APPENDIX A

CALIFORNIA POSTSECONDARY EDUCATION COMMISSION (CPEC)
QUESTIONNAIRE

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

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(6 pages total with this cover sheet)

This appendix is the required CPEC form summarizing plans for the MTM as a new academic degree program.
APPENDIX A

ACADEMIC DEGREE PROGRAM PROPOSALS:
INFORMATION REQUIRED BY THE
CALIFORNIA POSTSECONDARY EDUCATION COMMISSION (CPEC)

This questionnaire is to be completed by sponsoring faculty (department or group). It will be used by UCOP to prepare a report to the California Postsecondary Education Commission. If more space is required, please attach as many additional sheets as necessary. Attach to full proposal.

1. Name of Program:
   Master of Translational Medicine (MTM)

2. Campus:
   Berkeley and UCSF

3. Degree/Certificate:
   Master of Translational Medicine (MTM)

4. CIP Classification (to be completed by Office of the President):
   [UCOP]

5. Date to be started:
   Admissions open Fall 2012, first cohort admitted Fall 2013

6. If modification of existing program, identify that program and explain changes.
   N/A

7. Purpose (academic or professional training) and distinctive features (how does this program differ from others, if any, offered in California?):
   This is a one-year professional degree program designed to provide students with technical expertise in bioengineering; clinical experience to understand the needs, regulations, and demands of translating technology advances to patient care; a solid grounding in the business and entrepreneurship to bring these advances to market; and an appreciation of the ethical considerations that leaders in the field will face.

   The MTM program, to our knowledge, is the first of its kind in the country. A small number of similar programs exists (see Appendix J), but none that feature a joint degree offered between two universities with a specific focus on translational medicine. Note that the M.Eng. in Bioengineering (proposed by UC Berkeley’s College of Engineering in August 2011) offers a technical engineering focus for leadership in technical enterprises, while the proposed MTM incorporates clinical aspects for translating technological advances from “bench to bedside.”

   The program will link the translational undertakings at the UCSF Schools of Pharmacy, Nursing, Dentistry, and Medicine; the UCSF Clinical & Translational Science Institute (CTSI); and UC Berkeley’s College of Engineering and selected educational offerings in the Haas School of Business. It will provide students with an opportunity to gain expertise in applying translational science and engineering approaches to produce practical solutions to pressing societal health problems.
The MTM program will serve recent and early-career graduates seeking further expertise, clinical experience, and business and leadership skills to advance their careers and augment their professional qualifications. Prospective applicants are students with bachelor’s degrees (in engineering, pre-med, and a broad range of medical and biological fields), medical students pursuing a master’s option, medical residents, advanced pre-doctoral students, and potentially Ph.D. students, postdoctoral fellows, M.B.A.s, M.D.s, Pharm.D.s, R.N.s, D.M.D.s, and J.D.s.

Translational medicine is an emerging field, and the need for those who can rapidly advance diagnostic and therapeutic medical capabilities is critical. The MTM program responds to this emerging educational demand. As outlined in Section 1.4.7, of this proposal, the proposed MTM program aligns with many of the goals and objectives of the strategic academic plans at both UC Berkeley and UCSF.

N/A

N/A

These two courses are equivalent. Students are required to enroll in the version of the course that is offered on their home campus. For a full description of the capstone courses, see Appendix G.

BioE 260 – Anti-Medical School: Translational Challenges in Medicine (UCSF, 1 qtr unit)*
BioE 270 – Translational Challenges in Diagnostics, Devices, and Therapeutics (UCSF, 2 qtr units)*
BioE 301 – Ethical and Social Issues in Translational Medicine (UCB, 1 sem unit)*
Engin 271 – Engineering Leadership I (UCB, 3 sem units)*
Engin 272 – Engineering Leadership II (UCB, 3 sem units)*
Epi 150.03 – Designing Clinical Research for Residents and Students (UCSF, 2 qtr units)*
Epi 205 – Clinical Trials (UCSF, 1.5 qtr units)*
Bioengineering electives to necessary to fulfill 10 semester unit requirement (from approved list, and including allocated 296 units)
Business, Entrepreneurship, and Technology electives necessary to fulfill 8 semester unit requirement (from approved list)
Clinical R&D electives to necessary to fulfill 6 semester unit requirement (from approved list, and including allocated 296 units)

*These courses are not explicitly required for graduation, but will be strongly recommended by the Academic Advisers. The vast majority of the students in the MTM program will enroll in these classes, but exceptions can be made on an individual basis, as deemed necessary by the Academic Advisers.
Chart 1: MTM Sample Program (24s/36q units required)

<table>
<thead>
<tr>
<th>Fall Semester/Quarter</th>
<th>Winter Quarter</th>
<th>Spring Semester/Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Medical School: Translational Challenges in Medicine (1q unit = 2/3s unit)</td>
<td>Translational Challenges in Diagnostics, Devices, and Therapeutics (2q units = 4/3s units)</td>
<td>Engineering Leadership II (3s units)</td>
</tr>
<tr>
<td>Engineering Leadership I (3s units)</td>
<td>Clinical Trials (1.5q units = 1s unit)</td>
<td>Business Elective (2s units)</td>
</tr>
<tr>
<td>Designing Clinical Research (2q units = 4/3s units)</td>
<td>Clinical Elective (2q units = 4/3s units)</td>
<td>Capstone Project (4s units)</td>
</tr>
<tr>
<td>Bioengineering Elective (4s units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capstone Project (2s units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical and Social Issues in Translational Medicine (1s unit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALL SUBTOTAL: 12s units</td>
<td>WINTER + SPRING SUBTOTAL : 12.67s units</td>
<td>GRAND TOTAL: 24.67 units</td>
</tr>
</tbody>
</table>

For course descriptions and a full list of approved electives, see Section 5.

14. List UC campuses and other California institutions, public or private, which now offer or plan to offer this program or closely related programs:

To our knowledge, there are currently no UC or California independent university programs offering a Master of Translational Medicine. Stanford University does offer a Masters of Medicine (MOM) program, however, which has certain similarities. Specifically, the MOM program exposes Stanford Ph.D. candidates to clinical medicine with a view to fostering translational research. The goal of the MOM program is to train a new generation of Ph.D. students about human biology and disease, making them better able to translate new scientific discoveries into useful medical advances. In comparison to the proposed MTM program, Stanford’s MOM program lacks both the technical/engineering and business/leadership components present in the MTM curriculum, and it is only open to Stanford students enrolled in a Ph.D. program. The MTM program addresses a much broader need for professional training in both the clinical needs-finding and the industrial design and development of new medical technology.

15. List any related program offered by the proposing institution and explain relationship.

UC Berkeley’s College of Engineering and Department of Bioengineering have recently submitted a proposal for a new Master of Engineering (M.Eng.) degree. This degree will share the MTM’s focus on technological leadership, a capstone project, and the skills to translate new technologies into commercial ventures. However, the M.Eng. is strictly an engineering degree, distinct from the proposed MTM, which has a strong clinical component (evidenced by the partnership of UCSF in the joint program). The two degrees will offer a distinct choice for students seeking a professional master’s degree emphasizing bioengineering.

16. Summarize employment prospects for graduates of the proposed program. Give results of job market survey if such have been made.

The Master of Translational Medicine degree aims to prepare engineers and physicians to bring innovative treatments and devices into clinical use. Most graduates of the MTM program are expected to work in
industries that deliver healthcare products or patient care (upon receiving their MTM or after further academic or medical education). The program will produce leaders who will identify new opportunities to develop therapeutics, devices, and other technologies to improve health, and help bring them to consumers at a much faster rate. Jobs in biomedical engineering (whether bioengineers, clinicians, or others) are in the highest demand, according to the Bureau of Labor Statistics and other sources (see Appendix D).

In technical fields in California and elsewhere, industry is demanding engineers with professional master’s degrees, generating highly compensated employment opportunities for our MTM graduates. This high industry demand is reflected in substantially higher average salaries for engineers with master’s degrees versus those with only bachelor’s degrees.

**Engineering Graduates — Average Starting Salaries by Highest Engineering Degree Earned**

[Source: American Association of Engineering Societies – Engineering Workforce Commission (AAES-EWC) 2009]

<table>
<thead>
<tr>
<th>Engineering Degree Earned</th>
<th>Starting Salary (as of 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelors degree</td>
<td>$61,197</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>$76,428</td>
</tr>
<tr>
<td>Ph.D. degree</td>
<td>$90,388</td>
</tr>
</tbody>
</table>

**Engineering Graduates — Average Salaries for Supervisors with Master’s Degrees**

[Source: American Association of Engineering Societies – Engineering Workforce Commission (AAES-EWC) 2009]

<table>
<thead>
<tr>
<th>Number of Years Since Baccalaureate Degree</th>
<th>Average Salary (as of 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>$114,494</td>
</tr>
<tr>
<td>9-10 years</td>
<td>$122,102</td>
</tr>
</tbody>
</table>

17. Give estimated enrollment for the first 5 years and state basis for estimate.

The MTM student enrollment target is currently 20 students for Fall 2013, with plans for 26 for Fall 2014, and reaching steady state at 30 in Fall 2015. Enrollment in out-years would be based on the success of the program and determined in conjunction with overall enrollment targets for both campuses.

18. Give estimates of the additional cost of the program by year for 5 years in each of the following categories: FTE Faculty, Library Acquisitions, Computing, Other Facilities, Equipment. Provide brief explanation of any of the costs where necessary.

**Faculty costs:** Students in the MTM degree program will enroll in sections of graduate courses taught by the UC Berkeley and UCSF ladder-rank faculty, adjuncts, clinical professors, and lecturers in the same manner as other graduate students. The workload metrics for the faculty will remain largely unchanged by this program. However, any additional faculty workload or supplemental personnel — including adjunct, GSIs, or lecturers — necessary for these additional students will be paid for from program PDST revenue. The estimated costs of the core required and recommended courses are explicitly detailed in Appendix K.

**Library acquisitions:** No additional resources required.

**Computing requirements and cost estimates:** Funds from the PDST revenue will be allocated to both campuses for IT costs associated with program administration (see Appendix K, line items for “Computing costs” and “Network charges”). Should specific IT needs arise in conjunction with a particular capstone project that cannot be covered by the project leader, these costs may be covered through the budgeted PDST revenue at the discretion of the Faculty Co-Directors (see Appendix K, line item for “Instructional Lab/Capstone Project Support,” which includes such potential costs).
Equipment: No additional equipment is needed for administration of the program. Should specific equipment needs arise in conjunction with a particular capstone project that cannot be covered by the project leader, these costs may be covered using the budgeted PDST revenue at the discretion of the Faculty Co-Directors (see Appendix K, line item for “Instructional Lab/Capstone Project Support,” which includes such potential costs).

19. How and by what agencies will the program be evaluated?

The MTM degree program will be reviewed as a component of each campus’s departmental or graduate program review procedures. At Berkeley, these are established by the Program Review Oversight Committee (PROC); at UCSF, the process for providing evaluating every graduate program is delegated to the Graduate Council and stated in the Academic Senate Bylaw 125(6).

At Berkeley, since MTM is a new graduate degree for the Department of Bioengineering, the Engineering Dean will appoint a broad-based review committee – with members from the College of Engineering faculty, the College’s and MTM’s external advisory boards, and a Berkeley faculty member outside the College – to conduct a thorough evaluation after the first three years of the program, i.e., to review academic years FY2013-14, FY2014-15, and FY2015-16. A similar procedure is followed at UCSF: At the request of Graduate Council, the Graduate Division recruits an external review committee of senior faculty members in the same field as the program, plus a faculty representative from each of the Graduate Council and the Graduate Division. After a thorough review, final report to the Graduate Dean identifies strengths and weaknesses of the program and recommendations to improve its excellence.

In addition, each core and elective course that counts toward the MTM degree will be evaluated by the students via a questionnaire. A longitudinal study will be developed to assess regularly the impact of the MTM program on career development, productivity, and placement of graduates. The faculty Co-Directors for the MTM program will be responsible for keeping records and data that will provide the basis for annual reports on the performance of the program to be presented to the MTM program committee.
APPENDIX B

EMPLOYMENT PROSPECTS FOR GRADUATES

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

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This appendix features reports by three respected sources that discuss the projected growth in jobs for bioengineering graduates. The recent New York Times summary lists biomedical engineering as the fastest growing occupation, noting that for people entering the field, “a master’s is a must.”

Top 10 List: Where the Jobs Are

By CECILIA CAPUZZI SIMON
Published: April 13, 2011

Excerpt

Looming worker shortage. That’s not a phrase one expects to hear at a time of high unemployment. But when experts look at the Bureau of Labor Statistics’ list of the fastest-growing occupations, that’s what they see: more than a million new jobs on the horizon by 2018, and a worker pool that may not be trained to fill them.

Such a list was first compiled in 1946, just after the end of World War II, to help veterans on the G.I. Bill make smart educational choices. One need only pay attention to news reports to guess where the current shortages may be: eight of the fields in the top 10 categories are health care or wellness related; one is in financial services; and the other is in the information technology field.

But, points out Michael Wolf, an economist with the bureau, “The mere fact that a category is fast growing does not mean you can get a job in it.” For most of these occupations, training (sometimes years of it) is necessary.

1. BIOMEDICAL ENGINEER

Job Growth: 72 percent, or 12,000 new jobs by 2018

Salary: $82,550 mean; $103,000 for scientific and technical consultants
The Field: This relatively new specialty bridges the medical and engineering disciplines, with emphasis on engineering. Biomedical engineers design and build innovative devices (artificial limbs and organs, new-generation imaging machines) and improve processes (for genomic testing, or making and administering drugs).

Why It’s Growing: Thank the quick clip of technological advances. Pharmaceutical and genomic industries, in particular, are “exploding,” says Helmut H. Strey, associate professor of biomedical engineering at Stony Brook University, which has about 100 students in its master’s degree and Ph.D. programs.

Training: If you’re attracted to this field, you aren’t afraid of math, chemistry, physics and engineering, and already have the coursework. Engineers and biology majors are likely candidates for career transitions, though Dr. Strey believes that engineers will find it easier to complete required biology coursework than biologists will getting through the engineering. Either way, a master’s is a must.
“Employment of engineers is expected to grow about as fast as the average for all occupations over the next decade, but growth will vary by specialty. Biomedical engineers should experience the fastest growth… Biomedical engineers are expected to have employment growth of 72 percent over the projections decade, much faster than the average for all occupations. The aging of the population and a growing focus on health issues will drive demand for better medical devices and equipment designed by biomedical engineers. Along with the demand for more sophisticated medical equipment and procedures, an increased concern for cost-effectiveness will boost demand for biomedical engineers, particularly in pharmaceutical manufacturing and related industries. Because of the growing interest in this field, the number of degrees granted in biomedical engineering has increased greatly. Many biomedical engineers, particularly those employed in research laboratories, need a graduate degree.”
Employment and career prospects for bioengineers

Fueled by a strong demand for a talented workforce and increased government and private funding, academic programs in bioengineering are developing rapidly.

David Gough

This is an exciting time for bioengineering. Advances in the understanding of basic biological and cellular mechanisms are accelerating, and are being translated into practical applications that directly affect the public well-being—and that in some cases may lead to fundamental changes in our way of life. At the same time, academic programs in bioengineering are developing rapidly to supply engineering talents, and the bioengineering industry is starting to show its potential through the introduction of health-care products that have high value to the public. Even governmental funding agencies are awakening to the increasing prominence of bioengineering. These concerted developments bode well for the employment and career prospects of bioengineers.

The word “bioengineering” once conjured up images of super-humanoids with integrated replacement limbs or organs that had capabilities far beyond those of the natural tissues. These visions were entertaining but nonsensical. The public now has a more realistic understanding of what bioengineering can do when thoughtfully applied to biomedical problems. This awareness has been brought about by daily newspaper articles describing technological advances in biology and medicine, nightly television documentaries on the use of medical technology to combat illness, and the appearance of new technologies in general medical care procedures. This exposure not only has helped to rehabilitate the image of bioengineering, but also has made people more aware of the need for continued research and the value of technology transfer for the timely application of research results.

What kind of problems do bioengineers work on? The range is very broad, from molecules and genes to organs and whole-body systems. A brief, and certainly not inclusive, list of topics includes drug delivery systems, cardiac physiology and modeling, technologies for imaging the body and its components, biomechanics at the molecular, cell, organ, and whole-body levels, gene systems and their organization, devices for replacing neurological function, tissue engineering, biomaterials for use in the body, organ-replacement systems, molecular modeling, artificial blood, orthopedic devices, biosensors for detecting and monitoring metabolites and identifying specific genetic materials, cardiovascular mechanics and cardiac-assist devices, biochemical processing systems, bioinstrumentation and physiologic monitoring, bioinformatics and the structure of biological information, mathematical modeling and simulation of complex biological systems, application of new approaches to fabrication of devices that incorporate biological components, methods for identification and targeting of cancerous tissues, and sports medicine and rehabilitation. These areas share a common theme: the application and integration of new and classical engineering tools to address biomedical problems.

Bioengineering is a broad field because most people involved in biological endeavors function as engineers from time to time, regardless of their formal educational training.

National developments in bioengineering

In academia, bioengineering is experiencing unprecedented growth and development nationwide. Student enrollments have surged, probably as a result of the increased public awareness of field. Many universities want to take part in developing practical applications of the “new biology” and are hurrying to develop new programs. A new department of bioengineering has been inaugurated at a major university nearly every month for the last several years, and others are soon to emerge. There are approximately equal numbers of bioengineering and biomedical engineering programs, and they are similar in most regards—program titles are often chosen for historical reasons. The exceptions are certain bioengineering programs that emphasize applications in agriculture and the environment. Universities that have long had graduate bioengineering programs are now expanding them to include undergraduates. This remarkable development has been accelerated by timely resource awards to many institutions by the Whitaker Foundation. It is estimated that over 150 open bioengineering faculty positions are currently advertised or in the near-term pipeline, providing excellent academic employment opportunities for appropriately trained applicants.

The bioengineering industry is also growing. Companies are by and large concentrated in certain areas such as Boston, San Diego, Los Angeles, and the San Francisco Bay area, but the importance of the bioengineering industry to the local and state economy is beginning to be appreciated in other regions, and the present and future importance of bioengineering products for the public. The field is...
dominated by young companies, but a number of maturing companies have products in the pipeline or on the market. Investors are gaining a better appreciation for the unique features of the biotechnology sector, and sustained growth is expected. Recruiters from industry claim that the one characteristic that distinguishes bioengineers from other engineering professionals is their keen interest in the end product.

There have been important recent developments in bioengineering at the national level. In the last days of the Clinton administration, a bill was signed into law establishing the National Institute of Biomedical Imaging and Bioengineering, the newest member of the National Institutes of Health (NIH; Bethesda, MD). This recognized the crosscutting role of bioengineering in many projects of the other institutes and will help to further support the NIH mission.

Bioengineering at UCSD

Academic programs in bioengineering have been in place at the University of California, San Diego since 1966, not long after the campus was opened. The highly ranked bioengineering department is part of the Jacobs School of Engineering. The campus was designed to encourage interdisciplinary interaction with its system of undergraduate residential colleges and with the nearby UCSD Medical School, Scripps Institute of Oceanography, San Diego Supercomputer Center, and neighboring research institutions in the La Jolla area. At the undergraduate level, there are four curricular tracks including a mechanical engineering-oriented track, a pre-medical track, a chemical engineering-oriented biotechnology track, and a newly established bioinformatics track. The standard master’s and PhD offerings at the graduate level have recently been augmented by a Master’s of Engineering degree that provides an option for a design project carried out in collaboration with industry. The department also offers a new interdisciplinary PhD degree in bioinformatics, taught in conjunction with the departments of biology, chemistry, computer science, and mathematics. The department’s longstanding Industrial Internship Program provides educational enrichment by placing student interns in local bioengineering companies. This program draws on the substantial number of bioengineering companies in the southern California region and matches about 70 students each year.

The UCSD bioengineering department is ready to occupy a new building, the Powell-Focht Bioengineering Hall, that includes new resources for research and teaching. The building will also house the Whitaker Institute of Biomedical Engineering, a region-wide organization to promote bioengineering interaction among collaborators in the scientific neighborhood, including the Salk Institute, the Scripps Research Institute, and the Burnham Institute. The new building will also be the home of the von Liebig Center for Entrepreneurism and Technology Advancement, which has a mission of advancing the art of technology transfer to industry and, ultimately, the public. The center offers courses on entrepreneurship for students and faculty, provides resources and space for development of practical concepts, and facilitates contact with experts in technology advancement. Powell-Focht Bioengineering Hall will provide a regional center for a variety of bioengineering activities.

Industrial opportunities

A vibrant biotechnology industry surrounds UCSD. One of the most productive and concentrated life sciences clusters in the world, the region is home to a number of companies that employ bioengineers, including Abbott Laboratories, Advanced Tissue Sciences, Alliance Pharmaceutical, Aurora Biosciences, Baxter Healthcare, CardioDynamics, Celgene, Chiron Technologies Center for Gene Therapy, Digital Gene Technologies, GlySens, Guident, Integra LifeSciences, Innercool Therapies, Isis Pharmaceuticals, Medtronics, Molecular Reflections, Nanogen, the Genomics Institute of the Novartis Foundation, Novatec Laser, Oncosis, Sequenom, Siemens, VitaGen, Xenogenics, and many others. There are over 400 biotechnology and medical device companies in the region, and San Diego’s medical device sector is one of the fastest growing in the nation. San Diego boasts the highest number per capita of NIH grants in the nation, totaling over $680 million last year, and was rated best city in quality of life in a survey of life science executives nationwide.

A final word

Advances in science and technology are happening at an impressive pace and will have a fundamental impact on society. The necessary foundation of academic, industrial, government, and public-interest elements is in place. There is a strong demand in bioengineering for a talented workforce, and the need will increase as the field moves forward. The prospects are bright.

APPENDIX C

LETTERS OF SUPPORT
FROM UC BERKELEY AND UCSF
ACADEMIC LEADERS AND ADVISERS

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

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This appendix includes letters of support from UC Berkeley and UCSF academic leaders and faculty, dated November 2011. The letters are signed by the following:

UC Berkeley
1. Chancellor Robert J. Birgeneau
2. Professor Jitendra Malik, Associate Dean, Special Academic Initiatives, College of Engineering
3. Professor Lee Fleming, Faculty Director, Coleman Fung Institute for Engineering Leadership

UCSF
1. Chancellor Susan Desmond-Hellman
2. Professor Clay Johnston, Associate Vice Chancellor for Research and Director, Clinical & Translational Science Institute
3. Dean Sam Hawgood, School of Medicine
4. Dean Mary Anne Koda-Kimble, School of Pharmacy
November 15, 2011

Professor Kevin Healy  
Arnold and Barbara Silverman Chairman of Bioengineering  
Department of Bioengineering  
University of California, Berkeley  
306 Stanley Hall # 1762  
Berkeley, CA 94720-1762

Professor Sarah Nelson  
Chair, Department of Bioengineering and Therapeutic Sciences  
University of California, San Francisco  
UCSF Box 0912  
513 Parnassus Avenue, Room S-840  
San Francisco, CA 94143-0912

Dear Kevin and Sarah:

I am writing in support of the proposal to establish a new Master of Translational Medicine degree, a professional degree to be offered jointly by your departments at UC Berkeley and UCSF. The ability to translate scientific and technological advances into improved patient care is a critical focus of biomedical work on both of our campuses. This program will provide students with a unique set of skills to speed this translation and yield wide-ranging improvements in healthcare.

The relatively young UC Berkeley and UCSF bioengineering departments have built successfully upon the engineering, biological, and medical excellence of both campuses. This excellence propelled the doctoral program — administered by the Joint Graduate Group in Bioengineering, comprising faculty from both campuses — into the top five in the latest NRC rankings. The MTM program has the potential to strengthen the connection between our two UC campuses, to pioneer new collaborations, and to better serve students and medical professionals whose goals include clinical innovation, engineering problem-solving, and entrepreneurship.
Professional master's degrees in engineering have been extremely successful in attracting quality students. With the completion of this additional schooling and project work, graduates of these programs can be advantaged significantly in entering their professions. The MTM program serves a vital purpose, which requires a combination of engineering, clinical, regulatory, and business skills. Our academic programs in bioengineering, in combination with UCSF's Clinical & Translational Science Institute, UC Berkeley's Fung Institute for Engineering Leadership, and our academic programs in business and other pertinent fields, are well situated to provide education for the next generation of medical innovators. To my knowledge, there is no program in the UC system whose goals and training significantly overlap those of the proposed MTM.

I therefore enthusiastically endorse the proposal to create this innovative new Master of Translational Medicine degree.

With warm regards,

Yours sincerely,

Robert J. Birgeneau
November 15, 2011

Professor Sarah Nelson
Chair, Department of Bioengineering and Therapeutic Sciences
University of California, San Francisco

Professor Kevin Healy
Arnold and Barbara Silverman Chairman of Bioengineering
Department of Bioengineering
University of California, Berkeley
306 Stanley Hall # 1762
Berkeley, CA 94720-1762

Dear Sarah and Kevin:

I want to extend my strongest support for the establishment of the Master of Translational Medicine (MTM) professional degree program. I believe this is an exceptional opportunity for educational leadership in the College of Engineering, as well as in the Schools of Medicine and Pharmacy at UCSF. The MTM is sure to be extremely attractive to and beneficial for students.

I have been closely involved in the past year with the development of a series of professional master’s degree programs in engineering, with concentrations focused in six departments. The first cohort of students in those programs enrolled this fall. It is clear that there is a significant demand among excellent students for innovative, professional master’s programs that combine engineering and business; the addition of the strong clinical component for the MTM makes it unique and a particularly exciting addition to our work in educating students who will be leaders in their fields.

The College of Engineering will certainly make recommended and elective courses available to MTM students, and we are working closely with the program to ensure this.

I wholeheartedly endorse the MTM program, and will lend my support in any way as it develops.

Sincerely,

Jitendra Malik
Associate Dean, Special Academic Initiatives
November 15, 2011

Professor Sarah Nelson, Chair  
Department of Bioengineering and Therapeutic Sciences, UCSF  

Professor Kevin Healy, Chair  
Department of Bioengineering, UC Berkeley  
306 Stanley Hall # 1762  
Berkeley, CA 94720-1762  

Dear Drs. Healy and Nelson:

On behalf of the Coleman Fung Institute for Engineering Leadership, I am pleased to express my support for the creation of a Master of Translational Medicine professional degree program as a joint degree between UC Berkeley and UCSF. The Fung Institute is home to a suite of professional master’s degree programs in the College of Engineering. Uniting the engineering excellence of Berkeley and the clinical strength of UCSF, the MTM program would be a unique and outstanding addition to degree programs offered by the two campuses.

The call to educate new engineering leaders, particularly graduates of master’s programs, is resounding in the engineering profession, and it is of paramount importance in bioengineering, medicine, and other fields that will advance critical solutions in healthcare. The National Academy of Engineering has called for stepped-up efforts to educate engineers with “such traits as strong analytical skills, creativity, ingenuity, professionalism and leadership.” At the same time, the National Institutes of Health have recently spotlighted the need to move science and engineering discoveries more expeditiously from “bench to bedside.” The MTM program will produce graduates who will have these skills, equipped to lead the way in translating science and technology breakthroughs more quickly and surely into benefits for patients.

Engineering leadership courses offered through the Fung Institute will be among the recommended courses for MTM graduates. We have been working productively with the faculty and staff involved in the program to ensure the availability of those courses for MTM students, along with a solid plan to fund the costs of serving this new cohort.

I welcome and endorse the addition of the MTM program, and give it my full support.

Sincerely,  

Lee Fleming  
DIRECTOR, COLEMAN FUNG INSTITUTE FOR ENGINEERING LEADERSHIP  
PROFESSOR, INDUSTRIAL ENGINEERING & OPERATIONS RESEARCH  
UNIVERSITY OF CALIFORNIA  
COLLEGE OF ENGINEERING  
330B BLUM HALL # 5580  
BERKELEY, CA  94720-5580  

TELEPHONE: (510) 664-4586
November 16, 2011

PROFESSOR KEVIN HEALY
Arnold and Barbara Silverman Chairman of Bioengineering
UC Berkeley—Department of Bioengineering

CHAIR AND PROFESSOR SARAH NELSON
UCSF—Department of Bioengineering and Therapeutic Sciences

Dear Kevin and Sarah:

I write to lend my strong support for the proposal to create a new professional Master of Translational Medicine (MTM) degree that will be offered jointly by UC Berkeley and UCSF. Our campus has made translational medicine — applying ideas, insights and discoveries generated through basic science research to improving human health — one of its priorities for this decade, and I know that UC Berkeley’s bioengineers also have identified translation as a critical area of focus. This new degree will give students an important head start in making a vital impact as leaders in moving new discoveries into effective patient care.

This program is an excellent and natural collaboration for UCSF and UC Berkeley. Berkeley’s strength in engineering and business combined with UCSF’s excellence in clinical applications and biotechnology are a powerful combination for this new degree, and one that we believe students and employers will value. The success of our joint PhD program (administered by the Joint Graduate Group in Bioengineering) attests to this, with its national ranking among the top five programs in the country in the most recent survey conducted by the National Research Council. The MTM program will only strengthen our already productive and effective two-campus collaboration.

Among our strategic academic initiatives at UCSF are three that align directly with the MTM degree program: developing innovative, collaborative approaches that span disciplines; leading the way in translating discoveries into exemplary health; and educating leaders in healthcare. I believe the program will deliver a unique educational experience for students — one not found elsewhere in the UC system and one that is consistent with the objectives and aspirations of both campuses.

I lend my enthusiastic support for the proposed new

Sincerely,

Susan Desmond-Hellmann, MD, MPH
Chancellor
Arthur and Toni Rembe Rock Distinguished Professor
November 14, 2011

Professor Kevin Healy
Arnold and Barbara Silverman Chairman of Bioengineering
Department of Bioengineering
University of California, Berkeley
306 Stanley Hall # 1762
Berkeley, CA 94720-1762

Professor Sarah Nelson
Chair, Department of Bioengineering and Therapeutic Sciences
University of California, San Francisco
UCSF Box 0912
513 Parnassus Avenue, Room S-840
San Francisco, CA 94143-0912

Dear Drs. Healy and Nelson:

The Clinical and Translational Science Institute (CTSI) at UCSF and its associated programs enthusiastically support the proposed Master of Translational Medicine (MTM) joint degree program between UCSF and UC Berkeley. This program will link the UCSF Schools of Pharmacy and Medicine and the CTSI with the UC Berkeley College of Engineering and academic programs in business and other fields to provide scientists, medical professionals and engineers with the science, technology and business skill set needed to span the gap between basic sciences and their clinical utilization — accelerating these solutions from the bench into the market.

MTM students would have the opportunity to take courses offered through CTSI’s training programs. Ample space for these students will be provided in the courses, and provisions for funding their participation have been included in the budget for the new professional degrees. The proposed MTM program does not significantly overlap with any of the existing CTSI education and training programs (summarized below), although it will nicely synergize with them. The MTM fills a needed gap in education, and complements and works in synergy with existing programs:

Master of Advanced Study in Clinical Research
Managed by the Department of Epidemiology and Biostatistics at UCSF, this program provides a two-year course of study for advanced pre-doctoral students, post-doctoral fellows, and faculty members. Although this program targets some of the same population for student enrollment, the proposed MTM program does not have any overlap with this MS program because of the difference in disciplines.
Graduate Education in Medical Sciences (GEMS)

GEMS is a single over-arching program that is offered to UCSF basic science graduate students in any discipline. Unlike the MTM, GEMS-focused support is only available for pre-doctoral scholars. Participation in the program ranges from basic training in medical sciences and medically relevant coursework, designing and defending a research proposal in conjunction with a clinical research mentor, to developing a PhD dissertation project focused on a specific translational research problem. The MTM will be complementary to the current GEMS program, and MTM students might participate in courses, workshops and seminars provided by GEMS.

Training in Clinical Research (TICR)

This is an established program that offers 32 individual courses and three progressively more intensive educational opportunities: the Clinical Research Workshop, a one-year Advanced Training in Clinical Research, and a two-year Master’s in Clinical Research related to clinical and translational research methods. These programs are intended for advanced pre-doctoral students, post-doctoral students, residents, fellows and faculty who wish to master clinical research methods and pursue independent research careers. The program also includes a track in Implementation and Dissemination Sciences (IDS) which supports, funds, and mentors trainees who perform implementation and dissemination research across all levels at UCSF, and advocates for IDS at UCSF and nationally. There is a difference in disciplines that makes the MTM and TICR complementary and not competitive. (The courses MTM students are likely to take through CTSI programs are TICR courses.)

The MTM, unlike other existing translational medicine programs, will draw a student body from a diverse array of backgrounds, including engineering, bioengineering, business, medicine, basic research and industry. The CTSI is committed to the success of the MTM and to the overall vision of establishing a new group of young professionals equipped with the business acumen and scientific expertise to identify more efficiently opportunities for the application of engineering approaches to solve clinical problems.

Sincerely,

S. Claiborne Johnston, MD, PhD
November 15, 2011

Professor Kevin Healy
Arnold and Barbara Silverman Chairman of Bioengineering
Department of Bioengineering
University of California, Berkeley
306 Stanley Hall # 1762
Berkeley, CA 94720-1762

Professor Sarah Nelson
Chair, Department of Bioengineering and Therapeutic Sciences
University of California, San Francisco
UCSF Box 0912
513 Parnassus Avenue, Room S-840
San Francisco, CA 94143-0912

Dear Drs. Healy and Nelson:

Translating scientific findings to public benefit is a core mission at UCSF. The School of Medicine's mission of advancing scientific discovery to produce improvements in health requires cutting-edge research, innovative educational opportunities, and committed outreach to the community. We understand that our ability to translate fundamental scientific discoveries to improvement in health care quality and delivery depends on a robust clinical research enterprise which includes training and educating the next generation of scientists, physicians and healthcare professionals.

We strongly endorse the Master of Translational Medicine (MTM) joint degree program's ongoing preparations and efforts. The MTM will link the UCSF Schools of Medicine and Pharmacy and the UCSF Clinical Translational Science Institute (CTSI) with the UC Berkeley College of Engineering and School of Business, providing opportunities for engineers, PhD students, post-doctoral fellows, MBAs, MDs, PharmDs, RNs, and DMDs to gain expertise in applying translational science and engineering approaches to produce practical solutions to the health problems of the public.
This innovative, one of a kind, program will provide students with the skills to integrate the necessary scientific, technological, and business expertise required to drive scientific discoveries into public use for the improvement of health. By leveraging the expertise and technological resources at UCSF and UC Berkeley students will acquire the skills necessary to address real-world problems creatively in an interdisciplinary, team setting.

We share a continued commitment with the UCSF CTSI to change the face of university collaborative research by developing and implementing innovative and critical infrastructure and services in support of clinical and translational science. Empowering a new cadre of young professionals with the tools needed to work collaboratively across disciplines to develop technologies that address immediate health concerns, supports this shared commitment.

Sincerely,

Sam Hawgood, MBBS
Dean, School of Medicine
November 14, 2011

Dr. Kevin Healy  
Chair, Department of Bioengineering  
University of California, Berkeley

Dr. Sarah Nelson  
Co-Chair, Department of Bioengineering and Therapeutic Sciences  
University of California, San Francisco

Dear Kevin and Sarah:

As the oldest school of pharmacy in the West, we have a long history of accomplishment in science, patient care, and in training PhD researchers and PharmD clinicians. We have pioneered innovations in patient care ranging from the biology of drug dosing to the application of computers in drug design. Our success has been predicated on the School’s strong culture of collaboration as reflected by our researchers’ penchant to partner extensively with colleagues across departments, schools and institutions. Consequently, our faculty and students view research, clinical and pedagogical questions from different perspectives and respond in novel ways. In fact, one of the School’s strategic aims is to “shape the future of pharmacy science, policy, education and patient care by working in fresh and collaborative ways.”

The new Master of Translational Medicine degree program will further this goal, since it will strengthen the connections between the UCSF Schools of Pharmacy and Medicine and the UC Berkeley College of Engineering. This multi-site, multi-disciplinary effort will bring together engineers and biomedical professionals to catalyze new synergistic partnerships, and it will accelerate the pace of technology development through both education and practice.

The innovative new curriculum, which balances coursework with team-based design and development projects, will provide practical experience in solving real problems in translational engineering. We anticipate that some developments will have commercial potential. Graduates of this program will be perfectly positioned to work in industry developing health care products, with patients improving the quality of care, or in academia as members of a translationally-focused research teams.

On behalf of the School of Pharmacy, I am pleased to offer my strongest support for the UCSF and UC Berkeley joint Master of Translational Medicine degree program.

Best regards,

Mary Anne Koda-Kimble, Pharm.D.  
Professor and Dean  
T.J. Long Chair in Community Pharmacy Practice
APPENDIX D

LETTERS OF SUPPORT
FROM ACADEMIC LEADERS AT OTHER UC CAMPUSES

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

APPENDIX D – TABLE OF CONTENTS
(3 pages total with this cover sheet)

This appendix includes letters of support from faculty and academic administrators on other UC campuses, dated November 2011. The letters are signed by:

1. Professor Kyriacos A. Athanasiou, Chair and Distinguished Professor, Department of Biomedical Engineering, UC Davis

2. Professor Benjamin Wu, Chair, Department of Bioengineering, UCLA
Dear Graduate Division,

I am writing to lend my support to the UC Berkeley Bioengineering Department's proposal to create a Master's of Translational Medicine program.

Bioengineering is a profession which is expected to experience significant growth in the next decade. Graduates given the opportunity to gain an extra year of professional training and practical experience in a master of engineering program will not only find the job market more welcoming – they will also find their career path accelerated. Given the growing demand for advanced degrees in engineering on the part of potential employers, we believe that a UC Berkeley Master's degree in Translational Medicine would be of interest to and advantageous for our graduates.

Furthermore, a Translational Medicine Master program is an opportunity to greatly expand intercampus communication and integration. Graduates of UC Davis participating in the UC Berkeley Translational Medicine Master's program can serve as a bridge between our two campuses, forging research collaborations and opening doors to local industry and clinics. The cross-disciplinary nature of bioengineering also makes it uniquely suited to forge educational collaborations with other college of engineering departments, and the Master's in Translational Medicine is a powerful platform for making exposure to these collaborative efforts available to future engineering leaders.

We strongly endorse the Bioengineering Department's Master of Translational Medicine application, which takes advantage of and strengthens the relationships discussed above.

Sincerely,

Kyriacos Athanasiou, Ph.D., P.E.
Distinguished Professor of Biomedical Engineering and Orthopaedic Surgery
Child Family Professor of Engineering
Chair, Department of Biomedical Engineering
Editor-in-Chief Annals of Biomedical Engineering

November 14, 2011
November 14, 2011

Kevin E. Healy  
Professor and Chair, Department of Bioengineering 
370 Hearst Memorial Mining Bldg., #1760  
Berkeley, CA 94720-1760

Dear Kevin,

It is my pleasure to lend my support to the proposed professional Master of Translational Medicine (MTM) degree program. The Berkeley / UCSF bioengineering departments have maintained a standard of excellence during a period of extensive growth, in part by building relationships that took advantage of the excellent medical, scientific, and engineering research in the Bay Area. This degree differs significantly from other 1-year terminal MS programs by focusing on clinical and engineering expertise, skills that will be critical as bioengineering advances are translated into medical reality.

Berkeley Bioengineering’s history of collaboration within and between campuses, along with the established excellence of the department with entities such as UC Berkeley’s Center for Entrepreneurship and Technology and the Haas School of Business, put them in an enviable position. Considering the importance that bioengineering is likely to achieve in the coming years, the education of individuals capable of professional excellence in industry will be of critical importance. We believe that many graduates of a four year engineering program like ours will welcome the opportunity to pursue graduate studies at UC Berkeley, aiming to build upon their technical skills and accelerate their careers.

There currently exist few degrees anywhere which can address these needs, and none offer the opportunities as you proposed. We strongly endorse this proposal and wish you the best of luck in a speedy approval.

Sincerely,

Benjamin Wu, DDS, PhD  
Professor and Chair  
UCLA Department of Bioengineering
APPENDIX E

MOU REGARDING ALLOCATION OF RESOURCES BETWEEN UC BERKELEY AND UCSF

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

This appendix notes that a Memorandum of Understanding (MOU) between the Department of Bioengineering at UC Berkeley and the Department of Bioengineering and Therapeutic Sciences at UCSF is being prepared regarding the allocation of resources generated from the PDST and the payment of joint program expenses. The MOU will codify many of the complex two-campus agreements for resource allocation that have been described in the narrative of our proposal. A final signed copy will be submitted with the PDST proposal for the MTM degree.

In summary, the draft MOU will outline the agreements on the following:

- Student registration and “home campus” issues
- The estimated costs of the core required and recommended courses over the first three years
- The equitable division of PDST revenues to cover estimated administrative costs of the program
- The division of surplus revenue between the two departments each year, calculated on the basis of the number of student credit hours taken that year on each campus.
- The core required and recommended courses for the MTM curriculum, and the approval process for new elective courses
- Annual assessment and determination of the overall program-delivery costs
- Annual assessment of these agreements to ensure that they continue to be fair and workable, and serve the program well.
APPENDIX F

LETTERS APPROVING ENROLLMENT ALLOTMENTS

AND

A MEMO FROM THE JOINT GRADUATE GROUP IN BIOENGINEERING

REGARDING CESSATION OF ADMISSION

TO THE TERMINAL M.S.

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES

FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

NOVEMBER 16, 2011

APPENDIX F — TABLE OF CONTENTS

(4 pages total with this cover sheet)

This appendix addresses enrollment allotments on each campus. It includes the following:

- A letter from Andrew Szeri, Dean of the Graduate Division, UC Berkeley, approving the MTM enrollment target for UC Berkeley
- An email from Peter Taylor, Assistant Dean of Academic Affairs, Graduate Division, UCSF, approving the MTM enrollment target for UCSF
- A memo from the chairs of the Joint Graduate Group in Bioengineering outlining the group’s intention to cease admitting students to its terminal Master of Science program when and if the MTM is approved and established.
November 15, 2011

Professors Li Song and Tejal Desai  
MTM Proposers

Dear Professors Song and Desai,

I write to acknowledge that the Graduate Division will provide UCB’s Department of Bioengineering allotments for 2013-14 sufficient for an enrollment of 10 students in the Joint Master of Translational Medicine program, anticipating an additional three enrollments in 2014-15, and in 2015-16, a total of 15 enrollment slots for students for whom Berkeley will be the home campus.

The above numbers represent Berkeley’s enrollment commitment toward the joint program’s anticipated 2013-14 total enrollment of 20 students, which will eventually reach a steady state of 30 students as a whole in 2015-16.

Graduate Division understands that the enrollment formerly provided to the Graduate Group in Bioengineering for the Master of Science in Bioengineering will be transferred to the Joint MTM, and that no undergraduate slots will be reduced as a result of the Joint MTM’s establishment.

Wishing the program great success—

Yours truly,

Andrew J. Szeri  
Dean
Karen:

Our projected and approved year-average program enrollment for the MTM is:

- 20 students for AY 2013-14
- 26 students for AY 2014-15
- 30 students for AY 2015-16

The program revenue and costs for these three years is detailed on the attached sheet. Please let me know if I can provide you with anything additional.

Cheers,

Peter

Peter L. Taylor, Ph.D.
Assistant Dean of Academic Affairs
Graduate Division
University of California, San Francisco
1675 Owens Street, CC310
San Francisco 94143-0523
415-502-3224/ofc
415-476-9690/fax
November 15, 2011

Members of the Graduate Councils
University of California, Berkeley
University of California, San Francisco

Dear Colleagues:

This letter is to state the intention of the Joint Graduate Group in Bioengineering regarding our current enrollment allotment for the terminal Master of Science degree, with an emphasis in translational medicine. We have prepared this letter to be included as an appendix to the proposal to establish a new Master of Translational Medicine (MTM) degree, to be awarded jointly by the Department of Bioengineering at UC Berkeley and the Department of Bioengineering and Therapeutic Sciences at UCSF.

The Joint Graduate Group began admitting students to its existing M.S. degree program for the 2010-11 academic year, responding to faculty interest in offering an academic master's program emphasizing translational medicine. (The joint graduate group’s Plan II M.S. was approved in 1983 when the group was founded, but the option to offer it as a terminal degree had never been exercised.) With the cooperation and support of the Graduate Divisions at UC Berkeley and UCSF, a cohort of 16 students was admitted for Fall 2010, and a second cohort of 14 entered in Fall 2011.

The Joint Graduate Group intends to cease admitting students to its terminal M.S. when and if the Master of Translational Medicine professional degree is approved and established. Enrollment slots currently allocated for our M.S. program could be transferred to the MTM program, as deemed appropriate by the Graduate Division deans on each campus.

We are enthusiastic about the proposal for the new MTM degree, and we look forward to working toward its success with our colleagues on both campuses.

Sincerely,

Tejal Desai  
Co-Chair, UCSF

Sanjay Kumar  
Co-Chair, UC Berkeley

cc. Kevin Healy, Chair  
Department of Bioengineering, UC Berkeley

Sarah Nelson, Chair  
Department of Bioengineering and Therapeutic Sciences, UCSF
APPENDIX G
NEW REQUIRED AND RECOMMENDED COURSES
FOR THE MTM DEGREE

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

APPENDIX G – TABLE OF CONTENTS
(13 pages total with this cover sheet)

The courses outlined in this appendix are the new (or significantly revamped) courses that are required or strongly recommended for all MTM candidates. The courses were developed and finalized by the faculties in the Department of Bioengineering (UC Berkeley) and the Department of Bioengineering and Therapeutic Sciences (UCSF). They are pending approval by the Committees on Courses of Instruction at UC Berkeley and at UCSF. We anticipate that these approvals will be secured by early 2012 on both campuses. The courses are listed here; Bioengineering 296 is an entirely new course, while Bioengineering 270 and 290X are existing courses that are being reworked:

- **Bioengineering 270**: Translational Challenges in Diagnostics, Devices, and Therapeutics (UCSF)
- **Bioengineering 290X**: Ethical and Social Issues in Translational Medicine (UC Berkeley)
- **Bioengineering 296**: Master of Translational Medicine Capstone Project (UC Berkeley)
- **Bioengineering 296**: Master of Translational Medicine Capstone Project (UCSF)
Overview
The objective of the one-year professional Master of Translational Medicine (MTM) program is to develop engineering leaders who can synthesize the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. As part of the MTM curriculum, students will take a course that examines common challenges limiting translation of new diagnostics, devices, and therapeutics. The course will illustrate “real-world” experiences in translation of medical technology, ranging from feasibility demonstration to regulatory hurdles. The case studies will enable the student to anticipate challenges and devise appropriate, situation-specific solutions that will ultimately accelerate the development of new medical diagnostics, devices, and therapeutics. The course will be structured along the following general guidelines:

Course: BioE 270 (UCSF)
Title: Translational Challenges in Diagnostics, Devices, and Therapeutics
Units: 2.0 quarter units
Instructor: Shuvo Roy, Bioengineering & Therapeutic Sciences, UCSF
Offered: Winter Quarter
Prerequisites: Graduate Status
Course Format: Lectures, Homework, Project, and/or Presentations
Grading: Letter

Course Description
This course will introduce key concepts of the product development process as it relates to medical diagnostics, devices, and therapeutics. Topics will include strategies for needs assessment and concept generation, strategies for feasibility demonstration, and translation pathways for “real-world” adoption. The course will comprise didactic lectures, assigned readings, and interactive discussions around specific projects that will serve as “case-study” illustrations to step the students through the medical product-development process. Material will be presented by regular faculty as well as by scientist/physician entrepreneurs, corporate executives, device manufacturers, regulatory experts, health-policy specialists, intellectual-property attorneys, and venture capitalists.

Textbooks and/or Other Required Material
None

Course Objectives
The objective of the one-year professional MTM program is to develop engineering leaders who can synthesize the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. Successful completion of the
The course will enable the student to anticipate challenges and devise appropriate situation-specific solutions that will accelerate the development of new medical diagnostics, devices, and therapeutics.

**Topics Covered**
Variable, depending on class composition, but will include some topics from the following list:

- Needs finding
- Concept generation
- Market assessment
- Intellectual property
- Prototype fabrication
- Regulatory considerations
- Reimbursement planning
- Fundraising strategies

**Class/Laboratory Schedule**
Weekly classes involving lectures from expert guest lectures and interactive discussions with faculty. Students will work on a project that will culminate in a final report and/or presentation.

**Contribution of the Course to Meeting the Professional Component**
The course will expose students to common challenges limiting translation of new diagnostics, devices, and therapeutics. Class presentations on “real-world” experiences by guest faculty will illustrate the process of medical product development through actual examples. Students will be familiarized with issues of intellectual property, regulatory considerations, and reimbursement, which determine the fate of medical products that are otherwise technically feasible.

**Desired Course Outcomes**
The course will provide the student with an understanding of the medical product-development process. After completion, the student should be equipped to anticipate challenges that hinder translation and devise appropriate situation-specific solutions that will accelerate the development of new medical products.

**Assessment of Student Progress Toward Course Objectives / Grading**
Comprehension of the course material and assigned readings will be evaluated via homework assignments. Class participation in interactive discussions will used as a yardstick to assess intellectual engagement in course topics. The quality of the class project will convey the ability of the student to assimilate course material and apply it to a specific situation.

**Person(s) Who Prepared This Description**
Shuvo Roy, PhD (UCSF)
Abbreviated Transcript Title (19 spaces max.): Dev, Diag, Therap
Tie Code: TBD
Grading: Letter grade
Semesters offered: Winter Quarter (UCSF)
Courses that will restrict credit: None
Instructor: Shuvo Roy, UCSF
Duration of course: 10 weeks
Est. total number of required hours of student work per week: 4
Is course repeatable for credit: No
Overview
This course is designed to acquaint students with the ethical and social issues inherent in the translation of laboratory research into clinical innovations.

Course: Bio Eng 290X (UC Berkeley)
Title: Ethical and Social Issues in Translational Medicine
Units: 1 semester unit
Instructor: Terry D. Johnson
Offered: Fall Semester
Prerequisites: Graduate status in the MTM program
Course Format: 1 hour of lecture per week
Estimated number of student hours: 1-3 hours of readings and homework per week
Grading: Letter

Course Description
Members of the MTM program will, through a combination of lectures and guest speakers, learn about ethical challenges in translational medicine. Through a series of assignments they will learn to recognize ethical issues in their work and construct appropriate guidelines for conducting that work in an ethical manner.

Textbooks and/or Other Required Material
Online readings will be assigned.

Course Objectives
The course will prepare students to anticipate ethical challenges in their work and deal with them in a legal and honorable manner. This preparation is essential to future leaders in the field of translational medicine.

Topics Covered
Topics will include:
- Research ethics
- Business ethics
- Human and animal experimentation
- Conflicts of interest
- Informed consent
- Privacy protection
Class/Laboratory Schedule
Students will meet for lecture once per week.

Contribution of the Course to Meeting the Professional Component
By working in teams on case studies and attending lectures, students will learn to apply newly acquired knowledge and tools issues including research ethics, business ethics, conflicts of interest, informed consent, and protection of privacy - issues which professionals in the field of translational medicine must be acquainted with.

Desired Course Outcomes
MTM students will become aware of ethical issues commonly confronted in translational medicine and learn how to evaluate and act accordingly. They will also leave capable of independently considering new ethical issues that arise during their careers.

Assessment of Student Progress Toward Course Objectives / Grading
Students will be graded on class participation, attendance, and on several written and oral assignments.

Person(s) Who Prepared This Description
Terry Johnson

Abbreviated Transcript Title (19 spaces max.): Ethics in Trans. Med.
Tie Code: TBD
Grading: Letter grade
Semesters offered: Fall
Courses that will restrict credit: None
Instructor: Terry D. Johnson
Duration of course: 15 weeks
Est. total number of required hours of student work per week: 1-3 hours
Is course repeatable for credit: No
BIOENGINEERING 296
MASTER OF TRANSLATIONAL MEDICINE CAPSTONE PROJECT
(2 COURSES, AT UC BERKELEY AND AT UCSF)

Relationship Between the Two BioE 296 Courses
To accommodate the dual-campus nature of the MTM program, the capstone course will be arranged as two separate courses, with one course on each campus. Students will be required to apply 6 units of either capstone course to their degree; students home-campused at UC Berkeley will enroll in the Berkeley course, and those home-campused at UCSF will enroll in the UCSF course. The courses are essentially identical with two minor differences:

- The Berkeley course operates on the semester system, while the UCSF course operates on the quarter system
- The instructor for the Berkeley course will be the Berkeley MTM Faculty Co-Director, while the instructor for the UCSF course will be the UCSF Faculty Co-Director

Individual projects may be shared between capstone courses, such that project teams may consist of a mix of students home-campused at either university. For example, some students on a given project team may be enrolled in the UC Berkeley course while others may be enrolled in the UCSF course.

Each BioE 296 capstone project course will be at least 6 semester units for the Berkeley course, or 9 quarter units for the UCSF course, distributed over the academic year. Students must distribute their project work (and thus, their BioE 296 units) over the Fall and Spring semesters for the Berkeley course or over the Fall, Winter, and Spring quarters for the UCSF course; the number of units in each term should be proportional to the amount of project work.

Overview: UC Berkeley and UCSF Courses
The objective of the one-year professional Master of Translational Medicine (MTM) program is to develop engineering leaders who can synthesize the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. Students will develop and demonstrate this skill at synthesis through the capstone project. Projects will provide practical instruction and experience in solving real problems in translational medicine, and it is anticipated that some will lead to innovations with commercial potential. This experience, undertaken by each student as a member of a team and marked by extensive interaction with faculty, peers, and industry partners, enables the student to integrate the leadership and technical dimensions of the professional MTM curriculum. MTM capstone projects will be designed in accordance with the general guidelines on the following pages.

Continued
Bioengineering 296: UC Berkeley Course

Course: Bio Eng 296 (UC Berkeley)
Title: MTM Capstone Project
Units: variable
Instructor: MTM UC Berkeley Faculty Co-Director (Song Li)
Offered: Fall/Spring
Prerequisites: Graduate status in the MTM program
Course Format: Independent study
Estimated number of student hours: Variable
Grading: Letter

Course Description
Members of the MTM Program Committee will help design several capstone projects in collaboration with clinical, academic, and/or industry partners (a.k.a., the “project leaders”), aiming to incorporate emerging technologies, industry requirements, and the potential for significant economic or social impact in medicine and healthcare. Non-clinical project leaders are required to have a clinical collaborator for their project. All projects will be designed and vetted by the MTM Program Committee and in consultation with the MTM Advisory Board. The Berkeley Faculty Co-Director will serve as instructor for the course, and will work directly with the project leaders to ensure that the projects adhere to capstone requirements and objectives. The course instructor will also consult with each project leader to evaluate individual student progress.

Upon entry to the MTM program, each student will identify, in conjunction with his or her assigned academic adviser and capstone-course instructor, a suitable capstone project with a designated project leader. Students will receive a list of potential project leaders, each with a vetted project (as described above). Students will then have the opportunity to perform further vetting through research and conversations with potential project leaders. Finally, each student will place bids on his or her top three projects, which the MTM Program Committee will consider (along with student academic backgrounds and skill sets) when assigning teams to individual projects. Previous experience with this model of project assignment suggests that most students will be assigned to their top-ranked choice, and almost all students can be assigned one of their top three choices.

Each capstone project will engage project teams of approximately 2-5 students. The capstone-project team will meet at least once a week, typically with the project leader and/or course instructor, to engage in discussion focused on understanding and overcoming technical risks, marketplace risks, industry barriers, and potential policy risks. In tandem, the team develops and tests a tangible work product that responds to an identified industry problem.

Textbooks and/or Other Required Material
None
Course Objectives
The objective of the one-year professional MTM program is to develop engineering leaders who can synthesize the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. Students will develop and demonstrate this skill at synthesis through the capstone project.

Topics Covered
Variable, depending on the type of project on which each student works, but all projects will fall within the scope of translational medicine.

Class/Laboratory Schedule
Independent study with regular meetings to evaluate students, monitor progress, and ensure that each group has the tools and expertise necessary to carry their project forward. Meetings will be scheduled as determined by the needs and requirements of the students, project leaders, and course instructor.

Contribution of the Course to Meeting the Professional Component
By working in teams on capstone projects, students will learn to apply newly acquired knowledge and tools to actual clinical problems, identified by project leaders in conjunction with clinical collaborators and MTM faculty on the Program Committee. Each capstone project will present a variety of opportunities for students to strengthen their professional experience in the field of translational medicine. For example, students may analyze and target unmet clinical/industry needs for a new technology, product, or service; they may create a business plan for adapting an innovative technology into an industry/clinical solution; or they may design, produce, and test an actual device or system for a medical application.

Desired Course Outcomes
Projects will provide practical instruction and experience in solving real problems in translational medicine, and it is anticipated that some will lead to innovations with commercial potential. This experience, undertaken by each student as a member of a team and marked by extensive interaction with faculty, peers, and industry partners, enables the student to integrate the leadership and technical dimensions of the professional MTM curriculum.

Assessment of Student Progress Toward Course Objectives / Grading
The capstone will culminate in a comprehensive written and oral presentation of the goals, methods, and outcomes of the project. There will be regular meetings to monitor student’s progress towards their eventual goal. The students must identify the translational pathway for each team’s proposed device, software, therapy, or diagnostic test, including the scientific and technical discovery and development (i.e., design and/or validation milestones), as well as a plan for clinical testing, regulatory approval, and marketing. Each student must, during every participating semester, make a substantial and unique contribution to his or her capstone project, and will be
individually evaluated during regular meetings on demonstration of technical, business, and clinical knowledge, as well as design, analysis, synthesis, and communication skills based on the particular capstone topic.

**Sample Capstone Projects**

**Sample Master’s Project (industry-sponsored, example from Kyphon)**
The kyphoplasty procedure has problems with getting thick cement into the intervertebral space. Set design criteria, prototype, and test a device to deliver the cement.

**Sample Master’s Project (narrow question, well-defined translational pathway)**
Dr. Michael Harrison’s group at UCSF has developed a prototype surgical device for the treatment of sleep apnea. Write up the plan for bringing this device to market: funding for the development phase, preclinical testing, early-phase clinical trials, pivotal trial(s), regulatory issues, and marketing plan.

**Sample Master’s Project (open question, poorly-defined translational pathway)**
The Dr. Krys Bankiewicz’s lab at UCSF would like to bring its convection-enhanced delivery techniques for deep-brain viral drug delivery to the clinic. This project involves therapeutics (viral vectors), drug-delivery technologies (surgical device), and medical imaging. Develop a strategy for bringing it to the clinic.

**Person(s) Who Prepared This Description**
Kyle Kurpinski, PhD
Terry Johnson

**Abbreviated transcript title (19 spaces max.):** Capstone Project
**Tie Code:** SEMR
**Grading:** Letter grade
**Semesters offered:** Fall/Spring
**Courses that will restrict credit:** None
**Instructor:** MTM UC Berkeley Faculty Co-Director (Song Li)
**Duration of course:** 15 weeks
**Est. total number of required hours of student work per week:** Variable
**Is course repeatable for credit:** Yes
Bioengineering 296: UCSF Course

Course: Bio Eng 296 (UCSF)
Title: MTM Capstone Project
Units: Variable
Instructor: MTM UCSF Faculty Co-Director (Tejal Desai)
Offered: Fall/Spring/Winter
Prerequisites: Graduate status in the MTM program
Course Format: Independent study
Estimated number of student hours: Variable
Grading: Letter

Course Description
Members of the MTM Program Committee will help design several capstone projects in collaboration with clinical, academic, and/or industry partners (a.k.a., the “project leaders”), aiming to incorporate emerging technologies, industry requirements, and the potential for significant economic or social impact in medicine and healthcare. Non-clinical project leaders are required to have a clinical collaborator for their project. All projects will be designed and vetted by the MTM Program Committee and in consultation with the MTM Advisory Board. The UCSF Faculty Co-Director will serve as instructor for the course, and will work directly with the project leaders to ensure that the projects adhere to capstone requirements and objectives. The course instructor will also consult with each project leader to evaluate individual student progress.

Upon entry to the MTM program, each student will identify, in conjunction with his or her assigned academic adviser and capstone-course instructor, a suitable capstone project with a designated project leader. Students will receive a list of potential project leaders, each with a vetted project (as described above). Students will then have the opportunity to perform further vetting through research and conversations with potential project leaders. Finally, each student will place bids on his or her top three projects, which the MTM Program Committee will consider (along with student academic backgrounds and skill sets) when assigning teams to individual projects. Previous experience with this model of project assignment suggests that most students will be assigned to their top-ranked choice, and almost all students can be assigned one of their top three choices.

Each capstone project will engage project teams of approximately 2-5 students. The capstone-project team will meet at least once a week, typically with the project leader and/or course instructor, to engage in discussion focused on understanding and overcoming technical risks, marketplace risks, industry barriers, and potential policy risks. In tandem, the team develops and tests a tangible work product that responds to an identified industry problem.

Textbooks and/or Other Required Material
None
Course Objectives
The objective of the one-year professional MTM program is to develop engineering leaders who can synthesize the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. Students will develop and demonstrate this skill at synthesis through the capstone project.

Topics Covered
Variable, depending on the type of project on which each student works, but all projects will fall within the scope of translational medicine.

Class/Laboratory Schedule
Independent study with regular meetings to evaluate students, monitor progress, and ensure that each group has the tools and expertise necessary to carry their project forward. Meetings will be scheduled as determined by the needs and requirements of the students, project leaders, and course instructor.

Contribution of the Course to Meeting the Professional Component
By working in teams on capstone projects, students will learn to apply newly acquired knowledge and tools to actual clinical problems, indentified by project leaders in conjunction with clinical collaborators and MTM faculty on the Program Committee. Each capstone project will present a variety of opportunities for students to strengthen their professional experience in the field of translational medicine. For example, students may analyze and target unmet clinical/industry needs for a new technology, product, or service; they may create a business plan for adapting an innovative technology into an industry/clinical solution; or they may design, produce, and test an actual device or system for a medical application.

Desired Course Outcomes
Projects will provide practical instruction and experience in solving real problems in translational medicine, and it is anticipated that some will lead to innovations with commercial potential. This experience, undertaken by each student as a member of a team and marked by extensive interaction with faculty, peers, and industry partners, enables the student to integrate the leadership and technical dimensions of the professional MTM curriculum.

Assessment of Student Progress Toward Course Objectives / Grading
The capstone will culminate in a comprehensive written and oral presentation of the goals, methods, and outcomes of the project. There will be regular meetings to monitor student’s progress towards their eventual goal. The students must identify the translational pathway for each team’s proposed device, software, therapy, or diagnostic test, including the scientific and technical discovery and development (i.e., design and/or validation milestones), as well as a plan for clinical testing, regulatory approval, and marketing. Each student must, during every participating semester, make a substantial and unique contribution to his or her capstone project, and will be
individually evaluated during regular meetings on demonstration of technical, business, and clinical knowledge, as well as design, analysis, synthesis, and communication skills based on the particular capstone topic.

Sample Capstone Projects

**Sample Master’s Project (industry-sponsored, example from Kyphon)**
The kyphoplasty procedure has problems with getting thick cement into the intervertebral space. Set design criteria, prototype, and test a device to deliver the cement.

**Sample Master’s Project (narrow question, well-defined translational pathway)**
Dr. Michael Harrison’s group at UCSF has developed a prototype surgical device for the treatment of sleep apnea. Write up the plan for bringing this device to market: funding for the development phase, preclinical testing, early-phase clinical trials, pivotal trial(s), regulatory issues, and marketing plan.

**Sample Master’s Project (open question, poorly-defined translational pathway)**
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**Person(s) Who Prepared This Description**
Kyle Kurpinski, PhD
Terry Johnson

**Abbreviated transcript title (19 spaces max.):** Capstone Project
**Tie Code:** SEMR
**Grading:** Letter grade
**Semesters offered:** Fall/Winter/Spring
**Courses that will restrict credit:** None
**Instructor:** MTM UCSF Faculty Co-Director (Tejal Desai)
**Duration of course:** 10 weeks
**Est. total number of required hours of student work per week:** Variable
**Is course repeatable for credit:** Yes
APPENDIX H

EXAMPLES OF CURRENT RESEARCH PROJECTS
OF BIOENGINEERING FACULTY AT UC BERKELEY

The following is a sampling of translational faculty research at UC Berkeley and UCSF. The MTM program will draw on both the expertise of these faculty members as teachers and mentors in the program and on their research as potential sources of capstone projects for MTM students.

- **Magnetic Particle Imaging: Cancer Detection, Stem-Cell Tracking, and Cardiac Angiography**
  *(Professor Steve Conolly, UC Berkeley)*
  [http://stemcellcenter.berkeley.edu/PIs/conolly.html](http://stemcellcenter.berkeley.edu/PIs/conolly.html)
  Stem-cell biologists rely on exquisite optical microscopy to track stem cells and to elucidate their interactions with other cells. While there are methods for imaging stem cells *in vivo*, none of these are optimal. Optical methods have very poor resolution and sensitivity when the tagged cells are deep within an animal or human; MRI methods are costly and lack sensitivity.

  Conolly’s lab is pioneering a new imaging technique, called Magnetic Particle Imaging (MPI), which could track the location and viability of stem cells within the human body. He says MPI “could solve one of the greatest obstacles to human stem-cell therapy – the ability to track stem cells and see if the cells are thriving and becoming fully differentiated cells that can improve function of damaged organs.” The technology could revolutionize imaging (as MRI did 30 years ago). Conolly’s team at Berkeley has built all four of the MPI scanners currently operating in North America.

  The scanning technique results in clearer images, it is less dangerous than other common imaging methods for the 50% of patients over 70 who suffer from chronic kidney disease, and it is much more sensitive since the magnetization available is milli-tesla-equivalent instead of the nano-tesla as in MRI – potentially a million-fold gain in sensitivity. The scanner is table-top size, inexpensive, and push-button operated.

- **Smarter Drug Delivery** *(Professor Tejal Desai, UCSF)*
  Swallowing pills means medication must face the challenge of surviving the harsh environment of the digestive tract. As a result, people must take larger doses than they need. Using micro and nano-fabrication techniques developed by the computer chip industry, Desai’s lab is creating tiny devices that take multiple drugs directly to where they are needed, using less medication, minimizing side effects and making the process safer for the patient.

- **CellScope: A Cell-Phone Microscope for Disease Screening and Diagnosis** *(Professor Dan Fletcher, UC Berkeley)*
  Fletcher and his lab have developed the CellScope, which not only takes color images of malaria parasites but also of tuberculosis bacteria labeled with fluorescent markers. The prototype CellScope, described in the July 22, 2009, issue of the peer-reviewed, online journal *PLoS ONE*, moves a major step forward in taking clinical microscopy out of specialized laboratories and into field settings for disease screening and diagnoses. “The same regions of the world that lack access to adequate health facilities are, paradoxically, well-served by mobile phone networks,” said Fletcher. “We can take advantage of these mobile networks to bring low-cost, easy-to-use lab equipment out to more remote settings.”

  CellScope images can either be analyzed on site or wirelessly transmitted to clinical centers for remote diagnosis. The system could be used to help provide early warning of outbreaks by shortening the time
needed to screen, diagnose and treat infectious diseases. Some of Fletcher’s students have founded a company to produce the devices, and the CellScope is making its way to the marketplace – translating bioengineering research into better patient care.

- **Pre-sealing the Amniotic Membrane** *(Professor Michael Harrison, UCSF)*
  [http://www.pediatricdeviceconsortium.org/node/247](http://www.pediatricdeviceconsortium.org/node/247)
  Minimally invasive (“fetoscopic”) fetal surgery techniques continue to give rise to promising treatments for a number of birth defects. However, fetoscopic therapies are hindered by the unsolved “Achilles heel” of fetal surgery: pre-term premature rupture of membranes (PPROM). Despite advances in fetoscopic techniques, 6–10% of single port procedures – and up to 40–60% of longer, multiple port procedures – are still complicated by PPROM. Given that such procedures occur relatively early in gestation, PPROM is associated with significant morbidity and mortality. Effective sealing and restoration of membrane integrity during fetoscopic surgery will significantly reduce this devastating complication, enabling the full potential of fetal therapy to be realized.

  The Harrison lab is developing a so-called Amnioseal to pre-seal the chorioamniotic membrane prior to membrane disruption. The concept is similar to watching a magician puncture a balloon with a sharp object without causing it to burst – magic? No. The magician has pre-prepared the balloon by covering a small area with Sellotape. On puncture, the Sellotape creates a seal around the needle and provides mechanical support to the balloon, resulting in maintenance of the membrane integrity. The Amnioseal aims to create a similar seal prior to amniotic membrane puncture, thus preventing fluid leakage, membrane separation, and finally membrane rupture. The team has built a model uterus and is currently testing various biocompatible glues and sealants that work underwater.

- **Bioactive Hydrogels for Cardiac Tissue Engineering** *(Professor Kevin Healy, UC Berkeley)*
  [http://biomaterials.berkeley.edu/hydrogel.htm](http://biomaterials.berkeley.edu/hydrogel.htm)
  Congestive heart failure (CHF) affects millions of Americans and incurs approximately $30 billion of treatment expenditures annually, with an estimated 80% mortality at 8 years. Treatment options for CHF are still limited and it’s been proposed that transplantation of various types of stem cells may significantly improve regional contractile and left ventricle function. However, cellular transplantation has yielded mixed results, with necrotic/apoptotic loss of the vast majority of donor cells within days after transplantation. A rational approach toward the enhanced survival of cells transplanted into the myocardium is likely to greatly facilitate rapid advancement of effective human clinical applications of stem cell therapies to treat cardiovascular disease. Accordingly, we have developed bio-inspired hydrogels to be used as an assistive microenvironment for transplantation of cardiac progenitor stem cells into the infarcted myocardium. This project will focus on the translation of these novel hydrogels, assessing their ability to promote proliferation and differentiation of cardiac progenitor cells, and ultimately evaluation of their ability to improve cardiac function post MI.

- **Clinical and Point-of-Care Diagnostics** *(Assistant Professor Amy Herr, UC Berkeley)*
  [http://herrlab.berkeley.edu/research.html](http://herrlab.berkeley.edu/research.html)
  Appropriate, effective biomolecular analysis mechanisms are identified for diagnostic development based upon the physicochemical characteristics of putative, disease-specific biomarkers. Most disease states are complex – diagnosis and monitoring require more than simple binary detection of a small set of proteins. To compound the difficulty in assessing disease state, analytical-grade quantitation and specificity are difficult to achieve as part of a disease diagnostic, especially diagnostics employed in near-patient environments. Consequently, the Herr group is exploring the use of electrophoretic microfluidic formats, as such formats have been demonstrated to allow rapid, analytical-grade quantitation of small sample volumes through enhanced resolving power and high-efficiency operation.
Herr and her lab use innovative technology that combines approaches from engineering, chemistry, materials science, and systems biology to support her research into utilizing proteins as disease markers. “It is notoriously difficult to study proteins as disease biomarkers because of the diverse and dynamic nature of protein signaling,” said Herr. “The vast majority of measurement techniques used now are slow and labor-intensive. The technology can form a bottleneck. We are harnessing microfluidics to design fast, automated – and even quantitative – assays to map protein signaling like never before in diseases including cancer and autoimmune dysfunction.”

Her long-term goal is to develop highly specific diagnostic, prognostic, and treatment-monitoring tools based on disease state information encoded in protein biomarkers. The work seeks to advance “predictive and personalized medicine through diagnostic tests that are unimaginable today,” said Herr.

- **Biomimetic Scaffolds for Tissue Engineering** *(Associate Professor Song Li, UC Berkeley)*

  A leader in the fast-growing field of tissue engineering – a fusion of cell biology, materials science and engineering – Li is working to develop replacement arteries, nerve grafts and wound-healing technologies that work in concert with the body’s own natural repair systems. Three of his students are forming startup companies that will bring these technologies to the clinical setting in the next five to 10 years. “We’re trying to make biomimetic or bioinspired materials based on structures already in our tissues,” Li says. Key to his lab’s innovative products is the high-tech synthetic scaffolding they are built on. Using long fibers of polyesters (the bioabsorbable material surgical sutures are made of), the researchers can fashion membranes endowed with remarkable properties. To the naked eye, the membranes resemble shiny sheets of white tissue. But under the microscope, their surfaces reveal a nanoscale topography of grooves, divots and dimples that point cells in the direction they should grow and provide cargo space for stem cells, growth factors and other biomolecules that speed healing.

- **Imaging for Cancer Treatment** *(Professor Sarah Nelson, UCSF)*

  Magnetic resonance imaging (MRI), used with a novel pyruvate chemical compound that is specially labeled to be read by the MRI machine, is being applied for the first time in humans to study the aggressiveness of prostate cancer in patients and the success of prostate cancer therapies. The chemical compound is energized, then quickly injected into the prostate cancer patient before imaging begins.

- **Kidney Filtration System** *(Associate Professor Shuvo Roy, UCSF)*

  UCSF researchers have designed a model filtration system that could offer a new approach to treating patients suffering from end-stage renal disease, potentially removing the need for a clinic-based dialysis process altogether. Initial results of the research were presented in June at the annual conference of the American Society for Artificial Internal Organs in Washington, D.C. Roy also presented initial results of tests showing that silicon-based membranes are compatible with human blood and thus offer viable options as filters in implanted devices, such as the team’s model for an implantable artificial kidney.

  The filtration model is designed as a trap for mid-sized molecules that need to be filtered from the patient’s blood stream, with the upstream filter sized to leave large molecules such as proteins and blood cells in the blood, and the downstream filter sized to block urea and creatinine, while allowing electrolytes and nutrients to return to the blood stream. Ultimately, researchers say the system could provide an intermediary therapy for dialysis patients awaiting a kidney transplant, untethering them from tri-weekly visits to dialysis centers. It also could be used in an interim device in developing an implantable bio-artificial kidney, in which cell therapy would augment the function of the downstream filter to replace most of the functions of a real kidney.
APPENDIX I

SHORT VERSION OF CURRICULUM VITAE
OF FACULTY MEMBERS PARTICIPATING IN THE NEW PROGRAM

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

APPENDIX I – TABLE OF CONTENTS
(21 pages total with this cover sheet)

This appendix includes short CVs for the following faculty who are teaching core courses or playing leadership roles in the MTM degree program:

UC Berkeley
- Daniel Fletcher, Bioengineering (Associate Chair)
- Kevin Healy, Bioengineering (Chair) and Materials Science & Engineering
- Terry Johnson, Bioengineering
- Song Li, Bioengineering
- Ikhlaq Sidhu, Industrial Engineering & Operations Research
- Kyle Kurpinski, MTM Executive Director (staff)

UCSF
- Kirsten Bibbins-Domingo, Medicine and Epidemiology & Biostatistics
- Tejal Desai, Bioengineering & Therapeutic Sciences and Physiology
- Kathy Giacomini, Bioengineering & Therapeutic Sciences (Co-Chair) and Physiology
- Deborah Grady, Medicine
- Clay Johnston, Neurology and Epidemiology, Associate Vice Chancellor for Research
- Sarah Nelson, Bioengineering & Therapeutic Sciences (Co-Chair) and Physiology
- Shuvo Roy, Bioengineering & Therapeutic Sciences and Physiology
- Marc Shuman, Medicine & Urology
Dan Fletcher
John Lester Lloyd & Lynne Dewar Lloyd Distinguished Professor
in the College of Engineering
Department of Bioengineering
University of California, Berkeley
Deputy Division Director, Physical Biosciences Division,
Lawrence Berkeley National Laboratory
608B Stanley Hall, Berkeley, CA 94720-1762
510.643.5624
fletch@berkeley.edu
fletchlab.berkeley.edu

EDUCATION

2002  Postdoctoral Fellow, Biochemistry, Stanford University
2001  Ph.D., Mechanical Engineering, Stanford University
1997  D.Phil., Engineering Science, Oxford University
1994  B.S.E., Mechanical & Aerospace Engineering, Princeton University

PROFESSIONAL EXPERIENCE

2010-  Professor, Bioengineering, University of California, Berkeley
2007-  Deputy Division Director, Physical Biosciences Division, Lawrence Berkeley National Laboratory
2007-10 Associate Professor, Bioengineering, UC Berkeley
2002-07 Assistant Professor, Bioengineering, UC Berkeley
2003-  Faculty Scientist, Physical Biosciences Division, Lawrence Berkeley National Laboratory
2003-  Member, Nanoscale Science & Engineering Graduate Group, UC Berkeley
2002-  Member, Joint Graduate Group in Bioengineering, UC Berkeley & UCSF
2002-  Member, Biophysics Graduate Group, UC Berkeley
2002-  Faculty Affiliate, QB3, UC Berkeley

RECENT PUBLICATIONS


Kevin Healy
Jan Fandrianto Professor in Engineering
Departments of Bioengineering and Materials Science & Engineering
University of California, Berkeley
370 Hearst Memorial Mining Building, Berkeley, CA 94720-1762
510.643.3559
kehealy@berkeley.edu
mse.berkeley.edu/faculty/healy/KevinHealy.html

EDUCATION

1990
Ph.D., Bioengineering, University of Pennsylvania

PROFESSIONAL EXPERIENCE

2003-
Professor, Departments of Bioengineering and Materials Science & Engineering, UC Berkeley

2000-03
Associate Professor, Departments of Bioengineering and Materials Science & Engineering, UC Berkeley

1995-99
Associate Professor, Division of Biological Materials and Department of Biomedical Engineering, Northwestern University, Chicago, Illinois

1990-95
Assistant Professor, Department of Biomedical Engineering, Northwestern University, Evanston, Illinois

1989-95
Assistant Professor, Division of Biological Materials, Northwestern University, Chicago, Illinois

REPRESENTATIVE PUBLICATIONS


**Terry Johnson**
Lecturer
Department of Bioengineering
University of California, Berkeley
B108C Stanley Hall, Berkeley, CA 94720-1762
510. 664.4418
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bioeng.berkeley.edu/cv/tjohnson.php

**EDUCATION**

<table>
<thead>
<tr>
<th>Year</th>
<th>Degree</th>
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<tbody>
<tr>
<td>2000</td>
<td>M.S., Chemical Engineering</td>
<td>Massachusetts Institute of Technology</td>
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<td>1996</td>
<td>B.S., Chemical Engineering</td>
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**PROFESSIONAL EXPERIENCE**

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<tbody>
<tr>
<td>2001–</td>
<td>Lecturer, Bioengineering</td>
<td>University of California Berkeley</td>
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<tr>
<td>2008–</td>
<td>iGEM Adviser</td>
<td>University of California Berkeley</td>
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<tr>
<td>2000–01</td>
<td>Lecturer</td>
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<tr>
<td>1999–2000</td>
<td>Engineer</td>
<td>Engineering Labs Inc.</td>
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</tbody>
</table>

**RECENT PUBLICATIONS**


Song Li  
Professor  
Department of Bioengineering  
University of California, Berkeley  
108A Stanley Hall, Berkeley, CA 94720-1762  
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song_li@berkeley.edu  
ctelab.berkeley.edu

EDUCATION

1997  Ph.D., Bioengineering, University of California, San Diego  
1991  M.S., Beijing University  
1988  B.S., Beijing University

PROFESSIONAL EXPERIENCE

2011-  Professor, Department of Bioengineering, UC Berkeley  
2006-11  Associate Professor, Department of Bioengineering, UC Berkeley  
2001-06  Assistant Professor, Department of Bioengineering, UC Berkeley  
1998-2000  Assistant Scientist, Department of Bioengineering, UC San Diego

REPRESENTATIVE PUBLICATIONS


EDUCATION

1995       Ph.D., Electrical and Computer Engineering, Northwestern University
1993       M.S., Electrical and Computer Engineering, Northwestern University
1988       B.S., Electrical Engineering, University of Illinois at Urbana Champaign

PROFESSIONAL EXPERIENCE

2010-       Chief Scientist, Coleman Fung Institute for Engineering Leadership, University of California Berkeley
2005-       Professor, Industrial Engineering and Operations Research, UC Berkeley
2005-       Director, Center for Entrepreneurship and Technology, UC Berkeley
2008-09     Co-Chair, Management of Technology Program, UC Berkeley
2002-04     Visiting Associate Professor, General Engineering and Director of the Technology Entrepreneur Center, University of Illinois
2001-02     Chief Technical Officer and Vice President, Cambia Networks Inc.
1995-2001   Director and Vice President, 3Com Corporation / U.S. Robotics Internet Communications Business
1995-98     Director, Advanced Technologies Research Center, US Robotics / 3Com Corporation
1989-91     Hardware Engineer, Hewlett Packard

RECENT PUBLICATIONS


Kyle Kurpinski
Executive Director, Master of Translational Medicine Program
University of California, Berkeley | University of California, San Francisco
308 Stanley Hall, Berkeley, CA 94720-1762
510.664.4472
kkurpins@berkeley.edu

EDUCATION

2008  Ph.D., Bioengineering, University of California, Berkeley / San Francisco
2003  M.S., University of Michigan, Ann Arbor
2002  B.S., University of Michigan, Ann Arbor

PROFESSIONAL EXPERIENCE

2011-  Executive Director, Master of Translational Medicine Program,
       University of California, Berkeley / San Francisco
2007-11 Senior Product Development Engineer, NanoNerve, Inc., Fremont, CA

BOOK

Kurpinski, K. and Terry D. Johnson. How to Defeat Your Own Clone: And Other Tips for

REPRESENTATIVE PUBLICATIONS


Kirsten Bibbins-Domingo
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EDUCATION

<table>
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<tr>
<td>2002-04</td>
<td>M.A.S.</td>
<td>Clinical Research, University of California, San Francisco</td>
</tr>
<tr>
<td>1994-99</td>
<td>M.D.</td>
<td>University of California, San Francisco</td>
</tr>
<tr>
<td>1989-94</td>
<td>Ph.D.</td>
<td>University of California, San Francisco</td>
</tr>
<tr>
<td>1987-89</td>
<td>M.S.</td>
<td>University of Ibadan, Ibadan, Nigeria</td>
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<tr>
<td>1983-87</td>
<td>A.B.</td>
<td>Princeton University</td>
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PROFESSIONAL EXPERIENCE

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<td>Associate Professor, Medicine, University of California, San Francisco</td>
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<td>2004-09</td>
<td>Assistant Professor, Medicine, UCSF</td>
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<td>2003-04</td>
<td>Instructor, UCSF</td>
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<td>2001-03</td>
<td>Fellow, General Medicine, UCSF</td>
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<td>2000-01</td>
<td>Resident, Medicine, UCSF</td>
</tr>
<tr>
<td>1999-2000</td>
<td>Intern, Medicine, UCSF</td>
</tr>
</tbody>
</table>

RECENT PUBLICATIONS


Tejal Desai
Professor
Department of Bioengineering & Therapeutic Sciences and
Department of Physiology
University of California, San Francisco
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EDUCATION

1998 Ph.D., Bioengineering, University of California, San Francisco/
University of California, Berkeley
1994 Sc.B., Biomedical Engineering, Brown University

PROFESSIONAL EXPERIENCE

2010- Executive Committee, Graduate Program in Medical Education (GEMS)
2010- Director, Masters in Translational Medicine, UCSF
2009- Vice Chair, Department of Bioengineering and Therapeutic Sciences, UCSF
2009- Professor, Department of Bioengineering and Therapeutic Sciences, UCSF
2009- Chair, Joint Graduate Group in Bioengineering, UCSF/UC Berkeley
2007-09 Co-Chair, Joint Graduate Group in Bioengineering, UCSF/UC Berkeley
2005- Professor, Department of Physiology, Bioengineering Program, UCSF
2006-08 Adjunct Associate Professor, Department of Biomedical Engineering,
Boston University
2002-06 Associate Professor, Department of Pharmacology and Experimental Therapeutics,
Boston University
2002-06 Associate Professor, Department of Biomedical Engineering, Boston University
1998-2001 Assistant Professor, Department of Bioengineering, University of Illinois
at Chicago

OTHER POSITIONS HELD CONCURRENTLY

2006- Director, UCSF Biomedical Micro/Nanotechnology Core Facility
2005- Director, Therapeutic Micro and Nanotechnology Laboratory
2004-05 Associate Chair of Graduate Studies, Biomedical Engineering, Boston University
2004-05 Associate Director, Center for Nanoscience and Nanobiotechnology,
Boston University
2002-05 Core Director, Whitaker Center for Cellular and Subcellular Engineering
2002-05 Director, Laboratory of Therapeutic Microsystems, Boston University
1996 Visiting Scholar, Consiglio Nazionale della Ricerche, Rome, Italy
RECENT PUBLICATIONS


Hemocompatibility of Silicon-based Substrates for Biomedical Implant Applications, Dr. Shuvo Roy, Lalitha Muthusubramaniam; Rachel Lowe, PhD; William H Fissell, MD; Lingyan Li, PhD; Roger E Marchant, PhD; Tejal Desai, PhD, Ann Biomed Eng. 2011 Feb 2.

Kathleen M. Giacomini
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EDUCATION

1974  B.S., Pharmacy, University of Texas, Houston
1979  Ph.D., Pharmaceutical Science, State University of New York at Buffalo
1979-81 Postdoc, Clinical Pharmacology, Stanford University School of Medicine

PROFESSIONAL EXPERIENCE

1991-  Professor, Bioengineering & Therapeutic Sciences, Pharmaceutical Chemistry, and Cellular & Molecular Pharmacology, UCSF
1987-91  Associate Professor, Pharmacy, Pharmaceutical Chemistry, and Pharmacology, UCSF
1982-87  Assistant Professor, Pharmacy, Pharmaceutical Chemistry, and Pharmacology, UCSF

OTHER POSITIONS HELD CONCURRENTLY

2009-  Co-Chair, Department of Bioengineering & Therapeutic Sciences, UCSF
2006-  Faculty Member, Biomedical Sciences Graduate Program, UCSF
1998-09  Chair, Department of Biopharmaceutical Sciences, UCSF
1997-98  Vice Chair, Department of Biopharmaceutical Sciences, UCSF
1990-95  Vice Chair, Director of Graduate Program, Department of Pharmacy, UCSF

RECENT PUBLICATIONS


Deborah Grady
Professor in Residence,
Department of Medicine and of Epidemiology
Associate Dean, Clinical and Translational Research
Director, UCSF Women’s Health Clinical Research Center
University of California, San Francisco
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Deborah.Grady@ucsf.edu
www.whcrc.ucsf.edu/people/bios/grady_deborah.html

EDUCATION

1985-87    Mellon Fellow, University of California, San Francisco
1985-87    Resident, University of California, Berkeley
1985-86    M.P.H., University of California, Berkeley
1982-83    Resident, University of California, San Francisco
1981    Internship, University of California, San Francisco
1976-80    M.D., University of Virginia, Charlottesville
1968-72    A.B., Bryn Mawr College, Bryn Mawr, Pennsylvania

PROFESSIONAL EXPERIENCE

2008-    Co-Director, Clinical and Translational Science Institute, UCSF
2006-    Associate Dean, Clinical and Translational Research, UCSF Schools of Medicine and Nursing
2001-    Director, Clinical Research Center, UCSF Women’s Health
2000-    Director, Research Careers in Women’s Health, UCSF
2000-04    Acting Chief, Medicine Service, SFVA, General Internal Medicine Section
1998-    Professor, Departments of Epidemiology and of Medicine, UCSF
1998-99    Acting Chair, Department of Epidemiology, UCSF
1997-    Associate Director, UCSF Training in Clinical Research
1997-2006    Vice Chair, Department of Epidemiology, UCSF
1996-2001    Director, General Internal Medicine Clinical Research Fellowship, UCSF
1994-    Director, Women’s Health Clinical Research Fellowship, SFVA
1993-98    Associate Professor in Residence, Departments of Epidemiology and Medicine, UCSF
1993-2001    Founding Director, SFVA Women Veterans Comprehensive Health Center
1988-92    Director, Women’s Clinic, VAMC
1988-93    Assistant Professor in Residence, Departments of Epidemiology and Medicine, UCSF

RECENT PUBLICATIONS


S. Claiborne Johnston
Professor
Department of Neurology, Epidemiology, and Biostatistics
Associate Vice Chancellor of Research
Director, UCSF Clinical & Translational Science Institute
University of San Francisco
Box 0114, 505 Parnassus Ave, Moffitt 798, San Francisco, CA 94143 - 0114
415.502.7487
clay.johnston@ucsfmedctr.org

EDUCATION

1998-2001 Ph.D., Epidemiology, University of California, Berkeley
1996-98 Fellowship, University of California, San Francisco
1996-97 M.P.H., University of California, Berkeley
1993-96 Residency, Neurology, University of California, San Francisco
1992-93 Internship, Massachusetts General Hospital
1988-92 M.D., Harvard Medical School
1983-87 B.A., Amherst College

PROFESSIONAL EXPERIENCE

2009- Associate Vice Chancellor, Research, UCSF
2007- Professor, Epidemiology & Biostatistics, UCSF
2007- Professor, Neurology, UCSF
2005-06 Associate Professor, Neurology, UCSF
2003-05 Associate Professor in Residence, Epidemiology, UCSF
2003-06 Associate Professor in Residence, Neurology, UCSF
2003-05 Assistant Professor in Residence, Epidemiology, UCSF
2001-03 Assistant Professor in Residence, Epidemiology, UCSF
1998-2003 Assistant Professor in Residence, Neurology, UCSF
1996-98 Clinical Instructor, Neurology, UCSF
1987-88 Teaching Fellow, Physics, Harvard University

OTHER POSITIONS HELD CONCURRENTLY

2008- Director, Clinical & Translational Science Institute, UCSF
2006-08 Director, Novel Methods Program, CTSI, UCSF
2006-08 Director, Biostatistics, Research Ethics and Design Program, CTSI, UCSF
2003-10 Director, Neurology, Stroke Sciences Group
2002- Director, Neurology, Stroke Service

RECENT PUBLICATIONS


Sarah Nelson
Margaret Hart Surbeck Distinguished Professorship in Advanced Imaging, Co-Chair, Department of Bioengineering & Therapeutic Sciences
Professor, Department of Radiology and Biomedical Imaging
Director, Surbeck Laboratory of Advanced Imaging
Box 0775, University of California, San Francisco
San Francisco, CA 94143-0775
415.476.6383
sarah.nelson@radiology.ucsf.edu
cancer.ucsf.edu/people/nelson_sarah.php

EDUCATION

1985-87 Postdoc, Fox Chase Cancer Center, Philadelphia, PA
1982 Dr.rer.Nat., Applied Mathematics, University of Heidelberg, West Germany
1975 B.S., University of Manchester, England

PROFESSIONAL EXPERIENCE

2009- Co-Chair, Department of Bioengineering & Therapeutic Sciences, UCSF
2005- Director, Program in Bioengineering, UCSF School of Medicine
2004- Margaret Hart Surbeck Distinguished Professorship in Advanced Imaging, UCSF
2003- Director, Surbeck Laboratory of Advanced Imaging, UCSF
2002- Chair, Division of Bioengineering, UCSF
2002- Professor, Bioengineering, UC Berkeley
2000- Professor, Radiology, UCSF
1999-2001 Visiting Professor, Bioengineering, UC Berkeley
1997-2003 Scientific Director, Magnetic Resonance Science Center, UCSF
1994-2000 Associate Professor, Radiology, UCSF
1995-97 Associate Director, Magnetic Resonance Science Center, UCSF
1990-94 Assistant Professor, Radiology, UCSF
1988-90 Associate Member, Department of Nuclear Magnetic Resonance and Medical Spectroscopy, Fox Chase Cancer Center, Philadelphia
1987-88 Research Associate, NMR and Medical Spectroscopy, Fox Chase Cancer Center, Philadelphia
1985-87 Postdoctoral Fellow, Biostatistics Laboratory, Fox Chase Cancer Center, Philadelphia
1979-82 Research Fellow / Graduate Student of Special Research, Department of Applied Mathematics, University of Heidelberg, West Germany
1978 Mathematics Teacher, George Abbott School, Surrey, England
1975-78 Systems Analyst/ Applied Mathematician, EASAMS Ltd., Surrey, England

RECENT PUBLICATIONS


Shuvo Roy  
Associate Professor  
Department of Bioengineering & Therapeutic Sciences  
School of Pharmacy  
University of California, San Francisco  
Room BH203A, Box 2520, San Francisco, CA 94143-2520  
415.514.9666  
Shuvo.Roy@ucsf.edu  
bts.ucsf.edu/people/faculty/profiles/?counter=22

EDUCATION

2001  Ph.D., Electrical Engineering & Computer Science,  
Case Western Reserve University
1995  M.S., Electrical Engineering & Applied Physics, Case Western Reserve University
1992  B.S., Physics, Mathematics, and Computer Science, Mount Union College,  
Alliance, Ohio

PROFESSIONAL EXPERIENCE

2008-  Associate Professor, Department of Bioengineering and Therapeutic Sciences,  
UCSF
2002-08  Assistant Staff, Department of Biomedical Engineering, Cleveland Clinic
1998-2002  Project Staff, Department of Biomedical Engineering, Cleveland Clinic

RECENT PUBLICATIONS

Hemocompatibility of Silicon-Based Substrates for Biomedical Implant Applications. Ann  


Marc Shuman  
Professor  
Departments of Medicine and Urology  
Co-Leader, Prostate Cancer Program, UCSF Helen Diller Family Comprehensive Cancer Center  
University of California, San Francisco  
Box 1270, San Francisco, CA 94143-1270  
415.476.2125  
shuman@medicine.ucsf.edu  
urology.ucsf.edu/faculty/facShuman_bio.html

EDUCATION

1967 M.D., Thomas Jefferson Medical College  
1962 B.S., Philosophy / Chemistry, University of Wisconsin, Madison

PROFESSIONAL EXPERIENCE

2005- Clinical Director, California Institute for Quantitative Biomedical Research (QB3), San Francisco  
1998- Director, Prostate Cancer Program, Comprehensive Cancer Center, UCSF  
1998- Associate Director for Program Development, Helen Diller Family Comprehensive Cancer Center, UCSF  
1997-2000 Chief of Oncology, Division of Hematology-Oncology, UCSF  
1996-2004 Associate Director, Cancer Research Institute, UCSF  
1992-96 Interim Director, Cancer Research Institute, UCSF  
1989- Chief of Hematology, Division of Hematology-Oncology, UCSF  
1986- Professor, Department of Medicine, UCSF  
1981-86 Associate Professor, Department of Medicine, UCSF  
1976-81 Assistant Professor, Department of Medicine, UCSF  
1973-76 Postdoctoral Fellow, Division of Hematology-Oncology, Washington University, St. Louis  
1972-73 Clinical Fellow, Division of Hematology-Oncology, Washington University, St. Louis  
1971-72 Senior Resident, Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia  
1968-69 Junior Assistant Resident, Hospital of the University of Pennsylvania, Philadelphia  
1967-68 Intern, Pennsylvania Hospital, Philadelphia

RECENT PUBLICATIONS


APPENDIX J

COMPARABLE PROGRAMS
AT OTHER INSTITUTIONS

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES
FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

APPENDIX J — TABLE OF CONTENTS
(5 pages total with this cover sheet)

The proposed MTM degree program is, to our knowledge, one of the first of its kind anywhere. However, this appendix contains examples of and links to comparable professional degree programs at the following peer institutions. In their focus on technology innovation, each program shares some similarities to the proposed MTM degree program.

- University of California, San Diego
- Johns Hopkins University
- University of Pennsylvania
- Stanford University
- Temple University
- University of Rochester
- University of Texas, Medical Branch
University of California, San Diego
Master of Engineering (M.Eng.) in Bioengineering
www.be.ucsd.edu/graduate_programs_master_eng_degree

The purpose of the Master of Engineering (M.Eng.) degree at UCSD is to prepare design and project engineers for careers in the medical and biological engineering industries. This program addresses both the technical and professional needs of today’s engineers and is intended for students who are primarily interested in engineering design, development, manufacturing, and management within an industrial or professional setting. This terminal professional degree is course-intensive and designed to be completed in one academic year of full-time study. The M.Eng. degree does not require a thesis and is designed for maximum flexibility to allow for a wide variety of professional career goals. M.Eng. students participate in a M.Eng. Graduate Industrial Training Project. The individualized project enhances significantly the professional development of M.Eng. students in preparation for leadership in the medical and biological engineering industries.

Johns Hopkins University
Master of Science in Engineering (MSE) in Bioengineering Innovation and Design
cbid.bme.jhu.edu/educational-programs/masters.php

Johns Hopkins University offers a full-time 12-month Master of Science in Engineering (MSE) in Bioengineering Innovation and Design. Students in the Center for Bioengineering Innovation and Design engage closely with clinicians, engineers, and experienced industry advisers to design, build, and test devices that solve significant healthcare needs. Also incorporated in the BME design curriculum is a focus on technology commercialization. Members of the student design teams interact with clinical and corporate sponsors and have experiences that promote the development of their leadership, communications, and marketing skills, thus helping to ensure graduates’ professional success.

CBID’s mission is to improve human health by developing medical devices that solve important clinical problems, educate a new generation of medical-device engineers and fellows, and facilitate technology transfer. CBID capitalizes on Johns Hopkins’ renowned strengths in biomedical engineering and medicine and connections with clinicians and industry. Through these relationships the center strives to bridge the gaps between education, research, clinical practice, and commercialization. CBID brings the products of students’ work from the bench, to the bedside, to the marketplace and creates revolutionary new products that solve complex, clinically-relevant medical problems. CBID allows the BME department to double the number of student design projects it takes on each year, enhance students’ hands-on learning experiences, and encourage the culture of entrepreneurship and collaboration, and, ultimately, improve human health.

Separately, Johns Hopkins also offers a traditional MSE in Biomedical Engineering (a two-year program with independent lab work).

University of Pennsylvania
Executive Master’s in Technology Management
www.seas.upenn.edu/education/professional-executive.php

The Executive Master’s in Technology Management (EMTM) program is designed for candidates who operate at the intersection of technology and business — those who need to keep up with technology that is constantly changing and who want the business insights to translate technological innovation into
commercial success. The EMTM is a two-year, weekend (Friday/Saturday) executive program. Separately, the university also offers a terminal M.S. in Bioengineering.

The student body represents experienced managers, IT professionals and engineers from technology sector organizations like HP, Boeing, Lockheed Martin, IBM, Intel, and SAP, as well as firms from the financial services, pharmaceuticals, consumer goods, and other arenas, including Vanguard, SEI, Merrill Lynch, Morgan Stanley, GSK, Merck, Bristol-Myers Squibb, Pfizer, Campbell Soup, and W.L. Gore.

**Stanford University**  
**Biodesign Program**  
[http://biodesign.stanford.edu/bdn/index.jsp](http://biodesign.stanford.edu/bdn/index.jsp)

The objective of the Stanford Biodesign program is to train students, fellows, and faculty in the “Biodesign Process”: a systematic approach to needs finding and the invention and implementation of new biomedical technologies. Key components of the program include Biodesign Innovation Fellowships; classes in med-tech innovation; mentoring of students and faculty in the technology-transfer process; career services for students interested in med-tech careers; and community educational events. The program offers various courses with the option for a Graduate Certificate, as well as the Biodesign Innovation Fellowship, a program in which fellows spend 10 months learning about med-tech innovation — with coursework, needs finding, and project work.

Similar to the proposed MTM program, Biodesign features multidisciplinary teams of four graduate and/or postgraduate engineers, business professionals, bioscientists, and physicians collaborating in a process involving clinical immersion, identification and verification of clinical problems, invention, prototyping, early-stage testing, and project planning. However, the Biodesign program is geared more toward professionals who already have several years of industry or clinical experience, whereas the MTM program is focused on recently graduated students and early-stage professionals. *Note that the BioDesign program does not grant a degree.*

**Master of Science in Medicine**  

The “Master’s of Medicine” (MOM) program is a new master’s degree program that provides Ph.D. candidates serious exposure to clinical medicine with a view to fostering translational research. The goal of the MOM program is to train a new generation of Ph.D. students about human biology and disease, making them better able to translate new scientific discoveries into useful medical advances. Students admitted to any of the Ph.D. programs offered at Stanford have the opportunity to apply for admission to this program on a competitive basis. The first group of MOM students was admitted in spring 2006.

In practice, the program extends the total time of training by about one year beyond the usual length of Ph.D. training. During their first two years MOM participants will take basic biomedical science courses with the School of Medicine’s M.D. students, as well as a seminar series dedicated to issues in translational medicine. This course schedule allows MOM students to concurrently undertake Ph.D. course requirements and lab rotations. By early in the second year, students will choose labs for thesis research and elect clinical mentors. The Master of Science in Medicine degree will be conferred with the Ph.D. degree upon each student's successful completion of her or his doctoral program. Note that this program lacks both the technical/engineering and business/leadership components present in the MTM program, and is only open to Stanford students enrolled in a Ph.D. program.
**Temple University**  
**Master of Science in Clinical Research and Translational Medicine**  
[Chpsw.temple.edu/publichealth/degrees-offered/graduate-programs/ms-clinical-research-and-translational-medicine](http://chpsw.temple.edu/publichealth/degrees-offered/graduate-programs/ms-clinical-research-and-translational-medicine)

The M.S. program in Clinical Research and Translational Medicine is a full-time program, which provides detailed training in the requirements for conducting clinical research and an understanding of the complex scientific, ethical, and regulatory issues associated with such research. This degree program addresses the increased emphasis on high-quality clinical research to help translate the findings of basic research into clinical care. The program is collaboratively offered by the College of Health Professions and Social Work and the School of Medicine. Applicants to the program must hold a baccalaureate in a clinical or basic science. The program curriculum includes core courses in the College of Health Professions and Social Work (12 semester hours) and the School of Medicine (9 semester hours), as well as elective courses in an area of research interest (9 semester hours), and a comprehensive research project (6 semester hours). The master’s thesis documents the independent research of the student and demonstrates mastery of her/his primary area of interest. Note that this program lacks both the technical/engineering and business/leadership components present in the MTM program, and also includes a thesis as opposed to a team-based capstone project.

**University of Rochester**  
**Master of Science in Medical Technology Innovation**  
[www.urmc.rochester.edu/bme](http://www.urmc.rochester.edu/bme)

The mission of the University of Rochester Master of Science in Medical Technology Innovation is to create innovative device solutions to focused clinical problems through a cross-disciplinary collaboration. The program intends to affect directly improvement in patient care and outcomes, while promoting a unique education in both clinical care and bioengineering design. At the moment, the primary focus is on cardiovascular devices, but the program will be expanded to other surgical specialties in the coming year, including general surgery and orthopaedics. The curriculum includes eight weeks of clinical immersion (“Clinical Practicum”) in the summer, followed by two semesters of coursework and design/project work (“Design Practicum”). Over the course of the program, students are exposed to aspects of clinical needs finding, biology, entrepreneurship, engineering, regulatory issues, reimbursement, and intellectual property.

**University of Texas, Medical Branch**  
**Clinical Science Program (Ph.D. or M.S.)**  
[www.its.utmb.edu/learning/degree_programs/degreePrograms.html](http://www.its.utmb.edu/learning/degree_programs/degreePrograms.html)

The Graduate Program in Clinical Science provides advanced education for healthcare professionals who wish to conduct research in human subjects and populations. This multi-disciplinary graduate program leads to the Ph.D. or M.S. degree. It has enrolled 60 students since 2000, and has 41 graduates and 14 current students. Introductory courses in biostatistics, epidemiology, public health, and research design and methods are required, as well as a seminar course. Additional course work and original research experience is provided within four specialized tracks: (1) the Clinical Investigation track, (2) the Health Services Research Track, (3) the Biostatistics Track, and (4) the Health Informatics Track. The “Clinical Investigation Track” is most similar to the MTM program, as it emphasizes patient-oriented research, including understanding and application of basic biological sciences, laboratory methods used in clinical research, biostatistics, epidemiology, ethics in clinical investigation, design of clinical studies, and new drug development. Graduates of the Clinical Investigation Track will be equipped to translate basic science
knowledge to the development of new therapeutic and preventive approaches. This includes research into basic mechanisms of disease and clinical trials of new therapies.

According to available program information, the Clinical Science Program may interest a variety of individuals who wish to pursue advanced training in clinical research, including junior-faculty, senior research fellows, clinical fellows, and medical students in a combined degree program (M.D.-Ph.D. or M.D.-M.S.). Graduates are positioned to become future leaders in academic medicine and clinical/translational research. The M.S. version of the program is two years long (36 semester units). Note that the Clinical Science Program lacks both the technical/engineering and business/leadership components present in the MTM program, and also includes a thesis as opposed to a team-based capstone project.
APPENDIX K

PLANNING BUDGET

APPENDIX FOR A PROPOSAL FOR A PROGRAM OF GRADUATE STUDIES FOR THE JOINT MASTER OF TRANSLATIONAL MEDICINE (MTM) DEGREE

UNIVERSITY OF CALIFORNIA, BERKELEY – UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
NOVEMBER 16, 2011

APPENDIX K — TABLE OF CONTENTS
(3 pages total with this cover sheet)

This appendix is a spreadsheet detailing the budget for the first three years of the MTM degree program at UC Berkeley and UCSF. The approval of the PDST — including the required form stating the proposed PDST levels for 2013-14 and our plans to ensure student access, affordability, and diversity — is proceeding separately, pending the decision of the Graduate Council.
Projected fees and program-delivery costs

Funds will be balanced on a yearly basis according to the campus where each core course is delivered. Numbers in this version of the budget are derived from the "Course-delivery costs" spreadsheet.

You are expected to pay the following fees in the current 2015-16 academic year:

- UCSF registration fees
- Student services fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs to students:

- Total fees for a UCSF-based student: $44,892
- Total fees for a UCSF-based student: $49,137
- Total fees for a UCSF-based student: $51,683

Costs to UC Berkeley/UCSF:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
- Class pass fee for transit

Costs:

- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs
- Program direct costs

UC & costs incurred by the Berkeley/UCSF PDST fund:

- Tuition fee
- UC registration fee
- Graduate student association fee
- Campus fees
- Class pass fee for transit
- Student services fee
- Campus fees
## Details of core-course delivery costs

<table>
<thead>
<tr>
<th>Core MTM courses</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number of students</td>
<td>semester units per student</td>
<td>estimated cost (20 students)</td>
</tr>
<tr>
<td>UCB Engineering 271 - Leadership 1</td>
<td>3.00</td>
<td>$35,100</td>
<td>$46,999</td>
</tr>
<tr>
<td>Engineering 272 - Leadership 2</td>
<td>3.00</td>
<td>$35,100</td>
<td>$46,999</td>
</tr>
<tr>
<td>BioE 290X - Ethical and Social Issues in Translational Medicine</td>
<td>1.00</td>
<td>$11,700</td>
<td>$15,666</td>
</tr>
<tr>
<td>UCB Capstone</td>
<td>3.00</td>
<td>$12,860</td>
<td>$18,055</td>
</tr>
</tbody>
</table>

Subtotal: 10.00 | $94,760 | $127,720 | $152,831 |

**UCSF (converted to semester units)**

| Epi 150.03 - Designing Clinical Research | 1.33    | $29,960 | $40,506 | $48,608 | Clinical |
| Epi 205 - Clinical Trials               | 1.00    | $19,036 | $25,737 | $30,884 | Clinical |
| Anti-Medical School: Translational Challenges in Medicine | 0.67    | $15,323 | $15,782 | $16,256 | Bioengineering |
| Translational Challenges in Diagnostics, Devices, and Therapeutics | 1.33    | $30,645 | $31,564 | $32,511 | Bioengineering |
| UCSF Capstone                          | 3.00    | $12,860 | $18,055 | $22,500 | Bioengineering OR ch Already included in "Capstone project support" budget line item |

Subtotal: 7.33 | $107,824 | $131,645 | $150,759 |

**TOTAL**: 17.33 core units

NOTE: Proposed “Health Care Cost Analysis” course will also eventually be core, but does not yet exist (likely ~2 units of “Clinical”)

Epi 213 (Decision and Cost-Effectiveness Analysis in Medicine) will continue to be used as alternative until Cost Analysis course is established

<table>
<thead>
<tr>
<th>Available POST funds for course delivery</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>available amount</td>
<td>$25,720</td>
<td>$25,720</td>
<td>$36,111</td>
</tr>
<tr>
<td>amount used in above model</td>
<td>$261,506</td>
<td>$259,365</td>
<td>$391,597</td>
</tr>
<tr>
<td>potential total surplus/deficit</td>
<td>($94,959)</td>
<td>$2,141</td>
<td>$88,007</td>
</tr>
</tbody>
</table>

Any remaining surplus from the PDST will be split on an annual basis according to the division of elective credit hours between the two campuses.

**OTHER REFERENCE DATA**

<table>
<thead>
<tr>
<th>UCB estimated cost of leadership courses</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
<th>Estimated inflation %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership courses cost per unit</td>
<td>$85</td>
<td>$603</td>
<td>$621</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UCSF estimated teaching costs</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 FTE base salary (16 qtr unit load)</td>
<td>$200,000</td>
<td>$206,000</td>
<td>$212,180</td>
</tr>
<tr>
<td>benefits</td>
<td>$44,000</td>
<td>$45,320</td>
<td>$46,680</td>
</tr>
<tr>
<td>GAEI</td>
<td>$1,160</td>
<td>$1,195</td>
<td>$1,231</td>
</tr>
<tr>
<td>TOTAL 1.00 FTE (16 qtr unit load)</td>
<td>$245,160</td>
<td>$252,515</td>
<td>$268,990</td>
</tr>
<tr>
<td>1.00 FTE per quarter unit</td>
<td>$15,323</td>
<td>$15,782</td>
<td>$16,256</td>
</tr>
<tr>
<td>1.00 FTE per semester unit</td>
<td>$22,984</td>
<td>$23,673</td>
<td>$24,383</td>
</tr>
</tbody>
</table>

**Epi (CTSI) course costs**

<table>
<thead>
<tr>
<th>Epi 150.03 - Designing Clinical Research (per student)</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,498</td>
<td>$1,558</td>
<td>$1,620</td>
<td>4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Epi 205 - Clinical Trials (per student)</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>$952</td>
<td>$990</td>
<td>$1,029</td>
<td>4%</td>
</tr>
</tbody>
</table>