A Strategic Plan for the Department of Medical Information Science

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Systems Medicine: The Development of Information Systems for Deployment in Health Systems, via Systems Analysis of the Inputs (health measurements) and the Outputs (medical treatments).

Executive Summary

Healthcare is the biggest industry in the country and one of the fastest growing. But there is no viable infrastructure to manage the volume of healthcare needed for the aging population, nor insure the quality of that care. This plan proposes to make the University of Illinois at Urbana-Champaign a world leader in translational research on viable healthcare. That is, we propose to use the great strengths across the entire campus to develop a new health system using new concepts in information technologies and to deploy this system in real-world settings.

We propose to re-establish the Department of Medical Information Science (MIS) within the College of Medicine (COM). Effective management of chronic illness is *the* economic issue of the 21st century. Our strategy centers on a new personal health record that provides integrated and comprehensive views of the health of an individual and their place within a population. Such records move beyond traditional medical records considered by traditional departments of medical informatics into continually monitoring genome and lifestyle information. Implementing such records will require deep research and development into Healthcare Measurement (psychological and physiological features of individual lifestyle), Healthcare Infrastructure (information technologies for analyzing the health of populations at the level of individuals), and Systems Medicine (new health systems with personal treatments for each individual).

We will rely on the strength of COM in campus-wide collaborations, as demonstrated by the nationally prominent Medical Scholars Program. The new MIS will have flagship partners with the new Institute for Advanced Computation and the new Institute for Genomic Biology. These partnerships will support research collaborations into healthcare infrastructure and genomic medicine. To support our education mission, we will develop a campus interdisciplinary PhD program for biomedical informatics under the new Illinois Informatics Initiative.

In the 21st century, Medicine will be viewed as an Information Science, much as Biology has come to be. Systems Medicine will become a major research paradigm in Medicine, much as Systems Biology has become in Biology. Systems Medicine takes a whole systems approach using information technology to develop new health systems. Systems Medicine focuses on population health in the context of individual health, to provide personalized treatments for personalized lifestyles. The University of Illinois at Urbana-Champaign could be world leader in translational research by following this plan towards a national model for viable healthcare.

The Opportunity

The economies of modern societies are determined today by the economies of healthcare. Entitlements such as Medicare and Social Security are already the single largest part of the national budget. The proportion of the budget dedicated to these programs is growing as the demographics shifts to aging populations of baby boomers. But there is not an economically viable model for a national healthcare infrastructure, which can handle the management of chronic illness that dominates health costs.

Creating viable healthcare is a great opportunity for a great research institution like the University of Illinois. It is common now, due to the rise of systems biology, to hear that “biology is an information science”. Similar informational solutions are necessary to solve the problems of chronic health in the era of aging populations. It will become common to hear that “medicine is an information science”. Healthcare infrastructure ranks at the very top of societal problems and is one where UIUC could become the leader at the very top of research universities. We could become ***the*** leader in the rise of systems medicine.

From an economic standpoint, healthcare costs will bankrupt the State of Illinois as the Federal government phases out or limits its support for Medicare and Medicaid. Providing innovative solutions is thus a pressing problem for the leading state research university in Illinois. From an economic standpoint, Federal funding is a major source of income at UIUC and NIH is the major source of Federal funding. UIUC has never had a major NIH clinical center, largely due to lack of a major School of Medicine and Medical Center. The program outlined here, as part of the campus Translational Biomedical Initiative, shows how to turn this deficiency into an asset.

The National Research Council has just published a report jointly between the National Academy of Engineering and the Institute of Medicine on *Building a Better Delivery System: A New Engineering / Healthcare Partnership*. This report was sponsored by NSF, NIH, and the Robert Wood Johnson Foundation. The report recommends the establishment of multidisciplinary centers to conduct basic and applied research on the systems challenges to health care delivery, especially the application of information/communication technologies.

The Engineering Healthcare report was begun in the wake of the landmark Institute of Medicine reports on the current crisis in healthcare infrastructure, pushed by the pressing economic and societal need for chronic care. Each study report, such as the seminal 2002 *The Future of the Public’s Health in the 21st Century*, emphasized the critical role of new information systems as the backbone for new health systems and the necessary role of the federal government in funding new technology research for practical healthcare.

UIUC can become the national leader in viable healthcare. The key step is to re-establish the Department of Medical Information Science as a nationally prominent department focused upon healthcare infrastructure. It will be unique for a College of Medicine to host a department of biomedical informatics that is not focused on the infrastructure of a University Medical Center, thus upon medical records for teaching hospitals. Without the historical baggage of a teaching hospital and using the campus strengths in technology research and development, UIUC can become the leader of the new wave of systems medicine for viable healthcare.

The Problem

Consider a typical example of the healthcare problem. An elderly patient with chronic illness goes into their local clinic. They are given a bag-of-drugs, which is pretty much the same no matter what their illness. Each drug is a blockbuster pharma, empirically known to help 10% of the people, harm 10% of the people, and have little effect on the other 80%. But for a particular patient, no one knows which class they are in! The recent news concerning Vioxx from Merck is a perfect example of the broken health system, where a treatment effective for some persons with arthritis was harmful for some persons with heart disease. The problem is one of population health – it is not possible today to measure individual health on a subset of the population that statistically represents the millions of people who will be given a blockbuster drug.

The typical progress of any infrastructure is to create a provider pyramid, with expensive specialists at the top and inexpensive generalists at the bottom. The providers at the bottom are ordinary persons who provide care at minimal cost, with the assistance of technological infrastructure. For example, the telephone system developed switching machines to enable ordinary persons to place their own calls. Similarly, the health system must develop measurement machines to enable ordinary persons to diagnose and treat their own conditions. We must learn how to develop a scalable approach to improving healthcare.

What is needed is Population Health at the Level of Individuals. Health Measurement that covers all the areas essential to evaluate daily lifestyle for chronic management. Not just physiological parameters such as blood pressure and heart rate, but psychological parameters such as stress and sociality. Not just medicine in hospitals such as drugs and surgery but also health in homes such as diet and exercise. Managed expectations through lifestyle modification.

The First Leg of our proposed Health Tripod is *Measurements*.

To gather and then to analyze the health of entire populations, a new level of technology is needed. Health Infrastructure must utilize distributed computing to continuously monitor every individual in the entire population on both physiological and psychological features. The individual historical records can then be combined into a population database that can be statistically analyzed. To extract the treatment cohorts of similar persons with similar problems, new technologies for population clustering are needed, requiring large computations.

The Second Leg of our Health Tripod is *Infrastructure*.

Finally, with detailed population vectors in hand, health applications can be supported that revolutionize the practice of medicine. Systems Medicine, all the factors for all the persons, can support Viable Healthcare, health systems with quality care at acceptable cost. Chronic Illness can be managed on a routine basis by patients in their homes interacting with health infrastructure, leaving doctors in their hospitals for non-routine more-expensive care. Genomic medicine can target custom drugs to each population cohort, rather than shooting blind as done today with blockbuster drugs tested with limited trials. Infectious diseases can be managed by using population cohorts to estimate who will get sick when exposed and who likely will not.

The Third Leg of our Health Tripod is *Systems*.

The Health Tripod is: Medical - Measurements, Information - Infrastructure, Sciences - Systems.

The Solution

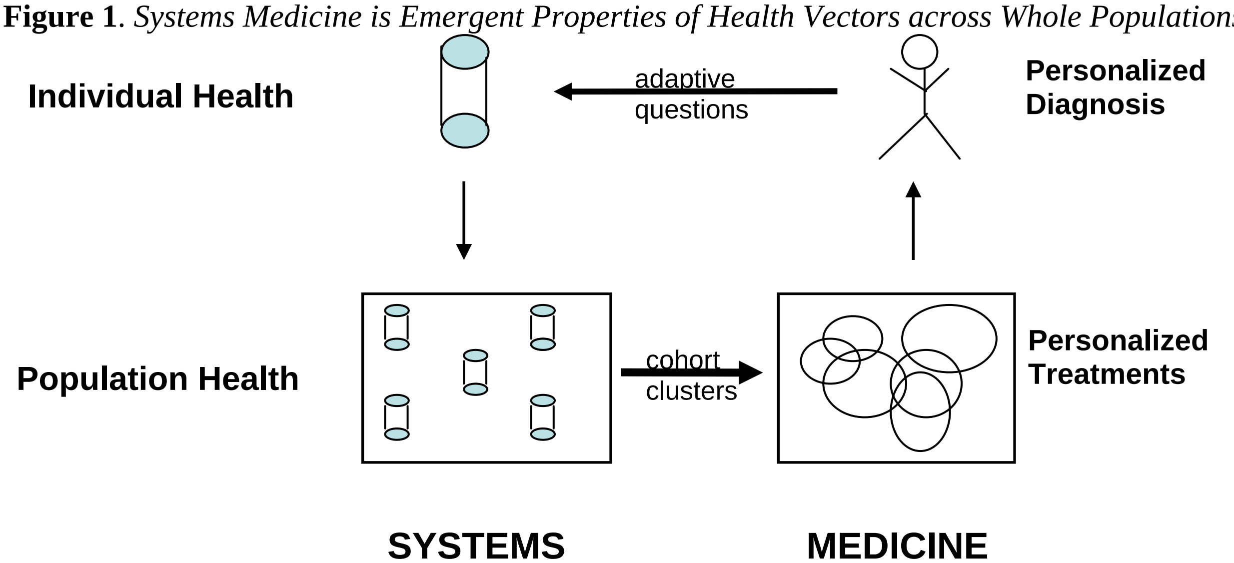
Systems Medicine studies complex systems, where emergent properties of the whole arise from complex interactions of the parts. In Systems Medicine, the emergent whole is population health and the interacting parts are individual health. That is, the health of individuals is measured in great depth, which after statistical analysis gives similar depth to the emergent properties of the whole population. This is in comparison with Systems Biology, where the properties of individual chemical units emerge into the whole of gene networks.

Shown in Figure 1, the "Systems" orientation focuses on health measurements. Individual Health is measured to new levels of detail, with daily health records across thousands of features. These can be gathered by combining psychological questionnaires, adaptively targeted to each individual, with physiological monitoring. Population Health is measured to new levels of detail, with health records from millions of individuals clustered into thousands of population cohorts.

The "Medicine" orientation focuses on personal care. Personalized diagnosis is possible on an individual basis, when adaptive questionnaires focus on the particular situation of the particular person during their teachable moment. Personalized treatment is possible on an individual basis, when cohort clusters enable different procedures to be recommended to different groups based on empirical evidence of best practices for that particular group. The level of detail provided by the new personal health records for individuals enables a deeper level of granularity for cohort groups, where customized treatments are possible for each group across the whole population.

Systems Medicine is fundamentally based on information and computation. "Information" implies more detail is available about individuals than ever before. Part comes from heredity, from personal analysis via genomic biology. Part comes from environment, from lifestyle analysis via health monitors. "Computation" implies more detail can be discovered about populations than ever before. This detail can be used to determine personalized treatments by statistically identifying the population cohorts to which an individual most closely belongs.

Figure 1. *Systems Medicine is Emergent Properties of Health Vectors across Whole Populations*



The Plan

We propose a cluster hire of new faculty into the Department of Medical Information Science. A new class of faculty is necessary to perform the basic research necessary to develop Systems Medicine for broad health measurements and the translational research necessary to deploy Systems Medicine to regional health systems. In particular, we propose hiring 15 new faculty, to cover the necessary topics. The request is for 10 pre-committed lines, which would expand to 15 faculty, given joint appointments and affiliates. Ten new faculty lines is the scale necessary to create a department that is nationally competitive in the chosen areas. Hiring these faculty will enable UIUC to become world leader of the new approach to viable healthcare.

The faculty will organizationally reside in the Department of Medical Information Science (MIS) within the College of Medicine (COM). The extreme flexibility and the campus outreach of this College will enable the new faculty to have a supportive home where they can earn tenure for their research for its own quality, rather than for its disciplinary correctness. The College of Medicine will provide the research arm for Systems Medicine. The development arm will partner with two new institutes under the Vice Chancellor for Research – the Institute for Advanced Computation (IAC) and the Institute for Genomic Biology (IGB).

Most of the MIS faculty will also have a joint appointment in a relevant department elsewhere on campus. The faculty might be thought of as studying the medical information relevant to the specialized knowledge of that department, so by necessity must interact with the experts. But their tenure lies within MIS, so they are permitted to be more applied and more technical than customary for the department experts, enabling informatics per se to be rewarded.

The Institute for Genomic Biology has already shown the feasibility of using a new interdisciplinary faculty pool to successfully recruit new-style high-quality researchers. The IGB has just recruited bioinformatics faculty from Harvard (into Statistics), from Stanford (into Bioengineering), from Rockefeller (into Computer Science). They also supported the transfer of the Interim Head of Medical Information Science (Bruce Schatz) from elsewhere on campus. This Head is residing within the IGB and actively advising the IAC on a healthcare initiative.

The cluster hires would span the important tripod subjects for healthcare infrastructure. The idea is to cover the campus, by using major strengths relevant to the new health system as the levers for the new department to facilitate. Engineering and Medicine would combine to develop and deploy new systems for healthcare infrastructure. The North Campus would support Engineering via IAC (Institute Advanced Computation) and Computer Science, while the South Campus would support Medicine via IGB (Institute Genomic Biology) and Veterinary Medicine. The College of Medicine (COM) would be the Central Campus catalyst for health systems.

The Internal Advisory Committee would be comprised of the relevant Heads of the Departments related to Engineering (Computer Science, Statistics, Bioengineering) and the Deans of the Colleges related to Medicine (Medicine, Veterinary Medicine, Applied Health Sciences -- AHS). These together constitute the computational partners of the UIUC BioDeans group. The Directors of the IAC and the IGB would also serve on this committee.

The goal is 15 new faculty hires, using the 10 allocated slots and shared appointments with other units. The concentration is population health informatics, supplemented with translational bioinformatics not covered by other units. To achieve a critical mass in health informatics, the other major biomedical informatics topics of medical informatics and medical imaging would be by-passed. The Department of Medical Information Science would be the dry lab complement for biomedical informatics to the Department of Bioengineering, which focuses on wet lab research such as functional imaging rather than dry lab research such as population analysis.

The 15 new faculty would be planned to spread roughly evenly across the health tripod areas. These prospective hires would cover the most important subjects for population health informatics. Critical areas would need to recruit multiple faculty to achieve critical mass.
One allocation strategy for spending 10 faculty lines would be 5 full-time faculty within the College of Medicine and 10 half-time faculty shared with other units. These full-time faculty would be concentrated in Systems Applications, with a role in Healthcare Measurements.

For the projected 10 half-time faculty, the IAC is committed to supporting 4 half-time faculty and the IGB is committed to supporting 1 half-time faculty. This committed support from the collaborating institutes will provide half of the required joint lines for achieving the full 15 new faculty. The other half (5) of the required joint lines will depend on making mutually beneficial arrangements with other units on campus. Possible joint sponsorship is indicated below.

***Measurements* (Healthcare):**

This faculty area would cover measuring health status, both psychological and physiological. The former category could be shared with the Colleges of ACES and AHS and LAS for diet and exercise and stress; the latter category could be shared with the IGB for genomic chemistry.

Diet – Nutrition (ACES) and Exercise – Kinesiology (AHS)
Metabolics – Physiology (LAS) and Energetics – Chemistry (LAS)
Stress – Psychology (LAS)

***Infrastructure* (Technologies):**

This faculty area would cover software and hardware for supporting healthcare information. The former could be shared with the IAC for multiple half-time slots developing personal health records; the latter could be shared with the College of Engineering for home sensor hardware.

Cohort Clustering – Statistics (LAS) and Data Mining – Computer Science (ENG)
Distributed Systems – Computer Science and Privacy Guarding – Computer Science
Personal Sensors – Electrical Engineering (ENG)

***Systems* (Applications):**

This faculty area would cover new health systems for personalized individual medicine, for chronic illness and for acute illness management. Most faculty slots here will be full-time in the College of Medicine, including some Clinical Faculty. Chronic epidemiology could be shared with the College of AHS; acute epidemiology could be shared with the College of VETMED.

Systems Medicine – COM and Population Epidemiology – AHS
Genomic Medicine – COM and Infectious Epidemiology – VETMED
Health Systems Management – COM

Research Collaborations

To perform influential research in health systems, it is necessary to perform research, development and deployment. The Department will be the core of the underlying research and do the initial development. For full development and subsequent deployment, the Department will collaborate with the Institute for Advanced Computation, the Carle Foundation Hospital, and the Center for Computational Medicine at the University of Michigan.

For development of fully fledged systems, necessary before deployment to large populations, there will be a close collaboration with the emerging Medical Informatics Theme within IAC. The IAC contains the National Center for Supercomputing Applications (NCSA), which has substantial expertise in building cyberinfrastructure for new applications. There is already joint development of health monitors for chronic illness between MIS and NCSA. Additional collaborations will continue with the NCSA Biomedical Applications Group, who are working with Carle Foundation Hospital on acute illness, e.g. tracking models for infectious diseases.

To provide an active laboratory for translational research into chronic illness, there will be an effective arrangement with the Health Systems Research Center (HSRC) at Carle Foundation Hospital. This Center hosts one of the national Medicare Coordinated Care Demonstrations ($15M from CMS over past 5 years) and has an experimental population of several thousand patients available for clinical trials. There is already a multi-year collaboration on healthcare infrastructure between MIS and HSRC, with multiple submitted proposals to public and private sources, into which Carle is putting seed money to prepare for national prestige clinical trials.

To provide an active laboratory for medical research, our Department of Medical Information Science will have a close collaboration with the School of Medicine at the University of Michigan. This School is one of the best nationally, with a full spectrum of major disease Centers, e.g. cancer, heart, diabetes, depression. Our collaboration will enable laboratory studies directly involving disease medicine. The Michigan collaboration is based within their new Center for Computational Medicine and Biology, which hosts their new $20M NIH Roadmap National Center for Integrative Biomedical Informatics (NCIBI). The founding Center Director was previously the Executive Vice President for Medical Affairs in charge of the Medical School and the Hospitals. There is already a multi-year collaboration between MIS and NCIBI, including several joint NIH proposals for computational modeling of human diseases.

Education Collaborations

The Department will develop a PhD program for high-technology biomedical informatics. The best Departments nationally already have such a program. This interdisciplinary PhD program would be in addition to the MIS-sponsored courses for the MD degree within the College of Medicine, such as statistics for M1 and epidemiology for M2. Since COM does not currently offer graduate degrees, the PhD degree would be a campus-wide program similar to the successful Neuroscience Program, with faculty drawn from existing departments but students specifically admitted to Biomedical Informatics. National recruitment of excellent students can be done through a modest expansion of the current successful Medical Scholars Program.

In keeping with our campus-wide orientation, we propose a new PhD program under the aegis of the new Illinois Informatics Initiative (III or I3). This Initiative proposes a Virtual College that will host campus-wide degree programs in interdisciplinary informatics. There will be no faculty lines within I3 itself, but affiliated faculty will have a home in an existing department and also belong to I3 for the purpose of supervising students in its degree programs. All the new faculty hires proposed for Biomedical Informatics would naturally fit as I3 faculty.

I3 is planned to be the host organization for the existing campus-wide Bioinformatics MS degree. I3 would be the natural host for the campus-wide Bioinformatics PhD degree currently being discussed as a priority within the Graduate College. The MIS Department will do some bioinformatics, but mostly with zero-time faculty outside the department. Most of the full-time (or half-time) MIS faculty will do medical (or health) informatics. A Medical Informatics PhD degree could be separate from the under-consideration Bioinformatics PhD program, or there could be a combined Biomedical Informatics PhD degree. Most existing departments nationally have a single degree, hosted within a large College of Medicine. Either option supports the MIS Department, but the combined degree program is probably stronger for earning training grants.

The national trend of establishing a School of Informatics especially boosts biomedical informatics due to its economic and social importance. Such Schools are common in Asia and Europe, such as the School of Informatics at Kyoto University in Japan that split off Computer Science and other more applied departments from Engineering. The School of Informatics at Indiana University was the first in this country; it absorbed the Department of Computer Science. The same process later happened at Arizona State. The Indiana School of Informatics has established a PhD program in health informatics, in collaboration with the School of Medicine.

It is important to host fellowships for the graduate students. This is one of the primary lures for recruiting students to a new program, and for recruiting faculty to join as supervisors. The UIUC Strategic Plan allocates $500K per year for interdisciplinary fellowships, which the I3 proposal assumes will become a major part of its endowment. So no separate allocation for fellowships is requested in this proposal for MIS. To support all students throughout their first year of study, when they take their core courses and do their lab rotations, would require $250K per year (10 new students per year at $25K each of internal monies excluding tuition, for 50 students steady-state in the PhD program). Note that a fellowship program of this scale has been the foundation of the successful CSE (Computational Science and Engineering) program at UIUC.

A Biomedical Informatics PhD program must be institutionally supported to be successful. As a long-term goal, a training grant must be earned to support all students through the first years of their study, with the later years when they are doing active research supported on research grants to their supervisors. The NIH National Library of Medicine (NLM) has an excellent funding program in Institutional Training Grants for Informatics Research, where up to 18 graduate students at $50K per year can be supported. http://www.nlm.nih.gov/ep/GrantTrainInstitute.html There are currently 18 grants nationally to existing programs who form the elite in biomedical informatics, including Medical Schools at Midwestern universities such as Vanderbilt, Indiana, Wisconsin, Minnesota, Missouri. An existing PhD program is required with existing student populations already progressing through the program.

The Competition

Medical Schools usually have an interdisciplinary PhD program for Medical Informatics, with a few core faculty. The national leaders are those universities, typically private, which have established a fully fledged Department of Medical Informatics. Traditionally, the Departments focus on medical records, supporting the teaching hospital associated with the Medical School. Hence the traditional name of Medical Informatics. In recent years, the best Departments have expanded their research areas into bioinformatics to support genome biology and into health informatics to support health systems. Hence the modern name of Biomedical Informatics.

Today, the best Departments of Biomedical Informatics have about 30 full-time faculty, such as those at Columbia University and at Vanderbilt University. These departments are closely associated with major Institutes for Medical Informatics, which focus on medical records for the University Health Center. The best Interdisciplinary Programs at private universities are typically smaller, on the order of 15 full-time faculty, such as those at Stanford and at Pittsburgh.

It is rare for a public university to host a biomedical informatics department. UIUC is distinctive in having an actual Department with tenure track faculty lines, even if small (3 full-time faculty and 10 joint) in the past. Most public universities with medical schools have an interdisciplinary program with associated faculty. This is true of the strong medical schools in the Big Ten, such as Michigan or Iowa. One exception is Ohio State, which has a Department of Biomedical Informatics with 10 full-time faculty in the College of Medicine and Public Health who collaborate with the College of Engineering and the Ohio Supercomputer Center.

Probably the best biomedical informatics department nationally at a public university is at the Oregon Health and Science University in Portland, which has 15 full-time faculty in Medical Informatics and Clinical Epidemiology. The founding Head graduated from the University of Illinois. The University of Texas successfully grew to 15 faculty in 10 years, by basing a new Department of Health Information Sciences at the Texas Medical Center in Houston.

There is a recent ambitious attempt at Arizona State University to create a new full-spectrum Department of Biomedical Informatics in Phoenix. Following state approval of a high-level committee report, there are committed faculty lines of the same scale as the best departments. Their models are Columbia and Stanford; they have 16 committed faculty lines projected to be 23 full-time faculty with another 20 affiliates. The Department at Arizona State is sited in their new School of Computing and Informatics within the College of Engineering, along with the Department of Computer Science and Engineering, enabling close technology collaborations.
See their July 2005 Strategic Plan at http://www.canis.uiuc.edu/~schatz/monitors/asu.bmi.pdf .

The University of Washington in Seattle is establishing a new Department of Global Health, jointly between the Schools of Medicine and of Public Health. The impetus was a $20M gift from the Gates Foundation. Although most of their mission concerns developing countries, they intend to devote some effort to chronic illness and information technologies.

The Cost

A Department of 15 faculty covering biomedical informatics at a public university would be nationally distinctive and on the path towards national prestige. We will need to move aggressively here, however, to avoid falling behind currently weaker universities. We have a unique advantage that our Medical School is part of our campus and can offer hard money tenure track academic positions. This is unusual among medical schools, where soft money non-tenure faculty appointments are the rule, and will aid recruiting engineering-quality faculty.

Supporting a fully fledged department is a substantial undertaking. Salary lines for all 10 new faculty must be allocated from state funds on a continuing basis, plus startup funds for initial recruitment. We will also form an External Advisory Committee composed of leaders in biomedical informatics at our peer institutions, e.g. Michigan, Vanderbilt, Indiana, Ohio State, Oregon Health and Science University, Arizona State University.

Total $1.5M per year annual expenses
Using College of Engineering salary levels (cf. new Department of Bioengineering)

Faculty 10 new Faculty lines + Head = **$1.1M**
Head + 3 Areas (Measurements, Technologies, Applications)
$150K + $450K for 5 fulltime + $450K for 10 halftime
Fulltime: $125K Professor, $100K Associate, $75K ea Assistant (3 total)
Halftime: 4 IAC, 1 IGB, 1 VETMED, 1 AHS, 1 ENG, 1 ACES, 1 LAS

Staff at Engineering levels is $40K per faculty for 10 FTE faculty = **$400K**
Assistant Head $60K, System Administrator $50K
Research Coordinator $45K, Secretary $35K each per Area (3 total)
Staff Total $260K Faculty Expenses $40K per year
Computer Expenses 50 new per year * $2K = $100K (for 25 Staff, 50 Students, Labs)

Total $5M startup expenses
Recruiting and Renovation $1M one-time
Faculty Startup (16 * $250K) $4M one-time

GRAND TOTAL over 10 year period $20M

Recouping the Costs: Research Grant Projection

15 faculty each has an individual grant NIH R01 or equivalent.
Average $200K per year direct, $100K ICR. Total is $1.5M recouped per year.

Department combines Measurement, Infrastructure, Systems to land NIH/NSF Centers.
Center for Population Health Measurement (Public Health Informatics)
Center for Model Genomic Medicine (Translational Bioinformatics)
Each $2M direct costs per year plus $1M ICR. Total is $2M recouped per year.

During the decade of investment, Department competes nationally to earn back its $20M.
We will land an NIH National Center in Biomedical Informatics (cf. NCIBI at Michigan).
$4M per year direct costs plus $2M per year ICR, with half ($1M) to UIUC.

In 2.5 years, half the faculty is recruited. Half of these have Individual Grants.
$.375M per year recouped.
In 5 years, all the faculty is recruited. Half have Individual (5) plus First Center.
$.75M Individual plus $1M Center. $1.75M per year recouped.
In 7.5 years, all recruited. All have Individual (15) plus Second Center.
$1.5M Individual plus $2M Centers. $3.5M per year recouped.
In 10 years, all recruited. MIS up to full strength. Landed National Center.
$1.5M Individual plus $2M Centers plus $1M National Center.

$4.5M ICR Soft Money recouped against
$1.5M State Hard Money recurring per year

Recoup all Costs in less than a Decade,
then run at 3 times the investment rate.

Hosting the Department: Space Requirements

Space for offices and laboratories needs to be provided in some appropriate building. The Digital Computer Laboratory (DCL) where Bioengineering and Computational Science are located might be suitable, particularly since this is in north campus Engineering space. If a Biomedical Research Building at the University or at Carle materialized, as recommended by the campus Translational Biomedical Research Initiative report and the University Strategic Plan, that would be another possibility. Finally, residing within the space to be allocated for the Institute for Advanced Computation would be mutually beneficial due to strong shared goals. It would be a good match for the MIS Department to reside in the same building, facilitating synergy between MIS and the IAC Theme on Medical Informatics.

Office Space 10,000 square feet (10K sf) for full faculty complement.
1000 sf. Administrative Suite. Head, Budget, Computer, Coordinator, Commons.
6000 sf. 3 Areas each with 5 faculty (150sf), 16 students (double), Secretary. (750+1200) * 3.
1500 sf. Computer Laboratory
1000 sf. Teaching Classroom.
500 sf. Demonstration Room.

Laboratory Space 30,000 square feet (30K sf) for full research complement.
$12M total costs per year is 120 FTE (at 10 FTE per $1M total costs)
Faculty $3M (5 full, 10 half), centers $6M (all MIS), national center $3M (half MIS)
This is ramp-up over a decade until earning a $20M direct ($30M total) scale national center.
CANIS Laboratory was 20 FTE (30 seats) with $2M total per year requiring 5000 sf.
This was the campus resource for biomedical informatics. http://www.uiuc.edu/research/
So 120 FTE requires 30,000 sf.

Grand Total is 40,000 square feet.

This is the same scale as the space request at Arizona State University. The ASU Department of Biomedical Informatics will require 60,000 square feet for 50% more faculty (since they plan to teach a large undergraduate population as well). The space is 27,000 sf for faculty laboratories and offices in their Arizona Biomedical Collaborative building next to their Translational Genomics Institute in Phoenix. The administrative and academic offices and classrooms will be housed with the School of Informatics on the main campus. The closest UIUC building for research laboratories is our Institute for Genomic Biology, but the IGB bioinformatics space is smaller than the ASU space for Biomedical Informatics and has already been allocated for the bioinformatics faculty hired within campus departments to work with wet lab biologists. For our proposed MIS Department, which is dry lab only, the Institute for Advanced Computation would be a good match. For example, MIS could grow to fill two floors in an expanded new wing of the IAC/NCSA Building.