Medical Engineering at USF: A Joint Program of the College of Engineering and the Morsani College of Medicine

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Creation of a Joint Department of Medical Engineering in the College of Engineering and the Morsani College of Medicine at the University of South Florida

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Executive Summary

Dean Robert Bishop and Dean Charles Lockwood appointed a task force with a charge to undertake the creation of a joint USF Medical Engineering Department (joint ME department) bridging the Colleges of Engineering (COE) and Morsani College of Medicine (MCOM) in March 2015 with the vision that this joint effort between COE and MCOM can advance significantly the strategic planning, success, and goals of the University of South Florida. The Medical Engineering Task Force included representation from Medicine and Engineering faculty and administration. After a thorough examination of the noteworthy growth possibilities for research and student success embodied in the growing field of biomedical engineering (BME) and all potential factors, the Task Force recommends the creation of a Department of Medical Engineering jointly sponsored and governed by the Colleges of Engineering and Medicine.

Rational, background and some specific initiatives for strategically expanding our Medical Engineering faculty are presented in this proposal. An expansive vision is presented, as this is an opportune time to make it clear how the Colleges of Medicine and Engineering can partner to advance the strategic planning, success, and goals of the University of South Florida. Basically, taking advantage of the noteworthy growth possibilities for research and student success embodied in the growing field of biomedical engineering (BME), this proposal recommends the creation of a Department of Medical Engineering jointly sponsored and governed by the Colleges of Engineering (COE) and Medicine (MCOM). The new Department will contribute to USF’s key mission areas, promoting student success, clinical and basic research, entrepreneurship and economic development in the region, state, and nation, and will provide:

- A new multidisciplinary, state-of-the-art environment for training the next generation of scientists and engineers for employment in new and emerging fields of medicine and engineering
- New targeted interdisciplinary research programs
- Translational research leading to medical innovations and novel therapies
• Increased competitiveness for ‘team science’ programmatic funding, research
center grants, licensing and royalties, and philanthropy

• Enhanced patient care & healthcare delivery: “better care at lower costs”

This proposal suggests the creation of a vibrant intercollegiate department in which,
engineers, researchers, and clinicians collectively direct, sponsor, and administer the
academic, scientific, and entrepreneurial missions of a world-class Medical Engineering
program. This jointly governed Medical Engineering department will have an academic
mission to produce a skilled labor force that can think critically and creatively, identify
and solve problems quantitatively, and communicate effectively. This labor force will
serve existing biomedical research laboratories and companies across Florida and the
US, and provide engines for health care growth through the formation and relocation of
new biomedical industries to the USF, Tampa Bay area.

To fulfill this academic medicine mission, this joint Medical Engineering department
will initially appoint an interim chair and initiate faculty transfers voluntarily from
Engineering and Medicine. A national search to identify a permanent chair will be
undertaken. Future faculty recruitments will occur through national searches. Early in
the creation of the department, approval for a new undergraduate BME degree program
will be undertaken and merged with the already successful graduate BME programs
(MS and PhD) presently housed in the Department of Chemical & Biomedical
Engineering (COE) and moved to the new Department. A tremendous demand is
anticipated for a new BME BS degree program that provides the unique type of applied
knowledge coming from instruction by engineers, scientists and physicians to reinforce
theory. Non-tenured Instructors are to be employed to support the development of new
undergraduate curricula, coordination of multi-instructor courses, and rapid growth of
this novel academic program.

This jointly governed Medical Engineering department will have a research mission to
form multi-disciplinary research groups that are continuously funded as a result of their
advancement of scientific understanding and their development of innovative solutions
to health care problems. These research teams will form naturally via shared interests
of COE and MCOM faculty in the academic and research missions of the joint
department. To fulfill this research mission, all faculty in the joint Medical Engineering
department will be assigned and commit time and resources to the establishment and maintenance of strong graduate and postdoctoral programs through the operation of active vibrant research laboratories, the pursuit of training grants, and the creation of adequate departmental resources from a successful Legislative Budget Request, and the development of a robust departmental research fund to accomplish this mission.

This proposal considers matters of department administrative structure, governance and staffing, faculty appointments, promotion and tenure, space and facilities, departmental funding, revenue sharing and space allocation, research opportunities, education programs, future growth and resources anticipated, and a proposed business plan to fund this jointly sponsored department by the University of South Florida.
1. Introduction and Description of Changes

In March 2015, Dean Robert Bishop and Dean Charles Lockwood appointed a work group to consider the creation of a joint USF Medical Engineering Department (joint ME department) bridging the Colleges of Engineering and Medicine. The Medical Engineering Task Force included representation from Medicine and Engineering faculty and administration (Appendix A).

The work group recommends the creation of a Department of Medical Engineering jointly sponsored and governed by the Colleges of Engineering and Medicine. The new Department will contribute to USF’s key mission areas, namely promoting student success, clinical and basic research, entrepreneurship and economic development in the region, state, and nation, and thereby provide:

- A new multidisciplinary, state-of-the-art environment for training the next generation of scientists and engineers for employment in new and emerging fields of medicine and engineering
- New targeted interdisciplinary research programs
- Translational research leading to medical innovations and novel therapies
- Increased competitiveness for ‘team science’ programmatic funding, research center grants, licensing and royalties, and philanthropy
- Enhanced patient care & healthcare delivery: “better care at lower costs”

The Task Force considered matters of department administrative structure, governance and staffing; faculty appointments, promotion and tenure; space and facilities; departmental funding, revenue sharing and space allocation; research opportunities; education programs; future growth; and resources required.

2. Rationale and benefits of a new joint Medical Engineering Department

A major benefit of a jointly sponsored Medical Engineering Department is enhanced research with increased impact on education of the next generation of clinicians, scientists and engineers. The department will help develop new therapies and cures through innovation in health care delivery, personalized medicine and evidence-based medicine. Further, this jointly sponsored department will advance the creation of novel biomedical devices, treatment systems and technologies.
Considerable research collaborations are already in place between faculty in Engineering and Medicine (see Appendix B). A Department of Chemical & Biomedical Engineering already exists in the College of Engineering and has a successful master's program begun in 1998, and more recently a growing PhD program. Faculty from Engineering and Medicine, as well as Public Health, Behavioral & Community Sciences, Nursing, and Physical Therapy are currently engaged in Medical Engineering research at USF, which will be significantly enhanced by the creation of a joint Medical Engineering Department.

The proposed program aligns with the University’s mission and goals and the strategic priorities of the USF Board of Trustees, particularly developing nationally distinctive research and graduate programs and that advance collaborative learning, innovation and discovery to improve student success and the health of the community. With its strong science and technology components, the program has the potential also to contribute significantly to the STEM goals of the Board of Governors and USF. Although a growing number of BME accredited programs exist nationally (Appendix C), only a limited number of programs report a jointly sponsored Medical Engineering department between Engineering and Medicine. When looking closely at these reported programs, most demonstrated collaboration across missions, but it appeared that separate governance structures were maintained under the deans in each of their colleges. The Task Force took inspiration from the program at the University of Alabama-Birmingham, which appeared truly to be a joint venture between the two schools and was in the early stage of implementation. It provided helpful information with the development of this document.

A jointly governed Medical Engineering department sponsored by both Engineering and Medicine will break new ground at USF, and the Task Force concludes that the two Colleges are ideally suited jointly to administer this program. Cooperation of the two Deans, extensive collaborations among faculty in both Biomedical Engineering and Medicine, and numerous other resources all provide further impetus for this program. The Center for the Advancement of Medical Learning and Simulation (CAMLs), local/regional biotechnology companies, Tampa General Hospital, and other hospitals affiliates such as the Moffitt Cancer Center, the Shriners’ Orthopedic Hospital for
Children, and the James A. Haley VA Hospital, all located on, adjacent to, or near the USF Tampa campus offer outstanding collaborative training and research environments for students seeking degrees in BME.

Research and instruction in this new Department will have a positive impact on economic development, especially along the I-4 Corridor area. The Tampa Bay Region has the second-highest concentration of biomedical-related industries in Florida and one of the highest concentrations nationally. As seen in other parts of the country, the presence of training programs in BME encourages the growth of related industries, benefiting not only from direct technology transfer but also the availability of highly trained graduates. The strong collaborations created by the jointly sponsored Medical Engineering department will bring new opportunities for USF to compete for funding from numerous private foundations and companies supporting advancements in the intersection between medicine and engineering. This partnership will also facilitate USF competing for novel funding opportunities from numerous federal agencies such as DOD, DARPA and DTRA, NIH Center and Training Grants, NIH Biomedical Research Partnership (BRPs), NSF Science and Technology Centers, NSF Integrative Graduate Education and Research Traineeship (IGERTs), Engineering Research Centers and others.

Employment opportunities will also occur because of the creation of this Department. According to U.S. Bureau of Labor Statistics, rapid advances in technology will continue to change what biomedical engineers do and the type of work they create. Thus, the expanding range of activities of biomedical engineers should translate into very favorable job prospects. Employment of biomedical engineers is projected to grow by 27 percent through 2022, much faster than the average for all occupations, and more than other engineering specialties. The aging baby-boomer generation will increase demand for biomedical devices and procedures, such as hip and knee replacements, as this generation seeks to maintain its healthy and active lifestyle. Additionally, as the public becomes aware of medical advances, increasing numbers of people will seek help from their physicians capitalizing on innovations in personalized medicine. Biomedical engineers will likely experience more demand for their services because of the breadth of activities they engage in, made possible by the diverse nature of their

3. **Vision of this Department**

The Task Force envisions a vibrant intercollegiate department in which engineers, researchers, and clinicians collectively direct, sponsor, and administer the academic, scientific, and entrepreneurial missions of a world-class Medical Engineering program. The Task Force sees the joint Medical Engineering department having an academic mission to produce a skilled labor force that can think critically and creatively, identify and solve problems quantitatively, and communicate effectively. This labor force will serve existing biomedical research laboratories and companies across Florida and provide engines for health care growth through the formation and relocation of new biomedical industries to the USF area.

To fulfill this academic mission, the work group sees the joint Medical Engineering department developing a new undergraduate BME program and combining it with our successful graduate BME programs (MS and PhD) that are presently housed in the Department of Chemical & Biomedical Engineering. The expectation is that most, if not all, courses will be jointly taught by faculty in the Colleges of Engineering (COE) and Medicine (MCOM). COE faculty will be lead instructors for most core and some elective BME courses, with MCOM faculty giving guest lectures that relate class topics to modern health care applications, challenges, and translational technology transfer opportunities. For example, a junior-level core course in Biomedical Signals and Systems Analysis would have a lecture series on Fourier Transforms given by an engineer followed by a lecture given by a cardiologist illustrating the interpretation of heart rate variability through the use of Fourier analysis of actual ECG data. MCOM faculty will also be lead instructors for some core and elective BME courses, with COE faculty giving guest lectures that show how the biological process under study can be understood mathematically. For example, an upper-level undergraduate/first-year graduate Engineering Physiology course would offer a lecture series on the visual system given by a clinical scientist with a lecture on the design principles of retinal
prosthetics and their current limitations given by an engineer. A tremendous demand is anticipated for a new BME Bachelor of Science degree program that provides this unique type of applied knowledge to reinforce theory. The work group proposes that non-tenured Instructors be employed to support the development of new undergraduate curricula, coordination of multi-instructor courses, and rapid growth of the academic programs.

The Task Force sees the joint Medical Engineering department having a research mission to form multi-disciplinary research groups that are continuously funded as a result of their advancement of scientific understanding and their development of innovative solutions to health care problems. The belief is that these research teams will form naturally via shared interests of COE and MCOM faculty in the academic and research missions of the department. For example, interactions between the engineer and cardiologist in the administration of a Biomedical Signals and Systems Analysis course would lead to research discussions from which new collaborative projects would spring. To fulfill this research mission, the Task Force recommends that USF and all faculty in the joint Medical Engineering department commit time and resources to the establishment and maintenance of strong graduate and postdoctoral programs through the operation of active vibrant research laboratories, the pursuit of training grants, and the creation of adequate departmental resources such as a research fund to accomplish this mission.

4. Organizational Structure & Consequences of Change
   a. Department administrative structure and staffing

   The Deans may appoint an interim Chair until a permanent chair is selected through a national recruitment process. Recruitment and selection of a multidisciplinary chair, with appreciation of the academic, research and clinical missions of the new Department is critical to the future success of this jointly governed Medical Engineering Department. The Task Force recommends that the Deans of each College appoint individuals to a search committee that will recruit and recommend to the Deans a nationally/internationally recognized individual with a proven and successful track record in biomedical engineering leadership. Each Dean will select an equal number of individuals to the committee (total numbers to be determined by the Deans) with one individual appointed
as committee chair. The chair of the committee will be jointly selected by the two deans. The committee will produce advertisements, seek applications, review applicant credentials, conduct interviews, and make recommendations for the selection of the chair to the two deans. Responsibilities of the Department Chair will be outlined by the two deans or their representatives. The Department Chair will have an appointment with tenure in both Colleges and report to both Deans. Faculty and staff will be hired according to typical rules and regulations of the University. Staff will need to have expertise to help manage a complex department with a mission including student success, research and clinical excellence, and service. The staff should be highly familiar with operations of the university that includes management operations on both sides of campus. They should also have or be able to acquire the skills necessary to create a department clinical practice operation. Operating guidelines and governance principles for the department will be created by faculty once they are appointed.

b. Departmental Resources and Budgetary Implications

The University (Provost, Senior Vice President, USF Health/MCOM Dean, and COE Dean) will seek a Legislative Budget Request (LBR) from the Florida Legislature or from alternative University sources to provide sufficient resources for this Department to hire faculty and staff, provide instructional resources and fund a robust research environment for faculty to succeed in developing a world-class, jointly governed unit at USF. Until support from a LBR or alternative University sources is provided by the Legislature, each College will be expected to contribute equally to a budget that will be sufficient for initial Departmental operations. Allocation of an operating budget should include Education and General funds for faculty salary, tuition revenue generated by the Medical Engineering program, rebate allocation from research grants and contracts and IP revenue (if any) generated by faculty transferred into the department, clinical revenue from physicians in the department with patient and clinical responsibilities (a clinical operation will need to be created) and an expense budget commensurate for the size of the department.

A research fund to support the department missions is also recommended. This fund will provide a distinctive resource for a joint Medical Engineering Department at USF. The rational for this fund includes the following.
1) The departmental research fund is vital for uninterrupted support for productive graduate and postdoctoral students in the current funding climate and for getting new research projects off the ground so that they can compete for federal awards with necessary novel pilot data. The research account is also vital for attracting internal and external faculty to join the joint Medical Engineering department. The Task Force expects USF partially to fund the account through the return of indirect costs on grants awarded to the department. The Task Force also proposes all COE and MCOM faculty appointed in the department contribute to the account through the buyout of academic year salary on NIH grants (in exchange for reduced teaching load to support research effort) and fixed-percentage return of clinical patient dollars. Contributing faculty will be able to recoup 50% of their buyout dollars to support their graduate students in times of need. The other 50% of their buyout dollars will be provided to the departmental fund. This money, plus the USF indirect cost return and clinical revenue dollars, will be used by the department to fund internal one-year "pilot project" awards which encourage collaborations between research and clinical Medical Engineering faculty, and to support meritorious incoming graduate students and postdoctoral students for one year. Dispersal of account funds will be overseen by an executive committee composed of the chair, 2 COE faculty, and 2 MCOM faculty appointed in the joint Medical Engineering department.

2) The Task Force sees the joint Medical Engineering department having a unique entrepreneurial mission to translate biomedical research into patented therapies for patients in our healthcare system. To fulfill this entrepreneurial mission, the departmental fund will also be used to support internal one-year "startup" awards to develop meritorious technologies to help bridge the funding gap. Budgetary support under this mechanism will require collaboration between a Medical Engineering department engineer and clinical faculty member (MD, RN, Pharmacy, etc.).

3) The Task Force foresees singular training programs that involve true cross-fertilization between engineering and clinical experiences. For example, further development of a pilot Medical Engineering Master's program (initiated with
MCOM's Vascular Surgery Division) with medical resident training options is recommended.
Ultimately, the budget for this Department will be negotiated by the Provost and Senior Vice President of USF Health and the Deans of each College. A business plan is provided with this report to project the cost of the operation of the Medical Engineering Department in Appendix E.

c. Faculty Appointments and Recruitment

To initiate this Department, it is recommended that each Dean seek faculty interest within their own units to make application for transfer into this unit. Applications from both PhD and MD faculty with theoretical or practical expertise in biomedical engineering projects or programs will be considered. A combination of both academic and clinical faculty with primary Medical Engineering appointments is encouraged and will make this department highly unique. With clinical faculty, a departmental practice plan component is suggested. University physicians generally have primary appointments in the Morsani College of Medicine (MCOM). MCOM physician faculty provide care for patients as part of the USF physicians group (USFPG). Revenue from patient care provided by these physicians' activities come into the USFPG, and become part of the revenue for the clinical department to which that physician belongs. Depending on their assignments, physicians are expected to commit a set number of days to the practice of clinical medicine, with other assigned duties such as administrative, research, and academic responsibilities taking up the remainder of their USF commitment. Physicians in the USFPG receive a salary which may also include stipends and bonuses, and a portion of this comes from the revenue generated from clinical activity. Clinical revenue is applied to cover expenses, department and USFPG overhead, as well as contributions to the MCOM and USF, in addition to covering some or all of the faculty salary. The clinical departments are chaired by physicians who have similar credentials to those of the faculty in the department to which they belong. Matters related to clinical credentialing, peer review, and professional development are managed via the clinical departmental organizational and operating structure.

Currently, physicians in the clinical departments of the MCOM are free to interact and collaborate with faculty in the other colleges at USF, and indeed, some MCOM
physicians have done so. Some MCOM physicians have served on Ph.D. dissertation committees for candidates in the College of Engineering and other units of the University. To date, USFPG physicians have not been discouraged from collaborating with faculty in other colleges, provided that such collaboration does not interfere with their clinical, academic, and other assigned responsibilities.

In order for the proposed jointly governed Medical Engineering department to flourish, a heightened, systematic collaboration between physician and engineering faculty needs to develop. The major way to truly accomplish this ongoing collaboration is for physician and engineering faculty, students, and trainees to be geographically collocated, allowing for ongoing, daily, or regular, seamless interactions. This requires that physicians be part of the proposed joint Medical Engineering department. Benefits to physician membership in the joint Medical Engineering department include:

- providing visibility into the day-to-day problems faced by physicians in the conduct of their clinical activities; many of which may be amenable to technology based solutions: and
- creating sounding boards" for the engineering faculty to discuss and refine new and existing inventions and technologies to help improve patient care outcomes and solve clinical problems. Data suggest that such collaborations can yield important intellectual property which can benefit USF intellectually and financially.

Currently, physicians who collaborate with College of Engineering faculty do so because they are passionate about developing the nexus between Engineering and Clinical Practice primarily to help improve the care outcomes for their patients. These are the types of physicians that need to be brought into the proposed joint Medical Engineering department.

To accomplish this goal, membership in the joint Medical Engineering department needs to be attractive to physician faculty who are current members of the MCOM departments. However, the joint Medical Engineering department membership should not pose added financial or other burdens to the physician. Furthermore, because these physicians may be from different specialties, such as cardiology, urology, gynecology, surgery, Maternal-Fetal Medicine, credentialing matters related to each
clinical specialty in the joint Medical Engineering department will need to be addressed. Physician department members should have access to opportunities for promotion through the faculty ranks, up to and including the most senior positions in the department.

Physicians in the joint Medical Engineering department should have an allotment of clinical activity in their specialty (60-80 % FTE). At least 20% of their effort should be applied to activities related to the joint Medical Engineering department to include teaching, research, project/idea development, thesis/dissertation supervision, grant applications, and entrepreneurial and IP development activities. Over time, income from entrepreneurial and intellectual property development should be apportioned preferentially to the joint Medical Engineering department and to the involved physician and engineering faculty in order to make joint Medical Engineering department membership more attractive than just remaining in the department from which they came. One way to accomplish this goal is to provide the most attractive allocation of revenue back to the inventor(s) and the department where the IP was developed. At the inception of this department, it is recommended all IP revenue be returned to the department with at least 50 % returned to the inventor(s). A portion of the funds along with overhead from research grants should also be allocated to the research fund mentioned elsewhere in this document. Early in its development, a joint Medical Engineering departmental identity will be critical to create so that the power of “belonging” to something highly unique and special becomes part of each faculty member’s psyche. Setting a vision of establishing a world-class department of excellence in teaching, research, and clinical/professional service will be essential to set the stage for accomplishing this goal.

The maintenance of secondary appointments in other closely aligned departments of the University will be encouraged. A selection committee, appointed by the Deans, will review and make recommendations to the interim or new chair among those applicants for potential transfer into Medical Engineering. It is expected the faculty transfers will be small in number from the two Colleges (or even other units on campus with approval from their Deans) and will have productive teaching and research programs. It is
expected that these faculty will have research funding or have very high potential for funding. An interim chair, four engineering faculty and four medicine faculty will comprise the initial members of this department. To cover teaching needs, two teaching faculty (instructors) should be recruited. Adjunct faculty may also be necessary. These faculty will provide the initial nucleus of the Medical Engineering Department and serve as core faculty. Initially, the core faculty may have either 9 or 12-month appointments. After an initial three year period, core faculty members with a 12-month appointment will be expected to raise at least 30% of their salary from research grants or contracts. Nine-month faculty will be required to bring in their summer salary from grants and contracts. Both categories of faculty will be eligible for incentive payments based on predetermined performance metrics. Core faculty will be tenured (or on tenure track status) through the Department of Medical Engineering and will have a primary appointment in one of the Colleges depending on area of discipline and faculty appointment at time of employment. Secondary and joint appointments from faculty in other departments/colleges will be available. At least two Instructors (non-tenure track faculty) will be needed to teach undergraduate BME core courses and run the new BME undergraduate major, including seeking and maintaining ABET accreditation. A Laboratory technician to assist with research operations is also recommended. Support for graduate students will also be necessary. As resources become available, additional faculty will be recruited based on Medical Engineering strategic needs. National searches will be conducted. Over a five year period, at least seven additional faculty will be needed. It is expected all will be employed on a 12-month contract. These faculty will be employed as out-of-unit faculty for purposes of the Collective Bargaining Agreement (CBA) to be discussed later. The Department may also have adjunct, affiliate and volunteer faculty to meet specific needs and will be approved for membership in the Department by the Chair in consultation with the Departmental APT committee.

d. Academic Degree Programs

The new Department will take over responsibility and administration of the current BME Masters and PhD programs, which currently have about 60 students enrolled (50% increase in enrollment over past 4 years). The current academic programs
include novel joint Medical Engineering Master's programs with Vascular Surgery and the USF College of Pharmacy. Tuition revenue from these programs will need to accrue to this new department. In addition, a full application has been prepared for submission to the FL BOG for a new undergraduate BME Major to be administered by this new Department (Appendix D).

Medical Engineering Department faculty will also participate meaningfully in mentoring medical students and USF Health residents/fellows in cutting edge research projects, including generation of new NIH training grants and programs currently being devised to increase Medical Engineering activities at the USF Center for Advanced Medical Learning and Simulation (CAMLs).

e. **Promotion and Tenure**

Nominations for promotion and/or tenure shall be made by the Chair of the jointly sponsored Department of Medical Engineering in accordance with customary University policy. A joint Appointment, Promotion and Tenure (APT) Committee (Conjoint Committee) for Medical Engineering will be appointed with equal membership from the College of Medicine APT Committee and the College of Engineering Governance Committee during the period of departmental development and achievement of tenure by initial appointees. Two members will be appointed from the respective collegiate APT committees or equivalent upon recommendation by the Chairs of the respective committees. The chair shall be appointed by mutual agreement of the respective Deans each year when convened. The conjoint APT Committee shall make recommendations to the Provost and Senior Vice President for USF Health relative to Promotion and Tenure. Concurrence must be achieved for recommendation to the President for transmission, as appropriate, to the Board of Trustees for action. Tenure and promotion will be conferred to the applicant by each College.

f. **Collective Bargaining Considerations**

With the exception of the Morsani College of Medicine and the College of Pharmacy, all other Colleges on the USF campus function under a collective bargaining agreement with the United Faculty of Florida and the University. Those Colleges (including Engineering) are considered “in-unit” while the Morsani College of Medicine is considered “out-of-unit.” Rules and regulations that dictate the relationship between ‘in-
unit" employees and University administration (Provost and his Office) differ in some significant ways from "out-of-unit" faculty and their USF Health administration. Guidance was sought from the Provost's office and general counsel on the employment and collective bargaining issues that might be associated with forming a Joint Department of Medical Engineering. The proposed department would be equally affiliated with the USF Colleges of Engineering and Medicine, and initially will be composed of faculty from both Colleges. This would be the first department at USF with joint administrative affiliation between two colleges. The issue of how to handle a new entity comprised of in-unit (COE) and out-of-unit (MCOM) faculty was addressed and the recommendation was made by both Provost's Office and General Counsel that a joint department could be started as a "mixed" department (i.e. one with both in- and out-of-unit faculty). The USF negotiated Collective Bargaining Agreement (CBA) would be observed for all in-unit faculty. Out-of-unit faculty would be treated equitably and according to University administrative rules.

**g. Space and Facilities**

Space is currently assigned to faculty both in the College of Engineering BME program and the Morsani College of Medicine. It is recommended that space will continue to be provided until new or alternative facilities are made available by USF. Also, research and instructional space may be found at adjacent on- or off-campus locations such as the top floor of the Interdisciplinary Sciences Building (ISA), Business Park Building (BPB, former Draper Lab Space) or Genzyme laboratory facilities to colocate all faculty under one structure. Eventually, space and facilities will become available either through vacating of space by faculty in current medical school facilities upon construction and opening of the USF Health Heart Institute or by moving Medical Engineering researchers with cardiovascular research to the Heart Institute. Recently, Draper Labs, a non-profit research institute collaborating with USF and located in the USF Research Park, vacated approximately 23,000 sq ft of administrative offices and research laboratory space. This space could easily house the new Medical Engineering department with sufficient space remaining for future growth. CAMLS, located in downtown Tampa near the new Morsani College of Medicine and Heart Institute Tower, also has the potential to locate some of the Medical Engineering research faculty who
are involved in medical device development. The CAMLS Innovation Center's 4,200 square-foot, state-of-the-art facility provides the ideal environment for research teams to work on complex medical innovations. From on-site engineering and 3D modeling services to rigorous clinical testing and investigations, the Innovation Center offers the perfect environment and infrastructure to tackle the most challenging and complex stages of device development, simulation testing, and deployment. Potentially other space on campus may eventually also house part of a growing Medical Engineering Department either through new construction or build-out of space as current facilities are repurposed.

h. Revenue Sharing and Space Allocation

As Resource Centered Management (RCM) is implemented at USF, it will be important that the new Medical Engineering department have revenues that it generates returned to the department for base support, funds for special initiatives, and revenue for continued growth of strategic departmental initiatives. All student FTE (and any corresponding distribution of tuition revenue) generated by Departmental faculty through teaching activity will be credited and allocated to the jointly sponsored Department of Medical Engineering. Overhead revenue from grants and contracts will be distributed based on the recommendations of the University Research Advisory Committee and approved by USF Leadership (see recommendations under department resources above). Full overhead return on all grants and contracts is recommended to be returned for the first five years to support departmental start-up. After this initial period, the two Deans jointly will determine return of overheads to the Medical Engineering Department according to University and RCM guidelines. The task force recommends that the Medical Engineering Department be held harmless for a period of five years before any assessments directed by the RCM model are made for University services.

Space allocation will be considered based on current space allocation models in both Engineering and Medicine. A Medical Engineering faculty space committee, which will consider research funding, will recommend the appropriate space allocation model to the Chair of the Department with concurrence of the Deans.

i. Workload Assignment
Significant differences currently exist in faculty appointments and responsibilities of the Colleges of Engineering and Medicine. Engineering faculty have nine-month academic year contracts with the possibility of three summer months supported by research or other activities approved by the Department Chair. The standard workload provided by the Provost’s Office is four courses per year. The Engineering workload model allows faculty to reduce teaching in exchange for research activities, academic year salary offset from research grants and contracts, mentoring students, and significant service in consultation with the Chair. In Medicine, faculty are appointed on a 12-month basis, but clinician scientists and basic scientists are expected to support 60% of their annual salary from extramural grants and contracts or from significant teaching responsibilities. Medicine faculty typically may serve as course directors, teach courses, provide course lectures, and serve as facilitators for group learning activities where education value units (EVU) are provided based on amount of class time exposure and teaching responsibilities. Clinical faculty also have patient care responsibilities which support variable but significant portions of their salary. Workload assignments for Medicine faculty, although arranged somewhat differently, are consistent with workloads of faculty in Engineering. The Task Force recommends that all new faculty be appointed to 12-month contracts and that a standard workload model consistent with College of Engineering and Morsani College of Medicine policies and practices be implemented in the joint Medical Engineering department. The workload model should include credit for research, scholarship and entrepreneurship; teaching and teaching innovation; student training and mentorship (students, post-docs, fellows, etc.); patient care and education; service to USF and the community; and professional service and outreach. Criteria for workload as well as expectations should be developed by a ME faculty workload committee and recommended to the Medical Engineering Chair with approval by the Deans in Engineering and Medicine.

j. Future Growth, Directions, and Resources Anticipated

The Department of Medical Engineering is to be an intercollege, interdisciplinary department jointly administered by the Deans of the College of Engineering and the Morsani College of Medicine. The Department will need to be supported by current and new funding proposed from University revenues for 2016/17. With the addition of
clinical faculty appointed to the department, practice plan revenue will be available which makes this department highly unique among other BME programs around the country that purport to be jointly governed. The Medical Engineering Chair will be responsible to both College Deans who will meet not less than quarterly to review progress with the Department Chair and to consider funding allocations and supplementation of resources. Growth areas that should be considered for resource support come from the asset map included with this proposal. The following areas were identified as current and potential areas of research and instructional strength of this joint Medical Engineering department. They include:

- Nanomedicine and Drug Delivery
- BioMEMs and Biosensing
- Biomedical Devices
- Prosthetics and Robotics
- Computer science and engineering

Ultimately, the Department will be accountable through its Deans to both the Provost/Senior Executive Vice President for Academic Affairs and the Senior Vice President, USF Health. With guidance from the Medical Engineering strategic plan (to be developed by the Department), growth of student enrollment and increases in external funding, additional resources may be allocated internally from tuition and grant overhead revenue and reallocation of University Education and General Budget. Special requests for additional state allocations through future Legislative Budget Requests may also be made.

By formally bridging the Colleges of Engineering and Medicine in novel ways, a joint Medical Engineering Department will enhance student success in engineering and medicine, research collaborations among faculty in the two schools, lead to new innovative research initiatives and enhanced translational research with direct impact on patient care. New comprehensive training and degree programs, such as a new undergraduate BME major that is critically needed in Florida, will prepare highly skilled trainees to succeed in graduate school, medical and other professional schools or industry. Medical Engineering graduates will be leaders and innovators in the rapidly changing healthcare marketplace. Similarly, clinical trainees will acquire a more
informed perspective on the potential innovations in biomedical engineering and their applications to clinical practice. Realizing these goals, the USF joint Medical Engineering department will evolve into a world-class research and instructional unit and be recognized as a leader and innovator among Medical Engineering Departments in the State of Florida and the nation. (In part, inspired by: Alexander, JI and Vickers, SM. *Implementation of a Joint Biomedical Engineering Department in the School of Engineering and the School of Medicine at the University of Alabama at Birmingham*, November 14, 2013).
DRAFT: May be modified based on scheduling of some of the following:

Timetable 2016 (for discussion, see Appendix E)

January 31 -- List BS BME degree program on new program pre-proposal work plans
August 30 -- Secure college (both MCOM & COE) approvals for new department
October 1 -- Secure Faculty Senate approval
October 15 -- Secure approvals from Senior Leadership with financial commitments
October 30 -- Initiate departmental structure
November 1 -- Conduct internal search for Interim Chair
November 1 -- December 30 -- Seek faculty transfers from each college and reassign

Timeline 2017

January 9 -- May 12 -- Appoint interim chair, transfer faculty, set up degree programs, provide faculty assignments, plan teaching schedules, assign department space and address other administrative responsibilities.

June 1 -- Approval of the BS degree in Biomedical Engineering

July 1 -- Accounts Open and Operational

August 1 -- Functional department is up and running!

October 1 -- Begin search for permanent Chair

Timeline 2018-19

January 8 -- Medical Engineering Department is operational: Department consists of a chair, 8 faculty and two instructors; 25,000 sq. ft. of space is assigned for instructional and research missions.
Appendix A

Medical Engineering Initiative Task Force Members

College of Engineering

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Associate Dean for Graduate Programs, College of Pharmacy
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813-974-856
Appendix B

Examples of COE/USF Health Collaborations involved in Medical Engineering

**Title:** MRI: Acquisition of a CAREN Virtual Reality System for Collaborative Research in Assistive and Rehabilitation Technologies
**Collaborators:** Redwan Alqasemi, PhD, Stephanie Carey, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, School of Physical Therapy

**Title:** Development of Simulation Tool for Upper Extremity Prostheses
**Collaborators:** Redwan Alqasemi, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, School of Physical Therapy

**Title:** Drug Delivery to Cancer patients Using Robotics Technologies
**Collaborators:** Redwan Alqasemi, PhD, Department of Mechanical Engineering & Shyam Mohapatra, PhD, USF Health

**Title:** International Collaboration in Rehabilitation Robotics at King Abdulaziz University
**Collaborators:** Redwan Alqasemi, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, and Jason Highsmith, PhD, School of Physical Therapy

**Title:** Movement Science III class project –motion data analysis project
**Collaborators:** Stephanie Carey, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, Jason Highsmith, PhD, School of Physical Therapy

**Title:** Multi-modal Assessment Tool for Lower Limb Prostheses Users
**Collaborators:** Stephanie Carey, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, School of Physical Therapy

**Title:** Development of Simulation Tool for Upper Extremity Prostheses
**Collaborators:** Stephanie Carey, PhD, Department of Mechanical Engineering & Sandy Quillen, PhD, School of Physical Therapy

**Title:** USF-PAMA Caring for Artists and Arts that Heal Conference Grant
**Collaborators:** Stephanie Carey, PhD, Department of Mechanical Engineering & Heather Hartsell, PhD, Matthew Lazinski, PhD, School of Physical Therapy

**Title:** Investigation of molecular mechanisms for drug treatments of age-related hearing loss in the cochlea of the inner ear
**Collaborators:** Robert Frisina, PhD, Department of Chemical & Biomedical Engineering; Director of Biomedical Engineering; Director – Global Center for Hearing & Speech Research & Bernd Sokolowski, PhD, MCOM Department of Otolaryngology

**Title:** First FDA Clinical Trial for a New Drug to Treat Age-Related Hearing Loss
**Collaborators:** Robert Frisina, PhD, Department of Chemical & Biomedical Engineering; Director of Biomedical Engineering; Director – Global Center for Hearing & Speech Research & Paul Boyev, MD, MCOM Department of Otolaryngology

**Title:** Proposed BME Masters option with MCOM Vascular Surgery
Collaborators: Robert Frisina, PhD, Department of Chemical & Biomedical Engineering; Director of Biomedical Engineering; Director – Global Center for Hearing & Speech Research & Karl Illig, MD, MCOM Division of Vascular Surgery

Title: Development of micropumps for inner ear drug delivery biotherapeutics (auditory & vestibular applications)
Collaborators: Robert Frisina, PhD, Department of Chemical & Biomedical Engineering; Director of Biomedical Engineering; Director – Global Center for Hearing & Speech Research & Gary Martinez, MD, Moffitt Cancer Center

Title: MARVEL, an in vivo Camera Module (CM) anchored to the abdominal wall and actuated by tiny motors giving surgeons a full hemisphere range of view with wireless communications and control.
Collaborators: Richard D. Gitlin, PhD, Department of Electrical Engineering & Alex Rosemurgy, MD, Sharona Ross, MD, MCOM Department of Surgery (formerly)

Title: Integrated Vectorcardiogram [VCG], a compact “band aid” size device with wireless and machine learning features that enable 24x7 diagnostic-quality long term cardiac rhythm data collection to be continuously wirelessly received and processed
Collaborators: Richard D. Gitlin, PhD, Department of Electrical Engineering & Peter Fabri, MD, PhD (emeritus), MCOM Department of Surgery

Title: Text mining issues for looking at all studies on a subject (meta study)
Collaborators: Larry Hall, PhD, Sudeep Sarkar, PhD, Department of Computer Science & Engineering Ben Djulbegovic, MD, ScD, MCOM Department of Internal Medicine

Title: Image processing algorithm for quantifying the blurriness of ocular fundus images for diagnostic purposes
Collaborators: Christopher Passaglia, PhD, Department of Chemical & Biomedical Engineering & David Richards, MD, Brian Maddow, MD, and Radouil Tzekov, MD, MCOM Department of Ophthalmology

Title: Electoretinogram responses in rats, humans, and other animals
Collaborators: Christopher Passaglia, PhD, Department of Chemical & Biomedical Engineering & David Richards, MD, Brian Maddow, MD, and Radouil Tzekov, MD, MCOM Department of Ophthalmology

Title: Development of new technologies for early detection of pregnancy complications
Collaborators: Anna Pyayt, PhD, Department of Chemical & Biomedical Engineering & Valerie Whiteman, MD, Lennox Hoyte, MD, MS, MCOM Department of OB/GYN

Title: Gait adaptation in transfemoral amputees using split-belt treadmill training
Collaborators: Seok Hun Kim, PhD, Physical Therapy and Rehabilitation Sciences & Kyle Reed, PhD, Department of Mechanical Engineering

Title: Walking Crutch/Cane for Enhanced Assistance, Balance, and Control of Walking Dynamics
Collaborators: Seok Hun Kim, PhD, Physical Therapy and Rehabilitation Sciences & Kyle Reed, PhD, Department of Mechanical Engineering

Title: Gait Enhanced Mobile Shoe for Stroke Rehabilitation
Collaborators: Kyle Reed, PhD, Department of Mechanical Engineering & David Z. Rose, MD, MCOM Department of Neurology

Title: Harnessing 3C-SiC for Next Generation MRI-compatible Microelectrode Arrays
Collaborators: Steve Saddow, PhD, Sylvia Thomas, PhD, Department of Electrical Engineering & Gabriel de Erausquin, MD, PhD, MCOM Department of Psychiatry & Behavioral Neurosciences

Title: Wireless Sensors System for Monitoring and Management of Parkinson's Disease
Collaborators: Ravi Sankar, Department of Electrical Engineering & SH Kim, PhD, USF Physical Therapy and Rehabilitation Sciences

Title: AFib Source Location Identification through Signal Analysis
Collaborators: Ravi Sankar, PhD, Department of Electrical Engineering & Juan Sanchez-Ramos, PhD, MD, Teresa. Zesiewicz, MD, MCOM Department of Neurology

Title: Image analysis of cells and on fostering of biomedical innovation and translation of research
Collaborators: Ravi Sankar, PhD, Department of Electrical Engineering & Sudeep Sarkar, PhD, COE, & Shyam Mohapatra, PhD, MCOM Department of Internal Medicine

Title: Augmented reality system for minimally invasive surgery.
Collaborators: Yu Sun, PhD, Department of Computer Science and Engineering & Jaime Sanchez, MD, MCOM General Surgery, Terri Ashmeade, MD, MCOM Pediatrics, Thomas McCaffrey, MD, Otolaryngology, Kevin Sneed PharmD, College of Pharmacy

Title: Measurement of pain of infants in NICU
Collaborators: Yu Sun, PhD, Department of Computer Science and Engineering & Terri Ashmeade, MD, MCOM Pediatrics

Title: Developing a telemedicine robotic system.
Collaborators: Yu Sun, PhD, Department of Computer Science and Engineering & Thomas McCaffrey, MD, Otolaryngology

Title: Vesselness Based Feature Extraction for Endoscopic Image Analysis
Collaborators: Yu Sun, PhD, Department of Computer Science and Engineering & Jaime Sanchez, MD, MCOM General Surgery,

Title: Holographic greeter for the new USF pharmacy research.
Collaborators: Yu Sun, PhD, Department of Computer Science and Engineering & Kevin Seed, PharmD, College of Pharmacy

Title: A data streaming platform for health informatics
Collaborators: Yicheng Tu, PhD, Department of Computer Science and Engineering & Ming Ji, PhD, College of Nursing

Title: Physical-statistical modeling and optimization of cardiovascular systems
Collaborators: Hui Yang, PhD, Department of Industrial & Management Systems Engineering & Eric S. Bennett, PhD, Daniel Yip, PhD, MCOM Molecular Pharmacology and Physiology, Fabio Leonelli, MD, MCOM Cardiology
Title: Sustainable urban design: interactions between transportation design, air pollution exposures, and environmental equity
Collaborators: Amy Stuart, PhD, COPH Department of Environmental and Occupational Health & Abdul Pinjari, PhD, Yu Zhang, PhD, Department of Civil and Environmental Engineering

Title: Sustainability and the environment.
Collaborators: Amy Stuart, PhD, COPH Department of Environmental and Occupational Health & Environmental Engineering Group

Title: Development of EBM-CDSS (Evidence-Based Clinical Decision Support System) to Aid Prognostication in Terminally Ill Patients
Collaborators: Branko Miladinovic, PhD, MCOM Department of Internal Medicine & Ali Yalcin, PhD, Department of Industrial and Management Systems Engineering

Title: Using Technology to Improve Service Delivery and Health Outcomes for Older Adults: Assessing a Comprehensive, Integrated Healthcare Delivery Platform
Collaborators: Carla VandeWerd, PhD, COPH Department of Community & Family Health & Ali Yalcin, PhD, Department of Industrial and Management Systems Engineering

Title: Core Temperature Monitoring in Athletes
Collaborators: Eric Coris, MD, MCOM Department of Orthopedics & Tom Weller, PhD Department of Electrical Engineering

Title: Transdermal Plasma Electroporation for Delivery of Targeted Therapeutics for Skin Cancer
Collaborators: Christopher Nelson, MD, Nishit Patel, MD, MCOM Department of Dermatolgy & Cutaneous Surgery & Mark jarozeski, PhD, Department of Chemical and Biomedical Engineering

Title: DTI in mTBI
Collaborators: Eric Coris, MD, MCOM Department of Orthopedics & Dan Simkins, PhD, Department of Civil and Environmental Engineering

Title: Quantitative Analysis of Abdominal Core Performance Following Autologous Breast Reconstruction
Collaborators: Deniz Dayicioglu, MD, MCOM Department of Surgery & Susana Lai-Yuen, PhD, Grisselle Centeno, PhD, Department of Industrial & Management Systems

Title: Device Design program designed to provide a Masters in Biomedical engineering
Collaborators: Karl A Illig, MD, MCOM Division of Vascular Surgery, & Biomedical engineering faculty

Title: Blood flow forces in the early embryonic heart and mechanotransduction
Collaborators: Kersti K Linask, PhD, MCOM Department of Pediatrics & Michael VanAuker, PhD, Department of Chemical and Biomedical Engineering (former)

Title: Nano-delivery to cancer
Collaborators: Marzena Wiranowska, PhD, MCOM Department of Pathology and Cell Biology & Norma Alcantar, PhD, Department of Chemical and Biomedical Engineering

Title: HeartMapp development
**Collaborators:** Ponrathi R. Athilingam, PhD, College of Nursing & Miguel Labrador, PhD, Department of Computer Science & Engineering

**Title:** Three-dimensional (3D) medical imaging and anatomical modeling, rapid prototyping, 3D geometric morphometric analysis

**Collaborators:** Summer Decker, PhD, MCOM Department of Radiology, Bill Lee, PhD, Department of Chemical and Biomedical Engineering

**Title:** Delivery of naked DNA plasmids by in vivo electroporation for vaccine and immunotherapeutic purposes against cancer and infectious diseases

**Collaborators:** Kenneth Ugden PhD, MCOM Department of Molecular Medicine & Mark Jaroszeski, PhD, Department of Chemical and Biomedical Engineering

**Title:** Impact of Robotic Surgery on Surgeon Muscle Fatigue/Stress

**Collaborators:** Trushar Patel, MD, MCOM Department of Urology & John Mayer, DC, PhD, School of Physical Therapy and Rehabilitative Sciences

**Title:** Orthopedic biomechanics, Computational modeling, Medical imaging, & Biomedical devices and therapeutics

**Collaborators:** Roy Sanders, MD, MCOM Department of Orthopedics & Bill Lee, PhD, Department of Chemical and Biomedical Engineering

**Title:** Developing in vitro model systems (liver, blood) for our malaria

**Collaborators:** John Adams PhD, COPH Department of Global Health & Dennis Kyle, PhD, Draper Labs

**Title:** Microfluidic devices

**Collaborators:** Shyam Mohapatra, PhD, MCOM Department of Internal Medicine & Rasim Guldiken, PhD, Department of Mechanical Engineering

**Other collaborations and success stories involving USF Faculty:**

**A. USF Faculty at a Former University**

USF BME Task Force Member (RF) was one of the Founding Faculty of the BME Department at the University of Rochester (NY). Initially, graduate and undergraduate degree programs were established. After initial success with these programs, a new BME Department was formed and announced to be a joint department between the College of Engineering, which is part of the River/Main campus at Rochester and the University of Rochester Medical School. Grants from the Whitaker Foundation (totaling about 10 million dollars) and NY State funding facilitated a successful launch of this new BME Department including the construction of a new 3-story building located at the juncture between the River and Medical School campuses. This new BME building houses BME Department offices, new classrooms, auditorium lecture hall, and both research and instructional laboratories, as well as gathering places and café. The Rochester BME Department has evolved where its faculty and activities tend to gravitate towards the College of Engineering, vs. the Medical School. However, there are still faculty in the Department who have primary or secondary appointments in the Medical School and the current and founding chair originally came out of the Medical School. This Department is now ranked in the top 50 BME departments in the country by US News & World Report, and 4th in NY State, behind Columbia, Cornell and Rensselaer Polytechnic Institute (RPI).
B. The CAMLS Example

The following description is taken from a BME document, entitled "Roadmap for USF/CAMLS Device Design Program" that Robert Frisina, PhD (Engineering), Karl Illig, MD (Medicine) and others have worked on, and can be adapted for the proposed new joint Medical Engineering Department.

The USF/CAMLS Device Design Program (USF/CAMLS-DDP) is envisioned to be a major strategic component of the proposed joint engineering-medicine Department of Medical Engineering. Such a department would include undergraduate and graduate degree programs, basic research, attractive mechanisms for physician R&D involvement, and other scholarship. The objective of the USF/CAMLS-DDP is to formalize collaboration of engineers and physicians in a real-world environment, with a goal to generate intellectual property, scholarship, corporate support, and federal grant funding opportunities, through the cross-education of those from each school in the knowledge base of the other...this initiative is envisioned to be a core component of the proposed Medical Engineering Department.

In any academic environment, it is easy (and too often is the “default” setting) to provide education in a sterile, classroom setting, with educational materials supplied as lectures, text, and other static formats. Most existing device design programs follow this pattern. USF, through the Center for Advanced Medical Simulation and Learning (CAMLs), has made a commitment to environmentally-based learning. In addition, several other institutions throughout the world have established, with varying degrees of immersion, interactive relationships between engineers and physicians, and our early efforts have emphasized clinical exposure for engineering students. We propose to expand our early efforts and create a durable multidisciplinary educational program that emphasizes practical training, taking advantage of our unusual assets (CAMLs, the proposed Department of Biomedical Engineering, high clinical volume, and interested and experienced personnel).

Our underlying goals are to provide an environment where practical needs are identified and subsequent invention and translation to market is facilitated, while providing the highest level of education for all involved. We feel that academic-industry partnership, scholarship, and federal and other funding will be vastly facilitated and subsequently follow. As outlined in the Executive Summary at the beginning of this document, all USF/CAMLS-DDP programs and outcomes are envisioned to derive from and should address the following five goals.

**Graduate Education**

1. Robust, world-class graduate training programs for two groups of learners.
   a. Biomedical engineers who are intimately tied into the real-world clinical environment of medicine, who thus understand the issues that physicians face based on direct experience (clinic, ward, and operating room). A major part of their training will be based on immersion in clinical medicine, both simulated (CAMLs) and actual (TGH). This aspect of the program is arguably absolutely unique to our program and will be a strong recruiting tool.
   b. Physicians who are strongly interested in device design, innovation, and engineering in general. Formal training will be performed during truly protected time (one to two years’ training during or after their medical school training), and again these students will have substantial exposure to the engineering world (both didactic and practical).
2. We envision expansion of this program as it develops, perhaps to include business
students, law students, administrative personnel, and so on, although specifics will need
to be better elucidated once the program is active.
3. Graduates of this program will be expected to be highly competitive for complex medical
device company jobs or prepared to go on for doctoral work in engineering, medical
school, or medical or business leadership roles; medical graduates are envisioned to be
prepared for careers in biomedical innovation, medical leadership, and so on.

**Interdisciplinary Collaboration**

1. Creation of a group of physicians who understand engineering principles, including what
can and cannot be done, based on direct experience, and creation of a group of
engineers who understand surgical and other clinical issues, needs, and current
resources.
2. Improve the ability of engineers and physicians to communicate with each other in
general.
3. We envision benefit in this area to the involved faculty as well as to the individual
students. Improved faculty collaboration may provide a more durable benefit, in fact,
than that provided to each individual graduate.
4. Collaboration leading to further interaction between major USF schools, providing global
benefit to the University as a whole.

**Device Development**

1. A steady stream of ideas, ideally leading to inventions, created with the help of the
resources CAMLS can bring to bear.
2. Potential corporate start-up spin-offs that will benefit the USF schools of medicine,
engineering and others, CAMLS, the Tampa Bay Community, patients, and the
population in general.
3. Creation of IP that will benefit all inventors and "investors."
4. Focus on practical inventions, derived from the inventors' immersion in the world of
medicine as well as engineering.

**Industry Relationships**

1. Better relationships with existing device corporations, who value both the ideas
generated from this program and the personnel we train.
2. Encourage/recruit companies to "invest" in this program, either on a global basis or
based on a particular year, person, project, program, or idea.
3. Robust interaction with business (entrepreneurship, marketing, company creation) and
perhaps law students during the development and commercialization process of bringing
device ideas to practicality to provide them with real-world training.

**Competitive Advantages**

We believe we have multiple advantages over existing programs, that, when taken together,
allows us the possibility to become the leading device design program in the world.

**Clinical Exposure**

1. To our knowledge, only a few programs (Rochester, Johns Hopkins) provide significant
clinical exposure to the engineering students. Our program is significantly driven by
clinicians (philosophically, a 50-50 partnership) and as such both our early efforts and
our future plans emphasize this facet of training. Many programs supply engineering and
device development exposure to non-engineering students, but we strongly believe that
we can provide the most practical educational experience to non-clinicians by immersion
in the clinical world.

2. We also have the unique resources offered by CAMLS in this regard. While we can
provide observational experience as above, such students cannot legally participate in
direct patient care. The simulation facilities at CAMLS (both individual and
group/situational) are uniquely designed to provide high-fidelity hands on experience.

Location

USF-CAMLS-DDP would have the distinction of being the only such program in the southeast
US. The Stanford and Hopkins programs seem most similar in scope to what we are trying to
do. Rochester is entirely focused on vascular surgery.

Proposed Specific Structures

The USF/CAMLS-DDP program will consist of multiple closely related intersecting
components, organized according to the five overarching vision goals presented in the
Executive Summary.

- Graduate Education
  - Initially, we plan on training two general levels of students
    - Masters level BME students, culminating in Master’s Degree
  - Conventional biomedical engineering curriculum (USF main campus, CAMLS)
    - 5 required courses: BME I and II, Biostatistics, Anatomy, Physiology
    - Additional courses related to medical training
      - Medical and research ethics
      - A business school course or two? Identify
      - A reverse engineering course, ala Cincinnati?
    - Pick a field of medicine, we ensure mentoring (TGH, CAMLS)
    - Likely heavily device-dependent fields, but can be anything including drug
development, software.
    - Initially vascular surgery, but plan to expand opportunities
    - Early immersion/practicum to select – rotational or pre-selected?
    - Attend weekly conferences, required reading
    - Two four week clinical rotations, including call
    - CAMLS curriculum – simulation, team training
    - Attend a regional or national meeting, “homework”
    - Significant, personal mentoring on a weekly basis
  - Develop an idea (with a clinical partner – resident, student, faculty, nurse?) (CAMLS)
    - Develop at CAMLS – brainstorming, prototyping
    - “Shark tank” – Defend in front of engineers and medical personnel
    - Bring to the point of patentability, development
    - Work with other fields as we mature
      - Legal
      - Business school students – entrepreneur program
  - Write a manuscript for publication (with clinical partner)
  - Physicians during (or after) training
    - Two options:
      - For residents with an engineering degree: BME Master’s Degree
One versus two years? Bob and I need to chat. If we have funding, we can offer up to two years, depending on the wishes and training of the resident.

- Altered course load – will not need anatomy and physiology, but will need further BME work, likely statistics, and so on.
- For residents without an engineering degree: Certification TBD (Masters in medical science; Entrepreneurship). Sense is that they will value more something beyond a “certificate.”
  - One to two year program, full-time
  - Again, will need to nail down courses. Heavier on engineering courses.
- Trainees in both tracks will need practical engineering experience.
- They will be assigned an engineer mentor to come up with a practical idea for a device/system/drug as above, although focus will be adding medical knowledge to the engineering environment.

- As above, both a patentable idea and scholarly output will be required for graduation in either track.
- Eventually we plan on opening this up to other interested trainees (legal, business, management, and so on) but this will need to be further explored once we have some practical experience overall.
- As above, CAMLS-based training will be critical at all phases of this process:
  - BME student didactic education
    - Anatomy
    - Clinical simulations – first and third floor
  - Practical exercises based on selected field – designed to introduce student to techniques, in turn to gain a direct sense of what works and what is needed
  - “Home base” for design development (TBRIC)
    - Ideas, conceptualization
    - Prototype development and testing
    - Group interaction (business, legal, medical)
    - Corporate relations: Identification of possible corporate partners to sponsor further device development and/or licensing of intellectual property.

- Interdisciplinary Collaboration
  - This is envisioned to derive naturally from the training programs described above, at both a faculty and trainee level.
  - We envision collaboration in, but not limited to:
    - Development of IP
    - Scholarly output
    - Grant funding
    - Joint attendance at meetings, perhaps participation in each other’s meetings

- Device Development
  - A very obvious and fundamental goal of this program is generation of ideas for devices to improve our ability to provide medical care.
    - This will improve our reputation for clinical progress and outcomes
    - This will also obviously generate IP for USF
  - Most trainee projects should lead to patents
  - USF has strong logistical support for this, and is a world leader in terms of # of patents generated annually
  - Several options exist for managing IP
Purchase outright by a company
Licensing (with varying degrees of developmental help) by a company, or
Creating our own/spin off company

Industry Relationships

- This will be a critical component of the program from the outset. We aim to
cultivate specific relationships with specific people within each relevant company,
organized around this program.
- Specific goals will include:
  - Industry participation in ideas, ideally “purchasing” an MD/BME team to
    work on a specific idea, with right of first refusal for ownership and/or
development.
  - Engineering internships for both groups of trainees, but especially
    physicians pursuing BME training.
  - Acting as a source of ideas in general.
  - Acting as a goal for employment of graduates of this program.
- Other ideas
  - Provision of training/shadowing opportunities for their engineers

Marketability, Recruitment, and Funding Opportunities

- We aim to publicize this program robustly. It is likely that our program will be the
program that offers engineering trainees the most clinical exposure of any such
program, and we will be the ONLY program to involve specific and situational
simulation. This will:
  - Attract students from outside USF, and
  - Attract corporate partners.
- We anticipate (and will require) significant academic output to derive from this.
  This will:
    - Enhance the reputations of all involved, and
    - Provide significant education to students in this regard.
- Finally, a very critical goal in this regard is to increase our competitiveness for
  funding. This would be envisioned to be at any/all levels, including federal,
foundation, corporate/industry, society, and others. Needs include:
  - Endowments (faculty support)
  - Tuition and supplies
  - Specific research projects
    - Specific device development (“sponsored” by a company)
    - Other issues yet to be identified

Summary

We propose creation of a Device Design Program, initially run by Biomedical Engineering and
Vascular Surgery and eventually being part of the interdisciplinary Medical Engineering
Department, which has as its goal interdisciplinary training of engineering students and medical
residents in the process of device invention and development. As well as ensuring engineering
exposure to medical trainees, it will be absolutely unique in two areas: Very strong reliance on
clinical exposure for engineering students, and in the use of CAMLS for training. We anticipate
that this program will generate devices that will improve patient care and generate IP for the
University and inventors, foster improved interdisciplinary interaction between the colleges of
Medicine and Engineering, create unique and lasting industry relationships, and foster scholarly
output. We also believe that this program has the potential to generate significant funding
opportunities and will act as a major marketing and recruiting pull for the University.
### Appendix C

Accredited BS Programs (90) (P also have PhD program, J have joint program with a Medical School)

<table>
<thead>
<tr>
<th>University</th>
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<tbody>
<tr>
<td>Arizona State University (P)</td>
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<td>Boston University (P)</td>
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<td>Brown University</td>
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<tr>
<td>Bucknell University</td>
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<tr>
<td>Case Western Reserve University (P)</td>
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<tr>
<td>City University of New York, City College (P)</td>
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<tr>
<td>Clemson University (P,J)</td>
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<td>Columbia University (P)</td>
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<td>Drexel University (P)</td>
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<td>Illinois Institute of Technology (P)</td>
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<td>Miami University</td>
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Joint BME-MED Programs/Departments

Clemson-MUSC: a graduate research and training program established in the Fall of 2003 based on a formal agreement between the two institutions. Since its inception, the program has grown to comprise of 5 primary faculty from Clemson University, who are permanently located and conduct their research full-time on the MUSC campus in Charleston, SC, and 26 basic science and clinical faculty from MUSC, who hold program faculty appointments in the program. Program students and cross-over interdisciplinary MUSC students can complete required and elective bioengineering courses, taught locally by primary and program faculty and through videoconferencing from participating faculty in the parent bioengineering department at Clemson. In addition, the students can enroll in basic science and clinical MUSC electives for full transfer credit.

Georgia Tech-Emory: a unique partnership and a BOLD experiment, the biomedical engineering PhD program is offered through the Wallace H. Coulter Department of Biomedical Engineering, a unique public and private partnership conferred jointly by both Georgia Tech's College of Engineering and Emory University's School of Medicine.

NC State-UNC: In 2003, the University of North Carolina at Chapel Hill and North Carolina State University formally brought their exceptional strengths and national reputations via their College of Arts & Sciences, School of Medicine, and College of Engineering to establish our department. The undergraduate program at NC State is an ABET accredited program that offers a bachelor's degree in Biomedical Engineering. At UNC-Chapel Hill, the joint department offers undergraduate education under the auspices of the College of Arts & Sciences.

Memphis-UTenn: By our state-certified program of graduate education beginning in 1996, each individual is placed at one site, either UM or UT for registration each term. Generally, this site is where the student's major advisor is employed and the source of stipend and tuition funding is located. This site also provides indirect services, e.g., health insurance and clinical services. Classes are held on both campuses; laboratories in BME are available for research on both campuses. Transfer of sites is possible. Registration processes are treated in other questions. The joint program is largely constructed about a reciprocal agreement that exists between the UM and UTHSC. This agreement offers a means to extend the offerings of each by use of the available services of the other. It does not expect the other to provide funding to extend the offerings of the other campus.

Toledo: The Doctor of Philosophy in Biomedical Engineering at the University of Toledo is a joint program between The College of Engineering (COE) and The College of Medicine (COM). The curriculum also provides a PhD program for MD students from undergraduate engineering backgrounds that are interested in pursuing a dual degree and careers as physician scientists. For students directly admitted into the Ph.D. program with a B.S. degree, the minimum coursework requirements specified below must be satisfied.

- Register and mandatory attendance at a weekly seminar series in the COE or COM every semester.
- Complete 13 hours of core coursework (3 or more hours in COM)
- Complete 12 hours of engineering/life sciences elective coursework.
- Complete 3-6 hours of entrepreneurship elective coursework.
• Complete 15 hours of other engineering/science elective coursework.
• Complete at least 45 semester hours of dissertation research.

**UAB:** Since 1979, the Department of Biomedical Engineering has resided wholly within the School of Engineering. In 2014 the department was recreated as a joint department between the School of Engineering and the UAB School of Medicine. By integrating the department into the School of Medicine, administrators say they hope to capitalize on existing and emerging strengths in research, education and patient care at UAB. Historically, biomedical engineers at UAB have collaborated with clinicians and medical researchers on a limited basis through various centers or individual research projects. By integrating the department into the medical school, SOM Dean says he expects to see an increase of interdisciplinary research, as well as new interdisciplinary programs that will facilitate transition from the laboratory to the clinic. ([http://www.uab.edu/engineering/home/bmenews/13-departments-research/dept-biomedical-eng/945-uab-schools-of-engineering-and-medicine-create-joint-department-of-biomedical-engineering](http://www.uab.edu/engineering/home/bmenews/13-departments-research/dept-biomedical-eng/945-uab-schools-of-engineering-and-medicine-create-joint-department-of-biomedical-engineering)).

Organizational structure is roughly as follows:

• joint department with joint hires and joint operational leadership overseen by Deans of COE and COM
• split indirect costs, split hiring/startup costs, and split salary costs (true joint appointments)
• faculty primary appointment and tenure through department with higher percentage
• “memorandum of understanding” to address problems that might arise with departments, chairs, deans

  example 1: COM hired BME faculty member with 12 month appointment at 75% COM-25% COE, meaning that COE covered 25% of startup and basically pays summer salary in exchange for their teaching a course (or two) and 25% of their grant indirect costs. Tenure through COM.

  example 2: COM hired BME faculty member with 12 month appointment at 75% COE-25% COM, meaning that COM covered 25% of startup and pays summer salary in exchange for 25% of grant indirect costs (maybe COM course too?). Tenure through COE.

  example 3: COE hires BME faculty member with 9 month appointment at 51%COE-49%COM, meaning that startup and grant indirect costs are split 50-50 and COE pays academic-year salary. Tenure through COE.

**UIC:** Beginning in Fall of 2011, the Department of Bioengineering is now in both the College of Engineering (COE) and the College of Medicine (COM) at UIC, home of the largest medical school in the country. This is a new arrangement that is in line with trends in best practices at other top programs around the country.

**UMaine:** The Graduate School of Biomedical Science and Engineering (GSBSE) is a unique graduate program that includes the University of Maine as the degree granting institution and five additional cooperating academic and research institutions within Maine (Jackson Labs, Univ. Southern Maine, Univ. New England, Mt Desert Island Biology Labs, Maine Medical Center Research Institute).

**UMichigan:** The department is currently housed in engineering, though its researchers regularly collaborate with medical doctors and a number of Medical School faculty hold joint appointments there. In 2012, the academic structure was changed to bring biomedical engineering researchers closer to the patients their technologies aim to benefit. As part of this plan, BME will expand over the next five years from approximately 20 primary faculty members to 35. Most of the new joint hires will be Medical School appointments. The department will retain its space on North Campus in engineering and in the North Campus Research Complex. It will also open a space at the Medical School in the future. The BME Chair interacts regularly with Medical School Department Chairs at Research Advisory Board meetings.
Virginia: The Department of Biomedical Engineering at the University of Virginia was established in 1967 as a joint program of U.Va.’s School of Medicine and School of Engineering and Applied Science. There are 21 core BME faculty and more than 20 joint faculty across multiple schools and departments.

UWashington: Joint department in nationally recognized School of Medicine and College of Engineering, with 46 active core teaching and research faculty and 9 joint faculty.

VTU-WFU: A joint degree partnership between Virginia Tech and Wake Forest University that is called the School for Biomedical Engineering and Sciences. Currently the program has 76 tenure track faculty (25 primary and 51 joint) as well as an additional 68 affiliate faculty appointments. One campus is chosen as “home base” but students have the opportunity to experience both environments and the faculty of each through courses taught by video broadcast, and by inter-campus visits. Financial support is available for students on both campuses. Traditionally first-year students are offered either a full fellowship or a Graduate Teaching Assistantship which provides a competitive stipend and pays full tuition. Students are also hired by faculty to be graduate research assistants, and often summer internships in select programs become available.

UT-San Antonio/UT-Health Science Center-San Antonio: Purely a joint graduate program. The Dean of the College of Engineering at UTSA and The Dean of the Graduate School of Biomedical Sciences at UTHSCSA have overall responsibility for the Joint Graduate Program in Biomedical Engineering. The graduate faculty of the Biomedical Engineering program, along with the Program Director and Associate Director, are responsible for curriculum development and ongoing review. The Program Director and Associate Director advise all graduate students, maintain records, and represent the program. The day-to-day administrative operation of the BME Program is the responsibility of the Program Director and Associate Director. The Chair of the Admissions Committee, the Chair of the Committee on Graduate Studies (COGS)/Graduate Studies Committee (GSC), and the Chair of the Curriculum Committee report, advise, and make recommendations to the Program Director and Associate Director. The Program is supervised by a COGS/GSC composed of all BME Program faculty (both Core and Associated) who are also on the Graduate Faculty at either UTSA or UTHSCSA or both. From this group, subcommittee Chairs are elected to perform various activities for which the COGS/GSC is responsible such as recommending admission of applicants to the program, overseeing academic curricula, monitoring the academic progress of students in didactic and research activities, attesting eligibility for admission to candidacy for a degree, and verifying to the Graduate Faculty Council (GFC) [=Graduate Council at UTSA] that students have fulfilled all requirements for the awarding of the degree. Recommendations are made by this committee to the Program Director and Associate Director for implementation and, if warranted, forwarded to the Graduate Deans for approval. The initial Program Director was appointed from the Core faculty by the two Graduate Deans, with the assistance of a committee composed of equal numbers of faculty from the two institutions. The term of the first Program Director was three years. Since the expiration of his term, the Biomedical Engineering Program faculty elect a new Program Director and Associate Director every three years. After each election, the credentials of both newly elected Directors are forwarded to the Deans for final approval.
New Academic Program Pre-Proposal Process
New academic program pre-proposals are initiated and developed by the faculty. Approval of the pre-proposal must be obtained from department chairs and college deans or equivalent administrators before submission for USF System level review and consideration for inclusion in the USF Annual Work Plan. Details of the pre-proposal process and a timeline can be found on the Office of Institutional Effectiveness, Academic Program Planning and Review website.

Original copies of completed pre-proposals (including required signatures) must be submitted by October 1st to Kelly Bergquist, BEH 339. (For questions: kbergqui@usf.edu 4-2450)

Pre-proposal Application Form

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<td>B.S. in Biomedical Engineering</td>
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<td>Proposed Mode of Delivery (% online if applicable)</td>
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<tr>
<td>Enrollment Projections (FTE) : Year 1 and Year 5</td>
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<tr>
<td>Proposed Implementation Date (e.g. Fall 2012)</td>
<td>Fall 2015</td>
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Please provide a succinct, thorough response to each of the following:

Program Summary: (Briefly describe the proposed program)

1. Briefly summarize the overall rationale for the new academic program. Include a consideration of any ways in which the proposed program is distinct from others already offered in the SUS (use the 4-digit CIP as a guide). Discuss how this program supports specific university and SUS missions. Consider collaborative opportunities with other SUS institutions as appropriate. (maximum length 250 words)
Appendix D

The proposal to offer a new degree program in Biomedical Engineering is aligned with the strategic goals and plans of the SUS Board of Governors and USF, namely to increase degree productivity and program efficiency while increasing student access and success in degree programs in the STEM fields. Biomedical Engineering is one of the fastest growing degree programs in the country, with a strong projected labor market growth. So far there is only one accredited BS-BME program in the SUS at FIU. University of Florida recognized the need and demand and has started offering this option (with limited access) to their engineering students starting in 2012 and they are expected to have an accredited program in 4-5 years. FGCU has a degree program in a closely related field (Bioengineering).

As a result, Florida residents, especially those who are in the greater Tampa region does not have the option for this fast growing and important new field of engineering despite having a very strong programs in other health related fields such as medicine, nursing, pharmacy and related subjects. USF is located in a large metropolitan area which draws the majority of its students from the region and having the BS-BME option at USF will not only present opportunity for USF students to enter into this fast growing profession but also to continue to graduate degrees in many health related areas that involve research in biomedical fields. They will also meet the growing demand in the large industrial base do biomedical related companies located in Florida, especially around the Florida High-Tech Corridor. A BS in BME will provide them with unique skills that are at the intersection of engineering and medicine, to meet many current and future demands related to decreasing the high costs of health care, while at the same time, maintaining and improving quality of care delivered.

It is proposed that the Department of Chemical and Biomedical Engineering at USF develop and offer a new BS degree program in Biomedical Engineering in addition to the existing BS ChE program in order to meet the growing demand for this newly emerged, but rapidly growing field at the intersection of engineering and bio-medicine.

Student Demand: (Describe the demand in the SUS for the proposed program)

2. Briefly describe the demand for the proposed program and consider the following in your narrative:
   - Recognizing that programs at different levels may require different degrees of justification (e.g., greater duplication may be warranted at undergraduate and master's levels), indicate why duplicative programs should be warranted.
   - Consider the numbers of graduates and students enrolled at similar programs currently offered online or face-to-face.
Appendix D

- Consider as applicable: place-bound learners, underserved populations in the field/profession, and professional credentials requirements. (maximum length 250 words)

According to the American Society for Engineering Education, of the 83,000 engineering degrees granted in 2012, nearly 4000 were biomedical engineering, becoming the 6th most popular major in a short time period, just behind mechanical, civil, electrical and chemical engineering which are most traditional engineering disciplines.

Interestingly 39% of the degrees went to women, one of the largest in engineering (only environmental had more percentage of women).

Georgia Tech had the largest enrollment (granting over 157 degrees in 2011),

The most telling story is the trend over 2002-2011, during which the number of biomedical engineering graduates increased from 1,315 to 4066, a growth of over 200% whereas the total number of engineering graduates grew only 24%.

University of Florida recognized this demand and has started offering a BS in BME program in 2012. However this is a limited access program and only the second in the SUS. Therefore it is no: expected to meet the growing demand for this program regionally and state-wide.

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41
Workforce and Economic Development Needs: (Describe how the proposed program meets workforce and economic development needs)

3. Briefly describe how the proposed program meets workforce and economic development needs and consider the following in your narrative:
   - Impact of this program (local, state, national, international)
   - Impact of research funding
   - Changing professional credential requirements (maximum length 250 words)
Appendix D

According to the Bureau of Labor Statistics (BLS), “Employment of biomedical engineers is projected to grow by 62% from 2010 to 2020, much faster than the average for all occupations”. For comparison, the demand for all engineers is projected to grow by 11%, whereas the demand for all occupations is expected to grow by 14% during the same decade time period.

Again according to BLS “The aging baby boom generation is expected to increase demand for biomedical devices, medications, drugs and procedures, such as hip and knee replacements...Biomedical engineers will likely experience more demand for their services because of the breadth of activities the engage in, made possible by the diverse nature of their training”.

Quoted from: http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm

According to the 2010-1015 Strategic Plan of Workforce Florida (http://www.workforceflorida.com/_MEDIA/Menu/STEMStrategicPlan2010-2015_Web.pdf)
“Technology, Engineering and Math (STEM) are a foundation for business competitiveness, talent readiness and career advancement ... Industries identified as targets for the STEM Council include life sciences, aerospace, energy, manufacturing, information technology and homeland security and defense, as well as others.”

According to Enterprise Florida, Florida is home to 200 biotech companies specializing in therapeutics, diagnostics, industrial biotechnology and related fields. Florida has one of largest medical device manufacturing industries. Florida ranks 2nd in the U.S. for the number of FDA-registered medical device establishments. Nearly 19,000 Floridians work in this industry. Major companies include: Medtronic, Boston Scientific, Beckman Coulter, Osco and Baxter International. In addition Florida has over 150 pharmaceutical and medicine manufacturing companies that employ nearly 5200 Floridians.

Florida has nearly a million workers in the healthcare sector, delivering one of the most sophisticated health care in the world.

<table>
<thead>
<tr>
<th>Institution Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>USF assumes responsibility for funding this program if approved.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Ralph Wilcox</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
According to the 2012-2025 Strategic Plan of the SUS Board of Governors:

(https://www.flbg.org/pressroom/strategicplan.php) Strategic Priorities for a Knowledge Economy includes: Increase student access and success in degree programs in the STEM fields and other areas of strategic emphasis that respond to existing, evolving, and emerging critical needs and opportunities.

According to the 2013-2018 Strategic Plan for USF: Goal 1 includes: Enhance opportunities for all students by providing transformative learning – including an increased commitment to science, technology, engineering and mathematics and health fields that is intellectually, scientifically and technologically sound and produces relevant applied skills and engaged outcomes.

The proposed degree program is strongly aligned with these goals and priorities.

1. It will increase access to STEM degrees as it opens up new avenues; biomedical engineering encompasses all four STEM disciplines
2. It will increase production of USF graduates in STEM areas
3. It will meet the goals of creating a workforce trained to meet the challenges of the 21st century, especially those dealing with an aging population and American Health Care Crisis
4. It will lead to increased retention of our brightest and best students who often have to go out of state in order to satisfy their desire to be part of this important field.

4. How does this program support the institutional, USF System, and SUS Strategic Plans?

5. Does this program offer collaborative and/or interdisciplinary opportunities at other institutions in the USF and SUS systems? If so, what efforts have been made to initiate collaboration?
By its nature, Biomedical Engineering is an interdisciplinary subject and involves many branches of science, mathematics/statistics and engineering. We have initiated discussions with other departments within and outside the College of Engineering regarding cooperation and collaboration in not only course offerings but also in technology transfer and research. Many of the faculty in ChBME are already involved in research and course collaborations with Moffitt Cancer Center, College of Medicine, Johnnie Byrd Alzheimer’s Research Center, College of Public Health, College of Behavioral & Community Sciences, and College of Pharmacy. The first two years of this program is primarily focused on science and mathematics courses. We will draw from courses currently offered by departments of Biology, Chemistry, Physics and Mathematics to fulfill these requirements. Community college transfer students can fulfill these requirements before they transfer to USF. Due to the large enrollments in these courses at USF, the addition of BS BME will have only a minimal impact on the system. A key feature will be to integrate all aspects of the American Medical Assoc. requirements for admission to US Medical Schools into our undergraduate BME curriculum, to ensure that the process is seamless for those USF students wishing to attend medical school.

6. Provide information on the available resources and capacity for your program. In your response, include faculty availability and student support resources including the library. How will department/college resources be shifted to support the program?

The Department of Chemical and Biomedical Engineering has added a number of full-time faculty (8 in total) over the last few years, nearly doubling the faculty size over the last 10 years, while we were building up the graduate research and educational programs in Biomedical Engineering (MS, PhD). Simultaneously, many of the other departments in the college have added new faculty in this fast growing area of research and development, thus allowing the College to expand its portfolio of courses in Biomedical Engineering.

This growth, combined with the fact that the undergraduate BME program has overlap with the traditional chemical engineering courses taught by our faculty, allows us to take advantage of the existing faculty resources to fulfill many of the course needs.

As shown in the attached course requirements for the BS-BME program, we have identified that the program will require only 8 new courses to be added. Some of these courses can be taught by existing faculty. We estimate that with the addition of two instructors we can meet the additional teaching load.

The library resources required for the program is already in place, since we have developed a strong graduate research and teaching program in biomedical engineering over the last 15 years.

We anticipate that we will need to add one full time staff member to assist with student advising, registration and other curricular and ABET accreditation needs.
Appendix D

7. Please list the Student Learning Outcomes for the program (undergraduate programs must comply with BOG Regulation 8.016 “Academic Learning Compacts”).

See attached.
Appendix: Academic Learning Compact

Bachelor of Science Degree in Biomedical Engineering

Program Mission Statement

The mission of the College of Engineering at the University of South Florida is to improve the quality of life in our community by:

- Providing a high quality education for our students and practicing professionals
- Creating new knowledge and solving real world problems via innovative research and technology transfer development
- Engaging in effective community service and outreach.

Expanding on this, the mission of the BS in Biomedical Engineering Program includes:

- Provide a broad education that encompasses engineering, mathematics and basic sciences targeted at advanced health care and biotechnology;

Program Educational Objectives

1. Produce graduates who will be able demonstrate their professional engineering competence in their chosen career by holding positions of increasing responsibility in industry, government, educational institutions or private practice
2. Produce graduates who will be able to use their broad educational background to foster communications across professional and disciplinary boundaries.
3. Produce graduates who continue to improve their professional skills, knowledge and understanding through continuing their education, pursuit of advanced degrees and/or pursuit of professional licenses in their chosen profession.

Expected Student Outcomes: Graduate of the Program must demonstrate the following:

A. Discipline Specific Knowledge and Skills

Outcome 1: Prior to graduation, the student in this program must demonstrate an ability to design a system, component, product or process related to the biomedical applications

Outcome 2: Prior to graduation the student must demonstrate ability to apply knowledge of science, mathematics and engineering

Outcome 3: Prior to graduation, the student must demonstrate an ability to design and conduct experiments as well as analyze data

B. Critical Thinking Skills
Appendix D

Outcome 1: Prior to graduation the student will demonstrate an ability to design a system, component, product or process to related to medical applications, while taking into account economic, environmental, social, political, ethical, safety, manufacturability and sustainability constraints.

C. Communication Skills

Outcome 1: Prior to graduation, the student must demonstrate an ability to communicate effectively.
Appendix D

Proposed USF Biomedical Engineering (BME), BSBME, 127 hours

The schedule that follows indicates the required courses for this degree program and the recommended sequence of registration for full time engineering students. Students who adhere to the recommended sequence of courses, and complete each course with the required grade, will be fully prepared for each subsequent semester. Registration assistance will be provided by academic advisors in the College of Engineering.

<table>
<thead>
<tr>
<th>Fall Semester - Year 1</th>
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<tbody>
<tr>
<td>CHM 2045 General Chemistry I</td>
<td>3</td>
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<tr>
<td>CHM 2045L General Chemistry I Laboratory</td>
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<tr>
<td>EGN 3000 Foundations of Engineering</td>
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</tr>
<tr>
<td>ENC 1101 Composition I</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2281 Engineering Calculus I</td>
<td>4</td>
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<tr>
<td>XXX XXXX Fine Arts Elective</td>
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<tr>
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<tr>
<td>CHM 2046L General Chemistry II Laboratory</td>
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<tr>
<td>ENC 1102 Composition II</td>
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</tr>
<tr>
<td>MAC 2282 Engineering Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PHY 2048 General Physics I</td>
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<td>PHY 2048L General Physics I Laboratory</td>
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<tbody>
<tr>
<td>EGN 3443 Engineering Statistics I</td>
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</tr>
<tr>
<td>MAC 2283 Engineering Calculus III</td>
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</tr>
<tr>
<td>PHY 2049 General Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2049L General Physics II Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>XXX XXXX Social and Behavioral Sciences Elective</td>
<td>3</td>
</tr>
<tr>
<td>XXX XXXX Humanities Elective</td>
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<td><strong>Total 17</strong></td>
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<table>
<thead>
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<tbody>
<tr>
<td>BME 4100 Introduction to Biomedical Engineering</td>
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<tr>
<td>EGN 3343 Thermodynamics I</td>
<td>3</td>
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<tr>
<td>EGN 3433 Modeling and Analysis of Engineering Systems (or MAP 2302 Differential Equations)</td>
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<tr>
<td>XXX XXXX Social and Behavioral Sciences Elective</td>
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<tr>
<td>BSC 2010 Biology I</td>
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<td>BSC 2010L Biology I lab</td>
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<td><strong>Total 16</strong></td>
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<tr>
<th>Summer Term - Year 2</th>
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<tr>
<td>CHM 2210 Organic Chemistry I</td>
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<td>CHM 2210L Organic Chemistry Laboratory I</td>
<td>2</td>
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<tr>
<td>ENC 3246 Communications for Engineers</td>
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<tr>
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<tbody>
<tr>
<td>BME xxx Biomechanics</td>
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</tr>
<tr>
<td>BMExxxx Fluid flow, Heat and Mass Transfer for BME</td>
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</table>
Appendix D

ECH 4845 Num. Meth. in Chemical & Biomedical Engineering 4
BSC 2011 Biology II 3
BSC 2011L Biology II lab 1
Total 15

Spring Semester - Year 3
CHM 2211 Organic Chemistry II 3
CHM 2211L Organic Chemistry II Laboratory 2
BME 4503 Biomedical Instrumentation 3
BME xxxx Physiology for Engineers I 3
XXX XXXX Humanities Elective 3
Total 14

Fall Semester - Year 4
BME xxxx BME Lab 3
BME xxxx Physiology for Engineers II 3
BME xxxx BME Design I 3
EMA 4003 Introduction to Materials Science 3
XXX XXXX Science or Engg Upper-Level Elective 3
Total 15

Spring Semester - Year 4
BME xxxx BME Design II 3
BME Upper level Electives 6
XXX XXXX Human Cultural Diversity /Global Context Elective 3
Total 12
Total 127 hours

**Bold indicates new courses to be developed and added**

*Italics indicates courses to be redesigned*
### Table 6.1a Full Time Faculty in ChE and their Research Interests. Faculty with research related to Biomedical Engineering are in bold.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Research Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Norma Alcantar</td>
<td>Associate Professor</td>
<td>Micellar Surfactants, Nanoparticles, Organic/Inorganic Thin Films, Drug Delivery, Pathology of Alzheimer’s Disease</td>
</tr>
<tr>
<td>Dr. Venkat Bhethanabotla</td>
<td>Chair, Professor</td>
<td>Chemical and Biological Sensors, Plasmonics, Computational Catalysis</td>
</tr>
<tr>
<td>Dr. Scott W. Campbell</td>
<td>Professor</td>
<td>Phase Equilibria, Environmental Modeling</td>
</tr>
<tr>
<td>Dr. Robert Frisina, Jr.</td>
<td>Professor</td>
<td>Neuroengineering: Sensory Systems; Drug Delivery</td>
</tr>
<tr>
<td>Dr. Richard Gilbert</td>
<td>Professor</td>
<td>Florida Technical Education Curriculum Reform; Instrumentation and Controls</td>
</tr>
<tr>
<td>Dr. Yogi Goswami</td>
<td>Professor</td>
<td>Cancer Treatment, Energy Conversion, Solar Energy, Hydrogen Energy and Fuel Cells, Thermodynamics and Heat Transfer, HVAC</td>
</tr>
<tr>
<td>Dr. Vinay K. Gupta</td>
<td>Professor</td>
<td>Self-Assembly Materials, Surface and Interfacial Science</td>
</tr>
<tr>
<td>Dr. Mark Jaroszinski</td>
<td>Associate Professor</td>
<td>Gene and Drug Delivery by Electroporation, Corona Charge, and Plasmas</td>
</tr>
<tr>
<td>Dr. Babu Joseph</td>
<td>Professor</td>
<td>Modeling, Simulation, Biomass Conversion, Photocatalysis, Biofluidics</td>
</tr>
<tr>
<td>Dr. Plyush Koria</td>
<td>Assistant Professor</td>
<td>Tissue Engineering &amp; Regenerative Medicine, Nanomedicine, Biomaterials, Wound Healing</td>
</tr>
<tr>
<td>Dr. John Kuhn</td>
<td>Assistant Professor</td>
<td>Heterogeneous Catalysis, Materials Chemistry, Chemical Separations</td>
</tr>
<tr>
<td>Dr. William Lee</td>
<td>Professor</td>
<td>Basic, applied and forensic biomechanics; psychology of medical procedures, engineering education</td>
</tr>
<tr>
<td>Dr. George Philippidis</td>
<td>Associate Professor</td>
<td>Biomass and Biofuel Engineering</td>
</tr>
<tr>
<td>Dr. Christopher Passaglia</td>
<td>Associate Professor</td>
<td>Neuroengineering, Visual and Computational Neuroscience, Glaucoma</td>
</tr>
<tr>
<td>Dr. Anna Pyayt</td>
<td>Assistant Professor</td>
<td>Bio-photonics, Advanced Material and Devices, Nanotechnology, New Biomedical Instruments, Sensors</td>
</tr>
<tr>
<td>Dr. Aydin K. Sunol, PE</td>
<td>Professor</td>
<td>Process and Product Systems engineering, Green Chemistry and Engineering, Supercritical fluids</td>
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</table>

### Adjunct Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Research Interests</th>
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<tbody>
<tr>
<td>Dr. David Eddins</td>
<td>Associate Professor</td>
<td>Auditory Perception and Hearing Enhancement Technology &amp; Signal Processing Corrosion of Engineering Materials</td>
</tr>
<tr>
<td>Dr. Alberto Sagues</td>
<td>Professor</td>
<td>Neural Substates of Auditory Processing using Multi-electrode Arrays in Normal and Disease States</td>
</tr>
<tr>
<td>Dr. Joseph Walton</td>
<td>Professor</td>
<td>Neuroengineering: Sensory Systems</td>
</tr>
<tr>
<td>Dr. Robert Frisina, Sr.</td>
<td>Research Professor</td>
<td>Gene and Drug Delivery by Electroporation, Corona Charge,</td>
</tr>
<tr>
<td>Dr. Richard Connolly</td>
<td>Research Professor</td>
<td></td>
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Other COE faculty with Biomedical Research Interests
## Appendix D

List of courses currently offered in Biomedical Engineering (Spring 2013)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Section</th>
<th>Format</th>
<th>Title</th>
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<tbody>
<tr>
<td>BME 4100</td>
<td>001</td>
<td>Class Lecture</td>
<td>Intro Biomedical Engineering*</td>
</tr>
<tr>
<td>BME 6931</td>
<td>797</td>
<td>Class Lecture</td>
<td>System on a Chip</td>
</tr>
<tr>
<td>BME 6931</td>
<td>798</td>
<td>Class Lecture</td>
<td>Biomedical Image</td>
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<tr>
<td>BME 4406</td>
<td>001</td>
<td>Class Lecture</td>
<td>Engineer of Biological</td>
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<tr>
<td>BME 6000</td>
<td>901</td>
<td>Class Lecture</td>
<td>Biomedical Eng 3</td>
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<tr>
<td>BME 6107</td>
<td>001</td>
<td>Class Lecture</td>
<td>Biomaterials I: Material</td>
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<tr>
<td>BME 6420</td>
<td>001</td>
<td>Class Lecture</td>
<td>Human Sensory Processes</td>
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<tr>
<td>BME 6931</td>
<td>001</td>
<td>Class Lecture</td>
<td>Biomedical Image</td>
</tr>
<tr>
<td>BME 6931</td>
<td>002</td>
<td>Class Lecture</td>
<td>System on a Chip</td>
</tr>
<tr>
<td>BME 6931</td>
<td>003</td>
<td>Class Lecture</td>
<td>Biomedical Engineering II</td>
</tr>
<tr>
<td>BME 6931</td>
<td>004</td>
<td>Class Lecture</td>
<td>Modern Biomed Technologies</td>
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<tr>
<td>BME 6931</td>
<td>006</td>
<td>Class Lecture</td>
<td>Bioelectronics</td>
</tr>
<tr>
<td>BME 4440</td>
<td>001</td>
<td>Class Lecture</td>
<td>Intro to Bioastronautics</td>
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</table>

**Fall 2012**

<table>
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<th>Course Code</th>
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<tr>
<td>BME 4100</td>
<td>001</td>
<td>Class Lecture</td>
<td>Intro Biomedical Engineering*</td>
</tr>
<tr>
<td>BME 6931</td>
<td>799</td>
<td>Class Lecture</td>
<td>Biomedical Sys. &amp; Pat.</td>
</tr>
<tr>
<td>BME 5320</td>
<td>001</td>
<td>Class Lecture</td>
<td>Theory &amp; Design of Bioprocess</td>
</tr>
<tr>
<td>BME 6000</td>
<td>001</td>
<td>Class Lecture</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>BME 6634</td>
<td>001</td>
<td>Class Lecture</td>
<td>Biotransport Phenomena</td>
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<tr>
<td>BME 6931</td>
<td>002</td>
<td>Class Lecture</td>
<td>Bioelectricity</td>
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<tr>
<td>BME 6931</td>
<td>901</td>
<td>Class Lecture</td>
<td>Cell and Tissue Engineering</td>
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</tbody>
</table>

*Former Course #: ECH 4931
I. PURPOSE & INTENT

According to the University of South Florida System's (USF System) established Principles of Shared Governance, organizational restructuring of academic units within member institutions of the USF System shall be implemented only after open dialogue and review among faculty and administration.

II. STATEMENT OF POLICY

In particular, any policy and procedure shall ensure that the academic unit(s) most affected by a proposed major restructuring shall be afforded the first opportunity to review and report their recommendations. Those recommendations shall then be reported to and reviewed by the Faculty Senate or equivalent representative body of that member institution, which will assess the effectiveness of the procedures followed, review the implications for the entire institution, and make a recommendation to the institution's administration.

Simultaneously, the USF System Faculty Council (SFC) will review the implications for the entire System, and make a recommendation to the Provost and Executive Vice President of the University of South Florida System. All stages of the review process shall be completed expeditiously, within ninety (90) days of the initial proposal.

III. DEFINITIONS OF TERMS

Major organizational restructuring is defined as any creation, dissolution, merger, or separation of academic departments, schools, or colleges. Proposals for such restructuring must include a written proposal submitted through the dean's office to the Provost and Executive Vice President of the University of South Florida System and/or the chief
academic officer (regional vice chancellor for academic affairs) of a member institution and/or the Senior Vice President for USF Health (if the proposal is in USF Health), and will include at a minimum:

A. A description of the proposed changes.
B. A rationale for the changes.
C. A reasonable statement of the financial and budgetary implications of the changes.
D. An examination of the likely consequences of the changes at the college/school, institution, and USF System levels, as well as any regional or societal implications.
E. A clear and specific timeline for the implementation of the changes.
F. A brief description of the nature of preliminary consultations with the academic entities affected by the changes, including a summary of the responses. This will normally report on discussion at the level of the college and/or department/school, depending on the entity most affected.

IV. PROCESS STEPS

- Each member institution of the USF System will adopt the following procedures: The Faculty Council (or equivalent) of the most affected college(s) or school(s) will receive the proposal from the initiating dean. In institutions without a representative body at that level, the Faculty Senate will receive the proposal.

- The proposal will be discussed at the next meeting of the receiving body. Members of affected academic entities will be invited in advance to comment in writing. The body may vote to recommend the proposal or to request further information and continue discussion at a second meeting.

- If necessary, and in case of emergency action, the president of any affected faculty governance body and/or the Provost and Executive Vice President of the University of South Florida System and/or the chief academic officer of a member institution (regional vice chancellor for academic affairs) and/or the Senior Vice President for USF Health (if the proposal is in USF Health) may call special meetings to expedite the process, including during summer months.

- The restructuring proposal, together with any commentary or recommendation from the Faculty Council (or equivalent), will be forwarded at the same time to the Faculty Senate of the affected member institution (unless the Senate was the initial receiving body) and to the SFC, with a copy to the initiating dean. These two bodies will report to the institution’s administration and/or the Senior Vice President for USF Health (if the proposal is in USF Health), with a copy to the Provost and Executive Vice President of the University of South Florida System.
and the initiating dean on: a) the sufficiency of consultation, and b) the implications of the proposed changes at the institution and system levels.

- The entire process, from receipt of the proposal by the Faculty Council (or equivalent), and ending with submission of the final report to the institution’s administration, shall take no more than ninety (90) days.

It is mutually recognized that the administration holds ultimate authority and responsibility for determining the most appropriate academic structure and organization within the University, including Sec. 447.209, Florida Statutes, while the Faculty Councils, Faculty Senates, and the SFC are bound to fulfill their responsibility as advisors on academic affairs to the USF System’s and the institution’s administrations.

Authorized and signed by:

Ralph Wilcox, Provost and Executive Vice President
Judy Genshaft, President
<table>
<thead>
<tr>
<th>Case No.</th>
<th>Date</th>
<th>Case Details</th>
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<td>Case 1</td>
<td>Successful</td>
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<tr>
<td>002</td>
<td>11-04-2023</td>
<td>Case 2</td>
<td>Failed</td>
</tr>
<tr>
<td>003</td>
<td>10-05-2023</td>
<td>Case 3</td>
<td>Successful</td>
</tr>
<tr>
<td>004</td>
<td>09-06-2023</td>
<td>Case 4</td>
<td>Failed</td>
</tr>
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</table>

**Best Case Scenario**

**Case of Confusion of Doctors**

**Conclusion:**

- The scenario highlights the importance of clear communication and double-checking in medical settings.
- Integration of technologies and systems can enhance patient care and reduce errors.

**Recommendations:**

- Regular training and drills on new systems and protocols.
- Enhanced communication tools between doctors and nurses.
- Monitoring and feedback mechanisms for continuous improvement.

**Analysis:**

- The high failure rate in cases 2 and 4 underscores the need for robust checks and balances.
- Lessons learned from these cases will be integrated into future training and protocols.

**Future Steps:**

- Ongoing review of incidents for pattern recognition.
- Comprehensive analysis of system failures and user interfaces.
- Collaboration with IT and medical teams for system improvements.

**Key Takeaways:**

- Clear communication is critical in avoiding confusion.
- Technology can be a double-edged sword. Its integration must be carefully considered for optimal patient outcomes.
- Continuous improvement and adaptation to new technologies are essential.

**Conclusion:**

By addressing the root causes and implementing systematic changes, we can reduce the risk of similar incidents in the future and improve patient safety.