UNIVERSITY OF CALIFORNIA, MERCED

UC Merced
Health Sciences and Medical Education

Embracing Collaboration, Innovation, and Technology
Creating Community Partnerships

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Recommendations From:

UC MERCED PLANNING GROUPS

HEALTH SCIENCES/MEDICAL SCIENCES

BIOMEDICAL and SYSTEMS BIOLOGY
RESEARCH INSTITUTE

Prepared by:
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UC Merced Health Sciences and Medical Education Planning for the San Joaquin Valley

UC Merced, the 10th campus of the University of California, opened its doors with a 55 member faculty to a highly diverse group of 850 undergraduate and graduate students in Fall 2005. While the Schools of Engineering, Natural Sciences and Social Sciences/Humanities/Arts serve as academic homes for the faculty, UC Merced's stellar research programs transcend school boundaries, reflecting the inter-disciplinary academic theme of the campus. Early campus research emphases in environmental sciences and world cultures have now expanded to include biological sciences, social sciences, public policy and management. A School of Management is planned to address policy and economic issues in the region and beyond. UC Merced is in the process of developing health science related programs and planning graduate medical education programs that will eventually lead to a School of Medicine. The challenges associated with California's changing demographics (aging, increasing diversity, and chronic disease in a population that is growing at twice the national average) are amplified in the San Joaquin Valley with its high proportion of underserved communities. Opportunities to expand training for health professional careers are needed to address the shortage of health care providers in the region and the state of California. UC Merced plans to address this gap by developing stellar biomedical and clinical sciences research program and innovative medical education programs.

Health sciences and medical education programs in the UC system are built upon outstanding research programs in basic and applied biomedical sciences and innovative curricula to train students in state-of-the-art patient care. It is increasingly recognized that solutions to complex problems, including many types of disease, will only be solvable by inter-disciplinary research teams. Development of biomedical research and health care training programs for the 21st century must be adapted to the changing face of research and heath care. Team-based approaches for patient care are on the rise and any comprehensive community health program will involve many components beyond the treatment of patients in clinics. UC Merced's academic environment encourages cross-disciplinary research; it is not unusual for faculty in basic sciences and engineering to be working with faculty in social sciences. The absence of discipline based departments and the emerging infrastructure that encourages collaboration and cooperation across disciplines is one of the hallmarks of UC Merced's academic programs. There is a campus commitment to development and implementation of innovative curriculum and pedagogies at the undergraduate and graduate levels. These commitments and tradition will extend to medical education programs that train the next generation of health care professionals. The evolution of health sciences and graduate medical education programs at UC Merced will be based upon programmatic efforts in two areas: development of state-of-the-art biomedical and clinical research and development of innovative medical education training programs.

Biomedical and Clinical Research

Research excellence is an essential component of health sciences and graduate medical education. Outstanding biomedical and clinical research programs attract the best faculty and students. Advances through biomedical and clinical research lead to increased understanding of the causes, treatment and prevention of human diseases. Understanding disease and its treatment in the context of demographics of the region leads to improved regional health care. Research experiences for students, whether it is in a laboratory, community, clinic, or other public sectors, develop skills in critical thinking, logical approaches to inquiry and discovery, and create a culture of life-long learning. Biomedical and clinical research at UC Merced will be developed under the umbrella of the Biomedical and Systems Biology Research Institute. This institute will build upon academic resources for health sciences that evolve at the UC Merced campus (Schools of Natural Sciences, Social Sciences/Humanities and the Arts, Management, and Engineering) and leverage clinical research carried out at UCSF-Fresno, UC Merced and other community partners. It will serve as the integrator between state-of-the-art biomedical and clinical research, creating a strong translational research component to addresses the health care challenges in the region. The integration of basic, applied and clinical research fundamentals will foster stellar biomedical and community health research, spawning discoveries, technological advances, community and public health strategies to address health disparities, encourage cultural competency, and importantly, impact the region in which the research is carried out. ***The development of the Biomedical and Systems Biology Research Institute at UC Merced is an exciting and essential component of building health sciences and medical education programs for the Valley.***

Medical Education Planning

The University of California recently completed comprehensive analysis of California's short- and long-term health needs. The shortage of health care providers and the state's changing demographics, including aging, increasing diversity, and chronic disease, in a population that is growing at twice the national average, mandate expanded health career training opportunities. Recent analyses of the health care status of the San Joaquin Valley revealed wide-spread disparities in health care access and health care provider shortages across the region relative to the state of California. A number of recommendations to address these disparities have been suggested, including increasing training opportunities for physicians and other health care professionals in underserved regions of California. Development of a medical education program in the San Joaquin Valley will provide training opportunities for new entrants to the physician workforce. A medical school in the region will attract and retain students and physicians into the San Joaquin Valley and bring students from underrepresented groups into medicine. A primary goal of the UC Merced medical education program is to increase the numbers of health care professionals practicing in the San Joaquin Valley, particularly from groups that are not traditionally represented in medicine. A University of California School of Medicine that leverages medical education opportunities in the communities it serves will raise the level of care across the valley, change perceptions about health care quality, keep health care

dollars in the region, and serve as an economic engine for the San Joaquin Valley. The School of Medicine at UC Merced will embrace collaboration, innovation, and technology, principles which are at the core of the academic mission of the UC Merced campus.

In summary, the *mission* of the proposed UC Merced School of Medicine is to advance the health and well being of the public with a focus on serving the needs of Central California. The *vision* for the medical school is to lead the nation in interdisciplinary education, research and patient care using collaboration, innovation, and discovery in the training of physicians and other health professionals. The *signature* of the UC Merced School of Medicine is to create healthy communities through campus partnerships. ***The UC Merced School of Medicine will provide avenues for highly diverse students and others throughout the state and nation to enter health care professions in the region.***

RECOMMENDATIONS FOR NEXT STEPS TO BUILD HEALTH SCIENCES AND MEDICAL EDUCATION

STEP 1 Understanding the medical school education model

A. Develop a feasibility plan for the distributed/regional model of medical education.

- Develop a business and financial plan for the proposed model of medical education for the Valley.
- Examine regional models for medical education elsewhere in the nation to understand the advantages and challenges of implementation and maintenance
- Consider regional models in the specific context of health care financing in California
- Establish the timeline to create a medical education program in the Valley, including academic, financial and community partnership goals.

B. Expand the biomedical research base (basic, applied and translational) that is essential for UC-based graduate medical education and a School of Medicine in the Valley

- Integrate and expand research efforts in the Biomedical and Systems Biology Research Institute –UC Merced with graduate medical education training.
- Work toward developing a clinical translational research base required for a UC Merced medical school by establishing collaborative applied clinical research programs with community health care partners.

STEP 2 Academic planning

- Work with UC Merced Senate to move towards developing a School of Medicine
- Continue to develop curricular paradigms for graduate medical education based on innovative basic and clinical training
- Explore how emerging telehealth technologies using high-performance computing and communications resources can be incorporated into the regional model of medical education at UC Merced

STEP 3 Build community relationships to engage community partners in medical education training

- Communicate plans for medical education in the Valley to health care partners
- Engage and inspire community leaders to foster a grass-roots effort in creating partnerships to build an innovative and creative medical education program for the Valley

PROPOSAL FOR A UC MERCED INSTITUTE

Biomedical and Systems Biology Research Institute

PROPOSAL PREPARED BY A FACULTY TASK FORCE

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In Consultation with
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EXECUTIVE SUMMARY

The proposal to develop an inter-disciplinary Biomedical and Systems Biology Research (BSBR) Institute based on systems biology approaches is an important component of the inter-disciplinary academic environment of UC Merced and is fundamental for building health sciences Systems biology is a new concept for life sciences that uses multi-disciplinary approaches and advanced technology to elucidate the function of complex biological phenomena, and then uses this knowledge for practical applications. The systems biology emphasis of the proposed Institute will create an environment for faculty and students from multiple disciplines to apply biological and technologic principles to address complex health problems. This Institute builds on the stellar technologic base in biomedical research that is evolving at UC Merced. The Institute is envisioned to form one of the essential research arms of medical education as programs for health professionals develop at UC Merced.

The purpose of this report is to draw attention to the need and promise of a systems biology-based research institute, to conceptualize an administrative structure and to identify a plan to build toward its development. The BSBR Institute is envisioned to have a faculty director, 12-15 core faculty, and a larger number of affiliated faculty members with research interests that fall within the scope of the Institute's mission. The Institute is built around technologic centers of innovative research and instrumentation that can be accessed by faculty and students campus-wide and by collaborators at other institutions. Centers of excellence that support the clinical and translational research for health and biomedical sciences may also be part of this institute. A 5-year plan with extensive fundraising efforts is envisioned. The concept proposal was developed by an inter-disciplinary cross-school faculty task force in consultation with the Dean of the School of Natural Sciences.

I. Vision

A central goal of the new University of California campus at Merced is to address the critical challenges facing the Central Valley, the state of California, the country and the world as we enter the 21st century. UC Merced's two existing institutes: the Sierra Nevada Research Institute and the World Cultures Institute address the key challenges of sustaining the environment and promoting multicultural diversity and cross-cultural understanding, respectively. A new institute at UC Merced focused on the critical question of sustainable energy is in the planning stages. These institutes cover many important challenges, but do not directly bear upon one of the most difficult and urgent problems in the San Joaquin Valley: human health and well-being. The San Joaquin Valley communities are medically underserved and have a higher incidence of health problems than other regions of California. Addressing these medical needs goes well beyond just building and staffing new hospitals. A central lesson in the history of health care is that improving the well-being of a community requires a systemic approach, including facilities, healthcare providers, outreach, educational and research institutions. The evidence for the success of this approach is the dramatic impact that the major university-based health centers have had on their communities—for example Johns Hopkins Medical School and UC San Francisco. A long-term goal of the new UC campus in Merced is to be a leader in a San Joaquin Valley healthcare and health sciences alliance, and to improve dramatically the well-being of the diverse San Joaquin Valley communities. As a first step towards this goal, UC Merced is proposing to develop a research institute (Biomedical and Systems Biology Research; BSBR) in the life sciences that will form the academic foundation for health science programs and future medical education professional schools. Development of a stellar research base to support biomedical programs is essential for medical education programs at UC Merced. To be successful, such an Institute must have a clear organizing principle that draws together its faculty and students.

Systems biology is a new approach for life sciences that uses multi-disciplinary approaches and advanced technology to elucidate the function of complex biological phenomena, and then uses this knowledge for practical applications. Examples include developing better treatments for human disease and better strategies to understand health-environment interactions. We propose that the systems biology research focus of the BRSB Institute will emphasize biomedical sciences. The goal of the proposed BRSB Institute is to establish programs of excellence in this new and exciting research area at UC Merced. The importance of systems biology to address complex life science problems is seen in the increasing emphasis in systems biology in the UC-system. Several campuses have an effort in this area, albeit not all are focused in biomedical sciences. An inter-campus program, QB3, involving UCSF, UCB and UCSC, brings together expertise from three campuses to apply quantitative biology for complex problem solving. A systems biology institute at UC Merced will facilitate inter-campus interactions and highlight UC Merced's interest and commitment in the new biology. It will provide a collaborative forum for community partners interested in biomedical and health sciences.

This inter-disciplinary Institute will be home to biologists, mathematicians, engineers, biophysicists, computer scientists, chemists and physicians who work at the interface of life sciences, engineering and computer science. Faculty, students and researchers from these different disciplines will develop new technologies to identify and measure the fundamental molecular components of biological processes, elucidate the relations between these components, and ultimately develop models to simulate the behavior of the system as a whole. The Institute would house Centers of Excellence (interfacing with campus wide core technologies) such as proteomics, genomics and gene manipulation, imaging, research computing, computational science and modeling, as well as advanced instrumentation development based in nanotechnology and materials science. These core capabilities will enable scientists to perform quantitative measurements at the level of single living cells, and then use these data to create computational models to predict the behavior of biological processes. The core technologies of the Institute, coupled with the increasing worldwide demand for better biomedical assays, will undoubtedly create and attract new biotechnology and instrumentation companies in the area. Thus, the Institute promises to become an economic driver for biotechnology in the region. The development of this multidisciplinary Institute will place UC Merced among a small group of prestigious institutions with multidisciplinary life sciences programs, including MIT, Harvard, and the UC multi-disciplinary research program, QB3. Since the Institute is envisioned as a first step in building a health sciences program at UC Merced, the initial areas of study will be oriented towards understanding complex factors contributing to human health and well-being.

II. Value to UC Merced

The proposed institute will bring multifold benefits to UC Merced. Most importantly, it will provide a focus for program development, targeted hiring and fund raising in an important, emerging scientific area. The institute will synergize strongly with the undergraduate and graduate life science and bioengineering programs and will build upon the research interests of the current faculty and the multidisciplinary principles upon which UC Merced is being developed. The institute will enhance UC Merced in the following ways:

Scientific Prestige

Developing a distinct and prestigious reputation of scientific excellence is central to the long-term success of UC Merced. Although the strengths of the individual faculty are a key ingredient for success, the relatively small size of the UC Merced faculty in the near term mandates a focus for scientific programs to gain national and international recognition. This focus is particularly important given the strong research reputations of UC Merced's nine sister campuses. UC Merced has made good progress in developing such programmatic focus in the areas of environmental science, through the Sierra Nevada Research Institute, and in energy science, through the proposed Energy Research Institute. Systems biology offers an excellent opportunity for UC Merced to establish a research program of comparable size and strength to the emerging programs at well-established universities and research institutes. Although these other programs are beginning with broader research bases and facilities, UC Merced has the unique

opportunity to focus its hiring priorities in this emerging discipline and coordinate this programmatic focus with the Schools of Natural Sciences, Engineering and Social Sciences, Humanities and Arts. The highly multidisciplinary nature of the proposed Institute can attract excellent faculty from many disciplines, including biology, chemistry, engineering, and computer science.

Enhanced Educational Programs

The undergraduate Biological Sciences, Human Biology, and Bioengineering majors and the graduate programs in Quantitative and Systems Biology and Bioengineering will be important beneficiaries of the proposed institute. The undergraduate biology degrees were designed following the recommendations of the 2003 NRC report *BIO2010: Transforming Undergraduate Education for Future Research Biologists* that emphasizes mathematics, computations, and the physical sciences, as well as the importance of undergraduate research opportunities, for all undergraduate bioscience majors. The proposed Institute will provide research opportunities for UC Merced undergraduates that will undoubtedly become one of the signature elements of the undergraduate programs at UC Merced. The approaches and technologies used at the Institute will provide undergraduates with unique skills that will open doors to numerous job opportunities in the biotechnology industry and will prepare students for a variety of professional careers. Students will gain experience using state-of-the-art technologies for studying biological systems and, importantly, gain appreciation of the power of predictive modeling in studying these systems--some of the same strategies that have been at the forefront of advances in molecular medicine and human health care. These enabling technologies include proteomics, genomics and gene manipulation, imaging, research computing, computational science and modeling, nanotechnology and instrumentation development. Emphases in the School of Engineering including nanotechnology, modeling, electrical engineering and computer science will leverage the strong biological science theme of this institute.

Fundraising

UC Merced must develop a clear and focused set of research programs to be successful in strategic fundraising from private individuals, foundations, and federal agencies. The campus' long-term commitment to specific research areas will increase the likelihood that these programs gain wide recognition. Biomedical and systems biology would offer many advantages as one of UC Merced's strategic programs. First, it is a discipline whose research products have broad applicability, ranging from medicine, to agriculture, to environmental restoration. Hence, components of the proposed Institute could fit the interests of many foundations and agencies. Second, as a highly multidisciplinary program, systems biology matches well the interests of many funding sources that sponsor cross-disciplinary research. Finally, the Institute will become a likely beneficiary of gifts from companies interested in seeing their technologies applied in advanced biological research.

III. Value to San Joaquin Valley Community

While the Institute has numerous benefits for UC Merced, it will also provide many benefits to the San Joaquin Valley. The Institute is envisioned as an "open" facility that welcome visits from local schools and organizations, and collaborations with researchers at other institutions. It will host educational events to meet the needs and interests of the local population. In this role, the Institute can act as a recruitment vehicle to interest San Joaquin Valley students, state-wide, national and international students in careers in health and biology. It will serve as an outreach mechanism to inform the local population of the value that health sciences and biomedical research brings to the region. Moreover, the Institute will provide a venue for local businesses and entrepreneurs to learn about UC Merced biotechnologies and meet interested faculty. The Centers of Excellence will be open to investigators at other institutions to carry out research, facilitate recruiting, and establish collaborations to address complex health and life science problems. Importantly, it will provide opportunities for many community partners to participate in and contribute to biomedical and health sciences research that impact the communities they serve.

Improved Healthcare and Health Sciences

The San Joaquin Valley communities face many stresses and challenges, including a dearth of targeted research focused on community health care needs and shortages of healthcare providers. Comprehensively addressing the health needs of a community is a multi-faceted and progressive endeavor. While physicians, nurses, dieticians, counselors, and other health professionals that directly provide health services are most visible, a large research and training infrastructure underlies premier health care systems. In particular, prestigious research programs in basic and applied health sciences are essential components of the top tier medical centers. Numerous collaborations between UC Merced faculty and faculty at UCSF-Fresno and CSU-Fresno are already emerging in both research and education related to health sciences. The proposed Institute will be an incubator for state-of-the-art research programs - a first step in creating world-class health sciences facilities and programs for the San Joaquin Valley.

Economic Development

The core technologies of the Institute, coupled with the increasing demand for new technologies, will lead to creation of biotechnology and instrumentation companies in the area, and will attract new companies to the area. Thus, the Institute could become a major economic driver for biotechnology in the region. Indeed, 1of 5 biotechnology firms in California were founded by a UC scientist and most are located within close proximity to a UC campus. Since the Institute is envisioned as a foundation for building health sciences at UC Merced, it is likely that initial areas of study will be oriented towards understanding health-related biological processes—a historically proven successful area for the biotechnology industry. One of the missions of the Institute will be to host programs and visits for business leaders and entrepreneurs to educate them about technologies and conversely, to encourage opportunities for collaboration with corporate and educational institutions and UC Merced faculty.

Institutional Outreach

It is increasingly recognized that treating the symptoms of a disease cannot be dissociated from an understanding and appreciation of contributing factors arising from the individual's socio-economic, cultural, and ethnic background. The demographics of the region and attendant health issues provide unique opportunities to create education programs that will prepare students for the communities in which they will live and in some cases, serve. The Institute can be an educational resource on the unique health challenges of the San Joaquin Valley. Further, by hosting research conferences, the institute can increase the awareness of the health issues in the San Joaquin Valley to the worldwide scientific community. Conversely, the multicultural setting will allow the Institute to initiate research programs focusing on the ethnic, cultural and societal factors that influence disease predisposition, disease progression, response to treatments, and well-being (social medicine). Social medicine is anticipated to be a major component in medical education at UC Merced. The World Cultures Institute at UC Merced will link with the institute through a common program of human biology to enable UC researchers, students and the community to impact the communities in which they live. Thus, while the institute will be housed within a "bricks and mortar" structure, the programs will extend well beyond these walls, both reaching out and bringing in the talent and resources needed to solve complex problems.

IV. Faculty

The institute is envisioned to encompass about 15-20 faculty from several disciplinary areas, including biology, math, physics, chemistry and engineering. Opportunities also exist for collaboration with the faculty of the World Cultures Institute, especially on issues related to community health and well-being, and other institutes that develop at UC Merced and other higher education institutions in the Valley.

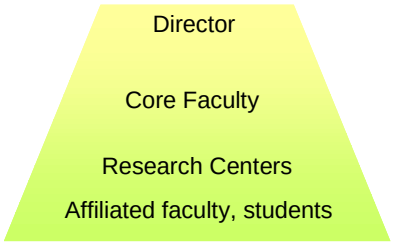
Currently, a number of faculty in the Schools of Natural Sciences and Engineering have research areas consistent with the Institute's initial research focus on human health-related biomedical research (Table 1 -Appendix 1). Like the other UC Merced institutes, the BSBR Institute will develop further as faculty members are hired for the campus' academic programs. Cell fate decisions are anticipated to be an early emphasis of biomedical research conducted in the BSBR Institute. In Natural Sciences, potential faculty members that might be included in this Institute are included in the School's strategic plan, within the hires planned for biology, math, physics and chemistry. We envision that development of a medical school will provide additional opportunities for faculty in clinical sciences to interface with biomedical scientists working in this institute. The School of Engineering is hiring additional faculty whose research interests may lie in this area as well.

The organizational structure of the Institute will include a group of Core Faculty (12-15) who would set the research directions of the Institute and serve as the planning group. These individuals would be responsible for the core technologies and centers of excellence required to support the Institute's research agenda. There will be multiple mechanisms for faculty across the campus and for community partners to be involved in

this Institute. Faculty can access technologies in the centers within the Institute (see following section), collaborate with members, and to the extent the research of the individual meshes with the research focus of the Institute, become a member of the Institute.

V. Proposed Institute Organization

The Institute will have a "center-based" organizational structure to address the special challenges encountered by multidisciplinary academic research institutes. While an



Institute is comprised of individual faculty with excellent independent research programs in the scope of biomedical research, the value of the research institute derives from the synergism and collaboration between institute members. In the proposed structure, the Institute would house multiple "centers" organized around the critical disciplines, such as advanced analytical methods, bioengineering, computational biology, genomics, etc. These research centers would not be administrative units nor be involved in resource allocation. Instead, each center would act as a "clearing house" for disciplinary expertise and research interests of its member faculty. The research centers would be led, on a rotating basis, by member faculty who would work with the Institute director to identify collaborative research opportunities and plan Institute events. Additionally, the Institute and center directors would develop plans for new centers within the institute. It is likely that several of these centers will form the basis for some of the campus instrumentation cores. This organizational structure provides agility need to develop research directions, while maintaining a diversity of ideas and expertise in decision-making.

VI. Facilities

The Institute will be comprised of Core faculty in the Schools of Engineering and Natural Sciences, and potentially some faculty members from Social Sciences/Humanities/Arts whose research fits the emphasis areas of the Institute. Initially the Institute will be located in the Science and Engineering building or at Castle at UC Merced, with a long-term goal of residing in its own facility (funded mainly through private support, and potentially indirect cost recovery receipts). Early plans for the facility include specialized research facilities (Centers of Excellence) that also serve the entire campus, as well as conference rooms and an auditorium for institute events.

The Institute's research efforts will be supported heavily through several core research facilities, which will be integrated with, and/or serve as campus cores.

VII. Development of the Institute

A key initial step in the development of the Institute is to recruit a senior leader in the field of Systems Biology. This leader will begin to work with a core group of existing faculty to define further the mission of the institute and to work with the Schools to

recruit additional faculty, using the process defined by the Provost for 2006 strategic planning. The Institute will require development of research cores/centers of excellence within the Institute. Fundraising for these cores is underway, and funds have been received for the Genome Analysis Core. Other research cores are likely to include molecular cell imaging/analysis, structural biology, bioinformatics and statistics.

Each core is a specialized research facility, equipped with the state-of-the-art equipment to carry out analysis to support the Institute's research goals, and broadly, the campus needs. The Cores are envisioned to fall within the core research facilities planned for UC Merced, with access for all UC Merced faculty and eligible affiliates. The cores will be housed initially within UC Merced's existing and planned facilities, including the Castle Building.

VIII. Resources

It is recognized that developing the institute will be at least a five year effort. The steps (several undertaken simultaneously) for developing the institute are as follows:

1. Recruit and appoint Director (from School Systems Biology FTE)
2. Identify current and future faculty who will be initial members of the institute
3. Continue active fund raising for Centers of Excellence
4. Identify location of administrative offices of institute within Science and Engineering I (SE1) or Castle.
5. Seek funds for an Institute building. The Dean of Natural Sciences is actively pursuing strategies for building development funds.

The Institute will be supported by the campus, research grants and fund raising efforts. Campus ftes allocated to the Schools will be the source of building the research programs of the institute. Graduate students enrolled in existing graduate programs and undergraduates in Science and Engineering majors will use the centers as they work with faculty advisors throughout the campus. It is anticipated that eventually portions of the indirect costs will be returned the Institutes and the Schools. These funds will be used to defray partially the cost of operations. Fund raising from private sources is anticipated to be a major part of the development of the Institute.

Fundraising targets for the Institute are shown below.

Table 1 - Fundraising Targets

Establishment of Research Cores	5,000,000
Endowed Chairs(5)	3,500,000
Operating Endowment (initial staffing)	1,250,000
Building and basic instrumentation	$70,000,000

Fundraising for the Centers is already underway with a $500,000 gift pledged to establish the Genome Center and $1,000,000 for an endowed chair supporting research in systems biology.

Endowed chairs are planned to support the faculty leads of major research areas and the Institute Director. The operating endowment will be used to support the Institute's administrative staff and operating costs, including maintenance of the core facilities. The Institute will also receive revenue from a portion of indirect cost return.
Institutes are typically provided some operating support from indirect cost recovery proceeds. These funds support the general categories of overhead – facilities and administration. At an appropriate time, a request will be made for these resources.

Appendix 1. Biomedical Sciences and Systems Biology Research Institute

Table 2 - Potential Faculty including planning AY2005-20 hires in Natural Science and Engineering with potential ties to the institute.

Maria Pallavicini (NS)	Stem cell biology/cell fate decisions
Michael Colvin (NS)	Biological systems modeling
David Ojcius(NS)	Cellular pathogenic interactions
Miriam Barlow (NS)	Evolution of antibiotic resistance
Arnold Kim (NS)	Mathematics for biological problems
Henry J. Forman (NS)	Redox regulation of signal transduction pathways
Jennifer Manilay (NS)	Developmental immunology
Matt Meyer (NS)	Bio-organic synthesis
AY ’05-’06 recruit (NS)	Stem cells
AY ’05-’06 recruit (NS)	Complex disease
Kara McCloskey (Eng)	Tissue Engineering
Bioengineering recruits (Eng)	To be determined

Medical Education in the San Joaquin Valley

RECOMMENDATIONS FROM
UC Merced Planning Group on Health Sciences/Medical Sciences
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Summary By
Maria Pallavicini
Dean, School of Natural Sciences
October 30, 2005

Members of the Health Sciences/Medical Sciences Planning Group

Name	Title	Department Affiliations	Institution
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EXECUTIVE SUMMARY

A planning group was constituted by Provost/Executive Vice Chancellor David Ashley to consider planning for health sciences and medical education at UC Merced. The UC Merced Planning Group on Health Sciences/Medical Science was comprised of visionary medical educators, community leaders, and faculty members from UC Merced and the Schools of Medicine at UC San Francisco and at UC Davis, UCSF-Fresno, and a number of consultants from elsewhere in the country. The Planning group considered the health care challenges facing the San Joaquin Valley and California, recommendations from advisory groups on strategies to alleviate the health care challenges, the unique inter-disciplinary environment at UC Merced, its blank slate for curriculum innovation and projected growth, and health care resources existing in the Valley. Considering these challenges, the Planning Group focused its recommendations on a medical education program. The planning group envisions a medical education program that integrates UC Merced's inter-disciplinary academic environment with community partnerships across the San Joaquin Valley (particularly in Fresno, Merced, and Modesto). A regional distributed model of medical education based on partnerships with community health providers in the Valley is recommended as a high priority. Students will receive training at UC Merced and at clinical training sites in the region, particularly Fresno. An administrative structure is envisioned to ensure development of three major components of the medical education program: biomedical-health sciences, social medicine and community partnerships. A primary goal of the UC Merced medical education program is to increase the numbers of health care professionals practicing in the San Joaquin Valley, in particular those from groups that are traditionally under- represented in medicine. A University of California School of Medicine that leverages medical education opportunities in the communities it serves will raise the level of care across the Valley, change perceptions about health care quality, keep health care dollars in the region, and serve as an economic engine for the San Joaquin Valley.

PART I: INTRODUCTION AND OVERVIEW

A. PURPOSE OF REPORT

In 2004, UC Merced Provost and Executive Vice Chancellor, David Ashley constituted a Health Sciences/Medical Sciences Planning Group to 'chart a course' for investing in a "health sciences presence worthy of both the Central Valley and the University of California". The Planning Group was comprised of visionary medical educators, community leaders, and faculty members from UC Merced and the Schools of Medicine at UC San Francisco and UC Davis, and a number of consultants from elsewhere in the country. The Planning Group began the process by first considering the health care challenges of the region and then focused on the need for medical education training opportunities in the San Joaquin Valley. They place a high level of importance on understanding the ethnic, cultural and societal factors that influence disease predisposition, disease progression, response to treatments, and well-being (social medicine). The Planning Group recognizes that building health sciences as an important component of developing a UC-quality medical education program. This effort is being developed under the auspices of the proposed Biomedical Sciences and System Biology Research Institute. The Planning Group took advantage of the "blank slate" at UC Merced to design a medical education program that begins to address some of the health care access needs of the San Joaquin valley. Several models were discussed, including a traditional teaching hospital based model and using other UC medical schools to train first and second year students followed by clerkships and rotations in the Valley. While the UC Merced Planning Group on Health Sciences/Medical Sciences group recognizes the critical need for programs in allied health; this report reflects their deliberations for medical school academic programs for physicians. ***The envisioned medical education program is based on UC Merced's unique inter-disciplinary academic environment and community partnerships that leverage health care resources across the San Joaquin Valley (particularly in Fresno, Merced, and Modesto, as well as in rural area clinics).***

The intent of this report is two fold: first to lay the groundwork to develop a medical school in the San Joaquin Valley, and second to describe the medical academic program recommended by the Planning Group. A common vision for the medical school by stakeholders in the Valley is essential to jointly build and develop a program that leverages resources, a key to this new initiative. ***Collaboration and cooperation of all stakeholders is required to meet the increasing health care needs of an aging, ethnically diverse population in one of the fastest growing regions in California. These efforts will undoubtedly improve the lives of all San Joaquin Valley residents.***

B. STATUS OF HEALTH CARE IN THE VALLEY

The San Joaquin Valley located in the Central California, encompasses almost 25,000 square miles (16% of California) from Stockton to Bakersfield, including both large rural areas and urban regions. The health status and health care demographics of the region are detailed in a recent report. Briefly, the population growth rate in the San Joaquin

Valley between 1990 and 2000, approximated 21%, about twice the population growth rate of California. The San Joaquin Valley population is comprised of multiple nationalities, ethnicities and races. In 2000, 40.2% of the persons in the Valley were Latino, 46.2% were White, 5.3% were Asian/Pacific Islanders and 4.6% were African American. Poverty levels are high in the San Joaquin Valley with a median per capita income in 2000 of $15,541 and a median family income of $40,140. In 2000 more than half of the children in the San Joaquin Valley lived in families with incomes less than 185% of poverty level. The challenges in the socioeconomic status of Valley residents are mirrored with challenges in health care status and health care access. Asthma and diabetes are prevalent in San Joaquin Valley residents. One in six non-elderly adults and one in ten Valley children did not have health insurance in 2001. Disparities in health care access, health status and health care insurance coverage are particularly problematic for Latinos and first-generation families. The shortage of health care providers in the San Joaquin Valley compounds these problems.

Health provider shortages are prevalent across the San Joaquin Valley. Health provider shortages include physicians, nurses, dentists, mental health professionals and other allied health professionals. On a population basis, the San Joaquin Valley has approximately 30% fewer primary care physicians than the rest of California and approximately 50% fewer specialists. Although the statewide physician-to population ratio has increased by approximately 25% over the past 25 years, retirements and a decline in the number of active patient care physicians since the early 1990's points to an increasing shortage of physicians in the future for the entire state of California. These shortages are likely to disproportionately affect areas of California that are already underserved, such as the San Joaquin Valley. The recruitment and retention of primary care practitioners in rural California is a major challenge. Factors that affect the primary care practitioner supply in underserved and rural areas include the solvency of local health care delivery systems, proximity to hospitals, and affiliations with academic health centers. The shortage of specialist physicians in the Valley is caused by many of the same factors and results in many patients leaving the area to obtain specialty care. Finally, the ethnic composition of the physician workforce is out of alignment with the evolving population demographics of California, a problem which is exacerbated in the San Joaquin Valley with its large ethnically diverse and underrepresented communities.

The health care needs of the San Joaquin Valley, and indeed California, have not gone un-noticed. A California Physician Workforce analyzed physician supply and demand through 2015 and recommended a number of strategies to address physician shortages, including increasing medical school capacity, targeted to communities and population groups expected to grow significantly or who are already facing shortages. Expansion of medical training and education in underserved and growing areas is anticipated to increase the number of primary care physicians in these areas. The location where medical students and residents complete their training clearly influences decisions where to practice. For example, more than 30% of the physicians completing their residency training at UCSF-Fresno stay in the San Joaquin Valley. Specific recommendations in education and training included development of a clinical campus in underserved regions,

location of residency programs and rotations for medical students and residents in the region.

The development of a medical education program in the Central Valley will provide training opportunities for new entrants to the physician workforce. A medical school in the region will attract and retain students and physicians into the San Joaquin Valley and bring students from underrepresented groups in medicine. ***A primary goal of the UC Merced medical education program is to increase the numbers of health care professionals practicing in the San Joaquin Valley, in particular those from groups that are not traditionally represented in medicine.***

C. HEALTH CARE ECONOMICS IN THE VALLEY

While the shortage of health care providers is of primary concern for health access, health economics issues abound in the San Joaquin Valley. Low reimbursement rates, extensive use of emergency medicine services, and dependence on government funding at the state and federal level for lower income residents are amongst the health economics issues in the San Joaquin Valley. In addition to the challenges of providing health care access for the underserved, there is a large efflux of insured dollars from the region as residents with insurance seek health care outside the region. A recent analysis of health care related dollars that left the San Joaquin Valley, based on patients with Central Valley zip codes who were discharged from hospitals outside the San Joaquin Valley, revealed a staggering loss of revenue from the region. In 2004, approximately$845 million left the San Joaquin Valley from residents, with residential zip codes in Merced, Fresno, Mariposa, and Stanislaus County seeking medical care outside the region, particularly in hospitals in the Bay Area (Appendix A). There is a perception by both the uninsured and insured that access to excellent health care requires treatment at facilities outside the San Joaquin Valley. This is clearly not the case as the quality of several health care facilities and physician practice groups in the region is exceptional. The outsourcing of health care dollars from the San Joaquin Valley precludes much needed improvements in health care infrastructures needed to address the health care needs of residents in the fastest growing region of California. ***A University of California School of Medicine that leverages medical education opportunities in the communities it serves will raise the level of care across the Valley, change perceptions about health care quality, keep health care dollars in the region, and serve as an economic engine for the San Joaquin Valley.***

D. THE UNIVERSITY OF CALIFORNIA- MERCED

The University of California in Merced opened its doors to undergraduate baccalaureate students in Fall 2005. UC Merced is the first new research university in the 21st century. With close to 60 faculty members at opening, 875 freshman and junior transfers and 36 graduate students, UC Merced is well on its way to providing outstanding undergraduate and graduate education and stellar research programs. The academic research environment at UC Merced is highly inter-disciplinary, a key to success in bringing together the best minds to solve complex problems in human health and health care. Indeed, UC Merced's inter-disciplinary emphasis on health of the environment and human health are woven throughout its current and planned research institutes (Sierra

Nevada Research Institute, World Culture Research Institute, Biomedical and Systems Biology Research Institute, and Energy Institute). The absence of discipline-based departments and presence of research institutes encourage student and faculty collaboration across multiple disciplines, bringing both depth and breadth to academics. Addressing the health care needs of the Central Valley communities is a complex problem that requires expertise in basic and applied sciences, public and health policy, management and social sciences. UC Merced is uniquely positioned to create and integrate both undergraduate and graduate education with medical education encompassing basic and applied sciences, social sciences, policy, public health and management. ***This integration will not only leverage academic resources available at UC Merced with the School of Medicine, but importantly will allow development of an integrated medical education program to produce culturally sensitive and aware graduates to better serve the increasingly diverse communities in the region and in California as a whole.***

The entering baccalaureate class (freshman and juniors) at UC Merced is highly diverse. Latinos/Hispanics comprise 25% of the entering class. Approximately 50% of the students are the first in their family to attend college, and amongst this group, ~50% come from families with less than $30,000 annual income. Approximately 30% of the inaugural class is from the Valley, with the remainder approximately equally distributed from the Bay Area and the Los Angeles region. More than 350 of the 875 entering students declared majors in biology, with more than 95% of these individuals wishing to pursue careers in health. ***The UC Merced School of Medicine will provide avenues for these highly diverse students and others throughout the state and nation, to enter health care professions in the region.***

The challenges of providing health care access to the residents of the San Joaquin Valley are enormous. The economics of not providing access to the Valley residents are also enormous. A School of Medicine in the San Joaquin Valley will help to meet some of these challenges. A recent UC report recommends that two new schools of medicine be established: one in the San Joaquin Valley and the other in the Inland Empire. Both UC Merced and UC Riverside are developing plans for Schools of Medicine and both plan to bring these proposals forward together to help meet the health care needs of all Californians.

PART II: SCHOOL OF MEDICINE

A. GUIDING PRINCIPLES

The Planning group identified a number of principles for medical education in the Valley.

- Excellence in comprehensive medical education to develop physicians and other health professionals dedicated to addressing the health needs of the Central Valley
- Collaborative medical student training with nurses, nurse practitioners, and social workers in team environments
- Importance of biomedical and community health research in a UC School of Medicine
- Importance of experiential, longitudinal learning in the curriculum
- Recognizing the limitations of and working within the fiscal climate of the University of California and the state of California
- Leveraging the health care resources across the San Joaquin Valley
- Addressing the health care needs of the San Joaquin Valley as rapidly as possible

Additional details of medical education curricular considerations can be found in Appendix B and C. Medical schools/centers, such as those that exist at five UC campuses, encompass bricks and mortar teaching hospitals. The costs of building a teaching hospital now exceed $2 million per bed, which is particularly challenging to consider in the current fiscal climate in California. However, an equally important consideration is the high operating costs of a teaching medical center, including reimbursement problems, how to absorb costs of new, medically necessary technologies, how to pay for the people and equipment needed for education and patient care, how to pay for training, and how to cover the expenses of UC medical hospitals used referral centers (taking the most costly, complex patients). The likelihood of successfully creating a new UC medical school in the San Joaquin Valley, based on the teaching hospital model, was considered to be financially unrealistic. Importantly, however, it was also recognized that the traditional teaching hospital model would not leverage the health care resources in the Valley. There are excellent hospital facilities, clinics, and physician practice groups scattered throughout the San Joaquin Valley. The geographical distribution of these resources is not uniform, although there is a uniform need for high quality health care access. ***The Planning group recommends a regional distributed model of medical education based on partnerships with community health providers in the Valley as a high priority.***

B. THE DISTRIBUTED MODEL

The distributed/regional model of medical education coupled with a longitudinal-experiential based curriculum will position UC Merced as an innovator in medical education. Existing medical education programs at Sutter Medical Center in Merced, Children's Hospital in Madera and Community Medical Centers in Fresno provide established resources of patients and faculty. Similarly there are other examples of outstanding opportunities for medical education throughout the Valley, including Modesto, Visalia, and a myriad of clinics. Integrating clinical programs and other community resources with UC Merced's strong basic and social science programs will provide the collaborative basis for a student/patient focused learning environment. Telemedicine opportunities through UCSF, UC Davis and UCSF-Fresno will be available to UC Merced medical students. Students will receive their medical degree from the UC Merced School of Medicine. The UC Merced School of Medicine is envisioned to have both ladder rank assistant/associate professors, full professorships, as well as affiliated faculty from community partnerships involved in medical education.

C. UC MERCED SCHOOL OF MEDICINE

The ***mission*** of the UC Merced School of Medicine is to advance the health and well being of the public with a focus on serving the needs of Central California. The ***vision*** for the medical school is to lead the nation in interdisciplinary education, research and patient care using collaboration, innovation, and discovery in the training of physicians and other health professionals. The ***signature*** of the UC Merced School of Medicine is to create healthy communities through campus partnerships. The School of Medicine embraces collaboration, innovation, and technology.

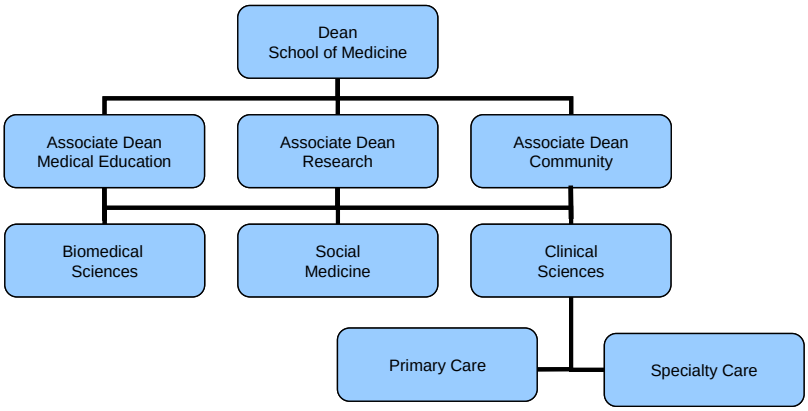
The medical education model is student centered and integrates applied, clinical and social sciences. It is problem-focused and technology-enhanced. Students learn through mentored, longitudinal relationships with faculty, patients, families and early clinical immersion. The curriculum is theme-based with themes woven across four years of the curriculum – evidence-based practice, ethics, multiculturalism, etc.
Mentors are located in partner institutions throughout the Valley and clinical clerkships are focused on clinical campuses in the Valley. A brief summary of the design considerations and principles for the new curriculum and the curriculum structure are located in Appendices B and C, respectively.

D. ADMINISTRATIVE STRUCTURE

The administrative structure is based upon a common community of the School of Medicine faculty. The community based teaching program must be of excellent quality, revenue neutral and provide 'value added' for all partners. It is envisioned that the faculty involved in medical education will hold appointments in the School of Medicine at UC Merced. In keeping with UC Merced's commitment to inter-disciplinary academics, it is envisioned that the UC Merced School of Medicine will not have traditional disciplinary based departments. Indeed, the medical education program will be inter-woven with academic programs evolving from the baccalaureate-undergraduate and

graduate programs at UC Merced in the Schools of Natural Sciences, Engineering and Social Sciences/Humanities/Arts.

The proposed administrative structure for the School of Medicine includes a Dean and three associate Deans, each responsible for medical education, research, and community partnerships. Three inter-disciplinary chairs in biomedical sciences, social medicine, and clinical sciences are at the hub of coordinating basic and applied research and clinical activities. The clinical sciences activities will include primary care and specialty care reflecting the commitment to emphasize primary care and care for underserved populations. Biomedical sciences and social science research efforts would be integrated to develop the understanding needed to provide health care to a culturally, ethnically and socio-economically diverse population and to continue the tradition of research excellence that is the hallmark of the UC system and UC medical schools.



The Biomedical and Systems Biology Institute at UC Merced is currently envisioned to carry out systems biology research in health and disease and may have administrative linkages with the School of Medicine.

E. PARTNERSHIPS AND COMMUNITY

Community partnerships are at the foundation of the School of Medicine. During the first two years the students will receive didactic training at UC Merced, and experiential learning at sites within 45-60 min from UC Merced. However, the rotations and clerkships during the second two years will be more broadly distributed in the region encompassing Fresno, Madera, Merced, Turlock and Modesto. For example, it is likely that the majority of pediatric rotations/clerkships would be done at Children's Hospital in Madera, whereas emergency medicine training might be performed at Community Hospital in Fresno, and family and community medicine in Merced and rural clinics. The concentration of hospitals in Fresno may suggest that specialized rotations are organized primarily through a hub in Fresno, whereas family and community medicine may be organized in other communities with strong family and community medicine or specialty training opportunities, such as Merced, Turlock, and Modesto. The Associate Dean for Community Partnerships will identify criteria for training sites, and have oversight over experiential learning and assessment at those sites. Affiliated residences at UCSF-Fresno, UC Davis and at Mercy Medical Center in Merced will provide additional training opportunities.

F. RESEARCH

Research excellence is an essential component of a medical school. Research experience, whether it is in a laboratory, in the community in public health settings, or in social sciences, develops skills in critical thinking, logical approaches to inquiry and discovery, and creates a culture of life-long learning. UC Merced's academic environment encourages cross-disciplinary research and it is not unusual for faculty in basic sciences to be working with faculty in social sciences. This tradition will extend to the medical school. Opportunities for students to participate in basic and applied biomedical research in the laboratory and in social sciences and community health, policy, management will be plentiful because the medical school will leverage resources from the entire campus (School of Natural Sciences, School of Social Sciences/Humanities and the Arts, School of Management, and School of Engineering). The planned Biomedical and Systems Biology Institute, encompassing biological sciences, bioengineering, applied mathematics and human biology, will be one of the premier research arms of the medical program. ***It is envisioned that translation medicine in the School of Medicine will emphasize research that addresses the health problems of people in the region.*** The integration of basic and applied science with social medicine will enable stellar biomedical and community health research, spawning discoveries, technological advances, community and public health strategies to address health disparities, encourage cultural competency, and importantly, impact the region in which the research is carried out.

G. STAFFING, EXPENSES AND TIMELINES

Estimates for staffing, expenses and timelines are based on rough estimates of start-up costs of the medical school at Florida State University that opened two years ago and is based upon a similar structural model as that proposed by the Planning Group. While recognizing that the FSU state model does not overlap completely with the UC model (particularly with the UC emphasis on biomedical sciences research), there are some commonalities in the start-up phase. Historically there have been cost savings in operating expenses in the distributed model compared to a teaching hospital model, where operating costs may exceed $1M per day. A detailed and in-depth analysis of the financial model is essential to consider the proposed medical education in the UC environment and with California health care economics.

Annual operating costs are anticipated to be approximately $50-60 million per year when the program is fully operational. An aggressive building timeline would phase the program in over a 5-7 year period with staggered hiring of senior leadership, faculty and administrative staff. The following table suggests a timeline for recruiting administrative staff if UC Merced were to accept students by 2011-2012 opening. While it would be very challenging for UC Merced to achieving this goal within this time frame, it provides a sense of the start-up duration to move ***aggressively*** toward opening a medical school and a basis for planning.

Hiring Timeline for Medical School Staff					
	2007	2008	2009	2010	2011
Dean	1				
Associate Deans	1	2			
Chairs	1	1	1		
Faculty Development Med Director		1			
Faculty		10	10	8	8
Senior Administrative Staff	1	3	6		

Initially, a Dean would be recruited who would, in turn, recruit three Associate Deans to head the areas of medical education, research and community partnerships. The Dean and Associate Deans form the program's senior leadership team. Three Chairs oversee the academic program areas of biomedical sciences, social medicine and clinical sciences, serving as administrative leads for the faculty in those programs. The Faculty Medical Director is a part-time role that ensures compliance with professional standards and accrediting bodies. Senior Administrative Staff include positions to carry out student and curricular affairs, community outreach, and business and financial functions. Personnel costs are estimated to be about half the budget in 2011.

The initial 36 faculty hires will be phased over four years. Expenses will include salaries and recruitment expenses. Equipment and supplies will need to be procured for the program beginning in year one, with continued procurement throughout the first five years.

A more detailed financial plan and business model for the School of Medicine is the next step in planning.

H. SPACE/FACILITIES CONSIDERATIONS

The distributed model for medical education leverages resources across the San Joaquin Valley. While didactic learning will be held at UC Merced, experiential learning, clerkships and rotations will occur across the San Joaquin Valley in facilities of selected community partners. Clinical learning centers are integral components of team based learning and practicum. These learning centers will house physical exam rooms, with telemedicine capabilities that link to UCSF, UC Davis School of Medicine, as well as to UCSF-Fresno and other Clinical Learning Centers in the region. A Clinical Learning Center will be developed at UC Merced ($45-55M) for students in their first two years of medical education, as well as for family and community practice teaching rotations for 3rd and 4th year students. The UCSF-Fresno facility may also provide learning opportunities in Fresno, although other facilities will most likely be needed as well as the program expands.

The Biomedical and Systems Biology Institute will bring together faculty and students for laboratory-based biomedical research. This Institute will initially be housed in the Science and Engineering Building I on campus or at Castle, where a health science focus may develop and administrative staff housed during the planning phase. Similarly the

World Cultures Institute in which research related to social and demographic issues of the region, including health, health disparities and health policy, are undertaken will be housed on campus in the Classroom and Office Building, or potentially in the Social Sciences and Management Building.

III. REFERENCES

1. "California Physician Workforce: Supply and Demand through 2015." Center for Health Workforce Studies. University at Albany, State University of New York. December 2004.

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3. Coffman, Janet, et. al. "Is There a Doctor In the House? An Examination of the Physician Workforce in California Over the Past 25 Years." Nicholas C. Petris Center on Health Care Markets and Consumer Welfare. University of California, Berkeley. Berkeley, California. June 2004.

Appendix A. Health Care Dollars Leaving San Joaquin Valley 2004

	Fresno		Mariposa		Merced		San Joaquin	
Product Line	Discharges	Gross Charges	Discharges	Gross Charges	Discharges	Gross Charges	Discharges	Gross Charges
CARDIOLOGY	536	$29,105,668	30	$797,137	206	$15,255,587	852	$44,593,447
DENTISTRY	32	$441,966			8	$259,559	13	$455,889
DERMATOLOGY	280	$3,418,277	6	$74,419	36	$552,235	67	$1,424,951
ENDOCRINE	363	$4,376,568	3	$34,434	63	$1,200,943	149	$3,529,749
GASTROENTEROLOGY	734	$17,238,988	34	$1,292,011	166	$4,748,143	446	$11,045,724
GENERAL MEDICINE	554	$15,940,613	17	$404,148	136	$5,464,417	379	$16,850,858
GENERAL SURGERY	939	$66,661,537	35	$2,471,518	326	$29,324,603	847	$66,401,889
GYNECOLOGY	114	$2,558,992	1	$6,349	40	$1,123,877	201	$5,537,152
HEMATOLOGY	150	$3,570,735	3	$173,778	36	$1,442,139	127	$4,694,153
HIV	5	$88,362			4	$513,341	5	$211,757
N/A	5	$2,593,872			3	$970,329		
NEONATOLOGY	797	$54,698,699	8	$157,238	205	$10,522,212	336	$39,690,208
NEPHROLOGY	337	$6,567,799	7	$103,548	51	$1,169,127	128	$2,531,209
NEUROLOGY	549	$11,484,948	8	$123,481	126	$3,349,330	364	$9,377,438
NEUROSURGERY	220	$20,874,312	8	$1,017,653	95	$9,770,584	230	$18,286,792
NORMAL NEWBORNS	589	$2,446,078	11	$33,167	129	$398,911	619	$1,078,967
OB/DELIVERY	525	$6,276,557	8	$93,418	154	$1,710,472	856	$9,510,734
ONCOLOGY MEDICAL	274	$13,212,852	6	$136,195	138	$7,653,396	262	$12,892,496
OPEN HEART	135	$30,894,049			39	$7,863,927	289	$62,989,290
OPHTHALMOLOGY	44	$775,715	1	$40,981	7	$161,342	23	$929,174
ORTHOPEDICS	744	$28,971,875	60	$4,043,753	394	$23,721,343	903	$60,654,267
OTHER OB	67	$732,116	1	$9,060	16	$284,831	107	$2,420,285
OTOLARYNGOLOGY	371	$3,708,902	6	$98,395	74	$2,949,766	111	$3,225,675
PSYCH/DRUG ABUSE	748	$10,905,737	35	$300,242	106	$1,195,571	378	$5,390,561
PULMONARY	1,940.00	$36,762,708	32	$1,175,464	199	$5,556,281	395	$16,567,181
RHEUMATOLOGY	20	$446,626	1	$0	5	$80,805	18	$185,103
THORACIC SURGERY	89	$22,146,655	4	$1,623,808	33	$5,989,491	115	$28,970,378
TRAUMA	42	$2,676,815	2	$84,160	22	$2,036,236	117	$15,309,053
UROLOGY	242	$13,063,945	17	$772,870	91	$5,393,213	164	$11,206,103
VASCULAR SURGERY	62	$4,948,587	3	$192,830	37	$3,419,881	84	$4,945,673
Total	**11,507**	**$417,590,553**	**347**	**$15,260,057**	**2,945**	**$154,081,892**	**8,585**	**$460,906,156**

Appendix B. Design considerations and principles for new curriculum

- Student centered, education structured for learning rather than for faculty convenience
- Integration of basic, clinical and social medicine within each course and across the curriculum
- The curriculum should be-patient-focused, embedding each primary concept in a clinical/health system context.
- The curriculum should help students increase their understanding developmentally and sequentially
- Learning should be enhanced with the use of information and instructional technology and simulations
- Each student should have a mentor who longitudinally provides professional support and guidance throughout the four years.
- The curriculum should encourage longitudinal connections between students and faculty members
- Early clinical immersion and anchoring in the community
- Early clinical skills and information technology development.
- learning should be explicitly defined expectations as competencies and learning objectives
- Students should be prepared for self-reflection and life-long learning

Appendix C. Curriculum Structure

- Initial course, introduction to the profession, will include strong clinical and information technology skills development which will make students immediately helpful to clinicians when they are placed in partner health care facilities.
    - Integrated block courses – draws upon basic, clinical and social sciences
    - Students will spend one day per week in partner clinical facility beginning in year one – longitudinal clinical experience.
    - Create areas of concentration, as opportunities to develop an academic minor or focus to study, as well as opportunities for scholarship.
    - Themes woven across four years of the curriculum – evidence-based practice, ethics, multiculturalism, etc.
    - Mentors, located in partner institutions throughout the Valley, provide longitudinal advising and mentoring for students.
    - Students will be divided into colleges for small group learning, and assigned to clinical partner campuses with a mentor.
    - Clinical clerkships will be focused on clinical campuses in the Valley and initially tied to where the student was assigned in the pre-clinical curriculum. Later clinical rotations will involve more hospitals for clinical experience.
- Pedagogy
    - Heavy use of small group discussion
    - Use problem-based or case-based learning
    - Use simulations and instructional technology – high fidelity simulations as well as web-based instructional technology programs.
    - Create and utilize clinical skills center and standardized patients
- Assessment
    - Use standardized knowledge exams
    - Use simulations
    - Use standardized patients and clinical performance exams
    - Use faculty, resident, peer, patient, nurse assessments of performance
    - Use self-assessment and reflection
    - Use e-portfolios