguished by its close integration of training in rigorous data science theory and methods, training in practical collaborative skills, and use of important data from many areas of the biomedical sciences.

We have attached letters of support from the 3 existing UC Biostatistics programs which attest to the high number of qualified applicants which are currently turned away from UC graduate programs in Biostatistics, the high quality of our proposed program, and the strong job market for new Biostatistics PhD's. Letters of review have been solicited from the Departments of Biostatistics at Harvard School of Public Health and at University of North Carolina's Gillngs School of Global Public Health, which are among the top 10 graduate programs in Biostatistics.

The proposed degree consists of 72 units, including 24 units in mathematical statistics from the Mathematics Department, intended to provide a sound theoretical foundation; 24 units of biostatistics incorporating data analysis and collaborative projects in the life sciences, intended to provide a foundation in the collaborative data analysis fundamental to professional life as a Biostatistician; 12 units of required coursework in Life Sciences, and an additional 12 elective units of Biostatistics, Statistics, or Computer Science. There will be two written qualifying exams, an oral Life Sciences examination requirement, an oral exam to advance to candidacy, and a written dissertation requirement. There is a strong emphasis on development of communication and collaboration skills.

The anticipated start date is Fall 2015 and approximately three to five students per year are anticipated, depending on funding. Three new core Biostatistics courses are proposed, staffed by consolidating existing teaching effort of Division of Biostatistics and Bioinformatics faculty into core courses, from less formal teaching commitments such as independent study courses. We anticipate that selected students and fellows from other training programs across the School of Medicine will benefit from these new Biostatistics courses, including Joint Doctoral Program students from the Department of Family and Preventive Medicine, and selected Biomedical Sciences, Neurosciences and Medical students.

Financial support for the approximately 6 Biostatistics PhD students during their first two years is anticipated to come from several large data analysis cores which current Biostatistics faculty support, and from Teaching Assistant positions. A pending training grant, submitted earlier this year, would allow enrollment of additional students. Support for the approximately 9-12 Biostatistics students working on their dissertation is expected to come from the current research grants from the major advisor, dissertation fellowships, and collaborative biomedical research projects. Need for a half-time administrative assistant is anticipated; over the first 5 years

support will come from funds provided by the Dean of the School of Medicine to the Division of Biostatistics, as shown in detail in Section 7.

1. INTRODUCTION

1.1. AIMS AND OBJECTIVES

We aim to train the next generation of biostatisticians in the mathematical theory, computational skills, and inferential methods needed to analyze complex biomedical data. The overall objective is to train new researchers to bring innovative and cutting-edge theoretical developments from the *theoretical data sciences* into the *practical world of tools and methods for biomedical BigData analysis*.

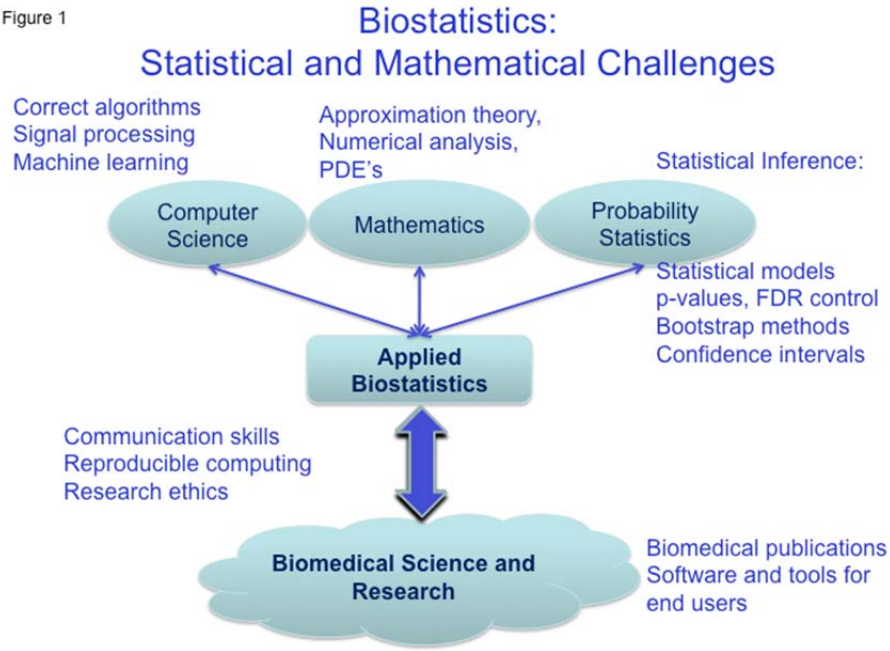
Specific Aims are to provide:

1. An integrated, comprehensive, and intensive didactic curriculum in biostatistics, statistics, and the mathematical foundations needed for analysis of biomedical data;
2. Rigorous training in computing, reproducible research practices and data management skills;
3. Substantive training in a specific domain of application in biomedical or public health sciences;
4. Instruction on research ethics, protection of human subjects, and confidentiality requirements;
5. Experiential learning and mentoring in communication and scientific writing skills and the ability to work in interdisciplinary teams.

The proposed program is distinguished by its interdisciplinary nature, and its close integration of rigorous data science theory and methods, training in practical collaborative skills, and use of important data from many areas of the biomedical sciences.

Students will receive mentorship from expert data sciences faculty drawn from 3 UCSD Schools. Led by the School of Medicine's Division of Biostatistics and Bioinformatics, the program includes faculty from the Department of Mathematics and from the 2 Computer Science Departments at UCSD's Jacobs School of Engineering. Our Biostatistics faculty provide statistical support to a rich array of research groups across the UCSD School of Medicine, including distinguished faculty with data analysis needs from the Departments of Medicine, Family and Preventive Medicine, Neurosciences, Cognitive Science, Psychiatry, and the School of Pharmacy and Pharmaceutical Sciences. Examples, data, and problems provided by these collaborating faculty will offer a rich training experience for our students and a fertile source of thesis projects.

Figure 1



The graduate program aims to prepare its students for an interdisciplinary career within an academic medical center, school of public health, health related government agencies, or the pharmaceutical and biotech industries. Focus areas include: predictive modeling and data mining with medical applications; clinical trials; public health; epidemiological and medical statistics; and drug, device and biomarker development. Students will be enabled to propose innovative quantitative models for biological phenomena, to develop appropriate

methodology for advanced data analysis, and to create new algorithms and tools suitable for analyses of complex studies, which will be published in the mainstream Biostatistics and Bioinformatics literature.

1.1.1. Program Overview

The PhD in Biostatistics is an interdepartmental program housed within the Department of Family and Preventive Medicine's Division of Biostatistics and Bioinformatics at the School of Medicine, and joint with the main campus Department of Mathematics. The core courses are Biostatistics offerings from the Division of Biostatistics and Bioinformatics, and Statistics offerings within the Department of Mathematics. Letters of support from the participating faculty and Chairs of the Departments of Mathematics, Computer Science and Engineering, and Electrical and Computer Engineering are included in Appendix A.

Program years 1 and 2 will include theoretical and applied classroom work in the core mathematical statistics and biostatistics courses, with additional electives in mathematics and/or computer science. The core courses incorporate classroom projects in theory and data analysis pertinent to biomedical data, and introduce literate programming and reproducible research practices. Year 2 requires a set of Biostatistics Rotations under the tutorship of a faculty mentor, using example data drawn from collaborative projects in biomedical or public health sciences, each with required oral, written, and web-based presentations. The student will select, by the end of year 2, a primary advisor from among participating program faculty. Additional training in the biomedical area of application will occur in years 3 and 4. Throughout, the student will participate in presentations and discussions in a seminar series and journal club.

The PhD thesis, completed in years 3-4 and potentially 5, will contain an original contribution of quality that would be acceptable for publication in the biostatistics literature, which extends the theory or methodology of biostatistics, or extends biostatistical methods to solve a critical problem in applied disciplines. A terminal Master's degree in Biostatistics is offered for students who fail to complete the PhD in a timely fashion.

1.1.2. Target audience

Individuals from a variety of backgrounds can make significant contributions to the field of biostatistics as long as they have sufficient background in statistics, mathematics, and computing, and have a strong interest or practical experience in life sciences, public health, or data analysis. Thus, our target audience includes undergraduate mathematics or statistics majors, and also undergraduate majors in public health with strong quantitative skills. We will also target those with a Master's degree in Statistics, Biostatistics or Epidemiology. Practical experience in data analysis is helpful but not required. All prospective students should be able to demonstrate good mathematical ability. Because communication skills are essential to the collaborative nature of Biostatistics, students should demonstrate good command of written and spoken English. Students should also demonstrate some prior coursework or practical experience in the life sciences (biological, environmental, medical, public health or agricultural sciences).

In addition to advertising nationally and internationally, we have identified several local institutions from which we expect to draw. The Department of Family and Preventive Medicine has an undergraduate Bachelor of Science in Public Health, and we expect to attract strong students from this program. We are fortunate to be within driving distance of 2 large and academically strong campuses of the California State University System that are designated Hispanic Serving Institutions, with large lower-income student populations and also serving large numbers of veterans: California State University (CSU) Fullerton (over 50% minority students, 11th in the US for number of bachelor's degrees awarded to minority students), and San Diego State University (over 50% minority students, 13th in the US for bachelor's degrees awarded to minority students). Each of these campuses has strong programs in Statistics at both the undergraduate and Master's level. UCSD's Division of Biostatistics has strong historical ties to each of these programs. We plan to conduct recruiting and outreach visits to these Departments in person, to assure a pipeline of strong candidates from challenging backgrounds who will be eligible for our Biostatistics PhD program.

We anticipate 2/3 of our students will be US residents with the majority from California and 1/3 will be international. Detailed projections by year are given in Section 7.

1.2. HISTORICAL DEVELOPMENT OF THE FIELD AND THE DIVISION

Brief History of Biostatistics and Statistics

The origins of Statistics and Biostatistics are tightly intertwined, and can be traced to 17th century efforts to analyze demographic and social data. A landmark was the publication in 1662 by John Graunt of *Natural and Political Observations Made upon the Bills of Mortality*, in which Graunt used mortality rolls to construct the first life tables for the city of London, and then to estimate the population size of the city and survival probabilities by gender and age. At this same time, the foundations of probability theory were laid in a series of letters in 1652 between the eminent mathematicians Blaise Pascale and Pierre de Fermat, which discussed games of chance. These two streams of 17th century inquiry would later merge into the fields of Statistics and Biostatistics.

In 1713, the new mathematical calculus of probability was formalized with publication of Jacob Bernoulli's *Ars Conjectandi*. During the ensuing 18th century, much of modern probability theory was developed by the great mathematicians of the age, including Daniel Bernoulli, Euler, Lagrange, and Laplace. Many statistical concepts were developed by these mathematicians, in the context of applications of probability theory to data from astronomy, to statistical models of smallpox epidemics, to analysis of risk and of life insurance annuities, and to modeling decisions from juries. Statistical concepts within these treatises on probability included use of an error distribution to model and combine measurement data, early tests of significance, and interval estimates rather than point estimates of a statistical parameter.

During the 19th century, the analysis of data and the rules of probability formally merged into the discipline of statistics, which at first meant study of data from demography and from society (i.e., data pertaining to the state). According to the Oxford English Dictionary, the English word "statistics" was introduced in 1791 with publication of *The statistical account of Scotland* by John Sinclair. During the 1800's the sense of the word broadened to the study of data from the sciences, not limited to the study of humanity. At this time, the two preeminent modern statistical societies were founded: the Royal Statistical Society in London in 1834 and the American Statistical Association (ASA) in Boston in 1839. Among the first members of the ASA were Lemuel Shattuck and Florence Nightingale, pioneers in the use of statistics to improve public health.

The basis of modern statistical institutions and practices were laid in the late 19th and early 20th centuries, with the work of Sir Francis Galton on linear regression, Karl Pearson on correlation and chi-squared tests and William Gosset on the t-test. Many terms and test statistics used today were developed at this time. Galton and Pearson founded the journal Biometrika in1919, which remains a leading journal in the fields of Statistics and Biostatistics. The first Department of Statistics was founded by Pearson, at University College London, in 1911, and the first Department of Biostatistics was established in 1918 at Johns Hopkins University, within the School of Public Health. Galton and Pearson's early work on heredity was continued by R.A. Fisher. It was Fisher who established the modern synthesis of likelihood-based statistical inference and also laid the foundations of statistical genetics. Fisher's influential works *Statistical Methods for Research Workers* (1925) and *Design of Experiments* (1935) came to define much of statistical practice.

A strong impetus to the field of Biostatistics came with the development of clinical research and clinical trials post World War II, ultimately leading to the current standards of evidence-based research in medicine and the life sciences. Most recently, rapid developments in "Big Data," including genomics, medical imaging, real time data from patient sensors and other areas have again led to increased demand for experts trained in analysis and inference from experimental and observational data, especially Biostatisticians.

Within the Statistics profession, the area of Biostatistics is well respected. The 2010 US News and World report jointly ranks Biostatistics and Statistics graduate programs. (Although these rankings are of debatable

utility, here they might serve as a gross indicator of professional standing.) Among the top five ranked programs, three are Biostatistics programs (University of Washington, Harvard School of Public Health, and John's Hopkins Department of Biostatistics.)

As of 2013, there were 36 PhD granting institutions in Biostatistics worldwide, 31 of these in the US. Departments of Biostatistics and graduate programs in Biostatistics are typically housed within a School of Public Health or a School of Medicine, and their faculty, students, and staff are active in supporting and collaborating in the research conducted by these schools. In California, UC Berkeley, UC Davis, USC and UCLA offer the Biostatistics PhD. UCLA's School of Public Health has the only freestanding Department of Biostatistics in California. Both UC Berkeley and UC Davis offer the Biostatistics PhD through an interdepartmental program similar to that proposed here.

Biostatistics at UCSD

The need for a Division of Biostatistics at UCSD was recognized by an external review group, the Perrin committee, in the fall of 1990. This committee consisted of senior faculty from the University of Washington, Stanford University and an editor from the Annals of Internal Medicine. Perrin committee recommendations included the establishment of a formal Biostatistics unit with an administrative identity in the School of Medicine. Subsequently in July of 2001, the Division of Biostatistics was formed in the Department of Family and Preventive Medicine, with Dr. Ronald Thomas as Division Chief. The Division was initiated with two FTEs. Since its inception the Division has grown to its present size of 10 full-time and one emeritus faculty. In 2005 the division was renamed as the Division of Biostatistics and Bioinformatics. Dr. Karen Messer was appointed as Division Chief in 2013, after a national search.

The eleven participating faculty from the Division of Biostatistics and Bioinformatics carry out a wide range of methodological and collaborative research. Faculty research interests include clinical trials methods, survival analysis, longitudinal data analysis, imaging, statistical genetics, semi-parametric and nonparametric statistics, computational statistics, Bayesian statistics, machine learning, and computational biology. Large collaborative projects in which Division faculty play key roles include Moores Cancer Center, Alzheimer's Disease Cooperative Study, Alzheimer's Disease Neuroimaging Initiative, HIV Neurobehavioral Research Program, Clinical & Translational Research Institute, Specialized Program of Translational Research in Acute Stroke, Women's Healthy Eating and Living, etc. The four faculty members of the Department of Mathematics carry out research in probability, statistics, and computational biology. The specific research areas include nonparametric estimation, semi-parametric models, time series, bootstrap methods, stochastic processes, survival analysis, measurement error, bioinformatics, and image processing.

1.3. TIMETABLE FOR DEVELOPMENT OF THE PROGRAM

We hope to enroll the first Biostatistics graduate class in Fall 2015, but if needed may postpone to Fall 2016. We have identified several sources of support for the program, including an NIH T32 training grant, with the grant application currently under review. We have developed both conservative and more optimistic timetables for enrollment numbers, to allow flexibility depending on level of support available. Detailed enrollment projections are given in Section 7. Under our conservative funding scenario starting in Fall 2015, approximately three students per year are anticipated, with full enrollment of 15 students by Fall 2019, assuming 5 years to graduation. Our longer-term target is of four or more students per year, with full enrollment of 20-25 students.

This new PhD program is consistent with the UCSD Campus goal to "Increase the graduate student population and further protect and enhance the quality of the student body" as laid out in the UCSD 2014 Strategic Plan. (http://plan.sdsc.edu/documents/Exec-Summary-Strategic-Plan.pdf). The program is included in the list of new graduate programs included in UCSD's Five-Year Planning Perspectives document that was submitted to UCOP in March 2014, which covers the period from 2014-2019.

1.4. RELATIONSHIP OF PROPOSED NEW DEGREE TO EXISTING ACADEMIC PROGRAMS

As explained below, the proposed program is expected to strengthen existing graduate programs in the Division of Physical Sciences, at the Jacobs School of Engineering, and in the Division of Health Sciences. In addition, it will synergize with existing undergraduate degrees in Mathematics and in Public Health.

1.4.1. PhD in Mathematics with a Specialization in Statistics

The Mathematics program offers the courses for 24 of the 56 required units in the Biostatistics PhD, as well as a number of electives. The graduate students in Biostatistics will increase the enrollment in each of these classes, by an expected 3-4 students per course per quarter. Conversely, interested MS and doctoral students in Mathematics/Statistics will be able to take the new Biostatistics courses offered by the program, which will make the Mathematics/Statistics program stronger and more appealing. The increased interaction between the two programs will also give extended access of the Mathematics/Statistics graduate students to Biostatistics faculty, e.g., for participation in PhD thesis committees. A possible downside would be competition for the same pool of PhD students. However, the two programs appeal to different student profiles: the Math/Statistics graduate students are theoretically oriented and are interested in methodological developments of statistics, with applications in finance and economics, as reflected by the research interests of the Math/Statistics faculty. In contrast, the Biostatistics graduate students typically have some prior experience working in life sciences and are strongly interested in applying their methodological training to specific areas of life sciences (HIV, Alzheimer's Disease, cancer, genetics).

In sum, we anticipate that both programs will get an important boost from this synergistic interaction, with negligible downward effect on enrollment into the Math/Statistics program.

1.4.2. Joint Doctoral Program in Public Health

Doctoral students in this program will benefit from the new course offerings of the Biostatistics program. There is a documented need for additional statistical courses for the JDP in Public Health. While most of the graduate courses in Biostatistics may be too technical for the standard JDP student, some of these courses will appeal to the statistically inclined JDP students.

1.4.3. Graduate Studies in computer science

Doctoral students in Computer Science programs use many statistical tools. In addition, this program is involved in a large number of life sciences projects. The proposed Biostatistics program will enhance the number of course offerings for the Computer Science students. The collaboration between the Division of Biostatistics and Bioinformatics, on one hand, and the two Computer Science (CS) departments, on the other, is built into the new PhD program in Biostatistics. This is a new connection that will help bridge two sides of the campus that have in the past not taken full advantage of the potential mutual benefit. We anticipate that on average 2-3 students in the Biostatistics program will take a course offered by the CS departments each year, and 4-5 students in the CS departments will take a course in the new Biostatistics program each year. Faculty in either program will serve on PhD thesis committees in the other program.

There is no noted negative impact on the CS programs.

1.4.4. Bioinformatics Graduate Program

While the areas of Bioinformatics and Biostatistics have some overlap, they appeal to different students and they lead to very different training. The students in Bioinformatics are required to have an engineering or biological sciences background; students in Biostatistics are required to have a mathematical and statistical background and often also are familiar with clinical research or public health.

Around the US, Biostatistics and Bioinformatics graduate programs co-exist, with varying amounts of overlap and interaction. Major universities will have both programs, often housed by different departments. Examples include: Johns Hopkins University, UCLA, Harvard University, and Stanford University.

To further explain the difference between programs, note that both areas require strong quantitative and analytical skills, but with different emphasis. *Bioinformatics* primarily uses tools from computer science for dealing with and processing high-throughput data with an emphasis on genomics. Emphasis is often on the ability to process large streams of data in a reproducible and well-documented "pipeline", such as the core processing from a genomics lab. Bioinformatics is often focused on applying existing tools and pipelines to process data as it comes off the lab bench into useable forms for more customized downstream analysis. Analyses are often exploratory, and because of the large array of variables, subsequent confirmatory analyses or experiments are often expected. *Biostatistics* uses modeling approaches from mathematical statistics and probability to identify rigorous and efficient approaches to complex data. The emphasis is on hypothesis-driven inference, accounting for the study or experimental design, potential biases in the data, and confounding variables or alternative explanations. Biostatistics is useful in complex settings where there is a temporal or spatial component, where there are correlated variables, or where data are pooled across related experiments or studies. Use of formal biostatistical principles can often identify more powerful approaches to data analysis. Formal tests of hypothesis are emphasized, and control of the false positive rate ("Type I" error) is often a priority. Emphasis is on quantifying the uncertainty in the result and the robustness of the conclusions; the analysis may be definitive or not, but the degree to which it is definitive will be presented.

Upon graduation the students of the two programs generally take different kinds of jobs. In Bioinformatics the jobs may be related to bench research/genomics/high throughput data. In Biostatistics the jobs may be involved with translational and clinical research.

1.4.5. Biomedical Sciences and Neurosciences Graduate Programs

We anticipate that several doctoral students in the Biostatistics program will fulfill their life sciences requirement using coursework from these programs each year. However, the impact on enrollment is anticipated to be minimal, and the interaction of Biostatistics graduate students with the faculty and students in these Programs are strengths. We anticipate that selected graduate students in these programs will take our new Biostatistics courses; currently Biostatistics faculty regularly offer independent study to these students, and this demand will be met by the new courses.

1.4.6. Other Graduate Programs

The impact on other graduate programs is anticipated to be minor.

Several programs are expected to benefit from the additional graduate level courses in applied Biostatistics that will be offered as part of the PhD in Biostatistics. The proposed degree is expected to strengthen the existing graduate program in Statistics within the Math Department, and also the Joint Doctoral Program in Public Health within the Department of Family and Preventive Medicine. It is anticipated that appropriate students in Computer Science and Engineering and in Electrical and Computer Engineering will benefit, as well as other qualified graduate students and fellows across campus. In addition, faculty at the UCSD School of Medicine are expected to benefit from the approximately 16 PhD candidates in Biostatics anticipated within the program, each of which will need a series of applied projects to work on throughout the course of their studies.

1.4.7. Undergraduate Programs in Mathematics and in Public Health

The new introductory graduate level classes in Biostatistics will be of interest to exceptional undergraduate seniors in the Probability and Statistics program within the Mathematics major, or the Epidemiology and Biostatistics specialization within the Bachelor of Science in Public Health program. Thus the new Biostatistics PhD program is expected to strengthen these undergraduate programs.

1.5. RELATION TO OTHER UC INSTITUTIONS

Approved Biostatistics PhD degree programs are in effect at UC Berkeley, UC Davis, and UCLA. No such program is offered in the San Diego area. The proposed UCSD program will interact with other UC programs

for curriculum development and research programs. Letters of support from the program directors of UC Berkeley, UC Davis, and UCLA are included in Section 10 of this document. All are enthusiastic in their support, and several offered constructive comments that have strengthened this proposal. They are unanimous in commenting on the high quality of our proposed program.

1.6. ADMINISTERING DEPARTMENT

The PhD in Biostatistics will be administered by the Division of Biostatistics and Bioinformatics of the Department of Family and Preventive Medicine in the UCSD School of Medicine.

1.7. PROGRAM EVALUATION

As described in detail in Section 6 on Governance, the Program in Biostatistics will be reviewed annually by the Biostatistics Graduate Committee and by an External Advisory Committee. The results of this review will be communicated to the Department of Family and Preventive Medicine's Education Committee by the Biostatistics Division Chief and the Graduate Program Director, for annual review at the Department level. At the Campus level, following established campus procedures, approximately eight years after admitting the first class of students the program will be reviewed by the UCSD Academic Senate's Graduate Council, the Graduate Programs Education Committee of the Committee on Educational Policy within the UCSD School of Medicine, and by the Office of Graduate Studies and Research.

2. PROGRAM

2.1. UNDERGRADUATE PREPARATION FOR ADMISSION AND APPLICATION REQUIREMENTS

Biostatistics is somewhat unique among scientific fields in that undergraduate training in the field is not a prerequisite for admission to graduate study in the field. Individuals from a variety of backgrounds can make significant contributions to the field of biostatistics as long as they have sufficient background in statistics, mathematics, and computing, and have a strong interest or practical experience in life sciences, public health, or data analysis. There are several paths to a Biostatistics PhD. One concerns undergraduate mathematics or statistics majors. Another possible undergraduate path leading to a degree program in statistics would be a major in public health. Another path includes individuals who have a Master's degree in Statistics, Biostatistics or Epidemiology, possibly with some experience in data analysis and/or public health. Practical experience in data analysis is helpful but not required. All prospective students should be able to demonstrate good mathematical ability. Because communication skills are essential to the collaborative nature of Biostatistics, students should demonstrate good command of written and spoken English. Students should also demonstrate some prior coursework or practical experience in the life sciences (biological, environmental, medical, public health or agricultural sciences).

The application fee is:

- $80.00 for U.S. Citizens and Permanent Residents
- $100.00 for International Applicants

The following documents are required:

- Statement of Purpose
- Transcripts (official transcripts will be required if admitted into the program)
- List of mathematics courses taken/projected as well as textbooks used
- Exactly three letters of recommendation (do not send more than three letters of recommendation)
- General Graduate Record Examination (GRE) test scores
- GRE Math Subject test scores

- TOEFL test scores (for foreign applicants from non-English speaking countries)
- PhD Applicants Who Are U.S. Citizens are required to complete a FAFSA (http://www.fafsa.ed.gov/). This will assist in determining which applicants are eligible for grants that may have been awarded to support the interdepartmental program by various agencies and donors. FAFSA information plays no role in admission decisions.

The minimal requirements for entrance into the PhD program are: a bachelor's degree with a 3.0 overall grade-point average; one year of calculus, a course in linear algebra and in probability, and upper division real analysis equivalent to the UCSD courses Math 140A/B (Foundations of Real Analysis), Math 180A (Probability) and Math 102 (Applied Linear Algebra) or Math 170A (Numerical Linear Algebra); facility with a programming language; and additional upper-division work in mathematics and/or statistics. Applicants whose first language is not English are required to take the Test of English as a Foreign Language (TOEFL). Applicants are also required to submit official college transcripts, three letters of recommendation, and a statement of interest. Applicants are evaluated based on submitted material.

In certain situations students will be admitted into the program who do not satisfy all prerequisites. In these cases course work deficiencies should be made up by the end of the first academic year following initial enrollment by earning a letter grade of B or better.

2.2. FOREIGN LANGUAGE

There will be no foreign language requirement. English is the common language of the discipline. There is a requirement that every student be able to communicate effectively in spoken and written English.

2.3. PROGRAM OF STUDY

2.3.1. Degree Type

All qualified students will obtain the degree in Biostatistics (PhD or MS). Students will enroll in the PhD but may be granted a terminal MS.

2.3.2. Course Requirements

PhD students are required to obtain 72 units of coursework from the following courses. For the MS degree the requirement is of 52 units (48 units of required courses in Mathematical Statistics and Biostatistics and 4 units in Life Sciences). Full time graduate student must register for a minimum of 12 units per quarter. These 12 units can be made up of a combination of required coursework as described below, additional elective coursework if any, and special study courses (BST 299). All student course programs, as well as any changes throughout the quarter, must be approved by a faculty advisor prior to registering for classes each quarter.

2.3.3. Required Courses (60 units)

a. Required (Core) Courses in the Department of Mathematics (24 units)
    i. MATH 281 A, B,C (Mathematical Statistics I-II, 4 units each)
    ii. MATH 282 A, B (Linear Models, 4 units each)
    iii. MATH 284 (Survival Analysis, 4 units)
b. Required (Core) Courses in Biostatistics (24 units)
    i. BST 221: Biostatistical Methods I (4 units)
    ii. BST 222: Biostatistical Methods II (4 units)
    iii. BST 223: Analysis of Longitudinal Data (4 units)
    iv. BST 227 A, B, C: Biostatistics Rotation (3 quarters, 3 units each)
    v. BST 290: Biostatistics Seminar/Journal Club (3 quarters, 1 unit each)

We note that all of the Biostatistics core courses except BST 290 carry a data analysis component. Students will be exposed to projects involving advanced data analyses to address complex life sciences problems. All courses except BST 290 are letter grade only.

c. Required Life Sciences (12 units)

Three courses at the upper division or the graduate level in Biomedical Sciences, Neurosciences, Epidemiology, Public Health, Biology, Systems Biology, Bioengineering, or Medicine, letter grade if possible.

These courses are intended to provide the students with background in the life sciences and an introduction to complex life sciences problems that will constitute the area of application of their thesis and future research. The students are strongly encouraged to take further Life Sciences elective courses that are relevant to their research. Selection of all Life Sciences courses should be made in consultation with the thesis adviser.

2.3.4. Elective Courses (12 units)

a. Biostatistics Elective Courses

Students are required to take at least 12 additional units of elective courses for letter grade from the following list, of which 8 or more units are from the Biostatistics electives. The Biostatistics elective courses are listed under one umbrella course number: BST 252, Advanced Topics in Biostatistics (4 units). This course is taught in rotation by the DBB faculty, once or twice a year, and the curriculum will vary. Among the topics are:

i. Design of Scientific Investigations
ii. Statistical Methods for Observational Studies
iii. Advanced Statistical Computing
iv. Clinical Trials
v. Bayesian Methods in Statistics
vi. Missing Data in Statistics

b. Statistical Methods Electives:

i. MATH 280 ABC (Probability Theory, 4 units)
ii. MATH 282 AB (Applied Statistics)
iii. MATH 287 B (Multivariate Analysis, 4 units)
iv. MATH 287 D (Statistical learning, 4 units)
v. MATH 287A, C (Time Series Analysis, 4 units each)
vi. MATH 202A (Applied Algebra I, 4 units)
vii. MATH 240ABC (Real Analysis, 4 units)
viii. MATH 271ABC (Numerical Optimization, 4 units)
ix. MATH 285 (Stochastic Processes, 4 units)

c. Computer Science Electives:

i. CSE 202 (Algorithm Design and Analysis)
ii. ECE 273 (Convex Optimization, 4 units)
iii. CSE 250B: (Learning Algorithms, 4 units)
iv. CSE 255: (Data mining and predictive analytics, 4 units)
v. CSE 260: (Parallel computation)
vi. CSE 283 (Genomics, Proteomics, Systems Biology, 4 units)

2.3.5. Biostatistics Rotations (BST 227 ABC)

The Biostatistics Rotations are a singular feature of this PhD program that takes advantage of the extensive involvement of the program faculty in collaborative and interdisciplinary work within the Life Sciences. Students will complete at least three and up to five quarter-length rotations before advancing to candidacy, each in the

form of an interdisciplinary applied data analysis project. They may work in collaboration with any UCSD faculty researcher who conducts studies or experiments which generate data in the medical, biological, public health or pharmacologic sciences, and who will serve as a subject area mentor, under the primary mentorship of any Biostatistics or Statistics member of the interdepartmental program. Each practicum will last a minimum of six weeks and will involve the analysis of original data. The student will prepare or substantially contribute to a project report, which will be reviewed and signed off on by the mentor. The rotation may be conducted as part of employment as a Graduate Student Researcher or as part of the dissertation research. A report based on an internship of at duration of at least six weeks at a facility, government health office, institute or company outside of UCSD focusing on biological or medical research can also be used to satisfy this requirement.

2.4. FIELD EXAMINATIONS

None.

2.5. QUALIFYING EXAMINATIONS AND DISSERTATION REQUIREMENTS

2.5.1. Preliminary Written Examination

The PhD Written Qualifying Examination will be given at the end of each Spring Quarter and also at the beginning of each Fall Quarter. Students in the PhD program must attempt the exam in the Spring Quarter immediately after they complete both the Math 281 ABC and BST 221-223 core course series. A well-prepared student will take these exams during the first year of the program. Otherwise, they are expected to take the exams during the second year of the program. At least one of the exams must be completed with a provisional PhD pass or better by the end of the first year. Two failures to pass the examination at the PhD Level will result in a recommendation to the Dean of Graduate Studies for disqualification of the student in the PhD program.

The PhD Written Qualifying Examination has two parts: A statistical theory part, developed and scored by the Statistics Group within the Math Department; and a biostatistics part, developed and scored by the Division of Biostatistics and Bioinformatics within the Department of Family and Preventive Medicine (FPM). The exam committees in charge may be different for each part of the exam. Whether or not students pass or fail is determined separately by the exam committees for the Statistical Theory part and the Biostatistics part of the exam. The student must pass at the PhD pass or provisional pass level. The Biostatistics Graduate Program Committee will appoint an exam committee that will be responsible for preparing, administering and grading the examination for the Biostatistics part of the exam. Each exam committee will forward its recommendation to the chair of the Graduate Program Committee, which will be the final arbiter of pass or fail.

Qualifying Examination Pass Levels	
PhD Pass	Excellent performance, suitable for continuing towards doctoral work
Provisional PhD Pass	Marginal performance at doctoral level
MS Pass	Not suitable for continuing towards doctoral work, but satisfactory for terminal MS
Fail	Unsatisfactory for Master's level work

2.5.2. Life Sciences Qualifying Examination

Students in the PhD program must also pass a Life Sciences Qualifying Examination. This consists of a seminar presentation of a statistical application in a particular area of life sciences. The presentation will be evaluated by an ad-hoc committee of three faculty members, including at least one outside (non-statistician)

member with expertise in the area of application. The exam is taken Pass/Fail. The student is allowed two attempts at taking this exam. The student should pass this requirement prior to the end of the third year of study. The presentation will be evaluated on the students' demonstration of a sufficient understanding of the area of application, and on the relevance of the statistical approach to this area.

2.5.3. Advancement to Candidacy

It is expected that by the end of the third year (9 quarters), students should have a field of research chosen and a faculty member willing to direct and guide them. A student will advance to candidacy after successfully passing the oral qualifying examination, which deals primarily with the area of research proposed. The student will also have successfully completed at least 68 units of required and elective courses within the Program. Required courses will be completed letter grade only.

Advisers must submit the Application for the Qualifying Exam (QE) four weeks prior to the exam date; exams taken before receiving Office of Graduate Studies approval may be deemed null and void. Students must be registered during the quarters in which they take any portion of their QE. To be eligible for the QE, the student must have:

- A "B" average in all work done in graduate standing;
- Satisfied all departmental or group requirements; and
- Removed all academic deficiencies

The preparation for the exam will be done by working closely with a faculty mentor (independent study) who is a regular member of the interdepartmental Program in Biostatistics. The exam committee consists of the Doctoral Committee. The PhD Qualifying Examination examines a student on the breadth and depth of knowledge expected from the coursework taken, and a special research topic approved by the committee. The primary purpose of the QE is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and clearly communicate its results, and successfully produce the dissertation required for a doctoral degree. A forty-five minute presentation given by the student is followed by a question period that covers the special research topic as well as coursework in general.

Graduate Studies guidelines for PhD Qualifying Examinations apply. A student who passes the PhD QE is eligible for Advancement to Candidacy for the PhD degree. Title and abstract of the PhD QE presentation will be distributed to all faculty and students of the participating departments in the Program in Biostatistics, who are invited to attend the presentation portion of the examination. The subsequent question period is a closed session between the student and the committee. The student must file the appropriate paperwork with the Office of Graduate Studies and pay the candidacy fee to be promoted to Candidacy for the PhD degree.

Qualifying Exam: Outcomes. A committee, having reached a unanimous decision, shall inform the student of its decision as "Pass" (no conditions may be appended to this decision), "Not Pass" (the Chair's report should specify whether the student is required to retake all or part of the exam, list any additional requirements, and state the exact timeline for completion of requirements to achieve a "Pass") or "Fail". If a unanimous decision takes the form of "Not Pass" or "Fail", the Chair of the QE committee must include in its report a specific statement, agreed to by all members of the committee, explaining its decision and must inform the student of its decision. Having received a "Not Pass" or "Fail", the student may attempt the QE one additional time. After a second exam, a vote of "Not Pass" is unacceptable; only "Pass" or "Fail" is recognized. Only one retake of the QE is allowed. A student who fails the QE on the second attempt will be recommended to the Dean of Graduate Studies for disqualification from the PhD program.

2.6. DOCTORAL DISSERTATION

The doctoral dissertation is an essential part of the PhD program. A topic will be selected by the student, under the advice and guidance of a Major Professor (thesis adviser) and a Dissertation Committee chaired by the

Major Professor. At least one member of the committee must be a tenured faculty from outside the Biostatistics program; often this will be a member of the biomedical sciences faculty who can provide a motivating problem or data set from an area of application, in collaboration with the major advisor. Students are encouraged to begin some research activity as early as possible during the second year of their graduate studies, and to use the Biostatistics Rotation to assess potential thesis advisers. The dissertation must contain an original contribution of quality that would be acceptable for publication in the biostatistics literature that extends the theory or methodology of biostatistics, or extends biostatistical methods to solve a critical problem in applied disciplines.

Acceptance of the dissertation by three designated members of the dissertation committee follows Graduate Studies guidelines. A draft of the dissertation shall be given to each dissertation committee member at least four weeks before the final examination described below.

2.7. FINAL EXAMINATION (DISSERTATION DEFENSE)

The entire dissertation committee will conduct a final oral examination, which will deal primarily with questions arising out of the relationship of the dissertation to the field of Biostatistics. The final examination will be conducted in two parts. The first part consists of a one-hour presentation by the candidate followed by a brief period of questions pertaining to the presentation; this part of the examination is open to the public. The second part of the examination will immediately follow the first part; this is a closed session between the student and the committee and will consist of a period of questioning by the committee members. Title and abstract of the oral presentation will be distributed to all faculty and students of departments that participate in the Biostatistics Program, who are invited to attend the presentation portion of the examination.

2.8. ADDITIONAL OR SPECIAL REQUIREMENTS

No special requirements are proposed.

2.9. RELATIONSHIP OF MASTER'S AND DOCTORAL PROGRAMS

Students will enroll in the PhD degree. Students who leave the PhD program prior to obtaining the PhD degree are eligible to obtain the MS degree under Plan II (SD Senate regulation 700), which requires a comprehensive written exam. The PhD written QE will serve in this role; students must pass at the MS level. Students are also required to have obtained 48 units of Core Courses with a passing grade.

2.10. TEACHING REQUIREMENTS

There is no formal teaching requirement for the PhD degree. No special preparations for a career in teaching are needed.

2.11. SAMPLE PROGRAM OF STUDY

	Fall Quarter	Winter Quarter	Spring Quarter
Year 1	Math 281A (Math Stat) (4) Math 282A (Linear Models) (4) BST 221 (Biostat Methods I) (4) BST 290 (Seminar/JC) (1)	Math 281B (4) Math 282B (4) BST 222 (Biostat Methods II) (4) BST 290 (Seminar/JC) (1)	Math 281C (4) Life Science elective BST 223 (Longitudinal Data) (4) BST 290 (Seminar/JC) (1)
Year 2	BST 252 (Adv. Topics) (4) BST 251A (Rotation) (3) Additional Elective (4) BST 290 (Seminar/JC) (1)	BST 252 (Adv. Topics) (4) BST 251B (Rotation) (3) Additional Elective (4) BST 290 (Seminar/JC) (1)	Math 284 (Surv. Anal.) (4) BST 251C (Rotation) (3) Life science elective BST 290 (Seminar/JC) (1)
Year 3	BST 299 Thesis Research Life Science elective BST 290 (Seminar/JC) (1)	BST 299 Thesis Research Additional Elective BST 290 (Seminar/JC) (1)	BST 299 Thesis Research BST 290 (Seminar/JC) (1)
Year 4	BST 299 Thesis Research BST 290 (Seminar/JC) (1)	BST 299 Thesis Research BST 290 (Seminar/JC) (1)	BST 299 Thesis Research BST 290 (Seminar/JC) (1)

2.12. NORMATIVE TIME TO DEGREE

The normative time for the PhD in Biostatistics is five years; a student must have advanced to candidacy by the end of 11 quarters. A student is eligible for support for a maximum of five years. The final thesis defense must have been conducted by the end of the 5th year.

Students must pass two written qualifying exams at the PhD level by the end of their second year. At least one of the exams must be completed with a provisional PhD pass or better by the end of the first year. In the second year, a student begins Biostatistics Rotations so that they become familiar with the process of doing research and familiarize themselves with a number of faculty members who may serve as their advisor. Optimally, a student advances to candidacy sometime in their third year; a student must have advanced to candidacy by the end of 11 quarters. This allows for the fourth and fifth year to concentrate on research and produce a thesis. In contrast to coursework, research is an unpredictable endeavor, so it is in the interest of the student to have as much time as possible to produce a thesis.

3. PROJECTED NEED

3.1. SIMILAR DEGREES OFFERED ELSEWHERE.

As of 2013, there were 36 PhD granting institutions in Biostatistics worldwide, 31 of these in the US. In California, UC Berkeley, UC Davis, USC and UCLA offer the Biostatistics PhD. UCLA's School of Public Health has the only freestanding Department of Biostatistics in California. Both UC Berkeley and UC Davis offer the degree through an interdepartmental program similar to that proposed here. At each of these sister institutions, the program is joint between a main campus Department of Statistics and a Division of Biostatistics within the School of Public Health (UC Berkeley) or School of Medicine (UC Davis). At USC, the degree is offered by the

Division of Biostatistics and Bioinformatics, within the Department of Preventive Medicine in the School of Medicine. There is no graduate program in Biostatistics south of Los Angeles.

3.2. STUDENT DEMAND FOR THE PROGRAM

We anticipate having many more applicants to the program than we can admit, similar to the other Biostatistics programs at UCLA, UC Berkeley and UC Davis and elsewhere. As noted in the letter of support from UC Davis, applications to UC Biostatistics PhD programs from well-qualified domestic and international students have been increasing, and there are more applicants than can currently be accommodated within the UC system. We anticipate that two thirds of our students will be in-state, and one third will be out-of-state (the majority of these being international students).

3.3. PLACEMENT OF THE GRADUATES

The demand for well-trained PhD level Biostatisticians continues to be strong within academic medical centers, industry, and government. As noted in the letter of support from UCLA, “There is an unmet demand for Ph.D. level Biostatisticians in medical research”, and the letter adds that the approximately 6 graduates each year from the UCLA program have no difficulty in finding research positions in academia, industry, or government. There are currently 40 open positions on the American Statistical Association job website appropriate for a new PhD in biostatistics. There are many additional positions open within academia and industry that are not currently listed on this site.

3.4. IMPORTANCE TO THE DISCIPLINE

Biostatistics has been a growing field of study at least since the 1960s. New problems in data analysis have grown rapidly along with advancements in science and technology. Many areas of biomedical science are suffering from a critical shortage of data scientists who have deep expertise in mathematics, statistics, and the underlying biomedical science. Recent editorials (Science, 2012: 10.1126 / science.1218685; Nature Methods, 2013; 10(9)) have noted major concerns with reproducibility in biomedical research associated with the “data deluge,” and have called for better training in experimental design and statistical inference across the biomedical sciences. The proposed program aims to address these issues. The program will produce PhDs in Biostatistics who will become researchers and instructors in methodological as well applied areas of biomedical data science.

3.5. IMPORTANCE TO SOCIETY

The importance of Biostatistics to society has been well recognized. Biostatistical tools are used daily in the advance of biomedical sciences, in understanding the mechanisms of human diseases, and in developing treatments for diseases. Biostatistics is used in the conduct of clinical trials, observational studies, and biological experiments including those that generate high-throughput data such as genomic studies, and has made major contributions to understanding the treatment of AIDS, cancer, cardiovascular, Alzheimer’s, and many other diseases. Biostatistical education is one of the core components of Clinical Research and Public Health education US- and world-wide.

3.6. RELATION TO PROFESSIONAL INTERESTS OF THE FACULTY

The participating faculty members, particularly those of the Division of Biostatistics and Bioinformatics in FPM and of the Department of Mathematics, have long been interested in a doctoral program in Biostatistics. A graduate program, through its steady stream of doctoral dissertations, will facilitate the development of methodological work, will assist in supporting collaborative projects, and will help to recruit high quality new faculty members and to retain existing faculty.

3.7. UNIQUE FEATURES OF THE PROGRAM

The UCSD program will be distinguished by its strong ties to the UCSD Department of Mathematics, providing the students with an unusually rigorous foundation in statistical theory. This is complemented by the strengths of the faculty in the Division of Biostatistics and Bioinformatics, five of whom have primary training in mathematical statistics or in pure mathematics. Along with the exceptional basic science strength of the collaborative projects available at UCSD School of Medicine, this is expected to result in an unusually technically strong Biostatistics program.

4. FACULTY

4.1. FACULTY RESEARCH AND MENTORING EXPERIENCE

4.1.1. Overview of Faculty Research Expertise and Involvement with Biomedical Data

As shown in **Table A**, participating faculty have vibrant research programs incorporating biomedical data across a spectrum of disease areas, areas of technical expertise, and data types. They participate as key personnel on active research grants totaling $160 million in direct costs (see Appendix **Table E**).

Table A. Participating Faculty Research Expertise and Involvement with Biomedical Data

Disease Areas	Biostatistical or Statistical Expertise	Data Types
Alzheimer's	GWAS and genomic tools and methods	Genomics, metabolomics, proteomics
Addiction	Bayesian computation	Neuroimaging
Behavioral health	Causal modeling and networks	Natural language processing
Cancer	Nonparametric curve estimation	Biomarker discovery
Cardiovascular	Mixed effects and time-to event models	Electronic health records archives
Diabetes	Large scale real time signal processing	Geographical information systems
HIV/AIDS	Machine learning and big data analytics	GPS data
Immunology	Bootstrap resampling theory / methods	Mobile wireless sensor data
Nephrology	Missing data and control of bias	Chemoinformatic fingerprints
Obesity	Methods for high throughput screening	High-throughput drug screens
Rheumatology	Adaptive study designs	Twitter feeds
Stroke	High-dimensional predictive models	

4.1.2. Overview of Faculty Teaching and Mentoring Experience

A criterion for Program faculty participation is a commitment to graduate education and mentorship. Many of the participating faculty are highly experienced pre-doctoral advisors. Biostatistics faculty have a strong track record of teaching and mentoring across the School of Medicine in applied biomedical domains. Over the past 10 years, they were primary biostatistical mentors for 28 predoctoral students in the Joint Doctoral Program in Public Health. The corresponding numbers for mathematics faculty are 19 predoctoral students and 16 publications.

4.2. FACULTY CREDENTIALS AND TEACHING COMMITTMENTS

The 14 faculty listed below have committed to regular classroom teaching in this program, and in particular to the courses listed in Section 5, which they regularly teach (existing courses), or will teach (new courses). (Please see letters in **Appendix E**.) All faculty have the PhD in Statistics or Mathematical Statistics, with the exception of the two faculty from computer science departments, who have the PhD in Computer Science. 3 additional Biostatistics faculty will participate in the Biostatistics Rotations, and in mentoring of students.

4.2.1. Division of Biostatistics faculty

All ten regular Biostatistics faculty members have committed to participating in BST 251 ABC, the biostatistics rotation (emeritus faculty is the exception). In addition eight Division of Biostatistics faculty members have committed to regular classroom teaching in the program (one joint with Mathematics, listed there). As indicated

below, three faculty members have committed to develop and teach the three new core courses (BST 221-223), and four faculty members have committed to teaching the rotating elective course BST 252, which will be taught twice per year. Brief vitae of the participating faculty are listed in **Appendix A,** and their letters of commitment are in **Appendix E.**

Classroom teaching commitments:

- **Messer**, Professor and Chief, Division of Biostatistics, FPM
  - Biostatistics Core course; supported by FTE, shifted from independent study teaching
- **Vaida**, Adjunct Professor, Division of Biostatistics, FPM
  - Biostatistics Core course, shifted from existing MAS teaching
- **Thompson**, Associate Professor in Residence, Dept. of Psychiatry (joint appointment pending, Division of Biostatistics)
  - Biostatistics Core course, new Division member, shifted from independent study teaching
- **Natarajan**, Adjunct Professor, Division of Biostatistics, FPM
  - Biostatistics Elective, Reworking of existing FPM elective
- **Jain**, Professor, Division of Biostatistics, FPM
  - Biostatistics Elective, supported by FTE. Reworking of existing FPM elective
- **Gamst**, Professor in Residence, Division of Biostatistics, FPM
  - Biostatistics Elective, shifted from independent study teaching
- **Donohue**, Adjunct Assistant Professor, Division of Biostatistics, FPM
  - Biostatistics Elective, new hire

4.2.2. Department of Mathematics faculty

Five Department of Mathematics faculty members (one with joint appointment in FPM) have committed to classroom teaching in the program. Each regularly teaches a core math course and course listed among the electives.

- **Xu** Professor, Division of Biostatistics, FPM and Dept. of Mathematics
- **Abramson**, Professor, Dept. of Mathematics
- **Bradic**, Assistant Professor, Dept. of Mathematics
- **Politis**, Professor, Dept. of Mathematics
- **Arias-Castro**, Associate Professor, Dept. of Mathematics

4.2.3. Departments of Electrical and Computer Engineering and Computer Science and Engineering

Two members of the computer science faculty with research interests in large-scale data analysis and data mining have committed to teaching in the program. Each regularly teaches one or more of the courses listed among the electives.

- **Lanckriet**, Associate Professor, Department of and Electrical and Computer Engineering
- **Dasgupta**, Professor, Department of Computer Science and Engineering

5. COURSES

5.1. PROPOSED NEW COURSES (#UNITS)

BST 221 Biostatistical Methods I (4) Introductory graduate course in the analysis of biomedical data. Continuous outcomes: linear regression model and ANOVA, robust alternatives based on permutations, model building; interaction and confounding. Analysis of binary and categorical data. Prerequisites: Enrollment in the Biostatistics program. (**Vaida**)

BST 222 Biostatistical Methods II (4) Intermediate level graduate course in the analysis of continuous response, categorical response, and censored survival data. Covers methods for stratified analyses of discrete data and case-control studies, multinomial regression models, Poisson regression and loglinear models, generalized linear models, splines, additive and generalized additive models, comparing survival distributions, proportional hazards and other censored data regression methods, recurrent events, competing risks, and multivariate survival models (**Thompson**). Prerequisites: BST 221.

BST 223 Analysis of Longitudinal Data (4) Presents modern approaches to the analysis of repeated measures and longitudinal data. Topics include general linear model for longitudinal data, parametric modeling of covariance, generalized estimating equations, linear, nonlinear and generalized linear mixed effects models, binary, categorical and count data, and modeling dropout in longitudinal studies. Data analysis and computational issues are addressed. (**Messer**) Prerequisites: BST 221, BST 222, Math 281A-B, Math 282A-B.

BST 227 A-B-C: Rotation (3 units) Assisting teaching faculty in biomedical research projects by performing data analyses under supervision. (**Biostat faculty**) Prerequisites: BST 221, BST 222, Math 281A-B.

BST 252: Advanced Topics in Biostatistics (4) Biostatistical methods and models selected from the following: genetics, bioinformatics and genomics; longitudinal or functional data; clinical trials and experimental design; analysis of environmental data; dose-response, nutrition and toxicology; survival analysis; observational studies and epidemiology; computer-intensive or Bayesian methods in biostatistics. Generally, the topics will differ every time the course is offered, within a 2-3 year cycle. Offered every year, in Winter and Spring. (**Natarajan, Jain, Gamst, Donohue**) Prerequisites: BST 221, BST 222.

BST 290: Seminar in Biostatistics (1) Seminar-1 hour. Seminar on advanced topics in the field of biostatistics. Presented by members of the Biostatistics Program and other guest speakers. (**Donohue**) May be repeated for up to 12 units of credit. (S/U grading only.)-I, II, III.

BST 299: Thesis Research (1-12) Research in biostatistics under the supervision of major professor. (S/U grading only.) Prerequisites: advancement to Candidacy for PhD and consent of instructor.

5.2. EXISTING COURSES (# UNITS)

MATH 280A-B-C. Probability Theory (4-4-4) Probability measures; Borel fields; conditional probabilities, sums of independent random variables; limit theorems; zero-one laws; stochastic processes. Prerequisites: advanced calculus and consent of instructor. (**Driver**)

MATH 281A. Mathematical Statistics (4) Statistical models, sufficiency, efficiency, optimal estimation, least squares and maximum likelihood, large sample theory. Prerequisites: advanced calculus and basic probability theory or consent of instructor. (**Abramson**)

MATH 281B. Mathematical Statistics (4) Hypothesis testing and confidence intervals, one- sample and two-sample problems. Bayes theory, statistical decision theory, linear models and regression. Prerequisites: advanced calculus and basic probability theory or consent of instructor. (**Abramson**)

MATH 281C. Mathematical Statistics (4) Nonparametrics: density estimation, regression, bootstrap and jackknife, testing. Introduction to statistical computing using S plus. Prerequisites: advanced calculus and basic probability theory or consent of instructor. (**Arias-Castro**)

MATH 282A-B. Applied Statistics (4-4) Sequence in applied statistics. First quarter: general theory of linear models with applications to regression analysis. Second quarter: analysis of variance and covariance and experimental design. Third quarter: further topics to be selected by instructor. Emphasis throughout is on the analysis of actual data. Prerequisite: Math. 181B or equivalent or consent of instructor. (S/U grades permitted.) (**Politis, Arias-Castro**)

MATH 284. Survival Analysis (4) Survival analysis is an important tool in many areas of applications including biomedicine, economics, engineering. It deals with the analysis of time to events data with censoring. This course discusses the concepts and theories associated with survival data and censoring, comparing survival distributions, proportional hazards regression, nonparametric tests, competing risk models, and frailty models. The emphasis is on semiparametric inference, and material is drawn from recent literature. Prerequisites: Math. 282A or consent of instructor. (**Xu**)

MATH 285A. Stochastic Processes (4) Elements of stochastic processes, Markov chains, hidden Markov models, Poisson point processes, renewal processes martingales, Brownian motion, Gaussian processes, Kalman filter. Other topics to be selected by instructor depending on interest of class. Prerequisites: Math. 180A (or equivalent basic probability course) or consent of instructor. (**Schweinberg**)

MATH 287A. Time Series Analysis (4) Discussion of finite parameter schemes in the Gaussian and non-Gaussian context. Estimation for finite parameter schemes. Stationary processes and their spectral representation. Spectral estimation. Prerequisite: Math. 181B or equivalent, or consent of instructor. (**Politis**)

MATH 287B. Multivariate Analysis (4) Bivariate and more general multivariate normal distribution. Study of tests based on Hotelling's T2. Principal components, canonical correlations, and factor analysis will be discussed as well as some competing nonparametric methods, such as cluster analysis. Prerequisites**:** Math 181B or equivalent, or consent of instructor. (**Bradic**)

MATH 287D. Statistical Learning (4) Topics include regression methods: (penalized) linear regression and kernel smoothing; classification methods: logistic regression and support vector machines; model selection; and mathematical tools and concepts useful for theoretical results such as VC dimension, concentration of measure, and empirical processes. Prerequisites**:** Math 287C or consent of instructor. (**Bradic**)

CSE250B - Principles of Artificial Intelligence: Learning Algorithms (4) Algorithms for supervised and unsupervised learning from data. Content may include maximum likelihood, log-linear models including logistic regression and conditional random fields, nearest neighbor methods, kernel methods, decision trees, ensemble methods, optimization algorithms, topic models, neural networks and backpropagation. CSE 103 or similar course recommended. (**Dasgupta**)

CSE250C - Machine Learning Theory (4) Theoretical foundations of machine learning. Topics include concentration of measure, the PAC model, uniform convergence bounds and VC dimension. Possible topics include online learning, learning with expert advice, multiarmed bandits and boosting. Prerequisites**:** CSE 103 and CSE 101 or similar course recommended. (**Dasgupta**)

CSE 255: Data mining and predictive analytics (4) Learning methods for applications. Content may include data preparation, regression and classification algorithms, support vector machines, random forests, class imbalance, overfitting, decision theory, recommender systems and collaborative filtering, text mining, analyzing social networks and social media, protecting privacy, A/B testing. Prerequisites**:** CSE 103 or similar recommended. (**TBD**)

CSE 260: Parallel computation (4) An overview of parallel hardware, algorithms, models and software. Topics include Flynn's taxonomy, interconnection networks, memory organization, a survey of commercially available multiprocessors, parallel algorithm paradigms and complexity criteria, parallel programming environments and tools for parallel debugging, language specification, mapping, performance, etc. Prerequisites**:** Graduate standing or consent of instructor. (**TBD**)

ECE 273. Convex Optimization (4) Convex optimization – theory and algorithms. Linear, quadratic, second-order cone programming; semidefinite and geometric programming; Lagrange duality theory. Gradient and descent methods; Newton's method, barrier and interior-point methods. Applications in finance, machine learning, likelihood theory. (**Lankreit**)

FPM 258 ABC Public Health Doctoral Lecture Series (4) This three-quarter lecture/seminar series for students in the UCSD/SDSU Joint Doctoral Program in Public Health (Epidemiology, Health Behavior and Global Health) is designed to promote critical thinking about current public health issues as well as professional skills and personal development (**TBD**)

6. ACADEMIC AND ADMINISTRATIVE RESOURCES

6.1. INSTITUTIONAL COMMITTMENTS

The School of Medicine and participating Departments are committed to ensuring the success of this program, which will bring outstanding quantitative pre-doctoral students to research at the intersection of biomedical and statistical sciences. 15% support for the Program Director will be provided, using funds provided by the Dean of the School of Medicine to the Division of Biostatistics and Bioinformatics. In addition, Dean's funds will support 10% released time for faculty support as needed for course development and other needs, and will support the half time Program Administrator (see *detailed budget below*). The participating Departments of Mathematics and of Electrical and Computer Engineering have each committed to provide 2 Teaching Assistant slots yearly (4 total) in the context of the related training grant submission, should this grant be funded. Importantly, these positions cover all in-resident tuition and fees and pay the student stipend. In addition, the Chair of the Department Family and Preventive Medicine, which houses the Division of Biostatistics and Bioinformatics, has committed office space for students adjacent to the Division's centrally-located faculty offices in the School of Medicine (see *letter of support*). This location will facilitate student interaction with Medical School researchers and with other students in Biostatistics, and mentoring by Biostatistics / Bioinformatics faculty. The major professor will be responsible for identifying office space once students have advanced to candidacy. As most students are anticipated to work with Biostatistics faculty on existing funded projects, this is not anticipated to be a difficulty. The Division of Biostatistics and Bioinformatics will also provide incidental support for refreshments and a keynote speaker in the Biostatistics Seminar series.

6.2. ADDITIONAL RESOURCES

We do not anticipate additional costs in faculty, library acquisition, or computing. The four new courses in Biostatistics will be staffed by shifting effort from existing independent study teaching or by newly appointed faculty. The new course offerings in Biostatistics are expected to fulfill the demand for the existing independent study courses. No equipment will be needed. The Biostatistics Rotations will be comprised of existing consulting projects by current Biostatistics faculty.

7. GRADUATE STUDENT SUPPORT

7.1. FLOW OF STUDENTS THROUGH THE PROGRAM

Anticipated flow of students through the program by year and by anticipated type of support is shown in **Table B** below. Here, we assume that 3 students are admitted each year, 2 California residents and 1 foreign student, and that time to graduation is 5 years. If additional high quality students are available and additional support is identified, we may admit up to 4 students per year, to meet our long-term steady-state target of 20 students total in the program. Alternatively, if less funding is available than anticipated, a cohort of 4 students every other year may be admitted.

7.2. TYPES OF FINANCIAL SUPPORT

Students will be supported by:

- Teaching Assistant Positions (generally first year students)
- Training grant fellowships (generally second and third year students)

- Graduate Student Research Positions (generally 4th and 5th year students)
- Biostatistics consulting positions in collaborative research (any level, depending on qualifications)
- Potential NIH and NSF graduate fellowships

TA's are employed at either 25% or 50% time (10 to 20 hours per week), and currently receive a monthly stipend of either $980 or $1961. In addition, TA's receive remissions covering most of their in-state tuition.

Table B: Flow of students through program, admitting 3 per year

Student Year in Program		**Program Calendar Year**					
		1	**2**	**3**	**4**	**5**	**# positions by type**
Year 1	CA resident	2	2	2	2	2	3 TA
	NR	1	1	1	1	1	
Year 2	CA resident		2	2	2	2	2 TG
	NR		1	1	1	1	1 other
Year 3	CA resident			2	2	2	2 TG
	NR			1	1	1	1 other
Year 4	CA resident				2	2	3 GSR
	NR				1	1	
Year 5	CA resident					2	3 GSR
	NR					1	
Total positions		3	6	9	12	15	

GSRs are hired by a faculty member to conduct statistical methods research. In addition, GSR's may be employed as collaborative statisticians in a consulting role, gaining valuable experience in applied statistics. GSR's are employed at either 25% or 49% time, and their monthly salary depends on how advanced they are in their degree. Those who have not yet advanced to PhD candidacy are appointed at Step III, receiving either $848 or $1696 per month. Students who have passed their PhD QE and advanced to candidacy are appointed at Step IV, receiving either $916 or $1832 per month. GSRs receive full remission on their in-state tuition and on their non-resident supplemental tuition.

The UCSD Division of Biostatistics and Bioinformatics has applied for an NIH T32 predoctoral training grant in Biomedical Big Data Science (application submitted 7/23/2014; RFA-HG-14-004). If funded, this grant will provide 60% tuition and fees remission and a stipend equal to that of a GSR for 4 to 6 students in the program, each year for 5 years. The division is committed to backfilling the 40% of tuition and fees for fellows in this training program. NIH has set aside funding to support up to 18 programs, and we expect that our submission will be very competitive. If we are unsuccessful this year, a second round of funding is anticipated in the coming year. Thus, while we can't guarantee this source of funding for our students, it seems likely to be available. Review is October 2014 and earliest start date is March 2015.

Students will be encouraged to apply for NSF Graduate Research Fellowships in years 1 and 2 of the program. They will be encouraged to apply for NIH F32 Fellowships upon advancement to candidacy. We will establish appropriate mentoring mechanisms to support these applications. Although we have not included these

positions in our projections, we expect that at any one time one or two students will be funded by these mechanisms.

7.3. AVAILABILITY OF FINANCIAL SUPPORT FOR STUDENTS

Table C shows the number and type of student positions needed, by calendar year, assuming a successful training grant submission. **Table D** shows the number and type of positions needed, assuming no training grant is awarded.

Table C: Number of positions needed, by calendar year and type of position, training grant

		Program Calendar Year				
Type of Position		**1**	**2**	**3**	**4**	**5**
Teaching Assistant positions		3	3	3	3	3
Training Grant positions	TG year 1		2	2	2	2
	TG year 2		0	2	2	2
GSR Methodology positions					3	4
GSR Consulting positions			1	2	2	4
Total number of positions		3	6	9	12	15

Table D: Number of positions needed, by calendar year and type of position, no training grant

		Program Calendar Year				
Type of Position		**1**	**2**	**3**	**4**	**5**
Teaching Assistant positions		3	3	4	4	5
Training Grant positions	TG year 1		0	0	0	0
	TG year 2		0	0	0	0
GSR Methodology positions				1	4	4
GSR Consulting positions			3	4	4	4
Total number of positions		3	6	9	12	15

The availability of these sources of support is outlined below:

- 3 TA slots each year have been allocated to the program from the undergraduate teaching in the BS in Public Health within the Department of Family and Preventive Medicine (see attached letter of support from the undergraduate program director, Dr. Cheryl Anderson). In addition, the departments of Mathematics and Electrical and Computer Engineering have committed 2 TA slots each to support the associated training grant, should this grant be awarded, for a total of up to 7 TA slots each year.
- 2-4 training grant slots will be available in each of years 2-5, as explained above, if the training grant is funded, (Table 2a).
    - Should the training grant not be funded, positions will be provided by GSR consulting slots and TA positions, as shown in Table D.
- 4 GSR positions in statistical methodology are available, and this is anticipated to continue.

    - Current Division of Biostatistics and Bioinformatics members with R01-level support for students include PI's Donohue, Natarajan, Messer, and Thompson, and these are able to support 4 or more students. To hold one of these appointments, students must be enrolled in at least 12 units and have a minimum cumulative GPA of 3.0.
    - Additional GSR positions may be anticipated by year 5 of the program.
- 4-6 GSR consulting positions are available in years 1-5.
    - Two positions each (4 total) are available from the large consulting services at the Cancer Center (Messer) and at CTRI (Xu). These are ideal sources of support and training for graduate students in Biostatistics. Several Biostatistics programs successfully use similar mechanisms as the major source of support for their PhD students, notably USC, UCLA and UPenn.
    - Other Biostatistics faculty able to support a consulting student include Jain, Vaida, Gamst.

7.4. DETAILED BUDGET

Figure 2 shows anticipated expenses and revenue, using the above assumptions of 3 students per year. We assume that tuition and fees for students supported by TA, GSR, and training grant positions will cover those students at the appropriate rate, and this is shown as "revenue".

We assume additional revenue will come in the form of "block grant" funds from the Dean of the School of Medicine, following the standard Office of Graduate Studies (OGS) funding model for graduate programs at UCSD. This funding model entails initial startup "block grant" funds of $50,000 per year for a new program until sufficient students have accrued, in our case in each of the first three years. Once 12- 13 total students are enrolled, we assume the program will receive block grant funds of approximately $4,000 per student as is standard for other graduate programs at UCSD, also from the Dean of the School of Medicine. Finally, we assume that non-resident student fees are returned to the program, again following the standard Office of Graduate Studies (OGS) funding model for graduate programs at UCSD

Also included are annual administrative expenses of 15% salary support for a faculty program director, 50% support for an administrative assistant, $2,000 each for supplies, recruitment, and incidental expenses (e.g., refreshments for seminars, meetings, and visiting students, etc.), and $20,000/year for the first 3 years to support faculty time for course development. These administrative expenses are escalated at 2%- 3% per year as shown.

Under these assumptions, the program will need approximately $40,000-$60,000 in additional revenue per year, totaling $247,759 over the 5 years of the program. This funding need will be covered by institutional support, in the form of start-up funds which have been provided to the Division of Biostatistics by the Dean of the School of Medicine, as well as by any additional funds provided by the Dean to support the program.

It is anticipated that a terminal 2-year Master's program will be started in year 2 or 3 of the program, and this should bring in additional revenue that may support additional students and help to cover administrative costs.

Department of Family and Preventive Medicine
PhD in Biostatistics - DRAFT BUDGET- 3 admits per year

Figure 2. 5 year budget for interdepartmental program in Biostatistics.

Numbers of students and positions, by type	Caldendar Year 2015-16	2016-17	2017-18	2018-19	2019-20
Residents	2	4	7	10	13
Nonresidents	1	2	2	2	2
Total No. of Students	3	6	9	12	15
TA positions	3	3	3	3	3
GSR and consulting positions	0	1	2	5	8
Training Grant Slots		2	4	4	4
Total no. positions	3	6	9	12	15

ASSUMPTIONS

Stipend, tuition/fees covered by TG years 2-3
Stipends covered by Faculty Major Advisor or consulting positon Years 4-5
Foreign students will have to pay NR fees
Advance to candidacy in 3rd year - no more N/R tuition from 3rd year for foregin students

	2015-16	2016-17	2017-18	2018-19	2019-20
Program Revenue					
Intial Start up Block Grant	$ 50,000	$ 50,000	$ 50,000		
Block grant ($4k per student)	$ -	$ -	$ -	$ 48,000	$ 60,000
TA position stipend	$ 52,961	$ 52,961	$ 52,961	$ 52,961	$ 52,961
Taship tuition fees	$ 47,940	$ 47,940	$ 47,940	$ 47,940	$ 47,940
GSRships stipend	$ -	$ 21,930	$ 43,860	$ 109,650	$ 175,440
GSRships tuiton fees		$ 15,980	$ 31,960	$ 79,900	$ 127,840
Training grant stipend		$ 44,952	$ 89,904	$ 89,904	$ 89,904
Training grant tuition fees		$ 24,131	$ 48,262	$ 48,262	$ 48,262
non res pay fees**	$ 15,102	$ 30,204	$ 30,204	$ 30,204	$ 30,204
subtotal revenue	**$ 166,003**	**$ 288,097**	**$ 395,090**	**$ 506,820**	**$ 632,550**
ProgramExpense					
Stipends- TA's	$ 52,961	$ 52,961	$ 52,961	$ 52,961	$ 52,961
Stipends- GSR's	$ -	$ 21,930	$ 43,860	$ 109,650	$ 175,440
Stipends- training grant positions	$ -	$ 44,952	$ 89,904	$ 89,904	$ 89,904
Tuiton and Fees from TA and GSR positions	$ 47,940	$ 95,880	$ 143,820	$ 191,760	$ 239,700
Nonresident fees	$ 15,102	$ 30,204	$ 30,204	$ 30,204	$ 30,204
subtotal expense	**$ 116,003**	**$ 245,927**	**$ 360,749**	**$ 474,479**	**$ 588,209**
program net	**$50,000**	**$42,171**	**$34,342**	**$32,342**	**$44,342**
Adminstrative expense					Escalation
Recruitment	$ -	$ 2,000	$ 2,040	$ 2,081	$ 2,122 2%
Administration (50%)	$ 33,750	$ 34,763	$ 35,805	$ 36,880	$ 37,986 3%
Program Director (15%)	$ 36,375	$ 37,466	$ 38,590	$ 39,748	$ 40,940 3%
Supplies and Expenses	$ 2,000	$ 2,040	$ 2,081	$ 2,122	$ 2,165 2%
Program/Course Development	$ 20,000	$ 20,000	$ 20,000		0%
administrative total	**$ 92,125**	**$ 96,269**	**$ 98,516**	**$ 80,831**	**$ 83,214**
Balance	**$ (42,125)**	**$ (54,098)**	**$ (64,175)**	**$ (48,489)**	**$ (38,872)** $ (247,759)

** assumes non-resident fees are returned to the program

TA position stipend (9 months @ 50%)

Salary	$	17,654
	$	17,654

GSR stipend (12 months - 9 mos. @ 50% + 3 mos. @ 100%)

Salary	$	21,930
	$	21,930

Training grant stipend, tuition and fee reimburesement rate

stipend	$	22,476	
	$	22,476	
tuiton and fees	$	7,865	60% reimbursment rate
health ins	$	2,871	paid from 4200 admin support
admin cost	$	1,329	remaining 4200 admin support
	$	12,065	
tuiton fee shortfall	$	(3,915)	

***Tuition/fee* Year 1**

	2015-2016 Tuition/Fees ($)	Health ins	total
resident	$ 13,109	$ 2,871	$ 15,980
non-reside	$ 15,102		

Currently, the 2013/2014 **compensation for a TA** is $1961.67/month for a 50% appointment (20 hours/week on average) and $980.83/month for a 25% appointment (10 hours/week average). In addition, a **fee and health insurance subsidy** will reduce fees owed by the student from $5,216.50 to $195.50/quarter. Those classified by UCSD as non-residents must also pay non-resident supplemental tuition of $5,034/quarter. For most Biostatistics doctoral students, these balances of fees and tuition are paid by the adviser or department. The non resident fees must be paid by the student by the Registrar's deadline.

Governance and management of the graduate program will be the responsibility of the Chief of the Division of Biostatistics and Bioinformatics, the Graduate Program Director, and the Graduate Committee. In addition, there will be an External Advisory Committee to provide feedback and review.

The Biostatistics Division Chief will have final responsibility for the overall effectiveness, coordination, and management of the graduate program, through the program of shared governance outlined below. She will assure that there is communication and coordination among the participating faculty and students, the Graduate Program Director, and the Graduate Committee..

The Graduate Program Director (PD) will oversee overall operation and administration of the Graduate Program, and day-to-day operations and management. A Graduate Committee and a half-time Program Administrator will assist the Program Director. Importantly, while the PD will have final responsibility for these areas, **whenever possible, all actively participating faculty will be included in the decision making process as ad hoc Graduate Committee members**. An independent External Advisory Committee will provide additional oversight.

7.5. ADMINISTRATIVE RESPONSIBILITIES OF THE PD AND DIVISION CHIEF

The Program Director will oversee programmatic and administrative aspects of this training program. She/he will chair the Graduate Committee, direct implementation of the curriculum and selection of students, assure the adequacy of didactic and problem-based training experiences, and assess if the program is meeting its goals of training the next generation of Biostatisticians. The PD will provide the administrative structure for decision-making, financial management, and career counseling. The Director will commit 15% effort to support the training program, supported from startup funds provided by the Dean of the School of Medicine to the Division of Biostatistics and Bioinformatics.

The Biostatistics Division Chief (Chief) will serve as an ex officio member of the Graduate Committee, and serve as Committee secretary. Together the PD and the Chief will help publicize research opportunities for students and faculty, identify appropriate courses and training activities, and identify and foster joint funding opportunities for additional research opportunities to ensure the continued health of the Interdepartmental Program.

As well as participating in the Graduate Committee structure below, the Division Chief and the PD will meet yearly in private session with the External Advisory Committee to receive and respond to the program's annual review.

7.6. GRADUATE COMMITTEE

The Graduate Committee, chaired by the PD, will carry out program monitoring and administration. The committee will include participating faculty from the Division of Biostatistics and at least 2 other participating departments (Mathematics, Computer Science and Engineering, Electrical and Computer Engineering), and at least 1 participating biomedical faculty member. Committee members will be appointed by the program PD for a period of 2 years, with the possibility of renewal for an additional 2 years. Committee membership will rotate across active program faculty; members of the Graduate Committee are required to be active mentors to program students or to teach in the core curriculum. To ensure staggered rotation, 3 members of the initial Committee cohort will be appointed for 3 years.

The Graduate Committee will meet quarterly to review progress, discuss mechanisms for promoting and advertising the program (including among our nearby minority serving undergraduate institutions, in particular California State University Fullerton and San Diego State University, with their strong undergraduate and Master's level Statistics programs), develop selection criteria for students, evaluate and select program applicants, address recruitment issues, evaluate the effectiveness of mentors, examine the appropriateness of training objectives and review the curriculum, and obtain feedback from faculty mentors and students on

program operation and successes and failures. The Graduate Committee will make decisions on both student admission, and faculty recruitment and retention into the Graduate Program. An annual program review meeting will be held to formally assess the program in these areas and provide a written review. An important role of the committee will be to ensure that the Biostatistics research rotations include many diverse areas of biomedical research, and that student mentorship is distributed across participating faculty members. As noted above, whenever possible, all actively participating faculty will be included in the decision making process as voting ad hoc Graduate Committee members. This will be in particular true for student admissions decisions (e.g., in funding decisions regarding students sponsored by faculty outside the Graduate Committee), curriculum decisions, and the annual review meeting.

As described in Section 2, the student must pass the preliminary written examination at the PhD pass or provisional pass level. The chair of the Biostatistics Graduate Program Committee will appoint an exam committee that will be responsible for preparing, administering and grading the examination for the Biostatistics part of the exam. Each exam committee will forward its recommendation to the Graduate Committee for its recommendation. Decisions of the committee will be made by deliberations followed by open vote, with simple majority necessary for adoption. In case of a tie, the Program Director's vote is tie-breaking.

7.7. EXTERNAL ADVISORY COMMITTEE

An External Advisory Committee will provide additional program oversight from perspectives that complement those of the program faculty, including development and evaluation of the curriculum, competencies of students, and minority recruitment. The Committee will include 3 UC faculty not directly involved with the day-to-day operation of the interdepartmental program and 2 non-UC members from the Biostatistics research community (e.g., from Biostatistics departments at Brown University, Vanderbilt, or Harvard) This committee will include experts in at least 2 disciplines of data science from among mathematics, computer science and biostatistics, and at least one established biomedical researcher. The Committee will meet yearly (more meetings if needed) in a private session with the students to get their assessment of the Program and then with the Graduate Committee to review Program operations and performance. This Committee will review the size and composition of the most recent applicant pool, the characteristics of the students the Graduate Committee has selected for appointment; representative courses of study and rotation projects, degree completion rates, and eventually career placement, publication records, and impact of the graduates of the Program. The External Advisory Committee will describe the strengths and weaknesses of the Program and recommend improvements in a report for the Graduate Committee. The External Advisory Committee will meet annually with the Division Chief and PD to present recommendations and findings at a time separate and distinct from meetings with the Graduate Committee.

7.8. PROGRAM ADMINISTRATOR

We will recruit a 50% time BS (or MS) level Program Administrator administrative assistant to support the Program Director. This person will be responsible for the administrative tasks of running the Program including: oversight of financial transactions, developing promotional materials for nationwide dissemination, responding to inquiries, serving as the go-to person for issues concerning students, making arrangements for speakers, reserving conference rooms, preparing correspondence, managing communications, collecting data on the performance of the training program, and assembling evaluation reports.

7.9. PROGRAM EVALUATION AND MONITORING

The quarterly meetings of the Graduate Committee will include formal program monitoring and the External Advisory Committee will conduct a formal annual review to be presented to the program leadership. The Graduate Committee will also hold an annual review, respond to the External Advisory Committee report and produce a written program evaluation. Both faculty and student input are necessary to this evaluation process. It is also necessary to track student development after program completion to assess program success. We describe these processes, and processes to select and retain faculty below.

7.10. SOLICITING STUDENT FEEDBACK

In addition to obtaining the regular UCSD course evaluation forms, we will foster opportunities for students to interact informally with each other and with the faculty, providing a casual forum for exchange about the strengths and weaknesses of the program. The Graduate and External Advisory Committees will solicit formal student feedback, including Program strengths and weaknesses and suggestions for improvements. Yearly, a peer-selected student will summarize student feedback and suggestions at the External Advisory Committee meeting, and participate in Committee discussions and recommendations for program changes. Program modifications will be based on ideas and feedback generated in the evaluation process, and with input from the External Advisory Committee. The Program Director and Graduate Committee will make final decisions regarding substantial program changes.

An exit interview will be conducted with all students 1 month after graduation (timed for greater objectivity in evaluating their experience). Students will evaluate the mentoring relationship, seminar series, and overall program strengths and weaknesses (see *Appendix X* for *Sample Evaluation Form*). In addition to programmatic evaluations, a critical outcome measure is the success of the students in pursuing careers in Biostatistics applications or research. The program will maintain contact with students to monitor this outcome measure. We will track research funding, publications, and leadership positions in their fields.

7.11. CRITERIA FOR FACULTY SELECTION AND RETENTION

Criteria for faculty selection include a strong publication history and funded research in an area pertinent to biostatistics, and a demonstrated commitment to graduate education. Faculty selection will cover a spectrum of areas in biomedical and data science. Faculty included in the research rotations will need to provide data pertinent to a current biomedical research problem and to have the expertise to analyze such data. They will need to demonstrate adequate funding to support a student during years 4 and potentially 5 of their graduate studies. Criteria for retention include appropriate participation in the program, such as teaching and mentoring, curriculum development, participation in the research rotations or in administration of qualifying examinations.

8. CHANGES IN SENATE REGULATIONS

No changes in Senate Regulations at the Divisional level or in the Assembly of the Academic Senate will be required in implementing this program.

9. APPENDICES: SUPPLEMENTARY DOCUMENTATION

9.1. APPENDIX A: FACULTY SHORT VITAE

9.1.1. Division of Biostatistics and Bioinformatics, Dept. of Family and Preventive Medicine

11 participating faculty

KAREN MESSER, Professor and Chief, Division of Biostatistics (PhD, UCSD)

As director of the Moores UCSD Cancer Center Biostatistics/Bioinformatics shared resource Dr. Messer's research interests are in statistical methods for cancer related research, ranging in scale from large "omics" data sets to small Phase II trials. Originally trained in mathematical statistics at UCSD, she has special interests in prognostic model development and in the analysis of genomic and other large scale data in cancer.

Selected Publications

1. Bao L, Pu M, **Messer K**. AbsCN-seq: a statistical method to estimate tumor purity, ploidy and absolute copy numbers from next generation sequencing data. *Bioinformatics*, 2014; 10.1093/bioinformatics/btt759.
2. Natarajan L, Pu M, **Messer K**. Statistical tests for the intersection of independent lists of genes: sensitivity, FDR and type I error control*. Annals of Applied Statistics*, 2012. **6**(2): p. 521-541
3. **Messer, K**., L. Natarajan, et al. Toxicity-evaluation designs for phase I/II cancer immunotherapy trials. *Statistics in Medicine*, 2010. 29(7-8): 712-720.
4. **Messer, K**. and A. Gamst. The asymptotic distribution of the delete-d Jackknife variance estimator for smooth functionals. *Journal of Statistical Planning and Inferenc*e, 2008. 138 (7): 2154-2162.
5. Goldstein, L. **Messer, K.,** Optimal Plug-in Estimators for Non-parametric Functional Estimation. *Annals of Statistics*, 1992. 20(3):1306-1328.

CHARLES BERRY, Professor Emeritus (PhD, Johns Hopkins University)

Dr. Berry's current research interest is on statistical models, methods, and software for exploring populations of integration sites such as occur in retroviral infections or in gene therapies using retrovirus-like constructions. During his career, Dr. Berry has been the principal statistician on multisite clinical trials, the California Tobacco Survey, and cohort studies. He is the author or co-author of more than 175 scientific publications. He has served as a reviewer for NIH Study Sections and been Statistical Editor of two medical journals. He has taught statistics to medical students, graduate students, and postdoctoral fellows in the biomedical sciences.

Selected Publications:

1. Natarajan L, **Berry CC**, and Gasche C. Estimation of Spontaneous Mutation Rates. *Biometrics*, 2003. 59: 555-561.
2. **Berry CC**, Moore P, And Dimsdale JE. Assessing the trade-offs between crossover and parallel group designs in sleep research. *Journal of Sleep Research*, 2006. 15(4): 348-357.
3. **Berry C**, Hannenhalli S, Leipzig J, and Bushman FD. Selection of Target Sites for Mobile DNA Integration in the Human Genome. *PLOS Computational Biology*, 2006. 2(11): e157, 2006.
4. Wang GP, **Berry CC**, Malani N, Leboulch P, Fischer A, Hacein-Bey-Abina S, Cavazzana-Calvo M, and Bushman FD. Dynamics of gene-modiffied progenitor cells analyzed by tracking retroviral integration sites in a human SCID-X1 gene therapy trial. Blood, 2010. Epub.
5. **Berry CC**, Gillet NA, Melamed A, Gormley N, Bangham CRM, Bushman F. Estimating Abundances of Retroviral Insertion Sites from DNA Fragment Length Data. *Bioinformatics*, 2012. 28(6): 755-762.

STEVEN EDLAND, Professor In-Residence (PhD, University of Washington)

Dr. Edland's primary research interest is the epidemiology, treatment, and prevention of chronic disease. Prior to joining UCSD, Dr. Edland provided statistical support to a number of nationally recognized epidemiologic investigations of Alzheimer's disease, including the Consortium the Establish a Registry of Alzheimer's Disease, the first nationwide longitudinal cohort study of Alzheimer's disease, the Mayo Clinic medical records-based Olmsted County Rochester Epidemiology Project, the "Kame study" of the prevalence, incidence, and risk factors for dementia and Alzheimer's disease in the Japanese-American residents of King County, WA, and other NIA program project Alzheimer's disease model patient registries. Dr. Edland's expertise in longitudinal analysis is now brought to bear in support of cohort studies and clinical trials administered by the UCSD Department of Neuroscience, where he has a joint appointment.

Dr. Edland enjoys the collaborative research process and bridging the gap between mathematical statistics and research application, with substantial experience supporting both clinical and bench research, including 21 years of continuous involvement in Alzheimer's Disease Research Centers (ADRCs), as founding director of the Mayo Clinic ADRC Biostatistics Core, and currently as director of the UCSD ADRC Biostatistics Core. Dr. Edland's collaborations often evolve into ancillary publication of context-specific statistical methods.

Dr. Edland's current active independent research is on the improved design, implementation, and analysis of clinical trials of chronic progressive disease such as Alzheimer's disease. Dr. Edland is a standing member of the NIH Special Emphasis Panel Alzheimer's Disease Pilot Clinical Trials (PAR 11-100), serves on Data Safety Monitoring Boards for several multinational clinical trials, and is PI of an NIA grant to advance novel designs and analysis plans for performance of Alzheimer's disease treatment trials.

Selected Publications:

1. **Edland, SD**. Bias in slope estimates for the linear errors in variables model by the variance ratio method. *Biometrics*, 1996. 52(1):243-248.
2. **Edland, SD**; et al. Estimation and sample design in prevalence surveys of dementia. *Journal of Clinical Epidemiology*, 1999. 52(5):399-403.
3. **Edland, SD**. How and when to test the relationship between level and longitudinal rate of change. *Statistics in Medicine*, 2000. 19(11):1441-1152.
4. **Edland, SD**; et al. NIA-funded Alzheimer centers are more efficient than commercial clinical recruitment sites for conducting secondary prevention trials of dementia. *Alzheimer's Disease & Associated Disorders*, 2010. 24(2): 159-164.
5. Ard, MC and **Edland, SD** Power calculations for clinical trials in Alzheimer's disease. *Journal of Alzheimer's Disease*, 2011 21:369-377.

ANTHONY GAMST, Professor In-Residence (PhD, UCSD)

Dr. Gamst works on problems in non-parametric and semi-parametric regression, resampling, and the analysis of high-dimensional data, with applications in imaging, biomarker data analysis, and other areas. He is the Director of the Computational and Applied Statistics Laboratory (CASL) at the San Diego Supercomputer Center (SDSC) and two large NIH, CDC, and state-funded research data centers. Together, these groups offer a variety of re-charge consulting services in mathematical and statistical modeling, software engineering, data management, and research information systems design and development.

Selected Publications:

1. Bertail P, **Gamst AC**, Politis DN Moderate Deviations in Subsampling Distribution Estimation. *Proceedings of the American Mathematical Society*, 2000. 129(2): 551-557.
2. **Gamst AC**, Wolfson T, Parry B Local Polynomial Regression Modeling of Human Plasma Melatonin Levels. *Journal of Biological Rhythms*, 2004 19(2): 164-174.
3. Fennema-Notestine C, **Gamst AC**, Quinn BT, Pacheco J, Jernigan TL, Thal L, Buckner R, Killiany R, Blacker D, Dale AM, Fischl B, Dickerson B, Gollub RL Feasibility of Multi-Site Clinical Structural Neuroimaging Studies of Aging Using Legacy Data. *Neuroinformatic*s, 2007. 5(4):235-245.
4. Messer K, **Gamst AC** The Asymptotic Distribution of the Delete-D Jackknife Variance Estimator for Smooth Functionals. *Journal of Statistical Planning and Inference*, 2008. 138(7):2154-2162.
5. **Gamst AC**, Donohue M, Xu R Asymptotic Properties and Empirical Evaluation of the NPMLE in the Proportional Hazards Mixed Effects Model. *Statistica Sinica*, 2009. 19(5): 997-1011.

SONIA JAIN, Professor (PhD, University of Toronto)

Dr. Jain's primary methodological research interests are in the area of Bayesian biostatistics, with special emphasis on nonparametric Bayesian mixture models. Dr. Jain also works in clinical trial design and analysis, statistical computing such as Markov chain Monte Carlo, and bioinformatics including statistical genetics and genomics. Dr. Jain is the lead Biostatistician for several collaborative projects in several disciplines, including Ophthalmology, HIV, Infectious Diseases, Pediatric Cardiology, Cancer, and PTSD-TBI.

Selected Publications

1. **Jain S** and Neal RM A Split-Merge Markov Chain Monte Carlo Procedure for the Dirichlet Process Mixture Model. Journal of Computational and Graphical Statistics, 2004. 13(1): 158-182.
2. Huelsenbeck JP, **Jain S**, Frost SWD, Pond SLK. A Dirichlet Process Model for Detecting Positive Selection in Protein-Coding DNA Sequences. ,*PNAS*, 2006. 103: 6263-6268.
3. **Jain S** and Neal RM. Splitting and Merging Components of a Nonconjugate Dirichlet Process Mixture Model (with Invited Discussion). *Bayesian Analysis*, 2007. 2(3): 445-500.

LOKI NATARAJAN, Adjunct Professor (PhD, UC Berkeley)

Dr. Natarajan's primary methodological research interests are in the area of exposure measurement error, with particular emphasis on dietary self-report. She is also working on efficient designs for Phase I trials, developing models for survival data when covariates violate the proportional hazards assumption of the usual Cox model, mutation rate estimation in cancer cell lines, and analysis of high-dimensional genomic data.

Dr. Natarajan is involved as lead biostatistician in many collaborative projects. A sampling of these include the Women's Health Eating, Living (WHEL) clinical trial and survivorship study (PI John Pierce), a Transdisciplinary Research in Energetics and Cancer (TREC) Program Project (PI Ruth Patterson), and several clinical and observational studies of sleep and inflammation (PIs Sonia Ancoli-Israel, Joel Dimsdale, Paul Mills). She is a member of the Biostatistics and Bioinformatics Shared Resource of the Moores UCSD Cancer Center (Dr. Karen Messer, Director), a statistical consulting service that provides statistical support to Cancer Center members.

Selected Publications

1. **Natarajan L**, Pu M, Messer, K Statistical tests for the intersection of independent lists of genes: sensitivity, FDR, and Type I error control. *Annals of Applied Statistics*, 2011. 6(2): 521-541.
2. **Natarajan L**, Pu M, Fan J, Levine RA, Patterson RE, Thomson CA, Rock CL, Pierce JP. Measurement error of dietary self-report in intervention trials. *Am J Epidemiol.*, 2010 172(7):819-27.
3. **Natarajan L**. Regression Calibration for Dichotomized Mismeasured Predictors. *Int J Biostat.*, 2009 5(1): nihpa121098.
4. O'Quigley J, **Natarajan L**. Erosion of regression effect in a survival study. *Biometrics*, 2004. 60(2):344-51
5. **Natarajan L**, Berry CC, Gasche C. Estimation of spontaneous mutation rates. *Biometrics*, 2003. 59(3):555-61.

REMA RAMAN, **Professor (PhD, University of Illinois at Chicago)**

Dr. Raman's primary research interests are in the area of correlated data analysis (clustered and longitudinal data), missing data problems, design, conduct and analysis of clinical trials in neurology and statistical monitoring. She currently directs the Data Core for the Specialized Program of Translational Research in Acute Stroke (SPOTRIAS) UCSD site, and co-directs the the Biostatistics Core of the INTRuST Consortium in PTSD/TBI and the Medical and Safety Core of the Alzheimer's Disease Cooperative Study (NIH-NIA funded). She is a current permanent member of the NINDS NSD-K study section, is as an ad-hoc study section member on several NIH study sections and serves as the Biostatistician on several Data and Safety Monitoring Boards.

Selected Publications

1. Doody RS, **Raman R,** Farlow M, Iwatsubo T, Vellas B, Joffe S, Kieburtz K, He F, Sun X, Thomas RG, Aisen PS, Siemers E, Sethuraman G, and Mohs R, for the Alzheimer's Disease Cooperative Study Steering Committee and the Semagacestat Study Group. A Phase 3 Trial of Semagacestat for Treatment of Alzheimer's Disease. *N Engl J Med* 2013; 369:341-350
2. Lyden, P. D., Hemmen, T. M., Grotta, J., Rapp, K. and **Raman, R**. Endovascular therapeutic hypothermia for acute ischemic stroke: ICTuS 2/3 protocol. *International Journal of Stroke*, 2014 9: 117–125.

3. Hemmen TM, **Raman R,** Guluma KZ, Meyer BC, Gomes JA, Cruz-Flores S, Wijman CA, Rapp KS, Grotta JC, Lyden PD; ICTuS-L Investigators. Intravenous thrombolysis plus hypothermia for acute treatment of ischemic stroke (ICTuS-L): final results. *Stroke*, 2010 41(10):2265-70.
4. **Raman R,** Thomas RG, Weiner MW, Jack CR, Ernstrom K, Aisen PS, Tariot PN, Quinn JF. MRI substudy participation in Alzheimer disease (AD) clinical trials: baseline comparability of a substudy sample to entire study population. *Alzheimer's Disease and Associated Disorders*, 2009. 23(4):333-6.
5. **Raman R,** Hedeker D. A mixed-effects regression model for three-level ordinal response data. *Statistics in Medicine*, 2005 24(21):3331-45.

FLORIN VAIDA, Adjunct Professor (PhD, University of Chicago)

Dr. Vaida's research interests are in mixed-effects models, proportional hazards mixed-effects models, missing data, and model selection, in particular as they apply to HIV/AIDS and NeuroAIDS studies. He is co-directing the Statistics Units of the HIV NeuroBehavioral Research Program and of the Translational Methamphetamine and AIDS Research Center at UCSD. Dr. Vaida is the Director of the Biostatistics Module for the CREST and MAS programs at UCSD. He served as a reviewer on several NIH/NIMH Special Emphasis Panels, and is an associate editor of several biomedical journals.

Selected Publications

1. Donohue MC, Haut R, Xu R, **Vaida F**. Conditional Akaike information under generalized linear and proportional hazards mixed models. *Biometrika*. 2011, 2:1-16.
2. **Vaida F**, Blanchard S. Conditional Akaike information for mixed-effects models. *Biometrika* 2005. 92:351-370.
3. **Vaida F**, Liu L. Fast implementation for normal mixed effects models with censored response. *Journal of Computational and Graphical Statistics* 2009. 18:797-817.
4. **Vaida F.** Parameter convergence for EM and MM algorithms. *Statistica Sinica*, 2005. 15:831-840.
5. **Vaida F**, Xu R. Proportional hazards model with random effects. *Statistics in Medicine*, 2000.19:3309-3324.

RONGHUI XU, Professor (PhD, UCSD)

Dr. Xu is a recipient of David P. Byar Young Investigator Award,and Fellow American Statistical Association. She is the Director of Design, Biostatistics and Ethics of the UCSD Clinical and Translational Research Institute (CTRI), partially funded by the NIH Clinical and Translational Science Award (CTSA). She is the lead statistician at the Organization of Teratology Information Specialists (OTIS) Collaborative Research Center, which carry out studies such as the Fetal Alcohol Spectrum Disorders Prevalence in the US and Vaccine and Medication in Pregnancy Surveillance System. Principal Research Interests: Survival Analysis; Random Effects Models; High Dimensional Data; Clinical and Translational Research; Reproductive Toxicology

Selected Publications

1. **Xu R**, O'Quigley J. Estimating average regression effect under non-proportional hazards. *Biostatistics*, 2000. 1:423-439.
2. **Xu R**, Adak S. Survival analysis with time-varying regression effects using a tree-based approach. *Biometrics*, 2002. 58:305-315.
3. **Xu R**, Li X. Comparison of parametric versus permutation methods with applications to microarray gene expression data. *Bioinformatics*, 2003. 19(10): 1284-1289.

4. Donohue MC, Haut R, **Xu R**, Vaida F. Conditional Akaike information under generalized linear and proportional hazards mixed models. *Biometrika*, 2011, 98(3): 685-700.
5. **Xu R**, Chambers C. A sample size calculation for spontaneous abortion in observational studies. *Reproductive Toxicology*, 2011,. 32(4): 490-493.

MICHAEL DONOHUE, Adjunct Assistant Professor (PhD, UCSD) –

Dr. Donohue's methodological interests include semiparametric and generalized linear mixed-effects models, model selection, asymptotics, and clinical trials design. His applied work includes the design, monitoring, and analysis of clinical trials and observational studies in the fields of Alzheimer's disease, anxiety disorders, fMRI pain response, smoking cessation, and childhood obesity.

More recently he has been investigating model selection and asymptotics for generalized linear and proportional hazards mixed-effects models. He received a KL2 Post-Doctoral Scholar Award to investigate efficient analysis methods for longitudinal clinical trials, particularly in the face of missing data typical in Alzheimer's disease trials. Dr. Donohue is a senior statistician on two ongoing Alzheimer's Disease Cooperative Study (ADCS) observational studies: Alzheimer's Disease Neuroimaging Initiative (ADNI) and Home Based Assessments (HBA). Both studies are designed to improve the statistical and economical efficiency of future Alzheimer's disease clinical trials. He has been working on power and study design for prodromal or asymptomatic Alzheimer's disease incorporating recent advances from ADNI in neuroimaging and fluid assay biomarkers. As a statistician with the Clinical and Translational Research Institute (CTRI), he also collaborates with a wide range of researchers across the School of Medicine.

Selected Publications

1. **Donohue MC,** Aisen PS. Mixed model of repeated measures versus slope models in Alzheimer's disease clinical trials. *J Nutr Health Aging*. 2012 16(4):360-4.
2. **Donohue MC**, Haut R, Xu R, Vaida F. Conditional Akaike information under generalized linear and proportional hazards mixed models. *Biometrika*. 2011. 2:1-16.
3. **Donohue MC**, Gamst AC, Thomas RG, Xu R, Beckett L, Petersen RC, Weiner MW, Aisen P and for the Alzheimer's Disease Neuroimaging Initiative, The relative efficiency of time-to-threshold and rate of change in longitudinal data. *Contemporary Clinical Trials*, 2011. 32:685-693.
4. Gamst A, **Donohue M**, Xu R. Asymptotic properties and empirical evaluation of the NPMLE in the proportional hazards mixed-effects model. *Statistica Sinica*, 2009. 19 (3)
5. **Donohue M,** Abramson I, Gamst A. A synergistic regression based on maximized rank correlation. *Communications in Statistics - Simulation and Computation*, 2008. 37:92-105.

LIN LIU, Adjunct Assistant Professor (PhD, Memorial University of Newfoundland)

Dr. Liu's primary methodological research interests are in the area of linear/nonlinear mixed-effects models and order restricted inference. She is interested in developing methodologies and statistical software for analyzing longitudinal HIV viral load data with censored values. She is also working on efficient methodologies in hypothesis testing and interval estimation under order restrictions with application in dose-response studies and toxicity studies. Her applied work includes the design, monitoring, and analysis of clinical trials and observational studies in the fields of infectious disease, cardiovascular disease, anxiety disorder, chronic pain, PTSD, sleep apnea and telemedicine.

Dr. Liu is the lead statistician at the San Diego VA Health Services Research and Development Division. She is also the lead statistician for an epidemiological study to assess the impact of Mexico's drug laws on behaviors and infectious disease status among injection drug users in San Diego (PI: Dr. Richard Garfein). Dr. Liu is an experienced statistician in HIV collaborative research, she was the statistician for Acute HIV Infection and Early Disease Research Program (AIEDRP), UCSD centers for AIDS research (CFAR) and the CFAR Network of Integrated Clinic Systems (CNICS).

Selected Publications

1. **Liu L**, Lee C.I.C. and Peng J. (2014), Simultaneous Confidence Bounds in Monotone Dose-Response Studies, *Journal of Statistical Planning and Inference, 145, 113-124.*
2. Vaida F. and **Liu L**. Fast Implementation for Normal Mixed Effects Models with Censored Response. *Journal of Computational and Graphical Statistics*, 2009. 18(4), 797-817.
3. **Liu L**, May S, Richman DD, Pond SK, Hecht FM, Markowitz M, Daar ES, Routy J-P, Margolick JB, Frost SDW, Little SJ and Smith DM. Comparison of Algorithms that Interpret Genotypic HIV-1 Drug Resistance to Determine the Prevalence of Transmitted Drug Resistance. *AIDS*, 2008. 22(7), 835-839.
4. Lee CC, Peng J and **Liu L**. Statistical Inference for the Difference between the Best Treatment Mean and a Control Mean. *Journal of the American Statistical Association*, 2006. 101, 1050-1058.
5. **Liu L**, Lee CC and Peng J. Max-min Multiple Comparison Procedure for Monotone Dose-Response Curves. *Journal of Statistical Planning and Inference*, 2002. 107, 133-141.

9.1.2. Department of Mathematics

4 participating faculty

IAN ABRAMSON, Professor (PhD, UC Berkley)

Dr. Abramson's research interests are in non-parametric statistical analysis, mixed-effects models, and empirical Bayes methods. His collaborative interests focus on NeuroAIDS. Dr. Abramson is the Director of the Statistics Unit of the HIV Neurobehavioral Research Center and of the Translational Methamphetamine and AIDS Research Center at UCSD.

Selected Publications

1. **Abramson I**. Adaptive density flattening - A metric distortion principle for combating bias in near neighbor methods. *Annals of Statistics*, 1984; 12: 880-886.
2. **Abramson I**. A recursive regression for high dimensional models with application to growth curves and repeated measures. *J. Amer. Stat. Assoc*., 1988; 83:4.
3. **Abramson I.,** Wolfson, T., Marcotte, T. D., Grant, I., & the HNRC Group. Extending the p-plot: Heuristics for multiple testing. *Journal of the International Neuropsychological Society*, 1999; 5:510-517.
4. **Abramson, I.,** Wolfson, T., & the HNRC Group. A likelihood approximation and shrinkage for unbalanced repeated measures. *Sankhya Series B*, 2002; 64:301-321.
5. Donohue, M**., Abramson, I**., Gamst, A. Asynergistic Regression Based on Maximized Rank Correlation. *Communications in Statistics – Simulation and Computation*, 2008; 37:92-105.

DIMITRIS POLITIS, Professor (PhD, Stanford University)

Dr. Politis's research interests include: A. Time Series, Random Fields and Point Processes (estimation and modeling); B. Resampling and subsampling methods: the block bootstrap, the circular bootstrap, the stationary bootstrap, the local bootstrap, the continuous-path bootstrap, the tapered block bootstrap, the local block bootstrap, the time-frequency bootstrap, and the linear process bootstrap; C. Nonparametric function estimation (probability and spectral density, regression, etc.) using `flat-top' kernels; D. Model-free Prediction and Regression.

Selected Publications

1. **Politis DN**, Romano JP, Wolf M, *Subsampling*, Springer-Verlag, New York, 1999.
2. **Politis DN**, Model-free Model-fitting and Predictive Distributions (with Discussion). Test, 2013; 22:183-250.
3. Paparoditis E, **Politis DN**, Nonlinear spectral density estimation: thresholding the correlogram. *J. Time Series Analysis*, 2012; 33:386-397.
4. Kreiss J-P, Paparoditis E, **Politis DN**, On the Range of Validity of the Autoregressive Sieve Bootstrap. *Annals of Statistics*, 2011; 39:2103-2130.
5. **Politis DN**, Higher-order accurate, positive semi-definite estimation of large-sample covariance and spectral density matrices. *Econometric Theory*, 2011; 27:703-744.

ERY ARIAS-CASTRO, Associate Professor (PhD, Stanford University)

Dr. Arias-Castro's research interests are in high-dimensional statistics, machine learning, spatial statistics, signal and image processing, community detection, and applied probability. He is currently an associate editor for the Annals of Statistics and for the Journal of the American Statistical Association.

Selected Publications

1. **Arias-Castr E**, Donoho DL, Huo X. Near-optimal detection of geometric objects by fast multiscale methods. *Information Theory, IEEE Transactions on,* 2005; 51:2402-2425.
2. **Arias-Castro E**, Candès EJ, Durand A. Detection of an anomalous cluster in a network. *The Annals of Statistics,* 2011; 39:278-304.
3. **Arias-Castro E**, Candès EJ, Plan Y. Global testing under sparse alternatives: Anova, multiple comparisons and the higher criticism. *The Annals of Statistics,* 2011; 39:2533-2556.
4. **Arias-Castro E**, Pelletier B. On the convergence of maximum variance unfolding. *The Journal of Machine Learning Research* 2013; 14:1747-1770.
5. **Arias-Castro E**, Verzelen N. Community detection in random networks. *The Annals of Statistics,* 2014 (accepted).

JELENA BRADIC, Assistant Professor (PhD, Princeton University)

Dr. Bradic's research interests are in numerous areas of high dimensional statistical estimation and inference. Those include but are not limited to semiparametric smoothing, in particular with regards to proportional and non-proportional high dimensional hazards models, robust model selection, computationally more feasible methods with emphasis on provable statistical guarantees in ultra-high dimensional settings with missing or correlated data. She is a recipient of LAHA award, for young scholars awarded by the Institute of Mathematical Statistics. She was awarded a NSF (single PI award) and one WCAI research grant. She also served as a referee on several leading statistics journals and participated in one of the NSF panels for Statistics.

Selected Publications

1. **Bradic J**, Fan J, Wang W. Penalized Composite Quasi-Likelihood for Ultrahigh-Dimensional Variable Selection. *Journal of Royal Statistical Society: Series B*, 2011; 73:325-349.
2. **Bradic J**, Fan J, Jiang J, Regularization for Cox's Proportional Hazards Model with NP-Dimensionality. *Annals of Statistics,* 2011; 39:3092-3120.
3. Ryzhov I, Han B, **Bradic J**. Cultivating disaster donors: a case application of big data analytics. *Management Science*, 2014 (accepted).
4. **Bradic J**, Song R. Gaussian Oracle Inequalities for Structured Selection in Non-Parametric Cox Model (submitted)
5. **Bradic J**. Efficient Support Recovery via Weighted Maximum-Contrast Subagging (submitted).

9.1.3. Department of Psychiatry

WESLEY THOMPSON, Associate Professor (PhD, Rutgers University)

Dr. Thompson's research interests center on the adaptation and application of statistical models of a dynamic covariation of multiple functional processes in order to identify potentially causal relationships between brain function, depression, and physical health. This work is supported by a NIH Career Development Award that Dr. Thompson received in 2006. He is also interested in developing statistical models that may explain the underlying mechanisms of healthy cognitive aging.

Selected Publications

1. **Thompson WK**, Xie M, White HR. Transformations of covariates for longitudinal data. *Biostatistics*, 2003. 4(3):353-64.
2. **Thompson WK**, Kupfer DJ, Fagiolini A, Scott JA, Frank E. Prevalence and clinical correlates of medical comorbidities in patients with bipolar I disorder. Analysis of acute-phase data from a randomized controlled trial. *J Clin Psychiatry*, 2006. 67(5):783-8.
3. **Thompson WK**, Rosen O. A Bayesian model for sparse functional data. *Biometrics*, 2008. 64(1):54-63.
4. **Thompson WK**, Siegle G. A Stimulus-Locked Vector Autoregressive Model for Slow Event. Related fMRI Designs. *Neuroimage*,. 2009 Feb 20.
5. Zablocki RW, Levine R, Schork AJ, Andreassen OA, Dale AM, and **Thompson WK** Covariate-Modulated Local False Discovery Rate. *Bioinformatics.* In press.

9.1.4. Department of Electrical and Computer Engineering

GERT LANCKRIET, Associate Professor (PhD, UC Berkeley)

Gert Lanckriet received a Master's degree in Electrical Engineering from the Katholieke Universiteit Leuven, Leuven, Belgium, in 2000 and the MS and Ph.D. degrees in Electrical Engineering and Computer Science from the University of California, Berkeley in 2001 respectively 2005. In 2005, he joined the Department of Electrical and Computer Engineering at the University of California, San Diego, where he heads the Computer Audition Lab (CALab), and is a co-PI of the Distributed Health Lab.

He was awarded the SIAM Optimization Prize in 2008 and is the recipient of a Hellman Fellowship, an IBM Faculty Award, an NSF CAREER Award and an Alfred P. Sloan Foundation Research Fellowship. In 2011, MIT Technology Review named him one of the 35 top young technology innovators in the world (TR35). His lab received a Yahoo! Key Scientific Challenges Award, a Qualcomm Innovation Fellowship and a Google Research Award. His research focuses on machine learning, optimization, big data analytics, and crowdsourcing, with applications in music search and recommendation, multimedia, and personalized, mobile health.

Selected Publications:

1. McFee, B., **Lanckriet, G.R.G**. Learning Content Similarity for Music Recommendation. *IEEE Transactions on Audio, Speech and Language Processing*, 2012. 20: 2207-2218.
2. Barrington, L., Turnbull, D., **Lanckriet, G.R.G**. Game-Powered Machine Learning. *PNAS*, 2012. 109: 6411-6416.
3. Turnbull, D., Barrington, L., Torres, D., **Lanckriet, G.R.G.** Semantic Annotation and Retrieval of Music and Sound Effects. *IEEE Transactions on Audio, Speech and Language Processing*, 2008. 16: 467-476.
4. **Lanckriet, G.R.G**., De Bie, T., Cristianini, N, Jordan, M.I., Noble, W.S. A statistical framework for genomic data fusion. *Bioinformatics*, 2004. 20:2626-2635.
5. **Lanckriet, G.R.G**., Cristianini, N., Bartlett, P., El Ghaoui, L., Jordan, M.I. Learning the Kernel Matrix with Semidefinite Programming. *Journal of Machine Learning Research*, 2004. 5: 27-72.

9.1.5. Department of Computer Science and Engineering

SANJOY DASGUPTA, Professor (PhD, UC Berkeley)

Sanjoy Dasgupta is a Professor in the Department of Computer Science and Engineering at UC San Diego. He received his PhD from Berkeley in 2000, and spent two years at AT&T Research Labs before joining UCSD. His area of research is algorithmic statistics, with a focus on unsupervised and minimally supervised learning. He is the author of a textbook, "Algorithms" (with Christos Papadimitriou and Umesh Vazirani), that appeared in 2006.

Selected publications:

1. Kpotufe, S. and **Dasgupta, S.** A tree-based regressor that adapts to intrinsic dimension. *Journal of Computer and System Sciences*, 2012. 78(5): 1496-1515.

2. **Dasgupta, S**. Two faces of active learning. *Theoretical Computer Science*, 2011. 412(19): 1767-1781.

3. **Dasgupta, S**. and Freund, Y. Random projection trees for vector quantization. *IEEE Transactions on Information Theory*, 2009. 55(7).

4. **Dasgupta, S.** and Schulman, L.J.. A probabilistic analysis of EM for mixtures of separated, spherical Gaussians. *Journal of Machine Learning Research*, 2007. 8:203-226.

5. **Dasgupta, S**. and Long, P.M. Performance guarantees for hierarchical clustering. *Journal of Computer and System Sciences*, 2005. 70(4):555-569.

9.2. APPENDIX B: EXTERNAL REVIEW LETTERS

We have solicited letters of review from Victor DeGruttola, Chair of the Department of Biostatistics at the Harvard School of Public Health, and from Joseph Ibrahim, Director of Graduate Studies in the Department of Biostatistics at University of North Carolina's School of Public Health. (Pending, 11/3/2014)

These departments are among the top 10 ranked graduate programs in Biostatistics or Statistics according to US News and World Report.

The solicitation email followed the suggested language below:

Dear Chair (or Program Director),

At UCX we are in the process of proposing a new graduate program leading to [degree title]. In accordance with the review policy established by the systemwide Coordinating Committee of Graduate Affairs (CCGA), I am providing you, as the Chair of an existing comparable program, with a copy of the current draft of our proposal. We would be very grateful for any feedback you may wish to offer us, so that the proposal may be made as strong as possible before submission.

As background, please understand that the format and contents of the proposal follow the required outline found in the CCGA Handbook, and that internal and external reviewers will later be asked to address the following four points when examining our final submission:

- Quality and academic rigor of the program
- Adequacy of the size and expertise of faculty to administer the program
- Adequacy of the facilities and budgets
- Applicant pool and placement prospects for the graduates

Victor De Gruttola
Chair, Department of Biostatistics
Henry Pickering Walcott Professor of Biostatistics

HARVARD | SCHOOL OF PUBLIC HEALTH

October 14, 2014

The quality and academic rigor of the proposed new PhD program appears to be very high. Required courses include existing offerings from the mathematics department as well as new courses to be created in the biostatistics department. The mathematics department courses provide a strong theoretical foundation in probability and inference (MATH 281 ABC), linear models (MATH 281) and survival analysis (Math 284). Newly created courses in the biostatistics department will include those in methods and longitudinal data; other important new developments includes biostatistics rotations and a journal club. Math 281 is a rigorous course that requires advanced calculus and basic probability theory, and develops the underlying theory required to train PhD level biostatisticians. The survival analysis course has an appropriate emphasis on modern semiparametric theory, and the linear models course provides classical training that includes anova and ancova. Newly developed courses in methods cover the application areas required for statisticians, and the longitudinal course covers important categories such as use of GEE and generalized linear mixed models. The biostatistics rotation assures that the students will be practical training in biomedical research projects by working closely with faculty on such projects.

In addition to required courses, the new PhD program will offer many electives. An advanced topics course will allow students to learn about cutting edge developments in a variety of research areas that vary from year to year and will thereby help them find dissertation topics. Many electives in the mathematics department, such as stochastic processes, time series methods, multivariate analysis, statistical learning, and machine learning, assure that students with a more theoretical bent will have ample opportunity to achieve a high level of technical skill.

The combined strength of the faculty in the departments of biostatistics, mathematics, electrical and computer engineering and psychiatry will ensure superb training in both the theoretical and applied aspects of the biostatistics. There are 8 faculty in the biostatistics department, who collectively provide a broad range of strengths in theoretical and applied research, as evidenced by publications in high quality statistics and biomedical journals. The faculty vary from those with more theoretical focus to those who are more applied; several have strength in both areas. All have strong external funding records. The program is further bolstered by very strong faculty in mathematics, who often publish in journals known for technical rigor.

The budget appears to be adequate for the development of the PhD program. The provision of15% support for the Program Director is essential to ensure the success of the project, as is the 10% released time for faculty support as needed for course development and other needs and the support for the half-time Program Administrator. Valuable also are

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commitments from the Departments of both Mathematics and Electrical and Computer Engineering to provide 2 Teaching Assistant slots yearly should a submitted training grant be funded. The availability of other funds for student support, however, assures that the program can begin even before training grant slots have been identified. Financial support for the approximately 6 Biostatistics PhD students during their first two years can be provided from several large data analysis cores which current Biostatistics faculty support, and from Teaching Assistant positions.

The job prospects for new recipients of the PhD degree in Biostatistics are excellent, and this will no doubt hold true for graduates of a program at UCSD. There is increasing need for biostatistics throughout industry, government, academic biomedical research programs, NGOs and in departments of statistics and biostatistics themselves. This need assures that recipients of new PhD degrees in biostatistics will have a broad range of opportunities. The strong reputation of the faculty involved in the program, and the intention to provide both classroom instruction and direct experience in applying statistical reasoning and methods in biomedical research projects will make graduates extremely valuable to a wide range of employers.

Sincerely,

Victor De Gruttola
Professor and Chair

9.3. APPENDIX C: LETTERS OF SUPPORT FROM UC BERKELEY, UC DAVIS, AND UCLA

UNIVERSITY OF CALIFORNIA, BERKELEY

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SANTA BARBARA · SANTA CRUZ

Sandrine Dudoit, PhD
Professor of Biostatistics and Statistics
Chair and Head Graduate Advisor, Graduate Group in Biostatistics
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March 15, 2014

Professor Karen Messer, PhD
Chief, Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
3855 Health Sciences Drive 0901
La Jolla, CA 92093-0901
(858) 822-4334
kmesser@ucsd.edu

RE: Proposal for an Interdepartmental Program of Graduate Studies in Biostatistics

Dear Professor Messer:

It is my pleasure to write this letter in strong support of your proposed Interdepartmental Program of Graduate Studies in Biostatistics. I believe this is a timely and important program, given the acute need for well-trained PhD-level biostatisticians in adacemia, government, and industry. It is surprising indeed that no such program exists already in the San Diego area – the only other such programs in California being at UC Berkeley, UC Davis, UCLA, and USC.

The interdepartmental nature of the proposed program, between the Department of Family and Preventive Medicine (FPM), the Division of Biostatistics, and the Department of Mathematics, ideally reflects the inherent interdisciplinary nature of biostatistics. By drawing on faculty and courses from these different units, students should receive a balanced training in both statistical methodology and subject-matter application. I was pleased by the mathematical statistics requirement in the curriculum, as I believe rigorous theoretical foundations are essential to provide sound answers to subject-matter questions. The computing and data analysis requirements are equally-important given the applied nature of our work and the routine handling of large and complex multivariate datasets. By housing the program in FPM, students should be exposed to a wide range of challenging and exciting collaborations, ensuring that their research addresses pertinent biological and medical questions.

In summary, I applaud your efforts to assemble a first-rate faculty team and propose such a strong program of study. I thus give this proposal my strongest support and wish you the best of luck with this exciting project.

Sincerely,

Sandrine Dudoit
Professor of Biostatistics and Statistics
Chair and Head Graduate Advisor, Graduate Group in Biostatistics
University of California, Berkeley

UNIVERSITY OF CALIFORNIA, DAVIS

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28 March 2014

Karen Messer
Chief, Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego

Dear Dr. Messer:

I'm writing to support your group's proposal for an interdepartmental Graduate Program in Biostatistics at UCSD. I have reviewed the program description submitted earlier this month to your Graduate Council, and will comment on your plans based on that description. My familiarity with graduate education in biostatistics reflects not only my own training but also some 40 years as a faculty member in the broad disciplines of statistics and biostatistics, many years of that spent training graduate students at Texas A&M, Harvard, and UC Davis. In addition, as our own Division of Biostatistics has grown, I've had the opportunity through faculty recruitment to assess the training offered at many other programs, and I've served as an external evaluator at several universities.

First, I'd like to note the continuing demand for graduate education in biostatistics. Our own program has experienced increased applications from well-qualified students, both domestic and international. We (and other UC programs) can't admit and fund all the people who would like to study biostatistics in the UC system, so an increase in capacity should be warranted. The demand for doctoral graduates remains strong, especially for students trained in analysis of "big medical data" such as that generated by imaging, -omics, and administrative database studies. The need for "big data" biostatisticians is likely to increase, given the focus on the one hand on personalized medicine, and on the other on evidence-based evaluation of healthcare delivery.

Your program looks well designed to train PhD biostatisticians to meet the future needs of medical and public health research. There is a healthy balance between theoretical and applied material. We occasionally get questions on the need for so much mathematical statistics, but I see two compelling arguments for a very strong foundation. First, many of the current research projects that come to us are very complex (the researchers all think they can do simple t-tests themselves using a spreadsheet.) The foundations of the methods we use are deep, and I think even applied practitioners should understand the basis for their analyses, including when violations of assumptions are dangerous and when they are inconsequential. Second, we hope that our doctoral graduates will not only apply existing methods, but also expand the field to meet new challenges. Our program also has strong ties to the mathematical statistics department, and I think this has strengthened the program considerably.

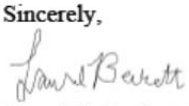
I'm especially pleased that your applied coursework includes not only standard applied courses such as longitudinal data, but also work in epidemiology and/or public health. Understanding the issues in study design will help prepare your graduates for the likely challenges they will face in writing grants and interacting with researchers from other disciplines. Your electives offer a nice range of potential topics; I think it will be especially critical to make sure you have adequate faculty to cover a variety of offerings as I believe almost all students should be exposed to statistical computing, observational studies, and clinical trials, in particular. Your available faculty members are all very good, but additional faculty would be helpful!

The mechanics of the program look fine to me, very standard for a UC interdisciplinary doctoral program, and quite comparable with our own. I'm not familiar with any special requirements at UCSD.

Finally, you note that funding will come primarily from GSR and Teaching Assistant funding, at least for now. A class of 4 PhD students is small, but since some of their coursework will overlap with Math Department courses, and some statistics students in the Math Department are likely to sign up for your courses, I expect they will not be too isolated. Training grants are a challenge. NIH expects you to demonstrate a track record and the ability to recruit eligible students (US citizens or permanent residents), and many students in our field are international and not eligible for training grants. You might think about building partnerships across disciplines so you can apply for inter-program training grants, until you build up a sufficient track record to apply on your own.

I'm delighted that you are expanding the UC system's capacity for graduate education in our discipline, and wish you every success with the new program. Please keep me posted and let me know what I can do to help!

Sincerely,



Laurel A. Beckett, Ph.D.
Professor and Chief, Division of Biostatistics
Department of Public Health Sciences

UNIVERSITY OF CALIFORNIA, LOS ANGELES **UCLA**

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DEPARTMENT OF BIOSTATISTICS
SCHOOL OF PUBLIC HEALTH
BOX 951772
LOS ANGELES, CA 90095-1772
PHONE: (310) 8255250
Tax: (310) 267-2113
e-mail: biostat@ucla.edu

March 31, 2014

Karen Messer, Ph.D.
Professor and Chief
Division of Biostatistics & Bioinformatics
University of California at San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093
Email: kmesser@ucsd.edu

Dear Professor Messer:

I am writing in support of your proposal for an interdepartmental program in Biostatistics at UCSD. There is an unmet demand for Ph.D. level Biostatisticians in medical research, despite the fact that within the statistical field, biostatisticians typically receive the highest salaries. Within the UC system, three institutions offer a doctorate in Biostatistics (UCLA, UC Berkeley, and UC Davis); at UCLA we confer an average of six doctorates per year, who find no difficulty in finding research positions in academia, government, or industry.

I believe your proposal for an interdepartmental degree is an effective way to train students in the theory and mathematical concepts of statistics relevant to medical research, and to provide an outstanding environment for them to get practical biostatistical training. Since UCSD does not have a separate School of Public Health, housing the program within the Department of Family and Preventive Medicine within the UCSD School of Medicine is the best choice for ths program. As you note, this would be the only program offering a Ph.D. in Biostatistics south of Los Angeles, and since Loma Linda does not offer a doctorate degree in Biostatistics, one of three in all of southern California so doing.

The coordination with the UCSD statistics group housed within the Mathematics Department is an important part of your proposal; the option of Computer Science electives broadens the different tracks a student might choose for his/her specialization. The inclusion of instruction in epidemiology and public health is an important part of the curriculum for a biostatistician. The prerequisites you list are very similar to those we require of our doctoral students.

You have put together a strong program, and your graduates should be well prepared for successful careers in Biostatistics.

Sincerely,

William G. Cumberland, Ph.D.
Professor and Chair

9.4. APPENDIX D: UCSD CHAIRS AND DEANS LETTERS OF SUPPORT

Letters are included from the Dean of the School of Medicine, the Dean of the Division of Physical Sciences, and the Chairs of the Departments of Family and Preventive Medicine, Mathematics, Electrical and Computer Engineering, and Computer Science and Engineering

UC San Diego
HEALTH SCIENCES

September 22, 2014

Bess H. Marcus, PhD
Professor and Chair
Department of Family & Preventive Medicine
Senior Associate Dean for Public Health
UCSD School of Medicine

Subject: New Graduate Program for the PhD in Biostatistics

Dear Professor Marcus:

On behalf of UCSD School of Medicine, I am pleased to express my strongest support for the proposed new graduate program leading to the PhD in Biostatistics. This pending program has already strengthened our ability to recruit and retain outstanding Biostatistics faculty. The new Biostatistics course offerings and trainees will greatly benefit our existing training and research programs. Building on the superb research environment at UCSD School of Medicine and the outstanding participating faculty from Biostatistics, Statistics and the Computer Sciences, I am confident that this new program will quickly develop into a leading graduate program in Biostatistics.

I am pleased to provide substantial institutional support to help this important program become established and grow. In particular, I endorse the use of the startup funds which I have provided to the Division of Biostatistics, in the amount of approximately $250,000 over 5 years for administrative and student support as outlined in the proposal.

In addition, I am pleased to provide program funding following the standard UCSD Block Grant funding model, as approved by UCSD Graduate Council and as recommended by Dean Barrett in her 9.22.14 letter to me. Consistent with start-up funding provided to other new PhD programs, I am pleased to provide a flat amount of $50,000 per year for approximately the first 3 years of the program. From year 4 on, it is projected that 12 to 13 or more students will be enrolled, and from this point, I will provide the standard block grant funds that the program "earns" on the basis of its enrollments. The per-student allocation will follow the Graduate Council's formula, which may take into account other resources available for student support, cost of living increases that may apply, and a possible merit component of up to 10% assigned by Graduate Council on the basis of program review. However, for planning purposes, the amount per student should be about $4,000 per year, as indicated in the proposal budget. Again following the standard UCSD graduate funding model, I am also pleased to return non-resident fees to the program.

This proposed program will train a generation of Biostatisticians, well-grounded in biomedical science, who will bring cutting edge methods from the data sciences and apply them in biomedical research. I am pleased to offer these substantial commitments to help ensure the program's successful development into one of the outstanding PhD programs in Biostatistics.

Sincerely,

David A. Brenner, MD
Vice Chancellor for Health Sciences
Dean, School of Medicine
University of California San Diego

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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OFFICE OF THE DIVISIONAL DEAN–PHYSICAL SCIENCES
9500 GILMAN DRIVE, #0352
LA JOLLA, CALIFORNIA 92093-0352

TELEPHONE: (858) 534-6882
FAX: (858) 534-5224

April 7, 2014

Karen Messer
Professor and Division Chief
Division of Biostatistics
Department of Family and Preventive Medicine
University of California, San Diego

Dear Professor Messer:

As Dean of the Division of Physical Sciences, I am pleased to support the proposed Interdepartmental Program of Graduate Studies in Biostatistics at UC San Diego. The Mathematics Department within the Division of Physical Sciences has an exceptionally strong statistics group and is poised to collaborate with other participants to make this program successful. There is strong demand for Ph.D. level biostatisticians in academia, industry, and the government and the Math Department's role in the proposed program will be a distinguishing factor. I am enthusiastic about the proposed program and am pleased to confirm my strongest support of it.

Sincerely,

Mark Thiemens

Mark Thiemens
Dean, Division of Physical Sciences

UC San Diego
HEALTH SCIENCES

July 28, 2014

Dear Karen,

It is my pleasure to write this letter in support of our new Interdepartmental Program of Graduate Studies in Biostatistics, housed in the Department of Family and Preventive Medicine. I believe there is an urgent need for the expanded educational opportunities the program will provide for Biostatistics graduate training within our Department and across the UCSD campus. I am committed to supporting and encouraging program growth, including by encouraging appropriate faculty teaching directed to the program, by helping to provide space for first and second year students, by encouraging grant submissions which will provide student support, such as training grants, and by supporting Division initiatives directed to the program such as appropriate use of Divisional resources.

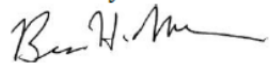
A strong graduate program in Biostatistics is expected to benefit faculty in all Divisions of our Department. Interaction with Biostatistics graduate students who will be interested in applied collaboration will be helpful for both junior and senior faculty with data analysis needs. Our existing students in our Joint Doctoral Program in Public Health and our undergraduate Bachelors of Science in Public Health are expected to benefit by the resulting increased availability of graduate level courses in Biostatics, as well as by interaction with Biostatistics graduate students who can provide technical assistance.

Our Department will benefit as well by the increased ability to attract strong new faculty recruits in Biostatistics and other quantitative fields. Finally, our Department will benefit by the increased collaboration with the Departments of Mathematics and Electrical and Computer Engineering and across the School of Medicine which will be fostered by this new interdepartmental program.

In addition to the strong institutional support provided by the Dean of the School of Medicine, I am pleased to provide institutional support in the form of shared office space for up to 6 Biostatistics graduate students each year. Providing students with shared office space will facilitate their interaction together and with our faculty, contributing to a sense of cohesion and to informal interactions important to their professional development.

You have my strongest support and I look forward to working together as we develop this program.

Sincerely,



Bess H. Marcus, Ph.D.
Professor and Chair

Bess H. Marcus, Ph.D., Professor and Chair
Department of Family and Preventive Medicine
9500 Gilman Drive #0628, La Jolla, California 92093-0628 Tel: (858) 534-8363 Fax: (858) 534-7517

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PETER EBENFELT
DEPARTMENT OF MATHEMATICS, 0112
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LA JOLLA, CALIFORNIA 92093-0112

TELEPHONE: (858) 534-1177
FAX: (858) 534-4932
E-MAIL: pebenfel@math.ucsd.edu

April 2, 2014

Karen Messer
Professor and Division Chief
Division of Biostatistics
Department of Family and Preventive Medicin
University of California, San Diego

Dear Division Chief Messer,

On behalf of the UCSD Department of Mathematics, I would like to express my strong and enthusiastic support for the proposed interdepartmental Program of Graduate Studies in Biostatistics at UCSD. Biostatistics has emerged as a central and important field with a significant mathematical/statistics component. The Mathematics Department has an exceptionally strong statistics group, and believes that this expertise will be useful to the proposed program. The Department is willing collaborate with the Division of Biostatistics to make the program successful. Thus, the Mathematics Department and I strongly support the proposed program.

Sincerely,

Peter Ebenfelt,
Professor and Chair,
Department of Mathematics.

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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
Shaya Fainman, Department Chair

9500 GILMAN DRIVE MC 0407
LA JOLLA, CALIFORNIA 92093-0407

March 17, 2014

Karen Messer, Ph.D.
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093

Dear Karen,

I am writing on behalf of the Department of Electrical and Computer Engineering in support of the new interdepartmental Program of Graduate Studies in Biostatistics that aims to prepare its students for an interdisciplinary career within an academic medical center, school of public health, health related government agencies, or the pharmaceutical and biotech industries. The connection to the Department of Electrical and Computer Engineering and our faculty who are interested in predictive modeling, data mining and large scale inference is innovative and has the potential for creative synergies between the participating departments.

We see a potential benefit to our students who wish to enhance their graduate studies through courses available through the Biostatistics program as well as potential collaborations with faculty and students associated with the program.

We are committed to offering ECE 273 – Convex Optimization on a regular basis as part of our own graduate program and we will welcome students from the Biostatistics program who are interested in taking this course as an elective. We fully support Professor Lanckriet's commitment to serve as a thesis advisor to students in the Biostatistics program.

We believe the development of this new program is timely and welcome development on our campus.

Sincerely,

Shaya Fainman
Distinguished Professor and Chair

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
OFFICE OF THE CHAIRMAN
FAX: (858) 822-1559

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA
92093-0404

October 31, 2014

Karen Messer, Ph.D.
Professor and Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093

Dear Karen,

I am writing on behalf of the Department of Computer Science and Engineering in support of the new interdepartmental Program of Graduate Studies in Biostatistics. The connection to the Department of Computer Science and Engineering and our faculty who are interested in predictive modeling, data mining and large scale inference is innovative and has the potential for creative synergies between the participating departments.

We see a potential benefit to our students who wish to enhance their graduate studies through courses available through the Biostatistics program as well as potential collaborations with faculty and students associated with the program.

We are committed to offering CSE 202 (Algorithm Design and Analysis); CSE 250B: (Learning Algorithms); CSE 255: (Data mining and predictive analytics); CSE 260: (Parallel computation); and CSE 283 (Genomics, Proteomics, Systems Biology) on a regular basis as part of our own graduate program and we will welcome students from the Biostatistics program who are interested in taking these courses as electives. We fully support Professor Sanjoy Dasgupta's commitment to serve as a thesis advisor to students in the Biostatistics program.

We believe the development of this new program is timely and welcome development on our campus.

Sincerely,

Rajesh K. Gupta

Professor and Qualcomm Endowed Chair
Department of Computer Science and Engineering
University of California, San Diego

9.5. APPENDIX E: UCSD FACULTY LETTERS OF SUPPORT

Letters of support are included from the four participating faculty members with primary appointments in Mathematics and the members from Electrical and Computer Engineering and Computer Science and Engineering.

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IAN ABRAMSON
PROFESSOR OF MATHEMATICS
TEL: (858) 534-3657
FAX: (858) 534-5273

9500 GILMAN DRIVE
LA JOLLA, CA 92093-0112
EMAIL: iabramson@ucsd.edu

February 9th, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093-0901
858-822-4334
kmesser@ucsd.edu

Dear Karen:

I am writing in enthusiastic support of your application for a new interdepartmental Program of Graduate Studies in Biostatistics. This is a timely and important program that answers an acute need for well-trained Ph.D.-level Biostatisticians in the Southern California region. Given the burgeoning Big Data needs in Medical Sciences and the robust presence of BioTech companies in the San Diego area, the graduates of these programs will have excellent job prospects!

This program plans to take advantage of the synergy opportunities with the Statistics group within the Department of Mathematics. In particular, six four-unit courses offered by the Department of Mathematics (Math 281A/B/C, Math 282A/B, and Math 284) will be among the required (core) courses in the new Ph.D. Program. I am currently teaching/have been teaching the 281 sequence for the past many years.

I am very happy to participate in the new Ph.D. program. I will continue to teach one of the core courses offered by the Department of Mathematics. Furthermore, I expect to be involved in training of graduate students in this program.

I believe this is an exciting development for UCSD and for Biostatistics, and I am happy to be a part of this project.

Sincerely,

Ian Abramson, Professor of Mathematics.

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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ERY ARIAS-CASTRO, ASSOCIATE PROFESSOR
DEPARTMENT OF MATHEMATICS, 0112
9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0112

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F: (858) 534-5273
E: eariasca@ucsd.edu
W: math.ucsd.edu/~eariasca

Letter of support for the establishment of a Ph.D. in Biostatistics at UCSD

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California San Diego

January 30, 2014

Dear Karen:

I am writing in enthusiastic support of your application for a new interdepartmental Program of Graduate Studies in Biostatistics. This is a timely and important program that answers an acute need for well-trained Ph.D.-level Biostatisticians in the Southern California region. Given the burgeoning Big Data needs in Medical Sciences and the robust presence of BioTech companies in the San Diego area, the graduates of these programs will have excellent job prospects!

This program plans to take advantage of the synergy opportunities with the Statistics group within the Department of Mathematics. In particular, six four-unit courses offered by the Department of Mathematics (Math 281A/B/C, Math 282A/B, and Math 284) will be among the required (core) courses in the new Ph.D. Program. Among those, I have been teaching 281C and 282B almost every year for the past several years. I would definitely welcome a fresh addition of talented students from this Biostatistics Ph.D. program. I may also want to be involved with supervising some of these students in the context of a rotation, to expose them to different types of data such a images (say from MRI) or other.

I believe this is an exciting development for Biostatistics (and more generally, Statistics) here at UCSD, and I am happy to be a part of this project.

Sincerely,

Ery Arias-Castro

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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DIMITRIS N. POLITIS
PROFESSOR OF MATHEMATICS AND ECONOMICS
TEL: (858) 534-5861
FAX: (858) 534-5273

9500 GILMAN DRIVE
LA JOLLA, CA 92093-0112
EMAIL: dpolitis@ucsd.edu
www.math.ucsd.edu/~politis

Jan. 28, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093-0901
858-822-4334
kmesser@ucsd.edu

Dear Karen:

I am writing in enthusiastic support of your application for a new interdepartmental Program of Graduate Studies in Biostatistics. This is a timely and important program that answers an acute need for well-trained Ph.D.-level Biostatisticians in the Southern California region. Given the burgeoning Big Data needs in the Medical Sciences and the robust presence of BioTech companies in the San Diego area, the graduates of these programs will have excellent job prospects!

This program plans to take advantage of the synergy opportunities with the Statistics group within the Department of Mathematics. In particular, six four-unit courses offered by the Department of Mathematics (Math 281A/B/C, Math 282A/B, and Math 284) will be among the required (core) courses in the new Ph.D. Program.

I have been teaching parts of the Math 281 and 282 sequences for over 15 years. I have also been teaching parts of the Math 287A/B/C/D sequence that Ph.D. students in Biostatistics may find attractive; the subjects comprise Time Series Analysis (287A and D), Multivariate Analysis (287B), and Statistical Learning (287D). In addition, every two years I have been teaching the Topics course 289A on the Bootstrap.

I am very happy to participate in the new Ph.D. program. In particular, I may teach one of the core courses offered by the Department of Mathematics, in understanding with my department. Furthermore, I may be involved in training of graduate students in this program.

I believe this is an exciting development for UCSD and for Biostatistics, and I am happy to be a part of this project.

Sincerely,

Dimitris N. Politis

Professor of Mathematics

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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JELENA BRADIC, PH.D.
ASSISTANT PROFESSOR OF STATISTICS
DEPARTMENT OF MATHEMATICS
UNIVERSITY OF CALIFORNIA AT SAN DIEGO
9500 GILMAN DRIVE 0112
LA JOLLA, CA 92093-0112
PHONE: (609) 423-5323
E-MAIL: JBRADIC@UCSD.EDU

February 19th, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093-0901
858-822-4334
kmesser@ucsd.edu

Dear Karen:

I am writing in enthusiastic support of your application for a new interdepartmental Program of Graduate Studies in Biostatistics. This is a timely and important program that answers an acute need for well-trained Ph.D.-level Biostatisticians in the Southern California region. I cannot overemphasize enough the need for *fundamental training of Biostatisticians*. Given the burgeoning Big Data needs in Medical Sciences, development of new and groundbreaking statistical methodologies is a must. Moreover, the high and ever-growing presence of BioTech companies in the San Diego area provides a unique opportunity for UCSD to become a *leading Biostatistics center of the Southern California*. For all the same reasoning, the graduates of these programs will have excellent job prospects!

This program plans to take advantage of the synergy opportunities with the Statistics group within the Department of Mathematics to which I am part of. Excellent mathematical training of the Faculty within the Biostatistics division, makes this collaboration smooth, easy and with great potential for high broad impact. In particular, six four-unit courses offered by the Department of Mathematics (Math 281A/B/C, Math 282A/B, and Math 284) will be among the required (core) courses in the new Ph.D. Program. I am currently teaching the Mathematical Statistics sequence MATH 281A/B and I have been teaching MATH 287D Statistical Learning in the past year.

I am very happy and very enthusiastic to participate in the new Ph.D. program. In particular, I may teach one of the core courses, and some of the elective courses (related to Big Data) offered by the Department of Mathematics, in understanding with my department. Furthermore, I will be extremely enthusiastic in training of graduate students in this program.

I believe this is an exciting development for UCSD and for Biostatistics, and I am happy to be a part of this project.

Sincerely,
Jelena Bradic

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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GERT LANCKRIET
ASSOCIATE PROFESSOR
ELECTRICAL & COMPUTER ENGINEERING
U.C. SAN DIEGO
9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0407
(858) 539-6003
gert@ece.ucsd.edu

February 25, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California San Diego
3855 Health Sciences Drive 0901
La Jolla, CA 92093-0901
858-822-4334
kmesser@ucsd.edu

Dear Karen:

I would like to convey my enthusiastic support for your effort to institute a new interdepartmental Program of Graduate Studies in Biostatistics. This program responds to an important need for Ph.D. level Biostatisticians in Southern California. The program graduates will be able to take advantage of the excellent job opportunities that the robust BioTech industry provides in the San Diego area.

My research interests in Computer Science overlap very nicely with the field of Biostatistics, and the proposed program will create synergies with my department. I have been teaching the course on Convex Optimization with Applications to Machine Learning for 8 years, and I will be happy to offer this course as an elective for your graduate students, in understanding with my department. Furthermore, I may make myself available as a thesis advisor to graduate students in your program.

This new program is a welcome development, and I am glad to participate in it.

Sincerely,

Gert Lanckriet

UNIVERSITY OF CALIFORNIA, SAN DIEGO

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UNIVERSITY OF CALIFORNIA, SAN DIEGO
DIVISION OF THE JACOBS SCHOOL of ENGINEERING

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0114
FAX: (858) 534-7029

March 19, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego

Dear Karen:

I would like to convey my enthusiastic support for your effort to institute a new interdepartmental Program of Graduate Studies in Biostatistics. This program responds to an important need for Ph.D. level Biostatisticians in Southern California. Graduates of the program will be able to take advantage of the excellent job opportunities that the robust BioTech industry provides in the San Diego area.

My research interests in Computer Science overlap nicely with the field of Biostatistics, and the proposed program will create synergies with my department. I have been teaching graduate-level courses in machine learning for over a decade, and I would be happy to offer these as electives for your graduate students, in understanding with my department. Furthermore, I will gladly make myself available as a thesis advisor to graduate students in your program.

This new program is a welcome development, and I am pleased to participate in it.

Sincerely,

Sanjoy Dasgupta
Professor
Department of Computer Science and Engineering
University of California, San Diego

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FAX: (858) 534-7029

March 19, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego

Dear Karen:

I would like to convey my enthusiastic support for your effort to institute a new interdepartmental Program of Graduate Studies in Biostatistics. This program responds to an important need for Ph.D. level Biostatisticians in Southern California. Graduates of the program will be able to take advantage of the excellent job opportunities that the robust BioTech industry provides in the San Diego area.

My research interests in Computer Science overlap nicely with the field of Biostatistics, and the proposed program will create synergies with my department. I have been teaching graduate-level courses in machine learning for over a decade, and I would be happy to offer these as electives for your graduate students, in understanding with my department. Furthermore, I will gladly make myself available as a thesis advisor to graduate students in your program.

This new program is a welcome development, and I am pleased to participate in it.

Sincerely,

Sanjoy Dasgupta
Professor
Department of Computer Science and Engineering
University of California, San Diego

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FAX: (858) 534-7029

March 19, 2014

Karen Messer, PhD
Professor and Division Chief
Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
University of California, San Diego

Dear Karen:

I would like to convey my enthusiastic support for your effort to institute a new interdepartmental Program of Graduate Studies in Biostatistics. This program responds to an important need for Ph.D. level Biostatisticians in Southern California. Graduates of the program will be able to take advantage of the excellent job opportunities that the robust BioTech industry provides in the San Diego area.

My research interests in Computer Science overlap nicely with the field of Biostatistics, and the proposed program will create synergies with my department. I have been teaching graduate-level courses in machine learning for over a decade, and I would be happy to offer these as electives for your graduate students, in understanding with my department. Furthermore, I will gladly make myself available as a thesis advisor to graduate students in your program.

This new program is a welcome development, and I am pleased to participate in it.

Sincerely,

Sanjoy Dasgupta
Professor
Department of Computer Science and Engineering
University of California, San Diego

9.6. APPENDIX G: DRAFT COURSE APPROVAL FORMS

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Fall 2015

Subject & Number	Units	Title
BST 221	4	Biostatistical Methods I

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student	3	0	0	0	0	0	0	0	5	4 Homework (4h)
12										

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit ____1_____ time(s). If more than once, justify:

[x] Final Exam Given If not, explain:

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Introductory graduate course in the analysis of biomedical data. Continuous outcomes: linear regression model and ANOVA, robust alternatives based on permutations, model building; interaction and confounding. Analysis of binary and categorical data.

Prerequisites: Enrollment in the Biostatistics PhD program.

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: N/A

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Florin Vaida, PhD, Associate Professor, Division of Biostatistics and Bioinformatics, Department of Family and Preventive Medicine

JUSTIFICATION: Core course for the new PhD program in Biostatistics

_____	_____	_____	_____
Department Chair	date	Registrar	date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____	_____		
Dean, School of Medicine	date	_____	_____
		Council of Provosts	date
_____	_____		
Dean of Graduate Studies	date	_____	_____
		CEP Subcommittee on Courses	date
_____	_____		
Graduate Council	date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Winter 2016

Subject & Number	Units	Title
BST 222	4	Biostatistical Methods II

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student 12	3	0	0	0	0	0	0	0	5	4 Homework (4h)

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit ____1_____ time(s). If more than once, justify:

[x] Final Exam Given If not, explain:

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Analysis of continuous response, categorical response, censored survival data. Methods for stratified analyses of discrete data and case-control studies, multinomial regression models, Poisson regression, loglinear models, generalized linear models.

Prerequisites: BST 221.

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: BST 221

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Karen Messer, PhD, Associate Professor, Division of Biostatistics and Bioinformatics, Department of Family and Preventive Medicine

JUSTIFICATION: Core course for the new PhD program in Biostatistics

_____	_____	_____	_____
Department Chair	date	Registrar	date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____	_____		
Dean, School of Medicine	date	_____	_____
		Council of Provosts	date
_____	_____		
Dean of Graduate Studies	date	_____	_____
		CEP Subcommittee on Courses	date
_____	_____		
Graduate Council	date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Spring 2016

Subject & Number	Units	Title
BST 223	4	Analysis of Longitudinal Data

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student 12	3	0	0	0	0	0	0	0	5	4 Homework (4h)

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit ____1_____ time(s). If more than once, justify:

[x] Final Exam Given If not, explain:

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Analysis of repeated measures and longitudinal data. General linear model, parametric modeling of covariance, generalized estimating equations, linear and generalized linear mixed effects models; binary data, modeling dropout in longitudinal studies. Data analysis and computational issues are addressed.

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: BST 221, BST 222, Math 281A, Math 281B, Math 282A, Math 282B

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Wesley Thompson, Associate Professor, Department of Psychiatry, UCSD

JUSTIFICATION: Core course for the new PhD program in Biostatistics

_____ _____ _____ _____

Department Chair date Registrar date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____ Dean, School of Medicine	_____ date	_____ Council of Provosts	_____ date
_____ Dean of Graduate Studies	_____ date	_____ CEP Subcommittee on Courses	_____ date
_____ Graduate Council	_____ date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Spring 2016

Subject & Number	Units	Title
BST 227	3	Biostatistical Rotation

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student 9	0	0	0	0	0	0	0	0	6	Rotation 3h

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit ____1_____ time(s). If more than once, justify:

[ ] Final Exam Given If not, explain: Final project required

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Assisting teaching faculty in biomedical research projects by performing data analyses under supervision. Prerequisites: BST 221, BST 222, Math 281A-B

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: BST 221, BST 222, Math 281 A-B

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Participating Faculty of the Division of Biostatistics and Bioinformatics, Department of Family and Preventive Medicine

JUSTIFICATION: Core course for the new PhD program in Biostatistics

_____ _____ _____ _____

Department Chair date Registrar date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____ Dean, School of Medicine	_____ date	_____ Council of Provosts	_____ date
_____ Dean of Graduate Studies	_____ date	_____ CEP Subcommittee on Courses	_____ date
_____ Graduate Council	_____ date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Spring 2016

Subject & Number	Units	Title
BST 252	4	Advanced Topics in Biostatistics

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student 12	3	0	0	0	0	0	0	0	5	Homework 4h

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit ____6_____ time(s). If more than once, justify:

[x] Final Exam Given If not, explain.

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Rotating topics in Biostatistical methods: genetics, bioinformatics and genomics; longitudinal or functional data; clinical trials and experimental design; analysis of environmental data; dose-response, nutrition and toxicology; survival analysis; observational studies and epidemiology; computer-intensive or Bayesian methods in biostatistics.

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: BST 221, BST 222

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Participating Faculty of the Division of Biostatistics and Bioinformatics, Department of Family and Preventive Medicine

JUSTIFICATION: Core course for the new PhD program in Biostatistics

_____ _____ _____ _____

Department Chair date Registrar date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____ Dean, School of Medicine	_____ date	_____ Council of Provosts	_____ date
_____ Dean of Graduate Studies	_____ date	_____ CEP Subcommittee on Courses	_____ date
_____ Graduate Council	_____ date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Spring 2016

Subject & Number	Units	Title
BST 290	1	Seminar in Biostatistics

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student	0	1	0	0	0	0	0	0	2	
3										

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit _____ time(s). If more than once, justify:

[ ] Final Exam Given If not, explain. Seminar presentation required

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Seminar on advanced topics in the field of biostatistics. Presented by members of the Biostatistics Program and other guest speakers

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: None

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Participating members in the Biostatistics PhD program and guest speakers

JUSTIFICATION: Course for the new PhD program in Biostatistics

_____ _____ _____ _____

Department Chair date Registrar date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____ Dean, School of Medicine	_____ date	_____ Council of Provosts	_____ date
_____ Dean of Graduate Studies	_____ date	_____ CEP Subcommittee on Courses	_____ date
_____ Graduate Council	_____ date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09)

Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

UNIVERSITY OF CALIFORNIA, SAN DIEGO REQUEST FOR COURSE APPROVAL

[x] New Course [ ] Reinstatement [ ] Deletion [ ] Renumbering: old number_____ [ ] Summer Session Only [ ] Change In Course Nature of Change:	Effective Quarter Year Spring 2016

Subject & Number	Units	Title
BST 299	4	Thesis Research in Biostatistics

Hours Per Week	Lec	Sem	Dis	Lab	Studio	Practicum	Tutorial	Med Clerk	Outside Prep	Other (describe)
Expected of Student 3	0	1	0	0	0	0	0	0	2	

If the course has multiple discussion or other sections, how should the grade reports be printed (check one)?

[x] Single List of all students [ ] By Dis Section [ ] By Lab Section [ ] By Studio Section [ ] By Tut Section

Grading - Undergraduate	[ ] Standard Grading (letter or P/NP) [ ] P/NP Only
Grading – Graduate and SOM	[x] Standard Option (Graduate) [ ] S/U Permitted [ ] S/U Only [ ] H/P/F (SOM) [ ] F (SOM)

May be taken for credit _____ time(s). If more than once, justify:

[ ] Final Exam Given If not, explain. Seminar presentation required

COURSE DESCRIPTION (In concise catalog description style, 40 word limit)

Research in biostatistics under the supervision of PhD thesis professor. Prerequisites: Advancement to PhD candidacy and consent of instructor.

ENFORCEMENT List prerequisites and other restrictions to be enforced by computer (see instructions).

Prerequisites that must be completed: None

Co-requisites (must be concurrent):

_____ _____

Chair, Electives Committee Date

Other restrictions:

Special course characteristics. Check all boxes that apply and see instructions for required explanations.

[ ] Use of animals [ ] Use of computer resources [ ] IP Grading [ ] Cross listed with _____ [ ] Conjoined with _____

Instructor and title:

Participating members in the Biostatistics PhD program

JUSTIFICATION: Course for the new PhD program in Biostatistics

_____ _____ _____ _____

Department Chair date Registrar date

APPROVALS – GRADUATE COURSE		APPROVALS - UNDERGRADUATE COURSE	
_____ Dean, School of Medicine	_____ date	_____ Council of Provosts	_____ date
_____ Dean of Graduate Studies	_____ date	_____ CEP Subcommittee on Courses	_____ date
_____ Graduate Council	_____ date		
Extent of approval: ☐ Indefinite ☐ Summer Only		Expires at the end of _____ quarter, 20____	

FO 2073 (REV. 12/11/09) Following all approvals, PLEASE return a copy to Denise LeStrange, SOM Electives Coordinator, MC 0729. Thank You!

9.7. APPENDIX H: GRANT SUPPORT OF FACULTY

The following tables present grant support for participating faculty who are also participating in the associated T32 training grant application, from which these tables are drawn. The intention is to demonstrate the breadth of research which participating faculty are engaged in, comprising both collaborative biomedical research and primary statistical methods research.

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Abramson, Ian	Co-Investigator HIV Neurobehavioral Research Center (HNRC)	NIMH P30 MH62512	04/01/2011-03/31/2016	$ 7,281,555
Abramson, Ian	Co-Investigator Translational Methamphetamine AIDS Research Center (TMARC)	NIDA 2P50DA026306-06	09/30/2009-05/31/2015	$2,314,100
Arias-Castro, Ery	PI Information Bounds and Algorithms for Community Detection and Extraction	ONR N00014-13-1-0257	02/01/2013 – 10/31/2015	$293,196
Arias-Castro, Ery	PI Detection of Clusters in Spatial Data and Images	NSF DMS 1223137	09/01/2012 – 08/31/2015	$884,959
Arias-Castro, Ery	PI Multi-manifold data modeling: theory, algorithms and applications	NSF DMS 0915160	09/15/2009 – 08/31/2014	$110,190
Bradic, Jelena	N/A	N/A	N/A	N/A
Dasgupta, Sanjoy	PI Data e-platform leveraged for patient empowerment and population health improvement	NSF IIS-1237174 (Patrick/Dasgupta)	10/01/2012 – 09/30/2016	$314,744
Dasgupta, Sanjoy	PI Quantifying and utilizing confidence in machine learning	NSF IIS 1162581 (Freund/Dasgupta/Chaudhuri)	04/30/2012 – 03/31/2016	$83,333 ($1,000,000)
Donohue, Michael	Key Personnel ALZHEIMER'S DISEASE NEUROIMAGING INITIATIVE	1 U01 AG24904-09 (Weiner, Micheal)	09/30/2010 - 07/31/2015	$1.79 Million
Donohue, Michael	Key Personnel MULTICENTER TRIAL OF HYDROXYCHLOROQUINE AND COLCHICINE IN ALZHEIMER'S DISEASE	5 U01 AG10483-23 (Aisen, Paul)	09/15/2007 - 11/30/2017	$7.56 Million

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Donohue, Michael	Key Personnel SAN DIEGO CLINICAL AND TRANSLATIONAL RESEARCH INSTITUTE	1UL1RR031980-01 (Firestein, Gary)	07/01/2010 - 03/31/2015	$6.8 Million
Freund, Yoav	PI (Freund/Dasgupta/Chaudhuri) RI-Medium: Quantifying and utilizing confidence in machine learning	NDF 1162581	09/01/2012 – 08/30/2016	$83,333 ($1,000,000)
Gamst, Anthony	Co-Investigator NRT and Quitline Services for Hospitalized Smokers (CHART)	NIH U01 CA159533 (Zhu, Shu-Hong)	09/27/2010-05/31/2014	$ 2,837,555
Gamst, Anthony	Co-Investigator Translational Methamphetamine AIDS Research Center (TMARC)	NIH P50 DA026306 (Grant, Igor)	09/30/2009-05/31/2014	$ 22,773,590
Gamst, Anthony	Co-Investigator The CNS HIV Anti-Retroviral Therapy Effects Research Study as a Resource	NIH N01 MH022005 (Grant, Igor)	09/01/2010-09/15/2015	$ 970,415
Gamst, Anthony	Co-Investigator Technical Validation of MRI Biomarkers of Liver Fat	NIH R01 DK088925 (Sirlin, Claude)	09/15/2010-06/30/2015	$ 3,289,286
Gamst, Anthony	Co-Investigator HIV Neurobehavioral Research Center (HNRC)	NIH P30 MH062512 (Heaton, Robert)	04/01/2011-03/31/2016	$ 8,930,000
Gamst, Anthony	Co-Investigator Nonsmokers and Tobacco Control Norms: Population Surveys and Intervention Studies	NIH U01 CA154280 (Zhu, Shu-Hong)	08/18/2011-07/31/2016	$ 5,543,557
Gamst, Anthony	Co-Investigator MAGNET – Development of MR Based Biomarker Panels for NAFLD _ A NASH CRN Ancillary Study	NIH R56 DK090350 (Sirlin, Claude)	09/24/2012-08/31/2014	$ 1,567,298
Gamst, Anthony	PI The Materials Genome Project for Functional Electronic Materials Design	DOE/LBL SD 2012-4301 (Gamst, Anthony)	10/08/2012-10/31/2017	$ 732,703

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Gamst, Anthony	Co-PI SenseHealth A Platform to Enable Personalized Healthcare through Context-aware Sensing and Predictive Modeling Using Sensor Streams and Electronic Medical Record Data.	NSF IIS 1344153 (Tilak, Sameer)	10/01/2013-09/30/2016	$ 617,681
Jain, Sonia	Biostatistics Core Co-Director PTSD/TBI Clinical Consortium (INTRuST)	DoD W81XWH08-2-0159	09/15/2008 – 09/14/2015	$12 million
Jain, Sonia	Lead Biomarker Biostatistician Army STARRS	USAMRAA and NIH/NIMH 5 U01 MH087981-05	07/01/2011 –06/30/2015	$800,000
Jain, Sonia	Director of Biostatistics Center for AIDS Research-G: Clinical Investigation Core	NIH/NIAID 5 P30 AI36214-17	05/31/2013 – 5/31/2018	$2.2 million
Lanckriet, Gert	Co-PI Large-Vocabulary Semantic Image Processing: Theory And Algorithms	NSF, CCF-0830535, Current	09/01/2008 – 02/28/2018	$196,119
Lanckriet, Gert	Senior Personal The Temporal Dynamics of Learning	NSF, SMA-1005256, Current	09/01/2010 – 08/31/2014	$64,935
Lanckriet, Gert	PI, An Integrated Framework For Multimodal Music Search And Discovery	NSF, IIS-1054960, Current	02/01/2011 – 01/31/2016	$77,159
Lanckriet, Gert	Co-Investigator Energetics & Breast Cancer: Obesity, Inflammation, Insulin Resistance & Risk	NCI 5U54CA155435-04, Current	07/07/2011 -05/31/2016	$1,183,628
Lanckriet, Gert	Co-Investigator GPS Exposure To Healthy Environments & Relations With Biomarkers Of Cancer Risk	NIH, 1R01CA179977-01, Current	09/01/2013 – 08/31/2017	$109,455
Liu, Lin	Co-Investigator Drug tourism to Mexico: Impact of Mexico's new drug law on HIV-HCV-TB in US IDUs	NIH/NIDA 5R01DA031074-04	08/01/2011-05/31/2016	$441,900

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Liu, Lin	Co-Investigator Quantifying Electronic Medical Record Usability to Improve Clinical Workflow	NIH R01 HS21290-02	09/01/2012 - 08/30/2016	$472,935
Liu, Lin	Co-Investigator In-Home Exposure for Veterans with PTSD	CDMRP W81XWH-12-1-0614	09/01/2012 - 08/30/2016	$551,000
Liu, Lin	Co-Investigator Yoga Therapy to Improve Function Among Veterans with Chronic Low Back Pain	VA RR&D RX10-006	10/01/2012 – 09/30/2016	$300,000
Liu, Lin	Co-Investigator Enabling Patient-Centered Sleep Apnea Care: Role of Sleep Measurement	VA CSR&D	10/01/2013 – 09/30/2015	$300,000
Messer, Karen	PI Tobacco control policy and population-level harm reduction	TRDRP; 21RT-0135	08/01/2012-07/31/2015	$175,000
Messer, Karen	Co-PI Genomic, clinical and behavioral signature of long term breast cancer survival	NCI; 5R01CA166293-02	01/01/2013-12/31/2017	$417,567
Messer, Karen	PI Population studies of cigarette smoking, other tobacco use, and lung cancer	NCI; 5R01CA172058-02	01/01/2013-12/31/2017	$126,585
Messer, Karen	Director of the Biostatistics Shared Resource; Specialized Cancer Center Support Grant	NCI; 3P30CA023100-27S9	06/01/2007 – 04/30/2015	$2,523,808
Messer, Karen	Co-Investigator Fluorophore-Conjugated Antibodies for Imaging and Resection of GI Tumors	NCI; 5R01CA142669-05	06/24/2010 – 04/30/2015	$234,284
Messer, Karen	Co-Investigator iDASH: Integrating Data for Anaylsis, Anonymization and Sharing	NIH; 5U54HL108460-04	09/20/2010 – 06/30/2015	$2,315,171
Messer, Karen	Co-Investigator Energetics & Breast Cancer: Obesity, Inflammation, Insulin Resistance & Risk	NCI; 5U54CA155435-03	07/07/2011-05/31/2016	$1,108,691

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Messer, Karen	Co-Investigator Predicting Toxicity and Success of Anti-GD2 Immunotherapy of Neuroblastoma	NCI; 5R01CA164132-02	04/01/2012-03/31/2015	$195,050
Messer, Karen	Co-Principal Investigator of subcontract Family Smoking Prevention and Tobacco Control Act National Longitudinal Study of Tobacco Users	NIDA; HHSN271201100027C	09/19/2011 -09/18/2016	$272,593
Messer, Karen	Co-Investigator Targeting a non-canonical RAS-driven pathway in pancreatic cancer	NCI; 5R01CA168692-03	07/01/2012-04/30/2017	$201,275
Messer, Karen	Co-Investigator Chronic Lymphocytic Leukemia Research Consortium	NCI; 5P01CA081534-13	05/01/1999 – 08/31/2017	$3,118,581
Messer, Karen	Co-Investigator ExRNA Biomarkers for Human Glioma	NCATS; 1UH2TR000931-01	08/01/2013 – 07/31/2015	$366,521
Messer, Karen	Co-Investigator Specific Targets for Therapy of Patients with CLL	LLS; SCOR award	10/01/2013 – 09/30/2018	$1,042,000
Natarajan, Loki	Co- PI Genomic, clinical and behavioral signature of long term breast cancer survival	NCI; 5R01CA166293-02	01/01/2013-12/31/2017	$417,567
Natarajan, Loki	Co-Investigator Specialized Cancer Center	NCI; 3P30CA023100-27S9	06/01/2007 – 04/30/2015	$2,523,808
Natarajan, Loki	Co-Investigator BNP and Neuroimmune Characteristics of CHF and Depression	NIH; 5R01HL073355-09	12/20/2010 - 11/30/2014	$426,227
Natarajan, Loki	Co-Investigator Energetics & Breast Cancer: Obesity, Inflammation, Insulin Resistance & Risk	NCI; 5U54CA155435-03	07/07/2011-05/31/2016	$1,108,691
Natarajan, Loki	Co-Investigator Novel Paradigms in Diabetic Complications	NCI; 1DP3DK094352-01	09/30/2011-06/30/2016	$5,950,661 Total
Natarajan, Loki	Co-Investigator Validating Machine-Learned Classifiers of Sedentary Behavior and Physical Activity	NCI; 5R01CA164993-03	12/01/2012-11/30/2016	$337,739

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Politis, Dimitris	PI Computer-intensive methods for nonparametric time series analysis	NSF	07/01/2013 – 06/30/2016	$240,000
Politis, Dimitris	PI ATD: Detection of Clusters in Spatial Data and Images	NSF	07/01/2012 – 06/30/2015	$884,959
Thompson, Wesley	Project PI ACISIR for Late-Life Depression Prevention	NIH 1P30MH090333-02 (Reynolds)	07/01/2011-04/30/2016	$47,433 ($1,668,501)
Thompson, Wesley	Co-Investigator Accelerated Biological Aging in Schizophrenia	NIH 1R01 MH094151-01 (Jeste)	05/01/2012 –04/29/2017	$531,968 ($740,176)
Thompson, Wesley	Co-Investigator Mapping Individual Cognitive Differences to Neural Variance and School Readiness	NIH R01HD061414-03 and 03S1 (Jernigan)	09/28/2010-07/31/2012	$154,384 + $370,901 ($574,897)
Thompson, Wesley	Co-Investigator Multi-Dimensional Successful Aging Among HIV-Infected Adults	NIH R01 MH099987-01 (Jeste/Moore)	01/09/2013 –12/31/2017	$687,791
Thompson, Wesley	Co-Investigator Real-Time Mobile Cognitive Behavioral Intervention for Serious Mental Illness	NIH R01 MH100417-01 (Depp)	07/10/2013-05/31/2017	$506,938
Thompson, Wesley	Co-Investigator A Psychiatric and Imaging Study of Pediatric Mild Traumatic Brain Injury	NIH 1R01HD068432-02 (Max)	09/01/2011-06/30/2015	$454,255
Thompson, Wesley	PI Polygenicity, Pleiotrophy, and Power: Novel Statistical Methods for Gene Discovery	NIH 1R01GM104400-01A1	06/05/2014 – 05/31/2018	$272,267
Vaida, Florin	Co-Investigator HIV Neurobehavioral Research Center (HNRC)	P30MH62512	04/01/2011-03/31/2016	1,205,126

Faculty Member	Faculty Member Role on Project and Grant Title	Source of Support Grant Number and Status	Project Period	Current Year Direct Costs Awarded (Total Direct Costs for Awards With Substantial Future Changes)
Vaida, Florin	Co-Investigator San Diego Clinical and Translational Research Center	UL1RR31980	07/01/2010-03/31/2015	4,791,442
Vaida, Florin	Co-Investigator iDASH: Integrating Data for Analysis, Anonymization and Sharing	U54HL108460	10/01/2010-09/30/2015	6,684,738
Vaida, Florin	Co-Investigator Central Nervous System Events in Primary HIV Infection	R21MH099979-01A1	09/25/2013-06/30/2014	$15,661 (Total 185,182)
Xu, Ronghui, “Lily”	Key Personnel Rheumatic Diseases and Psoriasis Pregnancy Registry—OTIS Autoimmune Diseases in Pregnancy Project.	Immunex Corporation/Amgen, Inc.	03/01/2005-11/19/2014	$3,437,727
Xu, Ronghui, “Lily”	Key Personnel Pregnancy Outcomes and Asthma Medications in Pregnancy: a Demonstration Project	PHS (AHRQ) Agency for Healthcare Research and Quality R18HS018474-01	09/01/2009-08/31/2014	$2,452,038
Xu, Ronghui, “Lily”	Key Personnel Early Identification of Affected Children and Risk Factors for FASD in Ukraine	NIH 2U01AA014835-09	09/30/2003-05/31/2017	$3,938,742
Xu, Ronghui, “Lily”	Role: Key Personnel Co_FASP Measurement of Prevalence of FASD in San Diego County	NIH-NIAAA U01 AA019879-01	09/20/2010-08/31/2015	$9,241,814
Xu, Ronghui, “Lily”	Key Personnel The Terflunomide Pregnancy Exposure Registry – an OTIS Autoimmune Diseases in Pregnancy Project	Sanofi-Aventis 20113565	10/25/2011-12/31/2019	$2,475,000
Xu, Ronghui, “Lily”	Key Personnel Cimzia® Pregnancy Exposure Registry – an OTIS Autoimmune Diseases in Pregnancy Project	UCB Pharma, Inc 20113868	02/13/2012-2/12/2017	$4,359,220

9.8. APPENDIX I: LETTERS OF ENDORSEMENT FROM UCSD REVIEW

Letters of endorsement are included from UCSD Dean of the Graduate Division, UCSD SOM Graduate Program Education Committee (GPEC), UCSD SOM Committee on Educational Policy (CEP), and UCSD Health Sciences Faculty Council (HSFC).

UC San Diego

September 23, 2014

David Brenner, MD
Vice Chancellor, Health Sciences
Dean, School of Medicine
Professor of Medicine

Subject: Funding model for the new PhD in Biostatistics

Dear David:

On behalf of the Graduate Division I am pleased to express my strongest support for the proposed new interdepartmental graduate program leading to the PhD in Biostatistics, which will be housed at the School of Medicine within the Department of Family and Preventive Medicine. UCSD has long needed such a program, and it is a pleasure to see it finally come to fruition under your leadership.

As you know, the proposal is currently under review at Health Sciences, and is included in UCSD's Five-Year Planning Perspectives document that was submitted to UCOP in March 2014. The targeted start date is Fall 2015 or 2016. The program proposal includes a detailed 5 year budget which is based on the standard Block Grant funding model as approved by Graduate Council.

Because this is a new academic graduate program housed in Health Sciences, we assume that you will provide program funding under our established block grant funding model. For the first 3 years of the program, we recommend that you provide a flat amount of $50,000 per year in block grant funds, which would be consistent with start-up funding provided to other new PhD programs. From year 4 on, it is projected that 12 to 13 or more students will be enrolled, and from this point, the program should receive the block grant funds that it "earns" on the basis of its enrollments. The precise amount will be driven by the Graduate Council's formula, and will take into account other resources available for student support, cost of living increases that may apply in the intervening period, and, eventually, a possible merit component of up to 10% assigned by Graduate Council on the basis of program review. However, for planning purposes, the amount per student should be of the order of $4,000 per year.

We look forward to working with you and with the Department of Family and Preventive Medicine in developing this important new program.

Yours sincerely,

Kim E. Barrett, Ph.D.
Dean of the Graduate Division

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cc: Karen Messer

GRADUATE DIVISION
University of California, San Diego • 9500 Gilman Drive #0003 • La Jolla, California 92093-0003
Tel: (858) 534-3555 • Fax: (858) 534-4304 • grad.ucsd.edu

UC San Diego
HEALTH SCIENCES

DATE: September 23, 2014

TO: Karen Messer
Chief, Division of Biostatistics & Bioinformatics

FROM: Robert Heaton
Chair, Graduate Program Education Committee (GPEC)

SUBJECT: Final Endorsement of Interdepartmental Doctoral Program in Biostatistics

This letter is to endorse your proposal for an interdepartmental program of graduate studies in biostatics. At the June 24, 2014 meeting of the Graduate Program Education Committee (GPEC), the committee unanimously voted to endorse the program pending clarification of several addressable points that came up in discussion. You were responsive to the request of the committee and delivered a revised proposal.

The GPEC re-convened on August 12, 2014 and reviewed the revised proposal. After discussion, the committee voted unanimously to endorse the revised proposal in its current form.

Robert Heaton, Ph.D.
Chair, Graduate Program Education Committee
9500 Gilman Drive, # 0603 • La Jolla, CA 92093
T: 858-534-4044 • rheaton@ucsd.edu

UC San Diego
SCHOOL OF MEDICINE

October 6, 2014

Karen Messer, Ph.D.
Professor and Chief, Division of Biostatistics and Bioinformatics
Department of Family and Preventive Medicine
UCSD School of Medicine
University of California, San Diego
Mail code 0901

Dear Dr. Messer:

Thank you for attending the meeting of the School of Medicine's Committee on Educational Policy (CEP) on September 9, 2014 to present the proposal for a new Program of Graduate Studies in Biostatistics. The CEP enthusiastically supports the proposal for the establishment of this Ph.D. program. This will be a valuable program that will address an important need for training Ph.D.-level biostatisticians. The CEP unanimously endorsed the establishment of this program.

The School of Medicine's Graduate Programs Education Committee (GPEC) had done a thorough job of reviewing the detailed program proposal before it was presented to the CEP. The CEP was informed that the GPEC unanimously endorsed the establishment of the Ph.D. program in biostatistics.

We wish you success in development of this program.

Sincerely,

Gordon Yung, M.D.
Chair, Committee on Educational Policy, School of Medicine
Professor of Medicine
Director, Advanced Lung Disease Program
Medical Director, Lung Transplant Program Director

9300 Campus Point Dr. #7376 La Jolla, CA 92037-7376 Tel: (858) 657-5050

UC San Diego
HEALTH SCIENCES

October 15, 2014

KAREN MESSER, Ph.D.
0901

Subject: Interdepartmental Program for the Ph.D. in Biostatistics

Dear Dr. Messer:

I would like to thank Dr. Florin Vaida and Dr. Loki Natarajan for attending the October 7, 2014 meeting of the Health Sciences Faculty Council (HSFC).

This constitutes official confirmation that the HSFC voted unanimously to endorse the interdepartmental program for the Ph.D. in Biostatistics.

We wish you success as you continue your efforts in creating this Ph.D. program.

Sincerely,

Bard Cosman, M.D.
Chair, Health Sciences Faculty Council

c: David A. Brenner, M.D., Vice Chancellor, Health Sciences
Florin Vaida, Dept. of Family and Preventive Medicine
Loki Natarajan, Dept. of Family and Preventive Medicine

HEALTH SCIENCES FACULTY COUNCIL
9500 Gilman Drive, MC 0602 San Diego, California 92093-0602 TEL: (858) 822-3855 FAX: (858) 534-1405