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Feasibility Study: Potential for Establishment of Joint National Library of Medicine / Uniformed Services University Graduate Programs in Biomedical Informatics

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Introduction

**Our partnership**

The National Library of Medicine (NLM) has a long-standing relationship with the U.S. military, originally established by the U.S. Army Surgeon General in 1836. In the early years the Library operated as the Army Medical Library (1922-1952), Armed Forces Medical Library to the Public Health Service (1952-1956), and was renamed later as the NLM (1956-present). This proposal builds on the relationship by establishing a contemporary strategic partnership between the NLM and USU.

Within the NLM supporting divisions include the Lister Hill Center for Biomedical Communications, the Specialized Information Services, the National Center for Biotechnology Information, and the Office of Computer and Communication Systems. Within USU the partnership is supported by the F. Edward Hẻbert School of Medicine (e.g. Biomedical Informatics Department, Preventive Medicine Department, Radiology Department) and the Graduate School of Nursing. The proposed degree programs would be interdisciplinary in nature led by the Biomedical Informatics Department.

**Articulating the need**

Interest in the discipline of biomedical informatics, and its associated fields (e.g. clinical informatics, bioinformatics, public health informatics) has grown exponentially within the past 5-10 years fueled in large part by the advancement of science and translation of its discoveries into practice. Discoveries such as the mapping of the human genome, development and deployment of electronic health records, internet connectivity and proliferation of health information to consumers, and biosurveillance systems have created new career and research opportunities across the nation and the globe. Our NLM/USU joint graduate program has identified need in three distinct but intersecting areas. Specifically, the need to:

* ***develop new biomedical informatics scholars-*** The rapid development and adoption of technology in the clinical, public health, disaster, humanitarian and military environments has created new opportunities for researchers and educators within academia and government service. New scientists, with the skills to integrate biomedical, clinical, and public health information systems to promote scientific discovery and speed the translation of research into practice are desperately needed to advance the vision of the National Institutes of Health and the nation. Our proposed Doctor of Philosophy degree program addresses this need.
* ***develop biomedical informatics professionals-*** With federal incentives and expectations regarding adoption of electronic health records and proving their “meaningful use” in clinical practice, the need for professionals to serve as facilitators and enablers of technology has never been greater. Within the Military Health System, many hospitals and clinics are recruiting Chief Medical Information Officers and other professionals to bridge the gap between the availability of technology and clinical practice. The majority of these individuals are not formally trained and often struggle to serve effectively in this critical role. Likewise, program managers/program officers at staff-levels are increasingly expected to assume roles relating to the evaluation and adoption of health information technology to solve clinical and business challenges; many of these individuals operate without the benefit of training or graduate education. Our proposed Master of Science degree program addresses this need.
* ***provide expand educational opportunities for physicians and other health professions –*** Health care providers are increasingly expected to understand and sometimes lead the adoption of technology in clinical practice. Many of these individuals work in small group practice settings and do not have the resources or interest in becoming “informaticians”. They require exposure to key biomedical informatics concepts but not necessarily full graduate degree programs. Our proposed graduate certificate program addresses this need.

**Students - overview**

We anticipate that our joint graduate programs in biomedical informatics will attract students from across the national capital area, the nation and the globe. Qualified applicants selected to attend the proposed graduate programs will likely include:

* Active duty members of the armed forces;
* Fellows and other trainees of the National Library of Medicine / National Institutes of Health;
* Federal employees residing in the national capital area;
* Other (e.g. state, local) government employees;
* Foreign nationals (through cooperative agreements); and
* Civilian applicants with no governmental affiliation.

The composition of each incoming student class will reflect the desired diversity of the student body, the development and capacity of a given graduate program, and the strongest qualified applicants.

**Faculty - overview**

Our faculty will include billeted and non-billeted faculty members of the Uniformed Services University. These faculty members will represent scientists and educators of the National Library of Medicine / National Institutes of Health, the Uniformed Services University, the Military Health System, and other federal agencies (see Key Processes section below). They represent subject matter experts in a variety of disciplines and fields including clinical informatics, public health informatics, bioinformatics, computer science, biostatistics, communications, health administration, nursing, medicine, imaging, clinical research, and others.

Curriculum

**Educational offerings**

The NLM-USU joint program in biomedical informatics includes three educational offerings designed to meet their career and academic goals. Options include a Doctor of Philosophy degree, a Master of Science degree, and a graduate certificate.

**Doctor of Philosophy in Biomedical Informatics (PhD)**

The doctoral program in biomedical informatics is designed to be a full-time, residential, research-focused academic experience with the primary goal of developing new scholars and leaders in academia and government. The minimum residency requirements for a doctoral degree will be 36 months of full-time graduate study. All requirements for a doctoral degree must be completed no later than seven years after initiating the program of graduate study at USU. Formal course work, participation in BID teaching experiences, research laboratory experiences, directed research, and participation in other academic activities are all components of the pre-doctoral graduate education program. Full-time status for trainees in graduate education programs will be defined as 12 or more credit hours per academic quarter. The minimum requirement for formal course work will be 63 credit hours, and the minimum requirement for total academic credit will be 144 credit hours.

To graduate from the PhD program, the student must successfully complete the minimum required coursework and experiences (outlined below), pass a qualifying examination, and author/defend an original dissertation. Specific courses and experiences may be waived based on previous graduate work/experiences via an established waiver process. Specific requirements are outlined below.

***Qualifying Examination***

The qualifying examination for the PhD program of study shall be conducted and graded by a committee consisting of a minimum of four graduate faculty members at the rank of assistant professor or above. Three members must be from the NLM/USU biomedical informatics department. The fourth member may hold either a faculty position in the NLM/USU biomedical informatics department, another department at USU, or have an appointment outside of USU. Additional members if desired, may either hold a faculty position at USU or have an appointment outside of USU. The majority of the Committee must always have full-time appointments at USU and be members of the department granting the degree. The Examination Committee shall be appointed by the director of the NLM/USU PhD program.

***Advancement to Candidacy***

Aspirants for the doctoral degree must complete all requirements for advancement to candidacy no later than two years of attendance after initiating a program of study. The requirements for advancement to candidacy include the minimal requirement of 63 credit hours of formal course work at the graduate level, a cumulative grade point average of 3.0 (B), successful completion of the qualifying examination and formation of a thesis committee. Waivers to the two-year requirement are considered in exceptional cases and be recommended by the NLM/USU PhD Program Director and approved by the Associate Director of Graduate Education. Candidacy waivers may not to exceed one year. Final approval of advancement to candidacy rests with the Associate Dean for Graduate Education acting on the recommendation of the student Examination Committee and the NLM/USU PhD Program Director.

***Dissertation***

A written dissertation based on the original experimental research will be required of all aspirants for a BID doctoral degree.

***Final Examinations/ Dissertation Defense***

An Examination Committee will be formed to read the dissertation, to certify its acceptability as to scope and quality, and to conduct the defense of the dissertation. The defense of the dissertation will consist of an oral examination followed by a public seminar. The oral examination will be closed to the public and will be conducted by an Examination Committee.

***Doctoral Seminars***

Active participation in doctoral seminars is required for development and scholarly citizenship. All PhD students are required to participate and will register for 1 credit per term. Students must complete a minimum of 6 doctoral seminar credit in their first 24 months of full-time study. Doctoral candidates are encouraged, but not required, to continue their participation.

***Teaching Experience***

Doctoral students must serve as a teaching assistant for a minimum of two BID courses, earning 6 credits. The student will assist the course director in planning and developing course material, delivering curriculum, evaluating student performance, and other activities as assigned.

***Research Laboratory Experience***

All students will complete a research experience with one or more NLM/USU faculty members. The student will engage directly in ongoing research studies by assisting the faculty member in all aspects of research that might be available to him/her. This may include literature reviews, authoring regulatory paperwork, assisting with research design, data collection, data analysis, data interpretation, authoring manuscripts, and or presenting findings. The experience (for credit) may be repeated as elective credit.

***Required Course Requirements for PhD Program (\* denotes required course)***

|  |  |
| --- | --- |
| **FOCUS AREA:** | **COURSES:** |
| Foundation of Biomedical Informatics  (15 credits required) | BID XXX Introduction to Biomedical Informatics (3)\*  BID XXX Methodological Foundations of Biomedical Informatics (3)\*  BID XXX Human Computer interaction (3)\*  BID XXX Foundations of Bioinformatics & Computational Biology (3)\*  BID XXX Imaging Informatics (3)\* |
| Computer Science  (6 credits minimum) | BID XXX Computer Science & Programming (4)\*  BID XXX Data Mining (3)  BID XXX Machine Learning (3) |
| Required support courses  (3 credits required) | IDO 704 Ethics and the Responsible Conduct of Research (1)\*  IDO 515 Grant Writing for Graduate Students (2)\*  IDO 511 Educational Methods (3) |
| Research Design/ Statistics  (12 credits required) | BID XXX Research Design & Methods I (3)\*  BID XXX Research Design & Methods II (3)\*  BID XXX Dissemination & Implementation (3)\*  PMO 900 Introduction to Clinical Trials (2)  PMO 996 Clinical Trial Design & Analysis (2)  PMO 511 Intro to Epidemiology I (4)  PMO 1003 Survey Design (3)  BID XXX Intro to Health Services Research (3) |
| Cognate Area  (12 credits minimum) | **Clinical/Health Informatics Concentration**  BID XXX Clinical Informatics (3)\*  BID XXX Clinical Information Systems & Databases (3)\*  BID XXX Leading and Managing Change (2)  BID XXX Decision Making, Process Improvement & Patient Safety (3)  PMO 592 Healthcare Technology Assessment (2)  BID XXX Evidence-based Medicine & Information Retrieval (3)  PMO 559 Decision Support in Healthcare Performance Improve. (4)  BID XXX Consumer Health Informatics (3)  *Other courses as negotiated*  **Public Health Informatics Concentration**  BID 501 Public Health Informatics (3)\*  BID XXX Disaster Information Management (3)\*  BID XXX Leading and Managing Change (2)  BID XXX Consumer Health Informatics (3)  BID XXX Social media and Public Health (2)  PMO 577 Intro to GIS in Public Health (2)  PMO 578 Remote Sensing Methods in Public Health (2)  *Other courses as negotiated* |
| Doctoral Seminar  (6 credits minimum) | BID XXX Biomedical Informatics Doctoral Seminar (1) |
| Teaching Exper.  (6 credits minimum) | BID XXX Teaching Experience (3) |
| Research Lab. Exper.(3 credits minimum) | BID XXX Research Laboratory Experience (3) |
| Total | Minimum of 63 credits of formal coursework and experiences |

**Master of Science in Biomedical Informatics (MS)**

The Master of Science in Biomedical Informatics degree program is designed to provide students the educational foundation necessary for informatics-related careers in health delivery, government service, and academia. Graduates of the program will be qualified to serve as either “Chief Medical Information Officers” or “Clinician Researchers” in the 21st century fast-paced and dynamic environment of health services delivery. Alternatively, graduates may seek research-oriented, program management, or other leadership positions in academia or government service.

The MS degree requires completion of a minimum of 48 quarter hours consisting of (1) core courses, (2) track and elective courses, and (3) a biomedical informatics practicum experience (unless waived). The MS degree provides two track options based on the student’s professional goals. Specifically, a Chief Medical Information Officer (CMIO) Development track and a Clinician Research track. All students must complete requirements for one of the two tracks to graduate.

The degree is designed to be completed in approximately 4-5 quarters if pursued as a full-time student or 9-10 quarters on a part-time basis.

***Required Core courses- (14 credits)***

* BID XXX Introduction to Biomedical Informatics (3)
* BID XXX Methodological Foundations of Biomedical Informatics (3)
* BID XXX Computer Science & Programming (4)
* BID XXX Human Computer interaction (3)
* BID XXX Ethical, Legal and Social Issues (1)

***TRACK REQUIREMENTS – (MUST SELECT ONE)***

***Chief Medical Information Officer Development track-***

*(required track courses - 17 credits)*

* BID XXX Clinical Informatics (3)
* BID XXX Health Information Systems & Databases (3)
* BID XXX Leading & Managing Change (2)
* BID XXX Decision Making, Process Improvement & Patient Safety (3)
* BID XXX Dissemination and Implementation (3)
* BID XXX CMIO Capstone Course (3)

PLUS (11) credits minimum in elective courses*– See appendix A*

***Clinician Research track-***

*(required track courses - 17 credits)*

* BID XXX Research Design & Methods I (3)
* BID XXX Research Design & Methods II (3)
* BID XXX Imaging Informatics (3)
* BID XXX Scientific & Grant Writing (2)
* BID XXX Intro to Health Services Research (3)
* BID XXX Clinician Researcher Capstone Course (3)

PLUS (11 credits minimum of elective coursework) *–* *See appendix A*

***Biomedical Informatics Practicum (BID XXX) –*** *6 credits minimum (unless waived)*

Students will be required to complete a hands-on informatics experience in a research laboratory, hospital/health system, government agency or other setting as approved by the student’s advisor. Students may elect to perform their practicum requirement by assisting in the teaching/development of graduate curriculum. If waived by the program director, the student will required to compensate these hours through additional coursework or directed study with a faculty member.

**Graduate certificate in biomedical informatics**

Clinicians, nurses and other health professionals of the 21st century commonly operate in a healthcare environment struggling to implement technology and provide health information useful for improving patient safety and clinical quality while realizing efficiencies. Many of these health professionals desire a deeper understanding of health informatics but not a new vocation as an informaticist. To that end, the program offers a graduate certificate program where accepted students can earn a graduate certificate for the completion of 6 graduate courses (normally 14-20 credits). Selection of the courses will be individualized based on student desires and faculty advisor concurrence.

**Key Processes**

**Program leadership**

Overall leadership for the proposed graduate education programs rests with the Deputy Director for Research and Education of the National Library of Medicine and the Chairman of the Biomedical Informatics Department of the Uniformed Services University. Operationally, however, both the proposed master’s degree and doctorate degree program will have designated faculty members to serve as the Program Director. The Program Director will be competitively selected and serve in the capacity for three to five academic years. Depending on the size of the student body and workload, an Associate Program Director may be warranted. All Program Directors and Associate Program Directors (if applicable) will be billeted or non-billeted faculty member of the Biomedical Informatics Department at the Uniformed Services University; no adjunct faculty will serve in that capacity.

The Program Directors will provide formal updates on the status and vision for the respective program when requested or at a minimum on an annual basis. These updates will be included in a larger report ultimately presented to the President of the Uniformed Services University, Director of the National Library of Medicine and their respective Board of Regents.

**Academic appointment – faculty**

Per the Uniformed Services University Instruction 1100, the President of the Uniformed Services University awards all faculty appointments.With respect to the proposed joint program, faculty appointments may fall within several categories as listed below:

* **Instructor, Assistant Professor, Associate Professor, and Professor (billeted) -** Faculty members with the unmodified title (billeted) will serve in a tenured, tenure eligible, tenure ineligible, or non-tenured status. Appointment is limited to those formally assigned to the Uniformed Services University on a full-time basis. This may include faculty who are civilian employees or members of the uniformed services.
* **Instructor, Assistant Professor, Associate Professor, and Professor (non-billeted)-** Faculty members with the unmodified title (non-billeted) will serve in a tenure ineligible status. Non-billeted faculty members could be qualified employees of the National Library of Medicine, Military Health System or other federal agency. Non-billeted faculty members are expected to regularly engage in research, education and service associated with the joint graduate programs. The faculty members’ primary job description at his/her agency should be modified to reflect this activity. Initial appointment is for up to three years; renewable. There is a promotion process associated with this status. This status is most appropriate for National Library of Medicine scientists who commit to playing an ongoing active role in the joint program to include graduate-level teaching and student mentoring.
* **Adjunct Instructor, Adjunct Assistant Professor, Adjunct Associate Professor, and Adjunct Professor –** Faculty members with modified title of adjunct - will serve in a tenure ineligible status. Adjunct faculty members could be qualified employees of the National Library of Medicine, Military Health System or other federal agency. Adjunct faculty is expected to periodically engage in research, education or service associated with the joint graduate programs. The faculty members’ primary job description at his/her agency need not be modified to reflect this activity. Initial appointment is for 2-3 years, renewable. There is a promotion process associated with this status.
* **Research Assistant Professor, Research Associate Professor, and Research Professor –** Faculty members in the modified professional title of Research will be principally engaged in research. These faculty members could be billeted at the Uniformed Services University, National Library of Medicine, or other federal agency. Teaching and non-research administrative service will typically not occupy more than 10-15% of their time. The appointment in tenure ineligible and renewable.
* **Visiting Assistant Professor, Visiting Associate Professor, and Visiting Professor –** A Visiting appointment is granted for a specific period of time to complement the scholarly activities associate with the joint program.
* **Distinguished Professor –** Appointment with the Distinguished prefix is limited to the full Professor rank and is reserved for senior individuals of national or international stature who contribute to the strength and development of the joint program. Appointments are biannual and renewable.

**Faculty development**

To ensure faculty preparedness to teach at a graduate level and to effectively mentor graduate students, a formal faculty development program will be established. All new faculty members, regardless of appointment type, will work with their respective program director to create a personal development plan that will set goals and align development resources to their specific needs. Each faculty development plan will be evaluated annually to measure progress.

**Academic promotion – faculty**

The academic promotion process for the proposed joint program will be governed by Uniformed Services University Instruction 1100. Each of the faculty appointment types (except Distinguished Professor) includes promotion opportunity. Promotion requirements differ by category (see instruction) but key areas evaluated for unmodified appointments (billeted or non-billeted) include scholarly achievement, peer review of scholarly activity, teaching, professional service, and institutional citizenship.

**Recruitment of students**

Like all other aspects of this program, recruitment of qualified students will be a joint responsibility. The Program Directors will work collaboratively with the USU Chairman of Biomedical Informatics Department and the USU Associate Dean for Graduate Education to develop professional promotional material and a recruitment plan. Both USU and the NLM will use the materials (in print and electronic format) to recruit potential students. The Programs will maintain an annual recruitment plan that is modified as program emphasis or opportunities present themselves. The Program Directors and the Chairman of the USU Biomedical Informatics Department will liaise with the USU Graduate Education Office (GEO) who manages recruitment of students (see below).

**Selection and admission of students**

The USU Graduate Education Office (GEO) is the coordinating office for student admission and management. The office will receive applications, compare the applications against pre-defined minimum eligibility criteria then present them to a NLM-USU Graduate Programs Admissions Committee for consideration. The GEO will oversee the Admissions Committee as it formally evaluates and rank orders applications for the PhD, MS and certificate programs. The Admissions Committee is responsible for establishing its selection criteria, holding a professional and fair assessment process, and ultimately selecting qualified students. Faculty will be appointed to the admissions committee in staggered terms not to exceed 3 years in length. The Chair of the admissions committee will be selected by consensus vote of the USU Biomedical Informatics Chair, NLM Deputy Director, PhD Program Director, and MS Program Director.

**Administrative management of students**

All graduate students, regardless of program, will be assigned an academic advisor from the NLM/USU faculty pool. The matching of students to advisor will be a thoughtful process based in part on the student’s educational goals and focused interest. The process of matching of doctoral students to faculty members is extremely important as incoming students will ideally be aligned with a faculty advisor/mentor prior to arrival on campus.

**Student advisement**

All graduate students will be advised a minimum of once per quarter by their advisor, usually prior to course registration. Doctoral students will receive additional advisement/mentoring as a byproduct of their development as scholars. Quarterly advisement will be acknowledged by both students and faculty; documented electronically (method TBD).

**Student research**

Degree-seeking students will be engaged in some form of research. Students will be encouraged to collaborate with faculty members, peer students, and others within the Military Health System or the National Library of Medicine. Student research involving “humans” or “animals” are subject to regulatory requirements will likely require completion and submission of required documents to the USU Institutional Review Board and maybe others (protocol specific).

**Resources**

* Requirements
* NLM existing resources
* USU existing resources
* Delta between requirements and existing resources

**Implementation Strategy**

* General approach
* Multi-year plan

**Recommendations**

* TBD

**Appendices**

(A) Proposed courses & course directors

**Appendix A**

**Proposed Course Directors**

|  |  |  |
| --- | --- | --- |
| Number | Course Title | Proposed Director |
| BID XXX | Introduction to Biomedical Informatics (3) | TBD |
| BID XXX | Methodological Foundations in Biomedical Informatics (3) | TBD |
| BID XXX | Computer Science & Programming (4) | TBD |
| BID XXX | Human Computer Interaction (3) | TBD |
| IDO 704 | Ethics and the Responsible Conduct of Research | USU Grad Faculty |
| IDO 511 | Educational Methods | USU Grad Faculty |
| IDO 515 | Grant Writing for Graduate Students | USU Grad Faculty |
| BID XXX | Intro to Health Services Research | Gimbel + others? |
| BID XXX | Clinical Information Systems & Databases (3) | TBD |
| BID 501 | Public Health Informatics (3) | Hakkinen (NLM)/ Jackson |
| BID XXX | Clinical Informatics (3) | TBD |
| BID XXX | Leading and Managing Change (2) | TBD |
| BID XXX | CMIO Capstone Course (3) | TBD |
| BID XXX | Clinician Researcher Capstone Course (3) | TBD |
| BID XXX | Decision Making, Process Improvement & Patient Safety (3) | TBD |
| PMO 592 | Healthcare Technology Assessment (2) | Jones/Gimbel |
| BID XXX | Research Design & Methods I (3) | TBD |
| BID XXX | Research Design & Methods II (3) | TBD |
| BID XXX | Foundations of Bioinformatics & Computational Biology (3) | Williams (USU) + others? |
| BID XXX | Imaging Informatics (3) | TBD |
| BID XXX | Biomedical Informatics Practicum (3) | Faculty |
| BID XXX | Directed Studies in Biomedical Informatics (1-12) | Faculty |
| BID XXX | Evidence-based Med. & Information Retrieval (3) | TBD |
| BID XXX | Data Mining (3) | TBD |
| BID XXX | Machine Learning (3) | TBD |
| PMO 900 | Intro to Clinical Trials (2) | Ottolini\* (USU) |
| PMO 996 | Clinical Trial Design & Analysis (2) | Wilkins\* (USU) |
| PMO 578 | Remote Sensing Methods in Public Health (3) | Masuoka\* (USU) |
| PMO 577 | Intro to GIS in Public Health (2) | Achee/Masuoka\* (USU) |
| PMO 559 | Decision Support in Healthcare Performance Improvement (4) | Barbour/Crawford\* (USU) |
| PMO 511 | Epidemiology I: Intro (4) | Rouse\* (USU) |
| PMO 1003 | Survey Design | Artino\* (USU) |
| BID XXX | Dissemination and Implementation (3) | Gimbel (USU) |
| BID XXX | Biomedical Informatics Doctoral Seminar (1) | Faculty |
| BID XXX | Biomedical Informatics Teaching Experience (3) | Faculty |
| BID XXX | Biomedical Informatics Research Laboratory Experience (3) | Faculty |
| BID XXX | Social Medical in Public Health (2) | TBD |
| BID XXX | Disaster Information Management (3) | TBD |
| BID XXX | Dissertation Research (1-12) | Dissertation Mentor |

\*Denotes existing graduate course in USU’s Preventive Medicine Department typically offered as a day course